buildtest Documentation

Release 0.10.2

Shahzeb Siddiqui

Aug 16, 2021

BACKGROUND

This documentation was last rebuild on Aug 16, 2021 and is intended for version 0.10.2.

If you are working off a latest release please see https://buildtest.readthedocs.io/en/latest/ for documentation. If you are working off devel branch then please refer to https://buildtest.readthedocs.io/en/devel/ which references the *devel* branch.

CHAPTER

ONE

STATUS

CHAPTER

TWO

USEFUL LINKS

1. Source Code: https://github.com/buildtesters/buildtest
2. Documentation: http://buildtest.rtfd.io/
3. Schema Docs: https://buildtesters.github.io/buildtest/
4. ReadTheDocs: https://readthedocs.org/projects/buildtest/
5. CodeCov: https://codecov.io/gh/buildtesters/buildtest
6. Slack Channel: http://hpcbuildtest.slack.com
7. Slack Invite: https://hpcbuildtest.herokuapp.com
8. CodeFactor: https://www.codefactor.io/repository/github/buildtesters/buildtest
9. Snyk: https://app.snyk.io/org/buildtesters/
10. Cori Test Repository: https://github.com/buildtesters/buildtest-cori

CHAPTER

THREE

DESCRIPTION

buildtest is a testing framework to help HPC sites write test for their system as part of their routine acceptance & regression test. buildtest provides a YAML interface to write tests which buildtest can validate and generate shell scripts that can run on your HPC system. The test template (YAML) is called **buildspec** which can define one or more test instance that is validated by a json schema. buildtest supports the following batch schedulers: IBM Spectrum LSF, Slurm, PBS and Cobalt. We publish the schema documentation, json schemas, and schema examples at https://buildtesters.github.io/buildtest/ which is useful when you are *writing buildspecs*.

To get started with buildtest, please see *installing buildtest* and *getting started guide*.

A spin-off project called lmodule is a Python API for Lmod. The buildtest module features were deprecated and moved to lmodule with the main objective is to automate module load testing. For more details on lmodule see https://github.com/buildtesters/lmodule

3.1 Summary of buildtest

Contents

3.1.1 Background

HPC System and Software Stack are tightly integrated with underlying architecture which makes them highly sensitive to changes in system such as OS, kernel, driver, or vendor updates. We need a testing framework to automate acceptance testing of an HPC system so that HPC Support Teams can increase **confidence** of their HPC system throughout the system lifecycle.

3.1.2 Motivation

There are many build automations tools for compiling source code into binary code, the most used tool is the **make** utility found in most Linux systems. Build scripts like **configure**, **cmake** and **autoconf** can generate files used by make for installing the software. Makefile is a file used by make program that shows how to compile and link a program which is the basis for building a software package. One can invoke **make test** which will run the target named **test** in Makefile that dictates how tests are compiled and run. Makefile is hard to interpret and requires in-depth experience with shell-scripting and strong understanding of how package is built and tested. Note that package maintainers must provide the source files, headers, and additional libraries to test the software and make test simply the test compilation and execution. Tools like *configure*, *cmake* and *autoconf* are insufficient for testing because HPC software stack consist of applications packaged in many formats and some are make-incompatible.

We wanted a framework that hides the complexity for compiling source code and provide an easy markup language to define test configuration to create the test. This leads to buildtest, which is a testing framework that generates test-scripts using YAML that is validated with JSON Schemas. YAML was picked given its ease-of-use and it lowers the barrier for writing tests.

3.1.3 Inception of buildtest

buildtest was founded by Shahzeb Siddiqui in 2017 when he was at Pfizer tasked for testing software stack for a data center migration.

Shahzeb was tasked with testing the software ecosystem by focusing on the most important application due to time constraints. During this period, several dozen test scripts were developed in shell-script that targeted core HPC tools such as compilers, **MPI**, **R**, **Python**, etc. A single master script was used to run all the tests which led to *buildtest*.

3.1.4 Preview of buildtest

You can run `buildtest help` followed by name of command and it will provide an overview of the buildtest.

Building Test

```
$ buildtest help build

Building Buildspecs
--------------------

Command                                                 Description

buildtest build -b <file>                               Build a single buildspec file
buildtest build -b <dir>                                Build all buildspecs␣
↪recursively in a given directory
buildtest build -b <file> -b <dir>                      Build buildspecs by file and␣
↪directory
```

(continues on next page)

(continued from previous page)

```
buildtest build -b <file> -b <dir> -x <file> -x <dir>       Exclude files and directory␣
↪when building buildspecs
buildtest build -t pass  -t python                          Build buildspecs by tagname
↪'pass' and 'python'
buildtest build -e <executor1> -e <executor2>               Building buildspecs by␣
↪executor
buildtest build -b <file> -t <tagname1> -e <executor1>      Building buildspecs with␣
↪file, directory, tags, and executors
buildtest build -b tutorials  --filter type=script          Build all tests in directory
↪'tutorials' and filter tests by type='script'
buildtest build -b tutorials  --filter tags=pass            Build all tests in directory
↪'tutorials' and filter tests by tags='pass'
buildtest build -b tutorials  --filter maintainers=@bob     Build all tests in directory
↪'tutorials' and filter tests by maintainers='@bob'
buildtest build --helpfilter                                Show list of filter fields␣
↪used with --filter option
buildtest -c config.yml build -b <file>                     Use buildtest configuration␣
↪file 'config.yml'
buildtest build -b <file> --rebuild 5                       Rebuild a test 5 times
buildtest build -b <file> --testdir /tmp                    Write tests in /tmp
```

Buildspec Interface

```
$ buildtest help buildspec

Finding Buildspecs
----------------------

Command                                                     Description

buildtest buildspec find                                    Discover and validate all␣
↪buildspecs and load all validated buildspecs in cache
buildtest buildspec find --rebuild                          Rebuild cache file
buildtest buildspec find --root /tmp --rebuild              Discover buildspecs in /tmp␣
↪and rebuild buildspec cache
buildtest buildspec find --paths                            Print all root directories␣
↪for buildspecs
buildtest buildspec find --buildspec                        List all available␣
↪buildspecs from cache
buildtest buildspec find --tags                             List all unique tags from␣
↪cache
buildtest buildspec find --executors                        List all unique executors␣
↪from cache
buildtest buildspec find --maintainers                      List all maintainers from␣
↪cache
buildtest buildspec find --maintainers-by-buildspecs        Show breakdown of all␣
↪buildspecs by maintainer names.
buildtest buildspec find --filter type=script,tags=pass     Filter buildspec cache based␣
↪on type=script and  tags='pass'
buildtest buildspec find --filter buildspec=<path>          Filter cache by buildspec␣
↪file
```

(continues on next page)

(continued from previous page)

```
buildtest buildspec find --format name,description          Format table columns by␣
↪field: 'name' and 'description
buildtest buildspec find --group-by-tags                    Group tests by tag name
buildtest buildspec find --group-by-executor                Group tests by executor name
buildtest buildspec find --helpfilter                       Show all filter fields
buildtest buildspec find --helpformat                       Show all format fields
buildtest buildspec find --terse                            Display output in terse␣
↪format
buildtest buildspec find invalid                            Show invalid buildspecs
buildtest buildspec find invalid --error                    Show invalid buildspecs with␣
↪error messages

Validate buildspecs
---------------------

Command                                                     Description

buildtest buildspec validate -b <file>                      Validate a buildspec with␣
↪JSON Schema
buildtest buildspec validate -b /tmp/ -x /tmp/network       Validate all buildspecs in␣
↪directory /tmp but exclude /tmp/network
buildtest buildspec validate -t python -t mac               Validate all buildspecs for␣
↪tagname 'python' and 'mac'
buildtest buildspec validate -e generic.local.bash          Validate all buildspecs for␣
↪executor 'generic.local.bash'

Buildspec Summary
-------------------

Command                                                     Description

buildtest buildspec summary                                 Show summary of buildspec␣
↪cache file

Show Content of buildspec
---------------------------

Command                                                     Description

buildtest buildspec show python_hello                       Show content of buildspec␣
↪based on test name 'python_hello'
```

Query Report

```
$ buildtest help report

View Test Report
----------------

Command                                                 Description

buildtest report                                        Display all tests results
buildtest report --filter returncode=0                  Filter test results by␣
↪returncode=0
buildtest report --filter state=PASS,tags=python        Filter test by multiple␣
↪filter fields.
buildtest report --filter buildspec=tutorials/vars.yml  Filter report by buildspec␣
↪file 'tutorials/vars.yml
buildtest report --format name,state,buildspec          Format report table by field
↪'name', 'state', 'buildspec'
buildtest report --helpfilter                           List all filter fields
buildtest report --helpformat                           List all format fields
buildtest report --oldest                               Retrieve oldest record for␣
↪all tests
buildtest report --latest                               Retrieve latest record for␣
↪all tests
buildtest report -r <report-file>                       Specify alternate report␣
↪file to display test results
buildtest report --terse                                Print report in terse format
buildtest report list                                   List all report files
buildtest report clear                                  Remove content of report file
buildtest report summary                                Show summary of test report
```

Inspect Tests

```
$ buildtest help inspect


Inspecting a Test
-----------------

Command                                                 Description

buildtest inspect list                                  Display all test names, ids␣
↪and corresponding buildspec file
buildtest inspect list -t                               Show output in terse format
buildtest inspect name hello                            Display all tests results
buildtest inspect name foo bar                          Display record of test name
↪'foo' and 'bar'
buildtest inspect buildspec tutorials/vars.yml          Fetch latest runs for all␣
↪tests in buildspec file 'tutorials/vars.yml'
buildtest inspect id <ID>                               Display record of test by␣
↪unique identifer
```

(continues on next page)

(continued from previous page)

```
buildtest inspect query -o hello                                Display content of output␣
↪file for test name 'hello'
buildtest inspect query -e hello                                Display content of error␣
↪file for test name 'hello'
buildtest inspect query -d first -o -e foo  bar                 Display first record of␣
↪tests 'foo', 'bar', and show output and error file
buildtest inspect query -d all foo                              Display all runs for tests
↪'foo'
```

3.1.5 Target Audience & Use Case

buildtest target audience is *HPC Staff* that wants to perform acceptance & regression testing of their HPC system.

buildtest is not

- replacement for *make*, *cmake*, *autoconf*, *ctest*
- a software build framework (easybuild, spack, nix , guix)
- a replacement for benchmark tools or test suite from upstream package
- a replacement for writing tests, you will need to write your tests defined by buildtest schemas, however you can copy/paste & adapt tests from other sites that are applicable to you.

Typical use-case:

- Run your test suite during system maintenance
- Perform daily tests for testing various system components. These tests should be short
- Run weekly/biweekly test on medium/large workload including micro-benchmark
- Run tests for newly installed software package typically requested by user.

If you are interested trying out buildtest check out *Getting Started* and Join Slack Channel.

3.1.6 Timeline

3.1.7 Related Projects and community efforts

Project	Description	State
ReFrame	is a high level regression framework for writing regression test for HPC systems. Tests are written in Python class andit has support for cray programming environment, job scheduler, module integration, parameter tests, test dependency,and sanity check. The project is led by CSCS.	Active
Pavilion2	is a framework for running and analyzing tests targeting HPC systems. Tests are written in YAML and majority of pavilion commands are implemented through python plugins using yapsy. Pavilion2 is developed by LANL.	Active
Automatic Testing of Installed Software (ATIS)	This project was presented by Xavier Besseron in FOSDEM14 that targets MPI testing using ctest and cdash. This project is no longer in development.	Obsolete
hpcswtest	is a HPC Software Stack Testing Framework developed by Idaho National Lab. The framework is built using C++11 and JSON file to define test configuration.	Obsolete
PVCS	is a validation engine to run large tests for HPC systems, the framework is written in Perl and recipe known as **Test Expression (TE)** are written in YAML. This project is developed by CEA.	Obsolete

The System Test Working Group hosted a BOF HPC System Testing: Procedures, Acceptance, Regression Testing, and Automation in SuperComputing '19. This working group is aimed at discussing acceptance and regression testing procedure and lessons learned from other HPC centers.

3.2 Terminology

Name	Description
Buildspec	is a YAML file that buildtest interprets when generating the test. A Buildspec may contain one or more test that is validated with a **global schema** and **sub schema**.
Schema	is a JSON Schema file (`.schema.json`) that defines structure of a buildspec file and it is used for validating a buildspec
Global Schema	is a JSON schema that validates buildspec file. buildtest will validate all buildspecs with global schema
Sub Schema	Each test section in a buildspec file is validated with one sub-schema defined by `type` field. The buildspec test section can only be validated with one sub-schema
Test Script	is a generated shell script by buildtest as a result of processing one of the Buildspec.
Settings	is a buildtest configuration file in YAML that configures buildtest at your site. The Settings file must be compatible with the Settings Schema.
Settings Schema	is a special schema file that defines structure of buildtest settings.
Executor	is responsible for running a **TestScript**. An executor can be of several types such as `local`, `slurm`, `lsf` which defines if test is run locally or via a scheduler. The executors are defined in the `Settings` file.

3.3 Installing buildtest

3.3.1 Requirements

You need the following packages to install buildtest.

- git
- Python >= 3.6

3.3.2 Cloning buildtest

To get started, clone the buildtest repository in your local machine as follows:

```
# HTTPS
$ git clone https://github.com/buildtesters/buildtest.git

# SSH
$ git clone git@github.com:buildtesters/buildtest.git
```

If you prefer the latest release use the **master** branch:

```
$ git clone -b master git@github.com:buildtesters/buildtest.git
```

3.3.3 Installing buildtest

To install buildtest, navigate to buildtest repo and source the setup script as follows:

```
# BASH users
$ source setup.sh

# CSH users
$ source setup.csh
```

This will add `buildtest` command in your $PATH and set environment variable **$BUILDTEST_ROOT** which points to root of buildtest repo.

You may want to create an isolated python environment of choice depending on your preference you can use any of the following:

- virtualenv
- conda
- pipenv

buildtest will provide tab completion for bash shell, this is managed by script bash_completion.sh, if you encounter any issues with tab completion please raise an issue at https://github.com/buildtesters/buildtest/issues/.

3.3.4 Development Dependencies (Optional)

If you plan to contribute back to buildtest, you will need to install additional dependencies as follows:

```
$ pip install -r docs/requirements.txt
```

3.3.5 Usage (`buildtest --help`)

Once you are setup, you can run `buildtest --help` for more details on how to use buildtest. Shown below is the output

```
$ buildtest --help
usage: buildtest [options] [COMMANDS]

buildtest is a HPC testing framework for building and running tests.

optional arguments:
  -h, --help            show this help message and exit
  -V, --version         show program's version number and exit
  -c CONFIGFILE, --config CONFIGFILE
                        Specify Path to Configuration File
  -d, --debug           Print debug messages to screen
  --color {on,off}      Enable or disable color

COMMANDS:

    build               Build and Run test
    buildspec           Buildspec Interface
    config              Query buildtest configuration
    report              Query test report
    inspect             Inspect a test based on NAME or ID
    history             Query build history
    edit                Edit a buildspec and validate with schema file
    schema              List schema contents and examples
    cdash               Upload test to CDASH server
    docs                Open buildtest docs in browser
    schemadocs          Open buildtest schema docs in browser
    help                buildtest command guide

References
________________________________________________________________________________
GitHub:                  https://github.com/buildtesters/buildtest
Documentation:           https://buildtest.readthedocs.io/en/latest/index.html
Schema Documentation:    https://buildtesters.github.io/buildtest/
Slack:                   http://hpcbuildtest.slack.com/

Please report issues at https://github.com/buildtesters/buildtest/issues

Copyright (c) 2021, The Regents of the University of California, through Lawrence␣
↪Berkeley National Laboratory (subject to receipt of any required approvals from the U.
↪S. Dept. of Energy), Shahzeb Siddiqui, and Vanessa Sochat. All rights reserved.
```

If you have got this far, please go to the next section on *Getting Started*

3.4 Getting Started

3.4.1 Building Test via buildtest

This guide will get you familiar with buildtest command line interface. Once you complete this section, you can proceed to *writing buildspecs* section where we will cover how to write buildspecs.

Once you install buildtest, you should find the *buildtest* command in your **$PATH**. You can check the path to buildtest command by running:

```
$ which buildtest
```

If you don't see buildtest go back and *install buildtest*.

When you clone buildtest, you also get a set of buildspecs that you can run on your system. The `buildtest build` command is used for building and running tests. Buildtest will read one or more buildspecs file that adheres to one of the buildtest schemas. For a complete list of build options, run `buildtest build --help`

Build Usage

```
$ buildtest build --help
usage: buildtest [options] [COMMANDS] build [-h] [-b BUILDSPEC] [-x EXCLUDE] [-e␣
↪EXECUTOR] [-t TAGS] [-f FILTER]
                                            [--helpfilter] [-k] [--max-pend-time MAX_
↪PEND_TIME]
                                            [--poll-interval POLL_INTERVAL] [--rebuild␣
↪REBUILD] [-r REPORT]
                                            [-s {parse,build}] [--testdir TESTDIR]

optional arguments:
  -h, --help            show this help message and exit

discover:
  select buildspecs

  -b BUILDSPEC, --buildspec BUILDSPEC
                        Specify a buildspec (file or directory) to build. A buildspec␣
↪must end in '.yml' extension.
  -x EXCLUDE, --exclude EXCLUDE
                        Exclude one or more buildspecs (file or directory) from␣
↪processing. A buildspec must end in
                        '.yml' extension.
  -e EXECUTOR, --executor EXECUTOR
                        Discover buildspecs by executor name found in buildspec cache
  -t TAGS, --tags TAGS  Discover buildspecs by tags found in buildspec cache

filter:
  Filter tests

  -f FILTER, --filter FILTER
                        Filter buildspec based on tags, type, or maintainers. Usage: --
↪filter key1=val1,key2=val2
```

(continues on next page)

(continued from previous page)

```
  --helpfilter          Show available filter fields used with --filter option

extra:
  All extra options

  -k, --keep-stage-dir  Keep stage directory after job completion.
  --max-pend-time MAX_PEND_TIME
                        Specify Maximum Pending Time (sec) for job before cancelling job.
↪ This only applies for batch
                        job submission.
  --poll-interval POLL_INTERVAL
                        Specify Poll Interval (sec) for polling batch jobs
  --rebuild REBUILD     Rebuild test X number of times. Must be a positive number␣
↪between [1-50]
  -r REPORT, --report REPORT
                        Specify a report file where tests will be written.
  -s {parse,build}, --stage {parse,build}
                        control behavior of buildtest build
  --testdir TESTDIR     Specify a custom test directory where to write tests. This␣
↪overrides configuration file and
                        default location.
```

Building a Test

To build a test, we use the `--buildspec` or short option `-b` to specify the path to buildspec file. Let's see some examples, first we specify a full path to buildspec file. In this example, buildtest will *discover buildspecs* followed by parsing the test with appropriate schema and generate a shell script that is run by buildtest. You can learn more about *build and test process*.

```
$ buildtest build -b $BUILDTEST_ROOT/tutorials/vars.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:15
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/vars.yml

+-------------------------------+
```

(continues on next page)

(continued from previous page)

```
| Stage: Discovering Buildspecs |
+-------------------------------+

+-------------------------------------------------------------------------------------------------
↪---------+
| Discovered Buildspecs                                                                          ␣
↪         |
+=================================================================================================+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪vars.yml |
+-------------------------------------------------------------------------------------------------
↪---------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------------
↪-------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/vars.yml



name            description
--------------  -------------------------------
variables_bash  Declare shell variables in bash

+----------------------+
| Stage: Building Test |
+----------------------+

 name           | id       | type   | executor           | tags          | testpath
----------------+----------+--------+--------------------+---------------+---------------
↪-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------
 variables_bash | 1c4ba849 | script | generic.local.bash | ['tutorials'] | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.
↪local.bash/vars/variables_bash/1c4ba849/variables_bash_build.sh




+----------------------+
| Stage: Running Test |
+----------------------+
```

(continues on next page)

(continued from previous page)

```
 name           | id       | executor           | status   |   returncode
----------------+----------+--------------------+----------+--------------
 variables_bash | 1c4ba849 | generic.local.bash | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/1 Percentage: 100.000%
Failed Tests: 0/1 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_hr_5xctx.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

Note: buildtest will only read buildspecs with `.yml` extension, if you specify a `.yaml` it will be ignored by buildtest.

The `--buildspec` option can be used to specify a file or directory path. If you want to build multiple buildspecs in a directory you can specify the directory path and buildtest will recursively search for all `.yml` files. In the next example, we build all tests in directory **general_tests/configuration**.

```
$ buildtest build -b general_tests/configuration/


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:43
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b general_tests/configuration/

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-----------------------------------------------------------------------------------------
↪------------------------------------------+
| Discovered Buildspecs                                                                  ␣
↪                                          |
+=========================================================================================
```

(continues on next page)

(continued from previous page)

```
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/disk_usage.yml             |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/ulimits.yml                |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/systemd-default-target.yml |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/ssh_localhost.yml          |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/kernel_state.yml           |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+
Discovered Buildspecs:  5
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  5

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-------------------------------------------------
↪-----------------------------------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/general_tests/configuration/disk_usage.yml
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/general_tests/configuration/ulimits.yml
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/general_tests/configuration/systemd-default-target.
↪yml
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/general_tests/configuration/ssh_localhost.yml
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/general_tests/configuration/kernel_state.yml



name                          description
----------------------------  ------------------------------------------------------------
↪-----
root_disk_usage               Check root disk usage and report if it exceeds threshold
ulimit_filelock_unlimited     Check if file lock is set to unlimited in ulimits
ulimit_cputime_unlimited      Check if cputime is set to unlimited in ulimits
ulimit_stacksize_unlimited    Check if stack size is set to unlimited in ulimits
```

(continues on next page)

(continued from previous page)

```
ulimit_vmsize_unlimited       Check virtual memory size and check if its set to unlimited
ulimit_filedescriptor_4096    Check if open file descriptors limit is set to 4096
ulimit_max_user_process_2048  Check max number of user process limit is set to 2048
systemd_default_target        check if default target is multi-user.target
ssh_localhost_remotecommand   Test if ssh on localhost works and if we can run remote␣
↪command.
kernel_swapusage              Retrieve Kernel Swap Usage

+----------------------+
| Stage: Building Test |
+----------------------+

 name                          | id       | type   | executor           | tags           ␣
↪          | testpath
-------------------------------+----------+--------+--------------------+-----------------
↪----------+-------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------
↪---------------------------------
 root_disk_usage               | 3ea2bacf | script | generic.local.bash | ['filesystem',
↪'storage'] | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.bash/disk_usage/root_disk_usage/3ea2bacf/root_disk_usage_
↪build.sh
 ulimit_filelock_unlimited     | 6f5a22d8 | script | generic.local.bash | ['system']     ␣
↪          | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/ulimits/ulimit_filelock_unlimited/6f5a22d8/ulimit_
↪filelock_unlimited_build.sh
 ulimit_cputime_unlimited      | ff97e86d | script | generic.local.bash | ['system']     ␣
↪          | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/ulimits/ulimit_cputime_unlimited/ff97e86d/ulimit_
↪cputime_unlimited_build.sh
 ulimit_stacksize_unlimited    | 0e951b96 | script | generic.local.bash | ['system']     ␣
↪          | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/ulimits/ulimit_stacksize_unlimited/0e951b96/ulimit_
↪stacksize_unlimited_build.sh
 ulimit_vmsize_unlimited       | 74ff2dc6 | script | generic.local.bash | ['system']     ␣
↪          | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/ulimits/ulimit_vmsize_unlimited/74ff2dc6/ulimit_vmsize_
↪unlimited_build.sh
 ulimit_filedescriptor_4096    | c37071b3 | script | generic.local.bash | ['system']     ␣
↪          | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/ulimits/ulimit_filedescriptor_4096/c37071b3/ulimit_
↪filedescriptor_4096_build.sh
 ulimit_max_user_process_2048  | 28118dbe | script | generic.local.bash | ['system']     ␣
↪          | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/ulimits/ulimit_max_user_process_2048/28118dbe/ulimit_
↪max_user_process_2048_build.sh
 systemd_default_target        | 9061f933 | script | generic.local.bash | ['system']     ␣
↪          | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/systemd-default-target/systemd_default_target/9061f933/
↪systemd_default_target_build.sh
 ssh_localhost_remotecommand   | ce0e5732 | script | generic.local.bash | ['ssh']        ␣
↪          | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/ssh_localhost/ssh_localhost_remotecommand/ce0e5732/ssh_
↪localhost_remotecommand_build.sh
```

(continued on next page)

(continued from previous page)

```
 kernel_swapusage             | 18c8b2a2 | script | generic.local.bash | ['configuration
↪']         | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.bash/kernel_state/kernel_swapusage/18c8b2a2/kernel_
↪swapusage_build.sh



+----------------------+
| Stage: Running Test |
+----------------------+

 name                           | id       | executor           | status   |   returncode
--------------------------------+----------+--------------------+----------+--------------
 root_disk_usage                | 3ea2bacf | generic.local.bash | PASS     |              0
 ulimit_filelock_unlimited      | 6f5a22d8 | generic.local.bash | PASS     |              0
 ulimit_cputime_unlimited       | ff97e86d | generic.local.bash | PASS     |              0
 ulimit_stacksize_unlimited     | 0e951b96 | generic.local.bash | FAIL     |              0
 ulimit_vmsize_unlimited        | 74ff2dc6 | generic.local.bash | PASS     |              0
 ulimit_filedescriptor_4096     | c37071b3 | generic.local.bash | FAIL     |              0
 ulimit_max_user_process_2048 | 28118dbe | generic.local.bash | FAIL     |              0
 systemd_default_target         | 9061f933 | generic.local.bash | FAIL     |              1
 ssh_localhost_remotecommand    | ce0e5732 | generic.local.bash | FAIL     |            255
 kernel_swapusage               | 18c8b2a2 | generic.local.bash | FAIL     |            127

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 4/10 Percentage: 40.000%
Failed Tests: 6/10 Percentage: 60.000%


Writing Logfile to: /tmp/buildtest_7ramcqlx.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

Building Multiple Buildspecs

You can append `-b` option to build multiple buildspecs in the same command. Buildtest will discover buildspecs for every argument (`-b`) and accumulate a list of buildspecs to run. In this example, we instruct buildtest to build a buildspec file and all buildspecs in a directory path.

```
$ buildtest build -b general_tests/configuration/ -b tutorials/vars.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:44
```

(continues on next page)

(continued from previous page)

```
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b general_tests/configuration/ -b tutorials/vars.yml

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-----------------------------------------------------------------------------------------
↪-----------------------------------------+
| Discovered Buildspecs
↪                                         |
+=========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/systemd-default-target.yml |
+-----------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/disk_usage.yml             |
+-----------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/kernel_state.yml           |
+-----------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/ulimits.yml                |
+-----------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪vars.yml                                       |
+-----------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/ssh_localhost.yml          |
+-----------------------------------------------------------------------------------------
↪-----------------------------------------+
Discovered Buildspecs:  6
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  6

+--------------------------+
| Stage: Parsing Buildspecs |
```

(continues on next page)

(continued from previous page)

```
+--------------------------+

 schemafile               | validstate   | buildspec
--------------------------+--------------+-----------------------------------------------
↪-------------------------------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/general_tests/configuration/systemd-default-target.
↪yml
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/general_tests/configuration/disk_usage.yml
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/general_tests/configuration/kernel_state.yml
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/general_tests/configuration/ulimits.yml
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/vars.yml
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/general_tests/configuration/ssh_localhost.yml



name                           description
-----------------------------  ------------------------------------------------------------
↪-----
systemd_default_target         check if default target is multi-user.target
root_disk_usage                Check root disk usage and report if it exceeds threshold
kernel_swapusage               Retrieve Kernel Swap Usage
ulimit_filelock_unlimited      Check if file lock is set to unlimited in ulimits
ulimit_cputime_unlimited       Check if cputime is set to unlimited in ulimits
ulimit_stacksize_unlimited     Check if stack size is set to unlimited in ulimits
ulimit_vmsize_unlimited        Check virtual memory size and check if its set to unlimited
ulimit_filedescriptor_4096     Check if open file descriptors limit is set to 4096
ulimit_max_user_process_2048   Check max number of user process limit is set to 2048
variables_bash                 Declare shell variables in bash
ssh_localhost_remotecommand    Test if ssh on localhost works and if we can run remote␣
↪command.

+----------------------+
| Stage: Building Test |
+----------------------+

 name                          | id       | type   | executor           | tags          ␣
↪          | testpath
-------------------------------+----------+--------+--------------------+------------------
↪----------+-----------------------------------------------------------------------------
↪-----------------------------------------------------------------------------------------
↪---------------------------------
 systemd_default_target        | 5ccc431b | script | generic.local.bash | ['system']    ␣
↪          | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/systemd-default-target/systemd_default_target/5ccc431b/
↪systemd_default_target_build.sh
 root_disk_usage               | 7492c276 | script | generic.local.bash | ['filesystem',
↪'storage'] | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.bash/disk_usage/root_disk_usage/7492c276/root_disk_usage_
↪build.sh
```

(continued on next page)

(continued from previous page)

```
 kernel_swapusage              | 168713a5 | script | generic.local.bash | ['configuration
↪']          | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.bash/kernel_state/kernel_swapusage/168713a5/kernel_
↪swapusage_build.sh
 ulimit_filelock_unlimited     | 9b348bb5 | script | generic.local.bash | ['system']     ␣
↪           | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/ulimits/ulimit_filelock_unlimited/9b348bb5/ulimit_
↪filelock_unlimited_build.sh
 ulimit_cputime_unlimited      | 2e5a5e58 | script | generic.local.bash | ['system']     ␣
↪           | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/ulimits/ulimit_cputime_unlimited/2e5a5e58/ulimit_
↪cputime_unlimited_build.sh
 ulimit_stacksize_unlimited    | de1f6873 | script | generic.local.bash | ['system']     ␣
↪           | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/ulimits/ulimit_stacksize_unlimited/de1f6873/ulimit_
↪stacksize_unlimited_build.sh
 ulimit_vmsize_unlimited       | 2d9bc797 | script | generic.local.bash | ['system']     ␣
↪           | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/ulimits/ulimit_vmsize_unlimited/2d9bc797/ulimit_vmsize_
↪unlimited_build.sh
 ulimit_filedescriptor_4096    | 6f0b9f41 | script | generic.local.bash | ['system']     ␣
↪           | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/ulimits/ulimit_filedescriptor_4096/6f0b9f41/ulimit_
↪filedescriptor_4096_build.sh
 ulimit_max_user_process_2048 | 7fc52728 | script | generic.local.bash | ['system']     ␣
↪           | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/ulimits/ulimit_max_user_process_2048/7fc52728/ulimit_
↪max_user_process_2048_build.sh
 variables_bash                | 223864f7 | script | generic.local.bash | ['tutorials']  ␣
↪           | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/vars/variables_bash/223864f7/variables_bash_build.sh
 ssh_localhost_remotecommand   | ce350fe9 | script | generic.local.bash | ['ssh']        ␣
↪           | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/ssh_localhost/ssh_localhost_remotecommand/ce350fe9/ssh_
↪localhost_remotecommand_build.sh




+----------------------+
| Stage: Running Test |
+----------------------+

 name                           | id       | executor            | status   |   returncode
--------------------------------+----------+---------------------+----------+--------------
 systemd_default_target         | 5ccc431b | generic.local.bash | FAIL     |            1
 root_disk_usage                | 7492c276 | generic.local.bash | PASS     |            0
 kernel_swapusage               | 168713a5 | generic.local.bash | FAIL     |          127
 ulimit_filelock_unlimited      | 9b348bb5 | generic.local.bash | PASS     |            0
 ulimit_cputime_unlimited       | 2e5a5e58 | generic.local.bash | PASS     |            0
 ulimit_stacksize_unlimited     | de1f6873 | generic.local.bash | FAIL     |            0
```

(continues on next page)

(continued from previous page)

```
 ulimit_vmsize_unlimited      | 2d9bc797 | generic.local.bash | PASS     |            0
 ulimit_filedescriptor_4096   | 6f0b9f41 | generic.local.bash | FAIL     |            0
 ulimit_max_user_process_2048 | 7fc52728 | generic.local.bash | FAIL     |            0
 variables_bash               | 223864f7 | generic.local.bash | PASS     |            0
 ssh_localhost_remotecommand  | ce350fe9 | generic.local.bash | FAIL     |          255

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 5/11 Percentage: 45.455%
Failed Tests: 6/11 Percentage: 54.545%


Writing Logfile to: /tmp/buildtest_c80lh443.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

Excluding Buildspecs

So far we learned how to build buildspecs by file and directory path using the `-b` option. Next, we will discuss how one may exclude buildspecs which behaves similar to `-b` option. You can exclude buildspecs via `--exclude` or short option `-x` which can be useful when you want to exclude certain files or sub directory.

For example we can build all buildspecs in `tutorials` but exclude file `tutorials/vars.yml` by running:

```
$ buildtest build -b tutorials -x tutorials/vars.yml
```

buildtest will discover all buildspecs and then exclude any buildspecs specified by `-x` option. You can specify `-x` multiple times just like `-b` option.

For example, we can undo discovery by passing same option to `-b` and `-x` as follows

```
$ buildtest build -b tutorials/ -x tutorials/


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:44
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/ -x tutorials/
```

(continues on next page)

(continued from previous page)

```
There are no Buildspec files to process.
```

Buildtest will stop immediately if there are no Buildspecs to process, this is true if you were to specify files instead of directory.

In this example, we build all buildspecs in a directory but exclude a file. Buildtest will report the excluded buildspecs in the output and `-x` option can be appended multiple times. The `-x` can be a file or a directory and behaves similar to `-b` option.

```
$ buildtest build -b general_tests/configuration/ -x general_tests/configuration/ulimits.
↪yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:45
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b general_tests/configuration/ -x general_tests/configuration/
↪ulimits.yml

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-------------------------------------------------------------------------------------------
↪---------------------------------------------+
| Discovered Buildspecs
↪                                                |
+===========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/ssh_localhost.yml          |
+-------------------------------------------------------------------------------------------
↪---------------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/disk_usage.yml             |
+-------------------------------------------------------------------------------------------
↪---------------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/ulimits.yml                |
+-------------------------------------------------------------------------------------------
↪---------------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/kernel_state.yml           |
```

(continues on next page)

(continued from previous page)

```
+-----------------------------------------------------------------------------------------------
↪-----------------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/systemd-default-target.yml |
+-----------------------------------------------------------------------------------------------
↪-----------------------------------------------+
+-----------------------------------------------------------------------------------------------
↪------------------------------+
| Excluded Buildspecs                                                                           ␣
↪                              |
+===============================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/ulimits.yml |
+-----------------------------------------------------------------------------------------------
↪------------------------------+
Discovered Buildspecs:  5
Excluded Buildspecs:  1
Detected Buildspecs after exclusion:  4

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------------
↪-----------------------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/general_tests/configuration/ssh_localhost.yml
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/general_tests/configuration/disk_usage.yml
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/general_tests/configuration/kernel_state.yml
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/general_tests/configuration/systemd-default-target.
↪yml



name                         description
---------------------------  ------------------------------------------------------------
↪----
ssh_localhost_remotecommand  Test if ssh on localhost works and if we can run remote␣
↪command.
root_disk_usage              Check root disk usage and report if it exceeds threshold
kernel_swapusage             Retrieve Kernel Swap Usage
systemd_default_target       check if default target is multi-user.target

+----------------------+
| Stage: Building Test |
+----------------------+

 name                         | id       | type    | executor           | tags              ␣
↪          | testpath
```

(continues on next page)

(continued from previous page)

```
----------------------------+----------+--------+--------------------+------------------
↪---------+-------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------
↪--------------------------------
 ssh_localhost_remotecommand | c5e27d66 | script | generic.local.bash | ['ssh']         ␣
↪         | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/ssh_localhost/ssh_localhost_remotecommand/c5e27d66/ssh_
↪localhost_remotecommand_build.sh
 root_disk_usage             | 0b5ef78e | script | generic.local.bash | ['filesystem',
↪'storage'] | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.bash/disk_usage/root_disk_usage/0b5ef78e/root_disk_usage_
↪build.sh
 kernel_swapusage            | e0458d95 | script | generic.local.bash | ['configuration
↪']         | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.bash/kernel_state/kernel_swapusage/e0458d95/kernel_
↪swapusage_build.sh
 systemd_default_target      | 185f833c | script | generic.local.bash | ['system']      ␣
↪         | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.bash/systemd-default-target/systemd_default_target/185f833c/
↪systemd_default_target_build.sh




+----------------------+
| Stage: Running Test |
+----------------------+

 name                         | id       | executor           | status   |   returncode
------------------------------+----------+--------------------+----------+--------------
 ssh_localhost_remotecommand | c5e27d66 | generic.local.bash | FAIL     |          255
 root_disk_usage             | 0b5ef78e | generic.local.bash | PASS     |            0
 kernel_swapusage            | e0458d95 | generic.local.bash | FAIL     |          127
 systemd_default_target      | 185f833c | generic.local.bash | FAIL     |            1

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/4 Percentage: 25.000%
Failed Tests: 3/4 Percentage: 75.000%


Writing Logfile to: /tmp/buildtest_2vpes2bw.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

Building By Tags

buildtest can perform builds by tags by using `--tags` or short option (`-t`). In order to use this feature, buildtest must load buildspecs in *cache* which can be run via `buildtest buildspec find`. If you are unsure of the available tags you can run `buildtest buildspec find --tags` or let buildtest tab-complete the available tags. For more details see *Querying buildspec tags*.

Let's assume you want to build by tag name `network`, buildtest will attempt to find all tests that contain `tags: ['network']` in the buildspec which is loaded in the buildcache cache. If a test matches the tag name, the test will be picked up during the discover process.

```
$ buildtest build -t network


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:45
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -t network

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-----------------------------------------------------------------------------------------
↪-----------------+
| Discovered Buildspecs                                                                  ␣
↪                 |
+=========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪tags_example.yml |
+-----------------------------------------------------------------------------------------
↪-----------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

BREAKDOWN OF BUILDSPECS BY TAGS
--------------------------------
Detected Tag Names: ['network']
+-----------------------------------------------------------------------------------------
↪-----------------+
| network                                                                                ␣
↪                 |
```

(continues on next page)

(continued from previous page)

```
+==========================================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪tags_example.yml |
+-------------------------------------------------------------------------------------------
↪-----------------+



+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/tags_example.yml



name                  description
--------------------  ----------------------------
string_tag            tags can be a string
list_of_strings_tags  tags can be a list of strings

+-----------------------+
| Stage: Building Test |
+-----------------------+

 name                  | id       | type   | executor           | tags                |␣
↪testpath
----------------------+----------+--------+--------------------+---------------------+---
↪-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------
↪---
 string_tag            | 61e3ee4c | script | generic.local.bash | network             | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.bash/tags_example/string_tag/61e3ee4c/string_tag_build.sh
 list_of_strings_tags | b497ac17 | script | generic.local.bash | ['network', 'ping'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.bash/tags_example/list_of_strings_tags/b497ac17/list_of_strings_tags_
↪build.sh




+-----------------------+
| Stage: Running Test |
+-----------------------+

 name                  | id       | executor           | status   |   returncode
```

(continues on next page)

(continued from previous page)

```
--------------------+----------+--------------------+----------+--------------
 string_tag           | 61e3ee4c | generic.local.bash | PASS     |            0
 list_of_strings_tags | b497ac17 | generic.local.bash | FAIL     |          127

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/2 Percentage: 50.000%
Failed Tests: 1/2 Percentage: 50.000%


Writing Logfile to: /tmp/buildtest__mqxs2b9.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

You can build by multiple tags by specifying `--tags` multiple times. In next example we build all tests with tag name `pass` and `python`.

```
$ buildtest build -t python -t pass


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:45
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -t python -t pass

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+------------------------------------------------------------------------------------------
↪--------------------+
| Discovered Buildspecs                                                                  ␣
↪                    |
+==========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-shell.yml    |
+------------------------------------------------------------------------------------------
↪--------------------+
```

(continues on next page)

(continued from previous page)

```
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-hello.yml    |
+-------------------------------------------------------------------------------------------
↪--------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪pass_returncode.yml |
+-------------------------------------------------------------------------------------------
↪--------------------+
Discovered Buildspecs:  3
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  3

BREAKDOWN OF BUILDSPECS BY TAGS
---------------------------------
Detected Tag Names: ['python', 'pass']
+-------------------------------------------------------------------------------------------
↪-----------------+
| python                                                                                  ␣
↪                  |
+=========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-shell.yml |
+-------------------------------------------------------------------------------------------
↪-----------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-hello.yml |
+-------------------------------------------------------------------------------------------
↪-----------------+


+-------------------------------------------------------------------------------------------
↪--------------------+
| pass                                                                                    ␣
↪                    |
+=========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪pass_returncode.yml |
+-------------------------------------------------------------------------------------------
↪--------------------+



+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-------------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/python-shell.yml
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/python-hello.yml
```

(continues on next page)

(continued from previous page)

```
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/pass_returncode.yml



name                      description
------------------------  --------------------------------------------------
circle_area               Calculate circle of area given a radius
python_hello              Hello World python
exit1_fail                exit 1 by default is FAIL
exit1_pass                report exit 1 as PASS
returncode_list_mismatch  exit 2 failed since it failed to match returncode 1
returncode_int_match      exit 128 matches returncode 128

+----------------------+
| Stage: Building Test |
+----------------------+

 name                      | id       | type   | executor             | tags            ␣
↪      | testpath
--------------------------+----------+--------+----------------------+-----------------
↪------+-------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------
↪----------------------
 circle_area               | 0b6ab2ac | script | generic.local.python | ['tutorials',
↪'python'] | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.python/python-shell/circle_area/0b6ab2ac/circle_area_build.sh
 python_hello              | 75d6ff53 | script | generic.local.bash   | python          ␣
↪      | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪var/tests/generic.local.bash/python-hello/python_hello/75d6ff53/python_hello_build.sh
 exit1_fail                | d2d34e26 | script | generic.local.sh     | ['tutorials',
↪'fail']   | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.sh/pass_returncode/exit1_fail/d2d34e26/exit1_fail_build.sh
 exit1_pass                | f150bc31 | script | generic.local.sh     | ['tutorials',
↪'pass']   | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.sh/pass_returncode/exit1_pass/f150bc31/exit1_pass_build.sh
 returncode_list_mismatch | 504a0b7b | script | generic.local.sh     | ['tutorials',
↪'fail']   | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.sh/pass_returncode/returncode_list_mismatch/504a0b7b/
↪returncode_list_mismatch_build.sh
 returncode_int_match      | cd33b94f | script | generic.local.sh     | ['tutorials',
↪'pass']   | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.sh/pass_returncode/returncode_int_match/cd33b94f/returncode_
↪int_match_build.sh




+----------------------+
| Stage: Running Test |
+----------------------+
```

(continues on next page)

(continued from previous page)

```
 name                       | id       | executor              | status    |   returncode
----------------------------+----------+-----------------------+-----------+--------------
 circle_area                | 0b6ab2ac | generic.local.python | PASS      |            0
 python_hello               | 75d6ff53 | generic.local.bash    | PASS      |            0
 exit1_fail                 | d2d34e26 | generic.local.sh      | FAIL      |            1
 exit1_pass                 | f150bc31 | generic.local.sh      | PASS      |            1
 returncode_list_mismatch | 504a0b7b | generic.local.sh      | FAIL      |            2
 returncode_int_match      | cd33b94f | generic.local.sh      | PASS      |          128

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 4/6 Percentage: 66.667%
Failed Tests: 2/6 Percentage: 33.333%


Writing Logfile to: /tmp/buildtest_5dxqutqv.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

When multiple tags are specified, we search each tag independently and if it's found in the buildspec cache we retrieve the buildspec file and add file to queue. This queue is a list of buildspecs that buildtest will process (i.e `parse`, `build`, `run`). You can *query tags* from buildspecs cache to see all available tags by running `buildtest buildspec find --tags`.

Note: The `--tags` is used for discovering buildspec file and not filtering tests by tag.

You can combine `--tags` with `--buildspec` to discover buildspecs in a single command. buildtest will query tags and buildspecs independently and combine all discovered buildspecs together.

```
$ buildtest build --tags pass --buildspec tutorials/python-hello.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:46
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build --tags pass --buildspec tutorials/python-hello.yml
```

(continues on next page)

(continued from previous page)

```
+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-------------------------------------------------------------------------------------------
↪--------------------+
| Discovered Buildspecs                                                                    ␣
↪                    |
+===========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-hello.yml    |
+-------------------------------------------------------------------------------------------
↪--------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪pass_returncode.yml |
+-------------------------------------------------------------------------------------------
↪--------------------+
Discovered Buildspecs:  2
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  2

BREAKDOWN OF BUILDSPECS BY TAGS
---------------------------------
Detected Tag Names: ['pass']
+-------------------------------------------------------------------------------------------
↪--------------------+
| pass                                                                                     ␣
↪                    |
+===========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪pass_returncode.yml |
+-------------------------------------------------------------------------------------------
↪--------------------+



+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-------------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/python-hello.yml
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/pass_returncode.yml



name                      description
```

(continues on next page)

(continued from previous page)

```
----------------------  --------------------------------------------------
python_hello            Hello World python
exit1_fail              exit 1 by default is FAIL
exit1_pass              report exit 1 as PASS
returncode_list_mismatch  exit 2 failed since it failed to match returncode 1
returncode_int_match    exit 128 matches returncode 128

+----------------------+
| Stage: Building Test |
+----------------------+

 name                    | id       | type   | executor           | tags              ␣
↪  | testpath
-------------------------+----------+--------+--------------------+-------------------
↪--+-------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------
↪------------------
 python_hello            | 3af45be7 | script | generic.local.bash | python            ␣
↪  | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.bash/python-hello/python_hello/3af45be7/python_hello_build.sh
 exit1_fail              | 91fe0aaf | script | generic.local.sh   | ['tutorials', 'fail
↪'] | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/exit1_fail/91fe0aaf/exit1_fail_build.sh
 exit1_pass              | e9a8bc57 | script | generic.local.sh   | ['tutorials', 'pass
↪'] | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/exit1_pass/e9a8bc57/exit1_pass_build.sh
 returncode_list_mismatch | c5e18c4a | script | generic.local.sh   | ['tutorials', 'fail
↪'] | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/returncode_list_mismatch/c5e18c4a/returncode_
↪list_mismatch_build.sh
 returncode_int_match    | 057c3071 | script | generic.local.sh   | ['tutorials', 'pass
↪'] | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/returncode_int_match/057c3071/returncode_int_
↪match_build.sh




+----------------------+
| Stage: Running Test |
+----------------------+

 name                    | id       | executor           | status   |   returncode
-------------------------+----------+--------------------+----------+--------------
 python_hello            | 3af45be7 | generic.local.bash | PASS     |            0
 exit1_fail              | 91fe0aaf | generic.local.sh   | FAIL     |            1
 exit1_pass              | e9a8bc57 | generic.local.sh   | PASS     |            1
 returncode_list_mismatch | c5e18c4a | generic.local.sh   | FAIL     |            2
 returncode_int_match    | 057c3071 | generic.local.sh   | PASS     |          128

+----------------------+
```

(continues on next page)

(continued from previous page)

```
| Stage: Test Summary  |
+----------------------+

Passed Tests: 3/5 Percentage: 60.000%
Failed Tests: 2/5 Percentage: 40.000%


Writing Logfile to: /tmp/buildtest_mcl96yu0.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

As you may see, there are several ways to build buildspecs with buildtest. Tags is great way to build a whole collection of tests if you don't know path to all the files. You can specify multiple tags per buildspecs to classify how test can be run.

Building by Executors

Every buildspec is associated to an executor which is responsible for running the test. You can instruct buildtest to run all tests by given executor via `--executor` option or short option `-e`. For instance, if you want to build all test associated to executor `generic.local.python` you can run:

```
$ buildtest build --executor generic.local.python
```

buildtest will query buildspec cache for the executor name and retrieve a list of buildspecs with matching executor name. To see a list of available executors in buildspec cache see *querying buildspec executor*.

Note: By default all tests are run in buildspec file. The `buildtest build --executor` option discovers buildspecs if one of the test matches the executor name. The `--executor` option is **not filtering on test level** like `--filter-tags` option.

In this example we run all tests that are associated to `generic.local.python` executor.

```
$ buildtest build --executor generic.local.python


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:46
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build --executor generic.local.python
```

(continues on next page)

(continued from previous page)

```
+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-----------------------------------------------------------------------------------------
↪----------------------+
| Discovered Buildspecs                                                                  ␣
↪                      |
+=========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪run_only_platform.yml |
+-----------------------------------------------------------------------------------------
↪----------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-shell.yml      |
+-----------------------------------------------------------------------------------------
↪----------------------+
Discovered Buildspecs:  2
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  2

BREAKDOWN OF BUILDSPECS BY EXECUTORS
------------------------------------
Detected Executor Names: ['generic.local.python']
+-----------------------------------------------------------------------------------------
↪----------------------+
| generic.local.python                                                                   ␣
↪                      |
+=========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪run_only_platform.yml |
+-----------------------------------------------------------------------------------------
↪----------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-shell.yml      |
+-----------------------------------------------------------------------------------------
↪----------------------+


[run_only_platform_darwin][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/run_only_platform.yml]: test is skipped because this test␣
↪is expected to run on platform: Darwin but detected platform: Linux.

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-------------------------------------------------
↪-----------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/run_only_platform.yml
```

(continues on next page)

(continued from previous page)

```
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/python-shell.yml



name                      description
------------------------  --------------------------------------------------
run_only_platform_linux   This test will only run if target platform is Linux
circle_area               Calculate circle of area given a radius

+----------------------+
| Stage: Building Test |
+----------------------+

 name                     | id       | type   | executor              | tags              ␣
↪      | testpath
--------------------------+----------+--------+-----------------------+--------------------
↪-----+-----------------------------------------------------------------------------------
↪-----------------------------------------------------------------------------------------
↪-------------------------
 run_only_platform_linux | 49a2b0c0 | script | generic.local.python | ['tutorials']     ␣
↪      | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪var/tests/generic.local.python/run_only_platform/run_only_platform_linux/49a2b0c0/run_
↪only_platform_linux_build.sh
 circle_area              | c8374cbd | script | generic.local.python | ['tutorials',
↪'python'] | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests/generic.local.python/python-shell/circle_area/c8374cbd/circle_area_build.sh




+----------------------+
| Stage: Running Test |
+----------------------+

 name                     | id       | executor              | status    |   returncode
--------------------------+----------+-----------------------+-----------+--------------
 run_only_platform_linux | 49a2b0c0 | generic.local.python | PASS      |            0
 circle_area              | c8374cbd | generic.local.python | PASS      |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 2/2 Percentage: 100.000%
Failed Tests: 0/2 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_qy1lygwq.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

Note: The `--executor` option can be appended to discover tests by multiple executors.

Filtering Buildspecs

buildtest has support for filtering buildspecs based on certain attributes defined in buildspec file. Upon *Discover Buildspecs*, buildtest will filter out tests or entire buildspec files. The `buildtest build --filter` option can be used to filter buildspecs which expects a **single** key=value pair. Currently, buildtest can filter tests based on `tags`, `type` and `maintainers`.

To see all available filter fields you can run `buildtest build --helpfilter` and buildtest will report the fields followed by description.

```
$ buildtest build --helpfilter
Field        Description
-----------  ---------------------------------
tags         Filter tests by 'tag' field
type         Filter test by 'type' field
maintainers  Filter test by 'maintainers' field
```

In this example, we will discover all buildspecs based on tagname `pass` and then filter each **test** by tagname **pass** specified by **–filter tags=pass**.

```
$ buildtest build -t pass --filter tags=pass


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:47
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -t pass --filter tags=pass

+--------------------------------+
| Stage: Discovering Buildspecs |
+--------------------------------+

+-------------------------------------------------------------------------------------------
↪--------------------+
| Discovered Buildspecs                                                                    
↪                    |
+===========================================================================================
```

(continues on next page)

(continued from previous page)

```
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪pass_returncode.yml |
+-------------------------------------------------------------------------------------------
↪--------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

BREAKDOWN OF BUILDSPECS BY TAGS
---------------------------------
Detected Tag Names: ['pass']
+-------------------------------------------------------------------------------------------
↪--------------------+
| pass
↪                    |
+===========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪pass_returncode.yml |
+-------------------------------------------------------------------------------------------
↪--------------------+


[exit1_fail][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/tutorials/pass_returncode.yml]: test is skipped because it is not in tag filter␣
↪list: {'tags': 'pass'}
[returncode_list_mismatch][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/pass_returncode.yml]: test is skipped because it is not in␣
↪tag filter list: {'tags': 'pass'}

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-------------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/pass_returncode.yml



name                  description
--------------------  -------------------------------
exit1_pass            report exit 1 as PASS
returncode_int_match  exit 128 matches returncode 128

+----------------------+
| Stage: Building Test |
+----------------------+

 name                 | id       | type   | executor         | tags                  |␣
↪testpath
```

(continues on next page)

(continued from previous page)

```
--------------------+----------+--------+-----------------+-----------------------+---
↪-------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------
↪----
 exit1_pass           | a0c6f68f | script | generic.local.sh | ['tutorials', 'pass'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/pass_returncode/exit1_pass/a0c6f68f/exit1_pass_build.sh
 returncode_int_match | 0a5db1fe | script | generic.local.sh | ['tutorials', 'pass'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/pass_returncode/returncode_int_match/0a5db1fe/returncode_int_match_
↪build.sh




+----------------------+
| Stage: Running Test |
+----------------------+

 name                  | id       | executor         | status   |   returncode
----------------------+----------+------------------+----------+--------------
 exit1_pass           | a0c6f68f | generic.local.sh | PASS     |            1
 returncode_int_match | 0a5db1fe | generic.local.sh | PASS     |          128

+-----------------------+
| Stage: Test Summary  |
+-----------------------+

Passed Tests: 2/2 Percentage: 100.000%
Failed Tests: 0/2 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_f08238td.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

buildtest can run filter tests by *maintainers*, this can be useful if you want to run tests that you are maintainer. The `maintainers` field is set per buildspec and not each test. You can filter maintiners via `--filter maintainers=<MAINTAINER_NAME>`. If the `maintainers` field is not specified the buildspec will be filtered out if `--filter maintainers` is specified. In this next example, we will build all tests for maintainer `@shahzebsiddiqui`.

```
$ buildtest build -b tutorials --filter maintainers=@shahzebsiddiqui


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:47
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
```

(continues on next page)

(continued from previous page)

```
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials --filter maintainers=@shahzebsiddiqui

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| Discovered Buildspecs                                                                     ␣
↪                                        |
+===========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪csh_shell_examples.yml                  |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-shell.yml                        |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/pre_post_cmds.yml                 |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/custom_run.yml                |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/compiler_status_regex.yml     |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/vecadd.yml                    |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_test.yml                    |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_tags.yml                        |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/executor_scheduler.yml           |
```

(continues on next page)

(continued from previous page)

```
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/gnu_hello_c.yml                |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪skip_tests.yml                           |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/env_create_manifest.yml            |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪selinux.yml                              |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_multiple_executor_sbatch.yml |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪run_only_distro.yml                      |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪vars.yml                                 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪burstbuffer_datawarp_executors.yml       |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/concretize_m4.yml                  |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪shebang.yml                              |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪runtime_status_test.yml                  |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/envvar_override.yml            |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪metrics_variable.yml                     |
```

(continues on next page)

(continued from previous page)

```
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪root_user.yml                           |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪status_regex.yml                        |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/compiler_exclude.yml          |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪environment.yml                         |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/multiple_executors.yml           |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪metrics_regex.yml                       |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪run_only_platform.yml                   |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪sleep.yml                               |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/status_by_executors.yml          |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/gnu_hello_fortran.yml         |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/env_install.yml                   |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/metrics_openmp.yml            |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_test_specs.yml              |
```

(continues on next page)

(continued from previous page)

```
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪add_numbers.yml                         |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪tags_example.yml                        |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪pass_returncode.yml                     |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/env_create_directory.yml          |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/pre_post_build_run.yml        |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_sbatch.yml                  |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-hello.yml                        |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/openmp_hello.yml              |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪maintainers_example.yml                 |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_buildspec_section.yml           |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪hello_world.yml                         |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/install_zlib.yml                  |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪executor_regex_script.yml               |
```

(continues on next page)

(continued from previous page)

```
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/mirror_example.yml                 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪shell_examples.yml                       |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_executor.yml                     |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/remove_environment_example.yml     |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
Discovered Buildspecs:  52
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  52


Buildspecs that failed validation
_______________________________________________________________________________________
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_tags.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_multiple_executor_sbatch.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪burstbuffer_datawarp_executors.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/env_install.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_buildspec_section.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_executor.yml

Buildspecs that were filtered out
_______________________________________________________________________________________
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪csh_shell_examples.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-shell.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/pre_post_cmds.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/custom_run.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/compiler_status_regex.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/vecadd.yml
```

(continues on next page)

(continued from previous page)

```
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_test.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/executor_scheduler.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/gnu_hello_c.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪skip_tests.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/env_create_manifest.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪selinux.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪run_only_distro.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪vars.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/concretize_m4.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪shebang.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪runtime_status_test.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/envvar_override.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪metrics_variable.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪root_user.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪status_regex.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/compiler_exclude.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪environment.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/multiple_executors.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪metrics_regex.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪run_only_platform.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪sleep.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/status_by_executors.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/gnu_hello_fortran.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/metrics_openmp.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_test_specs.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪add_numbers.yml
```

(continues on next page)

(continued from previous page)

```
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪tags_example.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪pass_returncode.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/env_create_directory.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/pre_post_build_run.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_sbatch.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-hello.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/openmp_hello.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪maintainers_example.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/install_zlib.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪executor_regex_script.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/mirror_example.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪shell_examples.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/remove_environment_example.yml

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile                | validstate   | buildspec
---------------------------+--------------+-----------------------------------------------
↪-------------------------------------------------------------------------------
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/csh_shell_examples.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/python-shell.yml
 spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/pre_post_cmds.yml
 compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/custom_run.yml
 compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/compiler_status_regex.yml
 compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/vecadd.yml
 spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/spack_test.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/script/executor_scheduler.yml
 compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/gnu_hello_c.yml
```

(continues on next page)

(continued from previous page)

```
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/skip_tests.yml
spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/env_create_manifest.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/selinux.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/run_only_distro.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/vars.yml
spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/concretize_m4.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/shebang.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/runtime_status_test.yml
compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/envvar_override.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/metrics_variable.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/root_user.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/status_regex.yml
compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/compiler_exclude.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/environment.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/script/multiple_executors.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/metrics_regex.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/run_only_platform.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/sleep.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/script/status_by_executors.yml
compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/gnu_hello_fortran.yml
compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/metrics_openmp.yml
spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/spack_test_specs.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/add_numbers.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/tags_example.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/pass_returncode.yml
spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/env_create_directory.yml
```

(continues on next page)

(continued from previous page)

```
 compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/pre_post_build_run.yml
 spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/spack_sbatch.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/python-hello.yml
 compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/openmp_hello.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/maintainers_example.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/hello_world.yml
 spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/install_zlib.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/executor_regex_script.yml
 spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/mirror_example.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/shell_examples.yml
 spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/remove_environment_example.yml



name         description
-----------  -------------------
hello_world  hello world example

+----------------------+
| Stage: Building Test |
+----------------------+

 name        | id       | type   | executor           | tags      | testpath
-------------+----------+--------+--------------------+-----------+----------------------
↪-------------------------------------------------------------------------------------------
↪-----------------------------------------------------
 hello_world | 9d31b492 | script | generic.local.bash | tutorials | /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.bash/
↪hello_world/hello_world/9d31b492/hello_world_build.sh




+----------------------+
| Stage: Running Test |
+----------------------+

 name        | id       | executor           | status   |   returncode
-------------+----------+--------------------+----------+--------------
 hello_world | 9d31b492 | generic.local.bash | PASS     |            0
```

(continues on next page)

(continued from previous page)

```
+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/1 Percentage: 100.000%
Failed Tests: 0/1 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_lfpditjy.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

Please see *Query Maintainers* on list of maintainers and breakdown of buildspecs by maintainers.

We can also filter tests by `type` field in the buildspec which corresponds to the schema type. In this next example, we filter all tests by spack schema type by passing option `--filter type=spack`. We inform buildtest to stop after build stage (`--stage=build`) for more details see *Configure Build Stages*.

```
$ buildtest build -b tutorials --filter type=spack --stage=build


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:48
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials --filter type=spack --stage=build

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-----------------------------------------------------------------------------------------
↪---------------------------------------+
| Discovered Buildspecs
↪                                       |
+=========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪status_regex.yml                       |
+-----------------------------------------------------------------------------------------
↪---------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪csh_shell_examples.yml                 |
```

(continues on next page)

(continued from previous page)

```
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪environment.yml                          |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪skip_tests.yml                           |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-hello.yml                         |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/multiple_executors.yml            |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_test.yml                     |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪metrics_regex.yml                        |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/concretize_m4.yml                  |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/mirror_example.yml                 |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪metrics_variable.yml                     |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪selinux.yml                              |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪sleep.yml                                |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪runtime_status_test.yml                  |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/metrics_openmp.yml             |
```

(continues on next page)

(continued from previous page)

```
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪tags_example.yml                         |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/envvar_override.yml            |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-shell.yml                         |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪maintainers_example.yml                  |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_tags.yml                         |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/remove_environment_example.yml     |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/env_install.yml                    |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_buildspec_section.yml            |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/install_zlib.yml                   |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/compiler_status_regex.yml      |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪hello_world.yml                          |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_multiple_executor_sbatch.yml |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_sbatch.yml                   |
```

(continues on next page)

(continued from previous page)

```
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪executor_regex_script.yml                |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/openmp_hello.yml               |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪add_numbers.yml                          |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/custom_run.yml                 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪run_only_platform.yml                    |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/gnu_hello_fortran.yml          |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪pass_returncode.yml                      |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/env_create_directory.yml           |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪burstbuffer_datawarp_executors.yml       |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪shebang.yml                              |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/gnu_hello_c.yml                |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/vecadd.yml                     |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/executor_scheduler.yml            |
```

(continues on next page)

(continued from previous page)

```
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/status_by_executors.yml           |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_executor.yml                     |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪vars.yml                                 |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪shell_examples.yml                       |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_test_specs.yml               |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/env_create_manifest.yml            |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/pre_post_build_run.yml         |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/pre_post_cmds.yml                  |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪run_only_distro.yml                      |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/compiler_exclude.yml           |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪root_user.yml                            |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
Discovered Buildspecs:  52
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  52
[status_regex_pass][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/tutorials/status_regex.yml]: test is skipped because it is not in type filter␣
↪list: spack
```

(continues on next page)

(continued from previous page)

```
[status_regex_fail][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/tutorials/status_regex.yml]: test is skipped because it is not in type filter␣
↪list: spack
[csh_shell][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/csh_shell_examples.yml]: test is skipped because it is not in type filter␣
↪list: spack
[bash_env_variables][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/environment.yml]: test is skipped because it is not in␣
↪type filter list: spack
[csh_env_declaration][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/environment.yml]: test is skipped because it is not in␣
↪type filter list: spack
[tcsh_env_declaration][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/environment.yml]: test is skipped because it is not in␣
↪type filter list: spack
[skip](/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/skip_tests.yml): test is skipped.
[unskipped][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/skip_tests.yml]: test is skipped because it is not in type filter list: spack
[python_hello][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/tutorials/python-hello.yml]: test is skipped because it is not in type filter␣
↪list: spack
[executors_vars_env_declaration][/home/docs/checkouts/readthedocs.org/user_builds/
↪buildtest/checkouts/v0.10.2/tutorials/script/multiple_executors.yml]: test is skipped␣
↪because it is not in type filter list: spack
[metric_regex_example][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/metrics_regex.yml]: test is skipped because it is not in␣
↪type filter list: spack
[metric_variable_assignment][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/metrics_variable.yml]: test is skipped because it is not␣
↪in type filter list: spack
[selinux_disable][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/tutorials/selinux.yml]: test is skipped because it is not in type filter list:␣
↪spack
[sleep][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/sleep.yml]: test is skipped because it is not in type filter list: spack
[timelimit_min_max][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/tutorials/runtime_status_test.yml]: test is skipped because it is not in type␣
↪filter list: spack
[timelimit_min][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/tutorials/runtime_status_test.yml]: test is skipped because it is not in type␣
↪filter list: spack
[timelimit_max][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/tutorials/runtime_status_test.yml]: test is skipped because it is not in type␣
↪filter list: spack
[timelimit_min_fail][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/runtime_status_test.yml]: test is skipped because it is␣
↪not in type filter list: spack
[timelimit_max_fail][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/runtime_status_test.yml]: test is skipped because it is␣
↪not in type filter list: spack
[metrics_variable_compiler][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/compilers/metrics_openmp.yml]: test is skipped because it␣
↪is not in type filter list: spack
```

(continued on next page)

(continued from previous page)

```
[string_tag][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/tutorials/tags_example.yml]: test is skipped because it is not in type filter list:␣
↪spack
[list_of_strings_tags][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/tags_example.yml]: test is skipped because it is not in␣
↪type filter list: spack
[override_environmentvars][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/compilers/envvar_override.yml]: test is skipped because it␣
↪is not in type filter list: spack
[circle_area][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/tutorials/python-shell.yml]: test is skipped because it is not in type filter list:␣
↪spack
[foo_bar][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/maintainers_example.yml]: test is skipped because it is not in type filter␣
↪list: spack
[default_status_regex][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/compilers/compiler_status_regex.yml]: test is skipped␣
↪because it is not in type filter list: spack
[override_status_regex][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/compilers/compiler_status_regex.yml]: test is skipped␣
↪because it is not in type filter list: spack
[hello_world][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/tutorials/hello_world.yml]: test is skipped because it is not in type filter list:␣
↪spack
[executor_regex_script_schema][/home/docs/checkouts/readthedocs.org/user_builds/
↪buildtest/checkouts/v0.10.2/tutorials/executor_regex_script.yml]: test is skipped␣
↪because it is not in type filter list: spack
[openmp_hello_c_example][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/compilers/openmp_hello.yml]: test is skipped because it is␣
↪not in type filter list: spack
[add_numbers][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/tutorials/add_numbers.yml]: test is skipped because it is not in type filter list:␣
↪spack
[custom_run_by_compilers][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/compilers/custom_run.yml]: test is skipped because it is␣
↪not in type filter list: spack
[run_only_platform_darwin][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/run_only_platform.yml]: test is skipped because it is not␣
↪in type filter list: spack
[run_only_platform_linux][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/run_only_platform.yml]: test is skipped because it is not␣
↪in type filter list: spack
[hello_f][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/compilers/gnu_hello_fortran.yml]: test is skipped because it is not in type␣
↪filter list: spack
[exit1_fail][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/tutorials/pass_returncode.yml]: test is skipped because it is not in type filter␣
↪list: spack
[exit1_pass][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/tutorials/pass_returncode.yml]: test is skipped because it is not in type filter␣
↪list: spack
[returncode_list_mismatch][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/pass_returncode.yml]: test is skipped because it is not in␣
↪type filter list: spack
```

(continues on next page)

(continued from previous page)

```
[returncode_int_match][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/pass_returncode.yml]: test is skipped because it is not in␣
↪type filter list: spack
[bash_login_shebang][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/shebang.yml]: test is skipped because it is not in type␣
↪filter list: spack
[bash_nonlogin_shebang][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/shebang.yml]: test is skipped because it is not in type␣
↪filter list: spack
[hello_c][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/compilers/gnu_hello_c.yml]: test is skipped because it is not in type filter␣
↪list: spack
[vecadd_gnu][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/tutorials/compilers/vecadd.yml]: test is skipped because it is not in type filter␣
↪list: spack
[executors_sbatch_declaration][/home/docs/checkouts/readthedocs.org/user_builds/
↪buildtest/checkouts/v0.10.2/tutorials/script/executor_scheduler.yml]: test is skipped␣
↪because it is not in type filter list: spack
[status_returncode_by_executors][/home/docs/checkouts/readthedocs.org/user_builds/
↪buildtest/checkouts/v0.10.2/tutorials/script/status_by_executors.yml]: test is skipped␣
↪because it is not in type filter list: spack
[variables_bash][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/tutorials/vars.yml]: test is skipped because it is not in type filter list: spack
[_bin_sh_shell][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/tutorials/shell_examples.yml]: test is skipped because it is not in type filter␣
↪list: spack
[_bin_bash_shell][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/tutorials/shell_examples.yml]: test is skipped because it is not in type␣
↪filter list: spack
[bash_shell][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/tutorials/shell_examples.yml]: test is skipped because it is not in type filter␣
↪list: spack
[sh_shell][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/shell_examples.yml]: test is skipped because it is not in type filter list:␣
↪spack
[shell_options][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/tutorials/shell_examples.yml]: test is skipped because it is not in type filter␣
↪list: spack
[pre_post_build_run][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/compilers/pre_post_build_run.yml]: test is skipped because␣
↪it is not in type filter list: spack
[run_only_macos_distro][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/run_only_distro.yml]: test is skipped because it is not in␣
↪type filter list: spack
[run_only_linux_distro][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/run_only_distro.yml]: test is skipped because it is not in␣
↪type filter list: spack
[vecadd_gnu_exclude][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/compilers/compiler_exclude.yml]: test is skipped because␣
↪it is not in type filter list: spack
[run_only_as_root][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/tutorials/root_user.yml]: test is skipped because it is not in type filter␣
↪list: spack
```

(continues on next page)

(continued from previous page)

```
Buildspecs that failed validation
_______________________________________________________________________________________
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_tags.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/env_install.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_buildspec_section.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_multiple_executor_sbatch.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪burstbuffer_datawarp_executors.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_executor.yml

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile                | validstate   | buildspec
---------------------------+--------------+-------------------------------------------
↪-------------------------------------------------------------------------------
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/status_regex.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/csh_shell_examples.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/environment.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/skip_tests.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/python-hello.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/script/multiple_executors.yml
 spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/spack_test.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/metrics_regex.yml
 spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/concretize_m4.yml
 spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/mirror_example.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/metrics_variable.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/selinux.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/sleep.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/runtime_status_test.yml
```

(continues on next page)

(continued from previous page)

```
compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/metrics_openmp.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/tags_example.yml
compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/envvar_override.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/python-shell.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/maintainers_example.yml
spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/remove_environment_example.yml
spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/install_zlib.yml
compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/compiler_status_regex.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/hello_world.yml
spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/spack_sbatch.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/executor_regex_script.yml
compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/openmp_hello.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/add_numbers.yml
compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/custom_run.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/run_only_platform.yml
compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/gnu_hello_fortran.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/pass_returncode.yml
spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/env_create_directory.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/shebang.yml
compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/gnu_hello_c.yml
compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/vecadd.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/script/executor_scheduler.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/script/status_by_executors.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/vars.yml
script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/shell_examples.yml
spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/spack_test_specs.yml
```

(continues on next page)

(continued from previous page)

```
 spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/env_create_manifest.yml
 compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/pre_post_build_run.yml
 spack-v1.0.schema.json    | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/spack/pre_post_cmds.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/run_only_distro.yml
 compiler-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/compilers/compiler_exclude.yml
 script-v1.0.schema.json   | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/root_user.yml



name                              description
--------------------------------  ------------------------------------------------------
↪-----------------
spack_test                        Install bzip2 and run spack test and report results
concretize_m4_in_spack_env        Concretize m4 in a spack environment named m4
add_mirror                        Declare spack mirror
add_mirror_in_spack_env           Declare spack mirror in spack environment
remove_environment_automatically  remove spack environment automatically before creating␣
↪a new environment
remove_environment_explicit       remove spack environment explicitly using the 'rm'␣
↪property
install_zlib                      Install zlib
spack_sbatch_example              sbatch directives can be defined in spack schema
spack_env_directory               Concretize m4 in a spack environment named m4
spack_test_results_specs_format   Run spack test results with spec format
spack_env_create_from_manifest    Create spack environment from spack.yaml
run_pre_post_commands             Install zlib

+----------------------+
| Stage: Building Test |
+----------------------+



 name                              | id       | type   | executor         | tags      |␣
↪testpath
----------------------------------+----------+--------+------------------+-----------+---
↪-----------------------------------------------------------------------------------------
↪-----------------------------------------------------------------------------------------
↪---------------------------------------
 spack_test                        | f7335039 | spack  | generic.local.sh | ['spack'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/spack_test/spack_test/f7335039/spack_test_build.sh
 concretize_m4_in_spack_env        | d94a6e65 | spack  | generic.local.sh | ['spack'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/concretize_m4/concretize_m4_in_spack_env/d94a6e65/concretize_m4_in_
↪spack_env_build.sh
```

(continues on next page)

(continued from previous page)

```
add_mirror                       | 90524672 | spack  | generic.local.sh | ['spack'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/mirror_example/add_mirror/90524672/add_mirror_build.sh
add_mirror_in_spack_env          | afceb91d | spack  | generic.local.sh | ['spack'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/mirror_example/add_mirror_in_spack_env/afceb91d/add_mirror_in_spack_
↪env_build.sh
remove_environment_automatically | 0d42b09d | spack  | generic.local.sh | ['spack'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/remove_environment_example/remove_environment_automatically/0d42b09d/
↪remove_environment_automatically_build.sh
remove_environment_explicit      | 0d62285b | spack  | generic.local.sh | ['spack'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/remove_environment_example/remove_environment_explicit/0d62285b/
↪remove_environment_explicit_build.sh
install_zlib                     | 4fc5b05a | spack  | generic.local.sh | ['spack'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/install_zlib/install_zlib/4fc5b05a/install_zlib_build.sh
spack_sbatch_example             | 49355ed6 | spack  | generic.local.sh | ['spack'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/spack_sbatch/spack_sbatch_example/49355ed6/spack_sbatch_example_build.
↪sh
spack_env_directory              | 8cc5ab5c | spack  | generic.local.sh | ['spack'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/env_create_directory/spack_env_directory/8cc5ab5c/spack_env_directory_
↪build.sh
spack_test_results_specs_format  | 81698401 | spack  | generic.local.sh | ['spack'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/spack_test_specs/spack_test_results_specs_format/81698401/spack_test_
↪results_specs_format_build.sh
spack_env_create_from_manifest   | 43d62843 | spack  | generic.local.sh | ['spack'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/env_create_manifest/spack_env_create_from_manifest/43d62843/spack_env_
↪create_from_manifest_build.sh
run_pre_post_commands            | e5639368 | spack  | generic.local.sh | ['spack'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/pre_post_cmds/run_pre_post_commands/e5639368/run_pre_post_commands_
↪build.sh
```

Discover Buildspecs

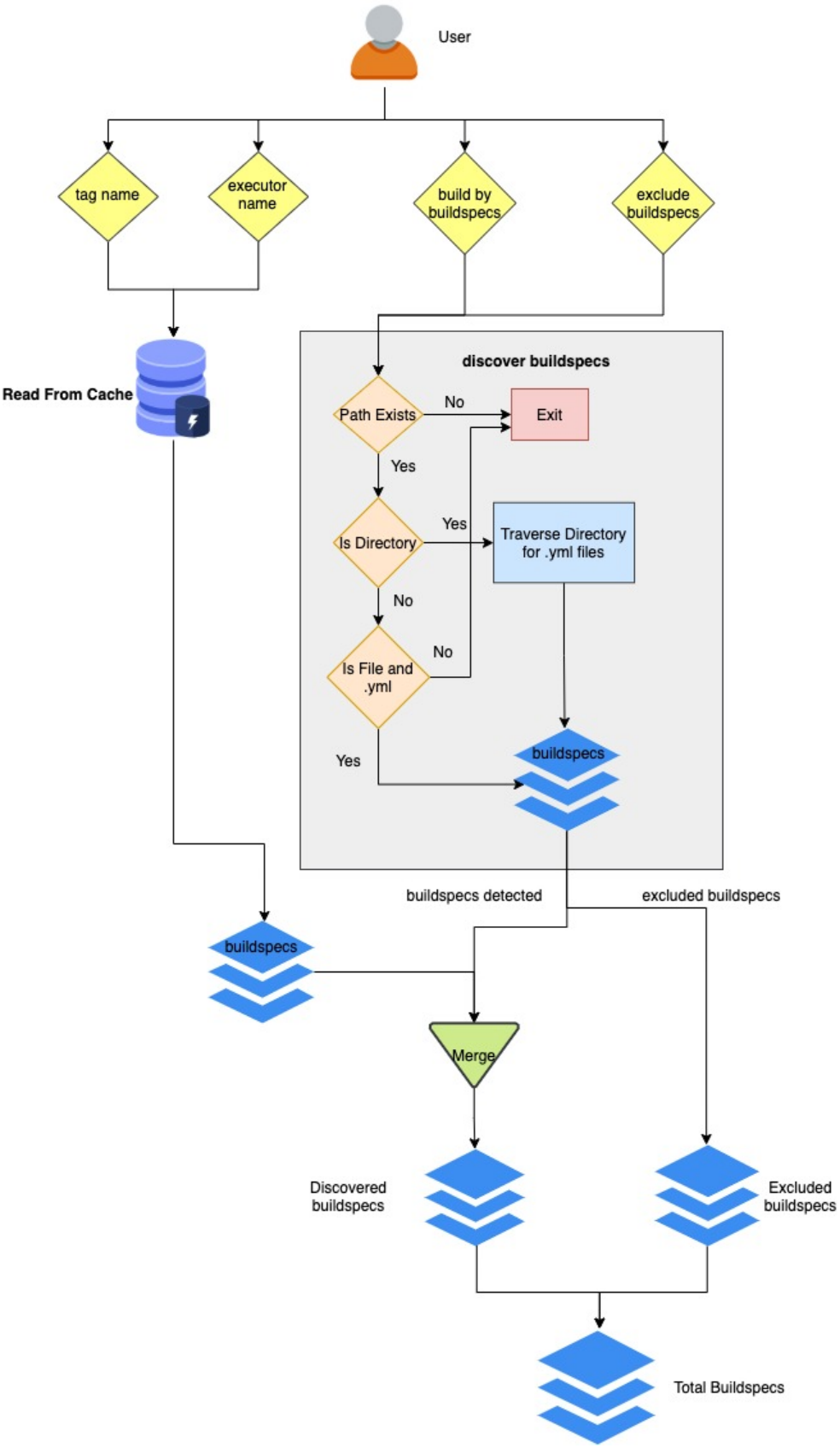
Now, let's discuss how buildtest discovers buildspecs since there are several ways to build buildspecs.

The buildspec search resolution is described as follows:

- If file or directory specified by `-b` option doesn't exist we exit immediately.
- If buildspec path is a directory, traverse directory recursively to find all `.yml` extensions
- If buildspec path is a file, check if file extension is not `.yml`, exit immediately
- If user specifies `--tags` or `--executor` we search in buildspec cache to discover buildspecs.

Shown below is a diagram on how buildtest discovers buildspecs. The user can build buildspecs by `--buildspec`,

–tags, or *–executor* which will discover the buildspecs. You can *exclude buildspecs* using `--exclude` option which is processed after discovering buildspecs. The excluded buildspecs are removed from list if found and final list of buildspecs is processed.


User
tag name
executor name
build by buildspecs
exclude buildspecs
Read From Cache
discover buildspecs
Path Exists
No
Exit
Yes
Is Directory
Yes
Traverse Directory for .yml files
No
Is File and .yml
No
Yes
buildspecs
buildspecs detected
excluded buildspecs
buildspecs
Merge
Discovered buildspecs
Excluded buildspecs
Total Buildspecs

Configure Build Stages

We can control behavior of `buildtest build` command to stop at certain phase using `--stage` option. The **–stage** option accepts `parse` or `build`, which will instruct buildtest to stop at parse or build phase of the pipeline.

Buildtest will validate all the buildspecs in the parse stage, so you can instruct buildtest to stop at parse stage via `--stage=parse`. This can be useful when debugging buildspecs that are invalid. In this example below, we instruct buildtest to stop after parse stage.

```
$ buildtest build -b tutorials/vars.yml --stage=parse


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:49
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/vars.yml --stage=parse

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-------------------------------------------------------------------------------------------
↪---------+
| Discovered Buildspecs                                                                    ␣
↪         |
+==========================================================================================+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪vars.yml |
+-------------------------------------------------------------------------------------------
↪---------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-----------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/vars.yml
```

(continues on next page)

(continued from previous page)

```
name            description
--------------  ------------------------------
variables_bash  Declare shell variables in bash
```

Likewise, if you want to troubleshoot your test script without running them you can use `--stage=build` which will stop after build phase. This can be used when you are writing buildspec to troubleshoot how test is generated. In this next example, we inform buildtest to stop after build stage.

```
$ buildtest build -b tutorials/vars.yml --stage=build


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:49
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/vars.yml --stage=build

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-----------------------------------------------------------------------------------------
↪---------+
| Discovered Buildspecs                                                                  ␣
↪         |
+=========================================================================================================+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪vars.yml |
+-----------------------------------------------------------------------------------------
↪---------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+
```

(continues on next page)

(continued from previous page)

```
 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/vars.yml



name            description
--------------  -------------------------------
variables_bash  Declare shell variables in bash

+----------------------+
| Stage: Building Test |
+----------------------+

 name           | id       | type   | executor           | tags          | testpath
----------------+----------+--------+--------------------+---------------+---------------
↪-----------------------------------------------------------------------------------------
↪-------------------------------------------------------
 variables_bash | 60fe63ed | script | generic.local.bash | ['tutorials'] | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.
↪local.bash/vars/variables_bash/60fe63ed/variables_bash_build.sh
```

Invalid Buildspecs

buildtest will skip any buildspecs that fail to validate, in that case the test script will not be generated. Here is an example where we have an invalid buildspec.

```
$ buildtest build -b tutorials/invalid_buildspec_section.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:49
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/invalid_buildspec_section.yml

+------------------------------+
| Stage: Discovering Buildspecs |
```

(continues on next page)

(continued from previous page)

```
+------------------------------+

+-------------------------------------------------------------------------------------------
↪------------------------------+
| Discovered Buildspecs                                                                    ␣
↪                              |
+=============================================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_buildspec_section.yml |
+-------------------------------------------------------------------------------------------
↪------------------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1


Buildspecs that failed validation
_____________________________________________________________________________________
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_buildspec_section.yml
No buildspecs to process because there are no valid buildspecs
```

buildtest may skip tests from running if buildspec specifies an invalid executor name since buildtest needs to know this in order to delegate test to Executor class responsible for running the test. Here is an example where test failed to run since we provided invalid executor.

```
$ buildtest build -b tutorials/invalid_executor.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:49
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/invalid_executor.yml

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-------------------------------------------------------------------------------------------
↪---------------------+
```

(continues on next page)

(continued from previous page)

```
| Discovered Buildspecs                                                                 ␣
↪                     |
+===========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_executor.yml |
+---------------------------------------------------------------------------------------
↪---------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1


Buildspecs that failed validation
────────────────────────────────────────────────────────────────────────────────
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_executor.yml
No buildspecs to process because there are no valid buildspecs
```

Rebuild Tests

buildtest can rebuild tests using the `--rebuild` option which can be useful if you want to test a particular test multiple times. The rebuild option works across all discovered buildspecs and create a new test instance (unique id) and test directory path. To demonstrate we will build `tutorials/python-shell.yml` three times using `--rebuild=3`.

```
$ buildtest build -b tutorials/python-shell.yml --rebuild=3



User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:50
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/python-shell.yml --rebuild=3

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+


+---------------------------------------------------------------------------------------
↪-----------------+
| Discovered Buildspecs                                                                 ␣
↪                 |
```

(continues on next page)

(continued from previous page)

```
+================================================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-shell.yml |
+-------------------------------------------------------------------------------------------
↪-----------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-----------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/python-shell.yml



name         description
-----------  ------------------------------------
circle_area  Calculate circle of area given a radius
circle_area  Calculate circle of area given a radius
circle_area  Calculate circle of area given a radius

+----------------------+
| Stage: Building Test |
+----------------------+

 name        | id       | type   | executor             | tags                      |␣
↪testpath
-------------+----------+--------+----------------------+---------------------------+------
↪-------------------------------------------------------------------------------------------
↪-----------------------------------------------------------------------
 circle_area | a1ef3290 | script | generic.local.python | ['tutorials', 'python'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.python/python-shell/circle_area/a1ef3290/circle_area_build.sh
 circle_area | 45c0e965 | script | generic.local.python | ['tutorials', 'python'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.python/python-shell/circle_area/45c0e965/circle_area_build.sh
 circle_area | 9b255d3f | script | generic.local.python | ['tutorials', 'python'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.python/python-shell/circle_area/9b255d3f/circle_area_build.sh




+---------------------+
| Stage: Running Test |
```

(continues on next page)

(continued from previous page)

```
+---------------------+

 name         | id       | executor              | status   |   returncode
--------------+----------+-----------------------+----------+--------------
 circle_area | a1ef3290 | generic.local.python | PASS     |            0
 circle_area | 45c0e965 | generic.local.python | PASS     |            0
 circle_area | 9b255d3f | generic.local.python | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 3/3 Percentage: 100.000%
Failed Tests: 0/3 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_dq1msjjf.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

The rebuild works with all options including: `--buildspec`, `--exclude`, `--tags` and `--executors`. buildtest will perform rebuild for all discovered tests, for instance in this next example we will discover all tests by tag name **fail** and each test is rebuild twice.

```
$ buildtest build -t fail --rebuild 2


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:50
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -t fail --rebuild 2

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-----------------------------------------------------------------------------------------
↪--------------------+
| Discovered Buildspecs                                                                  ␣
↪                    |
```

(continues on next page)

(continued from previous page)

```
+==============================================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪pass_returncode.yml |
+------------------------------------------------------------------------------------------
↪--------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

BREAKDOWN OF BUILDSPECS BY TAGS
---------------------------------
Detected Tag Names: ['fail']
+------------------------------------------------------------------------------------------
↪--------------------+
| fail                                                                                    ␣
↪                    |
+==============================================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪pass_returncode.yml |
+------------------------------------------------------------------------------------------
↪--------------------+



+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-------------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/pass_returncode.yml



name                      description
------------------------  --------------------------------------------------
exit1_fail                exit 1 by default is FAIL
exit1_pass                report exit 1 as PASS
returncode_list_mismatch  exit 2 failed since it failed to match returncode 1
returncode_int_match      exit 128 matches returncode 128
exit1_fail                exit 1 by default is FAIL
exit1_pass                report exit 1 as PASS
returncode_list_mismatch  exit 2 failed since it failed to match returncode 1
returncode_int_match      exit 128 matches returncode 128

+----------------------+
| Stage: Building Test |
+----------------------+

 name                     | id       | type    | executor         | tags                ␣
↪| testpath
```

(continues on next page)

(continued from previous page)

```
-------------------------+----------+--------+-----------------+-----------------------
↪+-------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------
↪----------------
 exit1_fail               | 5544d8dc | script | generic.local.sh | ['tutorials', 'fail']␣
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/exit1_fail/5544d8dc/exit1_fail_build.sh
 exit1_pass               | 1e4c9d01 | script | generic.local.sh | ['tutorials', 'pass']␣
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/exit1_pass/1e4c9d01/exit1_pass_build.sh
 returncode_list_mismatch | 0dc69200 | script | generic.local.sh | ['tutorials', 'fail']␣
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/returncode_list_mismatch/0dc69200/returncode_
↪list_mismatch_build.sh
 returncode_int_match     | 242ef5b9 | script | generic.local.sh | ['tutorials', 'pass']␣
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/returncode_int_match/242ef5b9/returncode_int_
↪match_build.sh
 exit1_fail               | 65bfeef1 | script | generic.local.sh | ['tutorials', 'fail']␣
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/exit1_fail/65bfeef1/exit1_fail_build.sh
 exit1_pass               | ae27ef4a | script | generic.local.sh | ['tutorials', 'pass']␣
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/exit1_pass/ae27ef4a/exit1_pass_build.sh
 returncode_list_mismatch | bb66d1f5 | script | generic.local.sh | ['tutorials', 'fail']␣
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/returncode_list_mismatch/bb66d1f5/returncode_
↪list_mismatch_build.sh
 returncode_int_match     | 2dfb02cd | script | generic.local.sh | ['tutorials', 'pass']␣
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/returncode_int_match/2dfb02cd/returncode_int_
↪match_build.sh




+---------------------+
| Stage: Running Test |
+---------------------+

 name                     | id       | executor         | status   |   returncode
--------------------------+----------+------------------+----------+--------------
 exit1_fail               | 5544d8dc | generic.local.sh | FAIL     |            1
 exit1_pass               | 1e4c9d01 | generic.local.sh | PASS     |            1
 returncode_list_mismatch | 0dc69200 | generic.local.sh | FAIL     |            2
 returncode_int_match     | 242ef5b9 | generic.local.sh | PASS     |          128
 exit1_fail               | 65bfeef1 | generic.local.sh | FAIL     |            1
 exit1_pass               | ae27ef4a | generic.local.sh | PASS     |            1
 returncode_list_mismatch | bb66d1f5 | generic.local.sh | FAIL     |            2
 returncode_int_match     | 2dfb02cd | generic.local.sh | PASS     |          128
```

(continues on next page)

(continued from previous page)

```
+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 4/8 Percentage: 50.000%
Failed Tests: 4/8 Percentage: 50.000%


Writing Logfile to: /tmp/buildtest_mz19a625.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

The rebuild option expects a range between **1-50**, the `--rebuild=1` is equivalent to running without `--rebuild` option. We set a max limit for rebuild option to avoid system degredation due to high workload.

If you try to exceed this bound you will get an error such as

```
$ buildtest build -b tutorials/pass_returncode.yml --rebuild 51
Traceback (most recent call last):
  File "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/bin/
↪buildtest", line 17, in <module>
    buildtest.main.main()
  File "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/main.py", line 99, in main
    helpfilter=args.helpfilter,
  File "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/cli/build.py", line 489, in __init__
    f"--rebuild {rebuild} exceeds maximum rebuild limit of 50"
buildtest.exceptions.BuildTestError: '--rebuild 51 exceeds maximum rebuild limit of 50'
```

Use Alternate Configuration file

If you want to use an alternate configuration file when building test you can use `buildtest -c <config> build`. buildtest will prefer configuration file on command line over the user configuration (`$HOME/.buildtest/config.yml`). For more details see *Which configuration file does buildtest read?*.

Keeping Stage Directory

buildtest will create setup the test environment in the *stage* directory where test will be executed. Once test is complete, buildtest will remove the *stage* directory. If you want to preserve the stage directory you can use `buildtest build --keep-stage-dir`, this is only useful if you want to run the test manually

3.4.2 Buildspecs Interface

Now that we learned how to build tests, in this section we will discuss how one can query a buildspec cache. In buildtest, one can load all buildspecs which is equivalent to validating all buildspecs with the appropriate schema. Buildtest will ignore all invalid buildspecs and store them in a separate file.

The `buildtest buildspec find` command is used for finding buildspecs from buildspec cache. This command is also used for generating the buildspec cache. Shown below is a list of options for `buildtest buildspec find`.

```
$ buildtest buildspec find --help
usage: buildtest [options] [COMMANDS] buildspec find [-h] [-b] [-e] [--group-by-tags] [--
↪group-by-executor] [-m] [-mb]
                                                     [-p] [-t] [--filter FILTER] [--
↪format FORMAT] [--helpfilter]
                                                     [--helpformat] [-n] [--terse] [-r]␣
↪[--root ROOT]
                                                     ...

positional arguments:

    invalid             Show invalid buildspecs

optional arguments:
  -h, --help            show this help message and exit
  -r, --rebuild         Rebuild buildspec cache and find all buildspecs again
  --root ROOT           Specify root buildspecs (directory) path to load buildspecs into␣
↪buildspec cache.

filter and format:
  filter and format options

  --filter FILTER       Filter buildspec cache with filter fields in format --filter␣
↪key1=val1,key2=val2
  --format FORMAT       Format buildspec cache with format fields in format --format␣
↪field1,field2,...
  --helpfilter          Show Filter fields for --filter option for filtering buildspec␣
↪cache output
  --helpformat          Show Format fields for --format option for formatting buildspec␣
↪cache output

terse:
  terse options

  -n, --no-header       Print output without header in terse output
  --terse               Print output in machine readable format

query:
```

(continues on next page)

(continued from previous page)

```
  query options to retrieve from buildspec cache

  -b, --buildspec       Get all buildspec files from cache
  -e, --executors       get all unique executors from buildspecs
  --group-by-tags       Group tests by tag name
  --group-by-executor   Group tests by executor name
  -m, --maintainers     Get all maintainers for all buildspecs
  -mb, --maintainers-by-buildspecs
                        Show maintainers breakdown by buildspecs
  -p, --paths           print all root buildspec paths
  -t, --tags            List all available tags
```

Finding Buildspecs - `buildtest buildspec find`

To find all buildspecs you can run `buildtest buildspec find` which will discover all buildspecs by recursively searching all *.yml* extensions. buildtest will validate each buildspec file with the json schema and buildtest will display all valid buildspecs in the output, all invalid buildspecs will be stored in a file for post-processing.

```
$ buildtest buildspec find
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| name                            | type     | executor                | tags           ␣
↪        | description                                                                    ␣
↪  |
+=================================+==========+=========================+================
| skip                            | script   | generic.local.bash      | tutorials      ␣
↪        | This test is skipped                                                           ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| unskipped                       | script   | generic.local.bash      | tutorials      ␣
↪        | This test is not skipped                                                       ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| status_regex_pass               | script   | generic.local.bash      | system         ␣
↪        | Pass test based on regular expression                                          ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| status_regex_fail               | script   | generic.local.bash      | system         ␣
↪        | Pass test based on regular expression                                          ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| metric_regex_example            | script   | generic.local.sh        | tutorials      ␣
↪        | capture result metric from output                                              ␣
↪  |
```

(continues on next page)

(continued from previous page)

```
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| executor_regex_script_schema     | script   | generic.local.(bash|sh) | tutorials     ␣
↪        | regular expression test with executor using script schema                    ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| add_numbers                      | script   | generic.local.bash      | tutorials     ␣
↪        | Add X+Y                                                                      ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| python_hello                     | script   | generic.local.bash      | python        ␣
↪        | Hello World python                                                           ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| _bin_sh_shell                    | script   | generic.local.sh        | tutorials     ␣
↪        | /bin/sh shell example                                                        ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| _bin_bash_shell                  | script   | generic.local.bash      | tutorials     ␣
↪        | /bin/bash shell example                                                      ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| bash_shell                       | script   | generic.local.bash      | tutorials     ␣
↪        | bash shell example                                                           ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| sh_shell                         | script   | generic.local.sh        | tutorials     ␣
↪        | sh shell example                                                             ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| shell_options                    | script   | generic.local.sh        | tutorials     ␣
↪        | shell options                                                                ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| bash_login_shebang               | script   | generic.local.bash      | tutorials     ␣
↪        | customize shebang line with bash login shell
↪  |
```

(continues on next page)

(continued from previous page)

```
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| bash_nonlogin_shebang           | script   | generic.local.bash      | tutorials     ␣
↪        | customize shebang line with default bash (nonlogin) shell                     ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| run_only_macos_distro           | script   | generic.local.bash      | mac           ␣
↪        | Run test only if distro is darwin.                                            ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| run_only_linux_distro           | script   | generic.local.bash      | mac           ␣
↪        | Run test only if distro is CentOS.                                            ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| metric_variable_assignment      | script   | generic.local.sh        | tutorials     ␣
↪        | capture result metric based on variables and environment variable             ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| selinux_disable                 | script   | generic.local.bash      | tutorials     ␣
↪        | Check if SELinux is Disabled                                                  ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| exit1_fail                      | script   | generic.local.sh        | tutorials fail␣
↪        | exit 1 by default is FAIL                                                     ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| exit1_pass                      | script   | generic.local.sh        | tutorials pass␣
↪        | report exit 1 as PASS                                                         ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| returncode_list_mismatch        | script   | generic.local.sh        | tutorials fail␣
↪        | exit 2 failed since it failed to match returncode 1                           ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| returncode_int_match            | script   | generic.local.sh        | tutorials pass␣
↪        | exit 128 matches returncode 128
↪  |
```

(continues on next page)

(continued from previous page)

```
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| sleep                           | script   | generic.local.bash      | tutorials     ␣
↪        | sleep 2 seconds                                                               ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| csh_shell                       | script   | generic.local.csh       | tutorials     ␣
↪        | csh shell example                                                             ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| string_tag                      | script   | generic.local.bash      | network       ␣
↪        | tags can be a string                                                          ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| list_of_strings_tags            | script   | generic.local.bash      | network ping  ␣
↪        | tags can be a list of strings                                                 ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| bash_env_variables              | script   | generic.local.bash      | tutorials     ␣
↪        | Declare environment variables in default shell (bash)                         ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| csh_env_declaration             | script   | generic.local.csh       | tutorials     ␣
↪        | csh shell example to declare environment variables                            ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| tcsh_env_declaration            | script   | generic.local.csh       | tutorials     ␣
↪        | tcsh shell example to declare environment variables                           ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| hello_world                     | script   | generic.local.bash      | tutorials     ␣
↪        | hello world example                                                           ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| foo_bar                         | script   | generic.local.sh        | tutorials     ␣
↪        | prints variable $FOO                                                          ␣
↪  |
```

(continues on next page)

(continued from previous page)

```
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| variables_bash                  | script   | generic.local.bash      | tutorials
↪        | Declare shell variables in bash                                            
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| run_only_platform_darwin        | script   | generic.local.python    | tutorials
↪        | This test will only run if target platform is Darwin                       
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| run_only_platform_linux         | script   | generic.local.python    | tutorials
↪        | This test will only run if target platform is Linux                        
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| circle_area                     | script   | generic.local.python    | tutorials
↪python       | Calculate circle of area given a radius                                
↪       |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| timelimit_min_max               | script   | generic.local.sh        | tutorials
↪        | Run a sleep job for 2 seconds and test pass if its within 1.0-3.0sec       
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| timelimit_min                   | script   | generic.local.sh        | tutorials
↪        | Run a sleep job for 2 seconds and test pass if its exceeds min time of 1.0
↪sec |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| timelimit_max                   | script   | generic.local.sh        | tutorials
↪        | Run a sleep job for 2 seconds and test pass if it's within max time: 5.0 sec
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| timelimit_min_fail              | script   | generic.local.sh        | tutorials
↪        | This test fails because it runs less than mintime of 10 second             
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| timelimit_max_fail              | script   | generic.local.sh        | tutorials
↪        | This test fails because it exceeds maxtime of 1.0 second
↪  |
```

(continues on next page)

(continued from previous page)

```
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| run_only_as_root                | script   | generic.local.bash      | tutorials     ␣
↪        | This test will only run if current user is root                             ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| spack_test                      | spack    | generic.local.sh        | spack         ␣
↪        | Install bzip2 and run spack test and report results                         ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| spack_env_directory             | spack    | generic.local.sh        | spack         ␣
↪        | Concretize m4 in a spack environment named m4                               ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| run_pre_post_commands           | spack    | generic.local.sh        | spack         ␣
↪        | Install zlib                                                                ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| remove_environment_automatically | spack    | generic.local.sh        | spack         ␣
↪        | remove spack environment automatically before creating a new environment    ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| remove_environment_explicit     | spack    | generic.local.sh        | spack         ␣
↪        | remove spack environment explicitly using the 'rm' property                 ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| spack_test_results_specs_format | spack    | generic.local.sh        | spack         ␣
↪        | Run spack test results with spec format                                     ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| concretize_m4_in_spack_env      | spack    | generic.local.sh        | spack         ␣
↪        | Concretize m4 in a spack environment named m4                               ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| spack_env_create_from_manifest  | spack    | generic.local.sh        | spack         ␣
↪        | Create spack environment from spack.yaml                                    ␣
↪  |
```

(continues on next page)

(continued from previous page)

```
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| spack_sbatch_example              | spack    | generic.local.sh        | spack          ␣
↪         | sbatch directives can be defined in spack schema                               ␣
↪   |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| add_mirror                        | spack    | generic.local.sh        | spack          ␣
↪         | Declare spack mirror                                                           ␣
↪   |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| add_mirror_in_spack_env           | spack    | generic.local.sh        | spack          ␣
↪         | Declare spack mirror in spack environment                                      ␣
↪   |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| install_zlib                      | spack    | generic.local.sh        | spack          ␣
↪         | Install zlib                                                                   ␣
↪   |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| executors_sbatch_declaration      | script   | generic.local.(bash|sh) | tutorials      ␣
↪         | Declaring env and vars by executors section                                    ␣
↪   |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| status_returncode_by_executors    | script   | generic.local.(bash|sh) | tutorials      ␣
↪         | define status and metrics per executor type.                                   ␣
↪   |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| executors_vars_env_declaration    | script   | generic.local.(bash|sh) | tutorials      ␣
↪         | Declaring env and vars by executors section                                    ␣
↪   |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| openmp_hello_c_example            | compiler | generic.local.bash      | tutorials␣
↪compile      | OpenMP Hello World C example                                                ␣
↪       |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| default_status_regex              | compiler | generic.local.bash      | tutorials␣
↪compile      | Regular expression check in stdout for gcc group
↪       |
```

(continues on next page)

(continued from previous page)

```
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| override_status_regex           | compiler | generic.local.bash      | tutorials␣
↪compile      | Override regular expression for compiler gcc/10.2.0-37fmsw7            ␣
↪       |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| override_environmentvars        | compiler | generic.local.bash      | tutorials␣
↪compile      | override default environment variables                                 ␣
↪       |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| custom_run_by_compilers         | compiler | generic.local.bash      | tutorials␣
↪compile      | Customize binary launch based on compiler                              ␣
↪       |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| vecadd_gnu_exclude              | compiler | generic.local.bash      | tutorials␣
↪compile      | Vector Addition example with GNU compilers but exclude gcc@10.2.0      ␣
↪       |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| hello_c                         | compiler | generic.local.bash      | tutorials␣
↪compile      | Hello World C Compilation                                              ␣
↪       |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| vecadd_gnu                      | compiler | generic.local.bash      | tutorials␣
↪compile      | Vector Addition example with GNU compiler                              ␣
↪       |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| hello_f                         | compiler | generic.local.bash      | tutorials␣
↪compile      | Hello World Fortran Compilation                                        ␣
↪       |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| pre_post_build_run              | compiler | generic.local.bash      | tutorials␣
↪compile      | example using pre_build, post_build, pre_run, post_run example         ␣
↪       |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| metrics_variable_compiler       | compiler | generic.local.bash      | tutorials␣
↪compile      | define metrics with compiler schema
↪       |
```

(continues on next page)

(continued from previous page)

```
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| show_lsf_user_groups            | script   | generic.local.bash      | lsf           ␣
↪        | Show information about all LSF user groups                                  ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| show_host_groups                | script   | generic.local.bash      | lsf           ␣
↪        | Show information about host groups using bmgroup                            ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| show_lsf_queues                 | script   | generic.local.bash      | lsf           ␣
↪        | Show LSF queues                                                             ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| show_lsf_queues_formatted       | script   | generic.local.bash      | lsf           ␣
↪        | Show LSF queues with formatted columns                                      ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| show_lsf_queues_current_user    | script   | generic.local.bash      | lsf           ␣
↪        | Show LSF queues available for current user                                  ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| show_lsf_configuration          | script   | generic.local.bash      | lsf           ␣
↪        | Show LSF configuration using lsinfo                                         ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| show_lsf_models                 | script   | generic.local.bash      | lsf           ␣
↪        | Show information about host models in LSF cluster                           ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| show_lsf_resources              | script   | generic.local.bash      | lsf           ␣
↪        | Show information about LSF resources                                        ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| lsf_version                     | script   | generic.local.bash      | lsf           ␣
↪        | Display lsf version using lsinfo                                            ␣
↪  |
```

(continues on next page)

(continued from previous page)

```
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| display_lsf_hosts               | script   | generic.local.bash      | lsf           ␣
↪        | Show all hosts in LSF cluster                                                 ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| display_hosts_format            | script   | generic.local.bash      | lsf           ␣
↪        | Show all hosts with column hostname and status                                ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| bhosts_version                  | script   | generic.local.bash      | lsf           ␣
↪        | display version from bhosts command                                           ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| current_user_queue              | script   | generic.local.bash      | slurm         ␣
↪        | show all current pending jobs for current user (squeue -u $USER)              ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| show_all_jobs                   | script   | generic.local.bash      | slurm         ␣
↪        | show all pending + running jobs (squeue -a)                                   ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| show_accounts                   | script   | generic.local.bash      | slurm         ␣
↪        | run sacctmgr list accounts                                                    ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| show_users                      | script   | generic.local.bash      | slurm         ␣
↪        | run sacctmgr list users                                                       ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| show_qos                        | script   | generic.local.bash      | slurm         ␣
↪        | run sacctmgr list qos                                                         ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| show_tres                       | script   | generic.local.bash      | slurm         ␣
↪        | run sacctmgr list tres                                                        ␣
↪  |
```

(continues on next page)

(continued from previous page)

```
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| slurm_config                    | script   | generic.local.bash      | slurm          ␣
↪        | run scontrol show config                                                      ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| show_partition                  | script   | generic.local.bash      | slurm          ␣
↪        | run scontrol show partition                                                   ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| nodes_state_down                | script   | generic.local.bash      | slurm          ␣
↪        | Show nodes in DOWN state                                                      ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| nodes_state_reboot              | script   | generic.local.bash      | slurm          ␣
↪        | Show nodes in REBOOT state                                                    ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| nodes_state_allocated           | script   | generic.local.bash      | slurm          ␣
↪        | Show nodes in ALLOCATED state                                                 ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| nodes_state_completing          | script   | generic.local.bash      | slurm          ␣
↪        | Show nodes in COMPLETING state                                                ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| nodes_state_idle                | script   | generic.local.bash      | slurm          ␣
↪        | Show nodes in IDLE state                                                      ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| node_down_fail_list_reason      | script   | generic.local.bash      | slurm          ␣
↪        | Show nodes DOWN, DRAINED, FAIL or FAILING and list reason                     ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
| dead_nodes                      | script   | generic.local.bash      | slurm          ␣
↪        | Show non-responding nodes                                                     ␣
↪  |
```

(continues on next page)

(continued from previous page)

```
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| get_partitions                  | script   | generic.local.bash      | slurm          ␣
↪        | Get all slurm partitions                                                    ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| sinfo_version                   | script   | generic.local.bash      | slurm          ␣
↪        | get slurm version                                                           ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| qsub_version                    | script   | generic.local.sh        | cobalt         ␣
↪        | print version for qsub command                                              ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| qselect_version                 | script   | generic.local.sh        | cobalt         ␣
↪        | print version for qselect                                                   ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| cqsub_version                   | script   | generic.local.sh        | cobalt         ␣
↪        | print version for cqsub command                                             ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| qdel_version                    | script   | generic.local.sh        | cobalt         ␣
↪        | print version for qdel command                                              ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| qmove_version                   | script   | generic.local.sh        | cobalt         ␣
↪        | print version for qmove command                                             ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| show_jobs                       | script   | generic.local.sh        | cobalt         ␣
↪        | Show all jobs in queue                                                      ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| show_queues                     | script   | generic.local.sh        | cobalt         ␣
↪        | Show all queues                                                             ␣
↪  |
```

(continues on next page)

(continued from previous page)

```
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| root_disk_usage                 | script   | generic.local.bash      | filesystem␣
↪storage     | Check root disk usage and report if it exceeds threshold                ␣
↪      |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| systemd_default_target          | script   | generic.local.bash      | system       ␣
↪        | check if default target is multi-user.target                            ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| ssh_localhost_remotecommand     | script   | generic.local.bash      | ssh          ␣
↪        | Test if ssh on localhost works and if we can run remote command.        ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| kernel_swapusage                | script   | generic.local.bash      | configuration ␣
↪        | Retrieve Kernel Swap Usage                                              ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| ulimit_filelock_unlimited       | script   | generic.local.bash      | system       ␣
↪        | Check if file lock is set to unlimited in ulimits                       ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| ulimit_cputime_unlimited        | script   | generic.local.bash      | system       ␣
↪        | Check if cputime is set to unlimited in ulimits                         ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| ulimit_stacksize_unlimited      | script   | generic.local.bash      | system       ␣
↪        | Check if stack size is set to unlimited in ulimits                      ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| ulimit_vmsize_unlimited         | script   | generic.local.bash      | system       ␣
↪        | Check virtual memory size and check if its set to unlimited             ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| ulimit_filedescriptor_4096      | script   | generic.local.bash      | system       ␣
↪        | Check if open file descriptors limit is set to 4096
↪  |
```

(continues on next page)

(continued from previous page)

```
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| ulimit_max_user_process_2048    | script   | generic.local.bash      | system       ␣
↪        | Check max number of user process limit is set to 2048                        ␣
↪  |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| runImage                        | script   | generic.local.bash      | containers␣
↪singularity | run container docker://godlovedc/lolcow                                    ␣
↪      |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| build_sif_from_dockerimage      | script   | generic.local.bash      | containers␣
↪singularity | build sif image from docker image docker://godlovedc/lolcow                ␣
↪      |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| build_sandbox_image             | script   | generic.local.bash      | containers␣
↪singularity | build sandbox image from docker image docker://godlovedc/lolcow            ␣
↪      |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| build_remoteimages              | script   | generic.local.bash      | containers␣
↪singularity | build remote hosted image from AWS                                         ␣
↪      |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| pullImage_dockerhub             | script   | generic.local.bash      | containers␣
↪singularity | Pull image docker://godlovedc/lolcow from DockerHub                        ␣
↪      |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| pullImage_sylabscloud           | script   | generic.local.bash      | containers␣
↪singularity | Pull image library://alpine:latest from Sylabs Cloud                       ␣
↪      |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| pullImage_shub                  | script   | generic.local.bash      | containers␣
↪singularity | Pull image shub://vsoch/singularity-images from SingularityHub             ␣
↪      |
+---------------------------------+----------+-------------------------+----------------
↪--------+-----------------------------------------------------------------------------
↪--+
| inspect_image                   | script   | generic.local.bash      | containers␣
↪singularity | Inspect image via 'singularity inspect'
↪      |
```

(continues on next page)

(continued from previous page)

```
+---------------------------------+----------+-------------------------+----------------
↪--------+-------------------------------------------------------------------------------
↪--+
```

buildtest will load all discovered buildspecs in a cache file (JSON) which is created upon running `buildtest buildspec find`. Any subsequent runs will read from cache and update if any new buildspecs are added. If you make changes to buildspec you should rebuild the buildspec cache by running:

```
$ buildtest buildspec find --rebuild
```

If you want to find all buildspec files in cache you can run `buildtest buildspec find --buildspec`. Shown below is an example output.

```
$ buildtest buildspec find --buildspec
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+
| buildspecs                                                                               ␣
↪                                               |
+==========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪skip_tests.yml                                 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪status_regex.yml                               |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪metrics_regex.yml                              |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪executor_regex_script.yml                      |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+
...
```

The `buildtest buildspec find --paths` will display a list of root directories buildtest will search for buildspecs when runninh `buildtest buildspec find`. One can define these directories in the configuration file or pass them via command line.

```
$ buildtest buildspec find --paths
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests
```

buildtest will search buildspecs in *buildspecs root* defined in your configuration, which is a list of directory paths to search for buildspecs. If you want to load buildspecs from a directory path, you can specify a directory via `--root` option in the format: `buildtest buildspec find --root <path> --rebuild`. buildtest will load all valid buildspecs into cache and ignore the rest. It's important to add `--rebuild` if you want to regenerate buildspec cache.

Filtering buildspec

Once you have a buildspec cache, we can query the buildspec cache for certain attributes. When you run **buildtest buildspec find** it will report all buildspecs from cache which can be difficult to process. Therefore, we have a filter option (`--filter`) to restrict our search. Let's take a look at the available filter fields that are acceptable with filter option.

```
$ buildtest buildspec find --helpfilter
Field      Description                Type
---------  -------------------------  ------
buildspec  Filter tests by buildspec  FILE
executor   Filter by executor name    STRING
tags       Filter by tag name         STRING
type       Filter by schema type      STRING
```

The `--filter` option expects an arguments in **key=value** format as follows:

```
buildtest buildspec find --filter key1=value1,key2=value2,key3=value3
```

We can filter buildspec cache by `tags=fail` which will query all tests with associated tag field in test.

```
$ buildtest buildspec find --filter tags=fail
+--------------------------+--------+------------------+----------------+----------------
↪-------------------------------------+
| name                     | type   | executor         | tags           | description   ␣
↪                                     |
+==========================+========+==================+================+================================
| exit1_fail               | script | generic.local.sh | tutorials fail | exit 1 by␣
↪default is FAIL                              |
+--------------------------+--------+------------------+----------------+----------------
↪-------------------------------------+
| returncode_list_mismatch | script | generic.local.sh | tutorials fail | exit 2 failed␣
↪since it failed to match returncode 1 |
+--------------------------+--------+------------------+----------------+----------------
↪-------------------------------------+
```

In addition, we can query buildspecs by schema type using `type` property. In this example we query all tests by **type** property

```
$ buildtest buildspec find --filter type=script
+--------------------------------+--------+-------------------------+--------------------
↪----+-----------------------------------------------------------------------------+
| name                           | type   | executor                | tags               ␣
↪    | description                                                                 |
+================================+========+=========================+====================+=========
| skip                           | script | generic.local.bash      | tutorials          ␣
↪    | This test is skipped                                                        |
+--------------------------------+--------+-------------------------+--------------------
↪----+-----------------------------------------------------------------------------+
| unskipped                      | script | generic.local.bash      | tutorials          ␣
↪    | This test is not skipped                                                    |
+--------------------------------+--------+-------------------------+--------------------
↪----+-----------------------------------------------------------------------------+
| status_regex_pass              | script | generic.local.bash      | system             ␣
↪    | Pass test based on regular expression                                       |
```

(continues on next page)

(continued from previous page)

```
+------------------------------+--------+-------------------------+--------------------
↪----+-------------------------------------------------------------------------------+
| status_regex_fail            | script | generic.local.bash      | system            ␣
↪    | Pass test based on regular expression                                         |
+------------------------------+--------+-------------------------+--------------------
↪----+-------------------------------------------------------------------------------+
| metric_regex_example         | script | generic.local.sh        | tutorials         ␣
↪    | capture result metric from output                                             |
+------------------------------+--------+-------------------------+--------------------
↪----+-------------------------------------------------------------------------------+
| executor_regex_script_schema | script | generic.local.(bash|sh) | tutorials         ␣
↪    | regular expression test with executor using script schema                     |
+------------------------------+--------+-------------------------+--------------------
↪----+-------------------------------------------------------------------------------+
| add_numbers                  | script | generic.local.bash      | tutorials         ␣
↪    | Add X+Y                                                                       |
+------------------------------+--------+-------------------------+--------------------
↪----+-------------------------------------------------------------------------------+
| python_hello                 | script | generic.local.bash      | python            ␣
↪    | Hello World python                                                            |
+------------------------------+--------+-------------------------+--------------------
↪----+-------------------------------------------------------------------------------+
| _bin_sh_shell                | script | generic.local.sh        | tutorials         ␣
↪    | /bin/sh shell example                                                         |
+------------------------------+--------+-------------------------+--------------------
↪----+-------------------------------------------------------------------------------+
...
```

Finally, we can combine multiple filter fields separated by comma, in the next example we can query all buildspecs with `tags=tutorials`, `executor=generic.local.sh`, and `type=script`

```
$ buildtest buildspec find --filter tags=tutorials,executor=generic.local.sh,type=script
+--------------------------+--------+------------------+----------------+--------------
↪-----------------------------------------------------------------+
| name                     | type   | executor         | tags           | description ␣
↪                                                                 |
+==========================+========+==================+================+==============
| metric_regex_example     | script | generic.local.sh | tutorials      | capture␣
↪result metric from output                                       |
+--------------------------+--------+------------------+----------------+--------------
↪-----------------------------------------------------------------+
| _bin_sh_shell            | script | generic.local.sh | tutorials      | /bin/sh␣
↪shell example                                                   |
+--------------------------+--------+------------------+----------------+--------------
↪-----------------------------------------------------------------+
| sh_shell                 | script | generic.local.sh | tutorials      | sh shell␣
↪example                                                         |
+--------------------------+--------+------------------+----------------+--------------
↪-----------------------------------------------------------------+
| shell_options            | script | generic.local.sh | tutorials      | shell␣
↪options                                                          |
+--------------------------+--------+------------------+----------------+--------------
↪-----------------------------------------------------------------+
```

(continues on next page)

(continued from previous page)

```
| metric_variable_assignment | script | generic.local.sh | tutorials      | capture␣
↪result metric based on variables and environment variable             |
+----------------------------+--------+------------------+----------------+-------------
↪-----------------------------------------------------------------+
| exit1_fail                 | script | generic.local.sh | tutorials fail | exit 1 by␣
↪default is FAIL                                                       |
+----------------------------+--------+------------------+----------------+-------------
↪-----------------------------------------------------------------+
| exit1_pass                 | script | generic.local.sh | tutorials pass | report exit␣
↪1 as PASS                                                             |
+----------------------------+--------+------------------+----------------+-------------
↪-----------------------------------------------------------------+
| returncode_list_mismatch   | script | generic.local.sh | tutorials fail | exit 2␣
↪failed since it failed to match returncode 1                          |
+----------------------------+--------+------------------+----------------+-------------
↪-----------------------------------------------------------------+
| returncode_int_match       | script | generic.local.sh | tutorials pass | exit 128␣
↪matches returncode 128                                                |
+----------------------------+--------+------------------+----------------+-------------
↪-----------------------------------------------------------------+
| foo_bar                    | script | generic.local.sh | tutorials      | prints␣
↪variable $FOO                                                         |
+----------------------------+--------+------------------+----------------+-------------
↪-----------------------------------------------------------------+
| timelimit_min_max          | script | generic.local.sh | tutorials      | Run a sleep␣
↪job for 2 seconds and test pass if its within 1.0-3.0sec           |
+----------------------------+--------+------------------+----------------+-------------
↪-----------------------------------------------------------------+
| timelimit_min              | script | generic.local.sh | tutorials      | Run a sleep␣
↪job for 2 seconds and test pass if its exceeds min time of 1.0 sec |
+----------------------------+--------+------------------+----------------+-------------
↪-----------------------------------------------------------------+
| timelimit_max              | script | generic.local.sh | tutorials      | Run a sleep␣
↪job for 2 seconds and test pass if it's within max time: 5.0 sec   |
+----------------------------+--------+------------------+----------------+-------------
↪-----------------------------------------------------------------+
| timelimit_min_fail         | script | generic.local.sh | tutorials      | This test␣
↪fails because it runs less than mintime of 10 second               |
+----------------------------+--------+------------------+----------------+-------------
↪-----------------------------------------------------------------+
| timelimit_max_fail         | script | generic.local.sh | tutorials      | This test␣
↪fails because it exceeds maxtime of 1.0 second                     |
+----------------------------+--------+------------------+----------------+-------------
↪-----------------------------------------------------------------+
```

We can filter output of buildspec cache by buildspec using `--filter buildspec=<path>` which expects a path to buildspec file. The buildspec must be in the cache and file path must exist in order to fetch the result. The path can be absolute or relative path.

In this next example, we will filter cache by file *tutorials/pass_returncode.yml* and use `--format name,buildspec` to format columns. The `--format buildspec` will show full path to buildspec and `name` refers to name of test. For more details on **–format** see *Format buildspec cache*.

```
$ buildtest buildspec find --filter buildspec=tutorials/pass_returncode.yml --format␣
↪name,buildspec
+--------------------------+-------------------------------------------------------------
↪-----------------------------------------------+
| name                     | buildspec                                                   ␣
↪                                                |
+==========================+=============================================================
| exit1_fail               | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/pass_returncode.yml |
+--------------------------+-------------------------------------------------------------
↪-----------------------------------------------+
| exit1_pass               | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/pass_returncode.yml |
+--------------------------+-------------------------------------------------------------
↪-----------------------------------------------+
| returncode_list_mismatch | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/pass_returncode.yml |
+--------------------------+-------------------------------------------------------------
↪-----------------------------------------------+
| returncode_int_match     | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/pass_returncode.yml |
+--------------------------+-------------------------------------------------------------
↪-----------------------------------------------+
```

Format buildspec cache

We have seen how one can filter buildspecs, but we can also configure which columns to display in the output of **buildtest buildspec find**. By default, we show a pre-selected format fields in the output, however there are more format fields available that can be configured at the command line.

The format fields are specified in comma separated format such as `buildtest buildspec find --format <field1>,<field2>,...`. You can see a list of all format fields by `--helpformat` option as shown below

```
$ buildtest buildspec find --helpformat
Field        Description
-----------  ----------------------------------
buildspec    Display name of buildspec file
description  Show description of test
executor     Display 'executor' property in test
name         Display name of test
tags         Display 'tag' property in test
type         Display 'type' property in test
```

In the next example, we utilize `--format` field with `--filter` option to show how format fields affect table columns. buildtest will display the table in order of format fields specified in command line.

```
$ buildtest buildspec find --format name,description,buildspec --filter tags=tutorials,
↪executor=generic.local.sh
+--------------------------+-------------------------------------------------------------
↪---------------------+-----------------------------------------------------------------
↪-----------------------------------------------+
| name                     | description                                                 ␣
↪                     | buildspec                                                       ␣
↪                                                |
```

(continues on next page)

(continued from previous page)

```
+============================+=================================================================================
| metric_regex_example       | capture result metric from output                                              ␣
↪                      | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/metrics_regex.yml       |
+----------------------------+---------------------------------------------------------------------------
↪---------------------+-----------------------------------------------------------------------------
↪-----------------------------------------------+
| _bin_sh_shell              | /bin/sh shell example                                                          ␣
↪                      | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/shell_examples.yml      |
+----------------------------+---------------------------------------------------------------------------
↪---------------------+-----------------------------------------------------------------------------
↪-----------------------------------------------+
| sh_shell                   | sh shell example                                                               ␣
↪                      | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/shell_examples.yml      |
+----------------------------+---------------------------------------------------------------------------
↪---------------------+-----------------------------------------------------------------------------
↪-----------------------------------------------+
| shell_options              | shell options                                                                  ␣
↪                      | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/shell_examples.yml      |
+----------------------------+---------------------------------------------------------------------------
↪---------------------+-----------------------------------------------------------------------------
↪-----------------------------------------------+
| metric_variable_assignment | capture result metric based on variables and environment␣
↪variable              | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/metrics_variable.yml    |
+----------------------------+---------------------------------------------------------------------------
↪---------------------+-----------------------------------------------------------------------------
↪-----------------------------------------------+
| exit1_fail                 | exit 1 by default is FAIL                                                      ␣
↪                      | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/pass_returncode.yml     |
+----------------------------+---------------------------------------------------------------------------
↪---------------------+-----------------------------------------------------------------------------
↪-----------------------------------------------+
| exit1_pass                 | report exit 1 as PASS                                                          ␣
↪                      | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/pass_returncode.yml     |
+----------------------------+---------------------------------------------------------------------------
↪---------------------+-----------------------------------------------------------------------------
↪-----------------------------------------------+
| returncode_list_mismatch   | exit 2 failed since it failed to match returncode 1                            ␣
↪                      | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/pass_returncode.yml     |
+----------------------------+---------------------------------------------------------------------------
↪---------------------+-----------------------------------------------------------------------------
↪-----------------------------------------------+
| returncode_int_match       | exit 128 matches returncode 128                                                ␣
↪                      | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/pass_returncode.yml     |
```

(continues on next page)

(continued from previous page)

```
+---------------------------+-----------------------------------------------------------
↪--------------------+-----------------------------------------------------------
↪-----------------------------------------------+
| foo_bar                   | prints variable $FOO                                      ␣
↪                      | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/maintainers_example.yml |
+---------------------------+-----------------------------------------------------------
↪--------------------+-----------------------------------------------------------
↪-----------------------------------------------+
| timelimit_min_max         | Run a sleep job for 2 seconds and test pass if its within␣
↪1.0-3.0sec           | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/runtime_status_test.yml |
+---------------------------+-----------------------------------------------------------
↪--------------------+-----------------------------------------------------------
↪-----------------------------------------------+
| timelimit_min             | Run a sleep job for 2 seconds and test pass if its␣
↪exceeds min time of 1.0 sec | /home/docs/checkouts/readthedocs.org/user_builds/
↪buildtest/checkouts/v0.10.2/tutorials/runtime_status_test.yml |
+---------------------------+-----------------------------------------------------------
↪--------------------+-----------------------------------------------------------
↪-----------------------------------------------+
| timelimit_max             | Run a sleep job for 2 seconds and test pass if it's␣
↪within max time: 5.0 sec   | /home/docs/checkouts/readthedocs.org/user_builds/
↪buildtest/checkouts/v0.10.2/tutorials/runtime_status_test.yml |
+---------------------------+-----------------------------------------------------------
↪--------------------+-----------------------------------------------------------
↪-----------------------------------------------+
| timelimit_min_fail        | This test fails because it runs less than mintime of 10␣
↪second                 | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/runtime_status_test.yml |
+---------------------------+-----------------------------------------------------------
↪--------------------+-----------------------------------------------------------
↪-----------------------------------------------+
| timelimit_max_fail        | This test fails because it exceeds maxtime of 1.0 second ␣
↪                      | /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/runtime_status_test.yml |
+---------------------------+-----------------------------------------------------------
↪--------------------+-----------------------------------------------------------
↪-----------------------------------------------+
```

buildtest makes use of python library named tabulate to generate these tables which are found in commands line like `buildtest buildspec find` and `buildtest report`.

Querying buildspec tags

If you want to retrieve all unique tags from all buildspecs you can run `buildtest buildspec find --tags`. This can be useful if you want to know available tags in your buildspec cache.

```
$ buildtest buildspec find --tags
+---------------+
| Tags          |
+===============+
| system        |
+---------------+
| pass          |
+---------------+
| compile       |
+---------------+
| slurm         |
+---------------+
| tutorials     |
+---------------+
| ping          |
+---------------+
| singularity   |
+---------------+
| fail          |
+---------------+
| python        |
+---------------+
| storage       |
+---------------+
| lsf           |
+---------------+
| network       |
+---------------+
| filesystem    |
+---------------+
| cobalt        |
+---------------+
| ssh           |
+---------------+
| mac           |
+---------------+
| configuration |
+---------------+
| spack         |
+---------------+
| containers    |
+---------------+
```

In addition, buildtest can group tests by tags via `buildtest buildspec find --group-by-tags` which can be useful if you want to know which tests get executed when running `buildtest build --tags`. The output is grouped by tag names, followed by name of test and description.

```
$ buildtest buildspec find --group-by-tags
```

(continues on next page)

(continued from previous page)

```
+---------------+----------------------------------+
| tags          | name                             |
+===============+==================================+
| tutorials     | skip                             |
+---------------+----------------------------------+
| tutorials     | unskipped                        |
+---------------+----------------------------------+
| tutorials     | metric_regex_example             |
+---------------+----------------------------------+
| tutorials     | executor_regex_script_schema     |
+---------------+----------------------------------+
| tutorials     | add_numbers                      |
+---------------+----------------------------------+
| tutorials     | _bin_sh_shell                    |
+---------------+----------------------------------+
| tutorials     | _bin_bash_shell                  |
+---------------+----------------------------------+
| tutorials     | bash_shell                       |
+---------------+----------------------------------+
| tutorials     | sh_shell                         |
+---------------+----------------------------------+
| tutorials     | shell_options                    |
+---------------+----------------------------------+
| tutorials     | bash_login_shebang               |
+---------------+----------------------------------+
| tutorials     | bash_nonlogin_shebang            |
+---------------+----------------------------------+
| tutorials     | metric_variable_assignment       |
+---------------+----------------------------------+
| tutorials     | selinux_disable                  |
+---------------+----------------------------------+
| tutorials     | exit1_fail                       |
+---------------+----------------------------------+
| tutorials     | exit1_pass                       |
+---------------+----------------------------------+
| tutorials     | returncode_list_mismatch         |
+---------------+----------------------------------+
| tutorials     | returncode_int_match             |
+---------------+----------------------------------+
| tutorials     | sleep                            |
+---------------+----------------------------------+
...
```

Querying buildspec executor

If you want to know all executors in your buildspec cache use the `buildtest buildspec find --executors` command. This can be useful when you want to build by executors (`buildtest build --executor`).

```
$ buildtest buildspec find --executors
+-------------------------+
| executors               |
+=========================+
| generic.local.bash      |
+-------------------------+
| generic.local.(bash|sh) |
+-------------------------+
| generic.local.csh       |
+-------------------------+
| generic.local.python    |
+-------------------------+
| generic.local.sh        |
+-------------------------+
```

Similar to `--group-by-tags`, buildtest has an option to group tests by executor using `--group-by-executor` option. This will show tests grouped by executor, name of test and test description. Shown below is an example output.

```
$ buildtest buildspec find --group-by-executor
+-------------------------+-----------------------------------+
| executor                | name                              |
+=========================+===================================+
| generic.local.bash      | skip                              |
+-------------------------+-----------------------------------+
| generic.local.bash      | unskipped                         |
+-------------------------+-----------------------------------+
| generic.local.bash      | status_regex_pass                 |
+-------------------------+-----------------------------------+
| generic.local.bash      | status_regex_fail                 |
+-------------------------+-----------------------------------+
| generic.local.bash      | add_numbers                       |
+-------------------------+-----------------------------------+
| generic.local.bash      | python_hello                      |
+-------------------------+-----------------------------------+
| generic.local.bash      | _bin_bash_shell                   |
+-------------------------+-----------------------------------+
| generic.local.bash      | bash_shell                        |
+-------------------------+-----------------------------------+
| generic.local.bash      | bash_login_shebang                |
+-------------------------+-----------------------------------+
| generic.local.bash      | bash_nonlogin_shebang             |
+-------------------------+-----------------------------------+
| generic.local.bash      | run_only_macos_distro             |
+-------------------------+-----------------------------------+
| generic.local.bash      | run_only_linux_distro             |
+-------------------------+-----------------------------------+
| generic.local.bash      | selinux_disable                   |
+-------------------------+-----------------------------------+
```

(continues on next page)

(continued from previous page)

```
| generic.local.bash      | sleep                              |
+-------------------------+------------------------------------+
...
```

Query Maintainers

When you are writing your buildspecs, you can specify the `maintainers` field to assign authors to buildspecs. buildtest can query the maintainers from the cache once buildspecs are loaded. You can retrieve all maintainers using `--maintainers` option or `-m` short option. In this example, we show all maintainers for buildspecs in buildspec cache

```
$ buildtest buildspec find --maintainers
+------------------+
| maintainers      |
+==================+
| @shahzebsiddiqui |
+------------------+
| @johndoe         |
+------------------+
| @bobsmith        |
+------------------+
```

If you want to see a breakdown of maintainers by buildspec file you can use `--maintainers-by-buildspecs` or `-mb` short option. This can be useful to get correlation between maintainers and the buildspec file.

```
$ buildtest buildspec find -mb
+------------------+-------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------------
↪-----------------------------------------------------------------------+
| maintainers      | buildspec                                                                     ␣
↪                                                                                                ␣
↪                                                                        |
+==================+===============================================================================
| @shahzebsiddiqui | ['/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/hello_world.yml', '/home/docs/checkouts/readthedocs.org/
↪user_builds/buildtest/checkouts/v0.10.2/general_tests/configuration/ulimits.yml'] |
+------------------+-------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------------
↪-----------------------------------------------------------------------+
| @johndoe         | ['/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/maintainers_example.yml']                                           ␣
↪                                                                                    |
+------------------+-------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------------
↪-----------------------------------------------------------------------+
| @bobsmith        | ['/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/maintainers_example.yml']                                           ␣
↪                                                                                    |
+------------------+-------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------------
↪-----------------------------------------------------------------------+
```

Terse Output

You can use the `--terse` option to print output of `buildtest buildspec find` in terse format that can be useful if you want to parse content of file. In example below, we will print output of tags in terse format, the first entry `tags` is the header followed by list of unique tags. The `--no-header` option can be used to disable printing of header title.

```
$ buildtest buildspec find -t --terse
tag
system
pass
compile
slurm
tutorials
ping
singularity
fail
python
storage
lsf
network
filesystem
cobalt
ssh
mac
configuration
spack
containers
```

Invalid Buildspecs - `buildtest buildspec find invalid`

buildtest will store invalid buildspecs in the cache file which can be retrieved using `buildtest buildspec find invalid`. buildtest will attempt to parse each buildspec and store error message for every buildspec. If you run without any options it will report a list of invalid buildspecs as shown below

```
$ buildtest buildspec find invalid
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| buildspecs                                                                                 ␣
↪                                        |
+===========================================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_executor.yml                    |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_tags.yml                        |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪burstbuffer_datawarp_executors.yml      |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
```

(continues on next page)

(continued from previous page)

```
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_buildspec_section.yml            |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_multiple_executor_sbatch.yml |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/env_install.yml                    |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/pbs/hostname.yml              |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/pbs/batch.yml                 |
+-------------------------------------------------------------------------------------------
↪----------------------------------------+
```

If you want to see error messages for each buildspec you can pass the `-e` or `--error` option which will display output of each buildspec followed by error message.

```
$ buildtest buildspec find invalid -e
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_executor.yml
_____________________________________________________________________________________
"[/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_executor.yml]: Unable to find executor: badexecutor in ['generic.local.bash',
↪'generic.local.sh', 'generic.local.csh', 'generic.local.zsh', 'generic.local.python']"
_____________________________________________________________________________________



/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_tags.yml
_____________________________________________________________________________________
['network', 'network'] is not valid under any of the given schemas

Failed validating 'oneOf' in schema['properties']['tags']:
    {'oneOf': [{'type': 'string'},
               {'$ref': '#/definitions/list_of_strings'}]}

On instance['tags']:
    ['network', 'network']
_____________________________________________________________________________________



/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪burstbuffer_datawarp_executors.yml
```

(continues on next page)

(continued from previous page)

```
_____________________________________________________________________________________________
'create_burst_buffer_multiple_executors' is too long

Failed validating 'maxLength' in schema['properties']['buildspecs']['propertyNames']:
    {'maxLength': 32, 'pattern': '^[A-Za-z_.][A-Za-z0-9_.]*$'}

On instance['buildspecs']:
    'create_burst_buffer_multiple_executors'
_____________________________________________________________________________________________



/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_buildspec_section.yml
_____________________________________________________________________________________________
'[/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪invalid_buildspec_section.yml]: type badscript is not known to buildtest.'
_____________________________________________________________________________________________



/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_multiple_executor_sbatch.yml
_____________________________________________________________________________________________
Additional properties are not allowed ('post_cmd' was unexpected)

Failed validating 'additionalProperties' in schema:
    {'$id': 'spack-v1.0.schema.json',
     '$schema': 'http://json-schema.org/draft-07/schema#',
     'additionalProperties': False,
     'definitions': {'env': {'additionalProperties': False,
                             'description': 'Used for managing spack '
                                            'environment using ``spack '
                                            'env`` command. ',
                             'properties': {'activate': {'additionalProperties': False,
                                                         'description': 'Activate '
                                                                        'a '
                                                                        'spack '
                                                                        'environment '
                                                                        'via '
                                                                        '``spack '
                                                                        'env '
                                                                        'activate``',
                                                         'properties': {'dir': {
↪'description': 'Activate '
↪
↪      'spack '
↪
↪      'environment '
↪
↪      'from '
↪
↪      'directory.',
```

(continues on next page)

(continued from previous page)

```
                                                                                'type':
↪'string'},
                                                                  'name': {
↪'description': 'Name '
                                                                                ␣
↪       'of '
                                                                                ␣
↪       'spack '
                                                                                ␣
↪       'environment '
                                                                                ␣
↪       'to '
                                                                                ␣
↪       'activate. '
                                                                                ␣
↪       'In '
                                                                                ␣
↪       'order '
                                                                                ␣
↪       'to '
                                                                                ␣
↪       'activate '
                                                                                ␣
↪       'spack '
                                                                                ␣
↪       'environment '
                                                                                ␣
↪       '``my-project`` '
                                                                                ␣
↪       'you '
                                                                                ␣
↪       'need '
                                                                                ␣
↪       'to '
                                                                                ␣
↪       'run '
                                                                                ␣
↪       '``spack '
                                                                                ␣
↪       'env '
                                                                                ␣
↪       'activate '
                                                                                ␣
↪       'my-project`` '
                                                                                ␣
↪       'which '
                                                                                ␣
↪       'is '
                                                                                ␣
↪       'specified '
                                                                                ␣
↪       'by '
```

(continues on next page)

(continued from previous page)

```
                                                                                ␣
↪       ``name: '
                                                                                ␣
↪       'my-project``.',
                                                                      'type':
↪'string'},
                                                           'options': {
↪'description': 'Pass '
                                                                                ␣
↪          'options '
                                                                                ␣
↪          'to '
                                                                                ␣
↪          ``spack '
                                                                                ␣
↪          'env '
                                                                                ␣
↪          'activate`` '
                                                                                ␣
↪          'command',
                                                                       'type
↪': 'string'}},
                                                  'type': 'object'},
                                       'concretize': {'description': 'If '
                                                                     ``concretize:
↪'
                                                                     'true`` '
                                                                     'is '
                                                                     'set, '
                                                                     'we '
                                                                     'will '
                                                                     'concretize '
                                                                     'spack '
                                                                     'environment '
                                                                     'by '
                                                                     'running '
                                                                     ``spack '
                                                                     'concretize '
                                                                     '-f`` '
                                                                     'otherwise '
                                                                     'this '
                                                                     'line '
                                                                     'will '
                                                                     'be '
                                                                     'ignored.',
                                                    'type': 'boolean'},
                                       'create': {'additionalProperties': False,
                                                  'description': 'Create '
                                                                 'a '
                                                                 'spack '
                                                                 'environment '
                                                                 'via '
```

(continues on next page)

(continued from previous page)

```
                                                                    '``spack '
                                                                    'env '
                                                                    'create``',
                                                     'properties': {'dir': {
↪'description': 'Create '
↪    'a '                                                                    ␣
↪    'spack '                                                                ␣
↪    'environment '                                                          ␣
↪    'in '                                                                   ␣
↪    'a '                                                                    ␣
↪    'specific '                                                             ␣
↪    'directory. '                                                           ␣
↪    'This '                                                                 ␣
↪    'will '                                                                 ␣
↪    'run '                                                                  ␣
↪    '``spack '                                                              ␣
↪    'env '                                                                  ␣
↪    'create '                                                               ␣
↪    '-d '                                                                   ␣
↪    '<dir>``. '                                                             ␣
↪    'Directory '                                                            ␣
↪    'path '                                                                 ␣
↪    'does '                                                                 ␣
↪    'not '                                                                  ␣
↪    'have '                                                                 ␣
↪    'to '                                                                   ␣
↪    'exist '                                                                ␣
↪    'prior '                                                                ␣
↪    'to '
```

(continues on next page)

(continued from previous page)

```
                                                                                ␣
↪    'execution '
                                                                                ␣
↪    'however '
                                                                                ␣
↪    'user '
                                                                                ␣
↪    'must '
                                                                                ␣
↪    'have '
                                                                                ␣
↪    'appropriate '
                                                                                ␣
↪    'ACL '
                                                                                ␣
↪    'in-order '
                                                                                ␣
↪    'to '
                                                                                ␣
↪    'create '
                                                                                ␣
↪    'directory.',
                                                                    'type':
↪'string'},
                                                                'manifest': {
↪'description': 'Specify '
                                                                                ␣
↪         'path '
                                                                                ␣
↪         'to '
                                                                                ␣
↪         'spack '
                                                                                ␣
↪         'manifest '
                                                                                ␣
↪         'file '
                                                                                ␣
↪         '(``spack.yaml`` '
                                                                                ␣
↪         'or '
                                                                                ␣
↪         '``spack.lock``) '
                                                                                ␣
↪         'when '
                                                                                ␣
↪         'creating '
                                                                                ␣
↪         'environment',
                                                                      'type
↪': 'string'},
                                                                'name': {
↪'description': 'Name '
```

(continues on next page)

(continued from previous page)

```
                                                                                ␣
↪     'of '
                                                                                ␣
↪     'spack '
                                                                                ␣
↪     'environment '
                                                                                ␣
↪     'to '
                                                                                ␣
↪     'create',
                                                                    'type':
↪'string'},
                                                                'options': {
↪'description': 'Pass '
                                                                                ␣
↪        'options '
                                                                                ␣
↪        'to '
                                                                                ␣
↪        '``spack '
                                                                                ␣
↪        'env '
                                                                                ␣
↪        'create`` '
                                                                                ␣
↪        'command',
                                                                      'type
↪': 'string'},
                                                             'remove_environment
↪': {'default': False,
                                                                                ␣
↪    'description': 'Remove '
                                                                                ␣
↪                   'existing '
                                                                                ␣
↪                   'spack '
                                                                                ␣
↪                   'environment '
                                                                                ␣
↪                   'before '
                                                                                ␣
↪                   'creating '
                                                                                ␣
↪                   'new '
                                                                                ␣
↪                   'environment. '
                                                                                ␣
↪                   'If '
                                                                                ␣
↪                   'set '
                                                                                ␣
↪                   'to '
```

(continues on next page)

(continued from previous page)

```
                                                                                ⌟
↪                    '``True`` '
                                                                                ⌟
↪                    'we '
                                                                                ⌟
↪                    'will '
                                                                                ⌟
↪                    'run '
                                                                                ⌟
↪                    '``spack '
                                                                                ⌟
↪                    'env '
                                                                                ⌟
↪                    'rm '
                                                                                ⌟
↪                    '-y '
                                                                                ⌟
↪                    '<name>``.',
                                                                                ⌟
↪    'type': 'boolean'}},
                                                 'type': 'object'},
                                       'mirror': {'$ref': 'definitions.schema.json#/
↪definitions/env',
                                                  'description': 'Add '
                                                                 'mirror '
                                                                 'in '
                                                                 'spack '
                                                                 'environment '
                                                                 'by '
                                                                 'running '
                                                                 '``spack '
                                                                 'mirror '
                                                                 'add``'},
                                       'rm': {'additionalProperties': False,
                                              'description': 'Remove '
                                                             'an '
                                                             'existing '
                                                             'spack '
                                                             'environment '
                                                             'via '
                                                             '``spack '
                                                             'env '
                                                             'rm``.',
                                              'properties': {'name': {'description
↪': 'Remove '
                                                                                ⌟
↪ 'spack '
                                                                                ⌟
↪ 'environment '
                                                                                ⌟
↪ 'by '
                                                                                ⌟
↪ 'name. '
```

(continues on next page)

(continued from previous page)

```
                                                                                ␣
↪ 'This '
                                                                                ␣
↪ 'will '
                                                                                ␣
↪ 'run '
                                                                                ␣
↪ '``spack '
                                                                                ␣
↪ 'env '
                                                                                ␣
↪ 'rm '
                                                                                ␣
↪ '-y '
                                                                                ␣
↪ '<name>``.',
                                                                  'type':
↪'string'}},
                                                 'required': ['name'],
                                                 'type': 'object'},
                                       'specs': {'$ref': 'definitions.schema.json#/
↪definitions/list_of_strings',
                                                    'description': 'Add '
                                                                   'specs '
                                                                   'to '
                                                                   'environment '
                                                                   'by '
                                                                   'running '
                                                                   '``spack '
                                                                   'add '
                                                                   '<specs>``. '
                                                                   'The '
                                                                   '``specs`` '
                                                                   'is a '
                                                                   'list '
                                                                   'of '
                                                                   'string '
                                                                   'which '
                                                                   'expect '
                                                                   'the '
                                                                   'argument '
                                                                   'to '
                                                                   'be '
                                                                   'name '
                                                                   'of '
                                                                   'spack '
                                                                   'package.'}},
                                'type': 'object'},
                    'install': {'additionalProperties': False,
                                'description': 'Install spack packages '
                                               'using ``spack install`` '
                                               'command',
```

(continues on next page)

(continued from previous page)

```
                                'properties': {'options': {'description': 'Pass '
                                                                          'options '
                                                                          'to '
                                                                          '``spack '
                                                                          'install`` '
                                                                          'command',
                                                           'type': 'string'},
                                               'specs': {'$ref': 'definitions.schema.
↪json#/definitions/list_of_strings',
                                                         'description': 'List '
                                                                        'of '
                                                                        'specs '
                                                                        'to '
                                                                        'install '
                                                                        'using '
                                                                        '``spack '
                                                                        'install`` '
                                                                        'command'}},
                                'type': 'object'},
                    'test': {'additionalProperties': False,
                             'properties': {'remove_tests': {'description': 'Remove '
                                                                            'all '
                                                                            'test '
                                                                            'suites '
                                                                            'in '
                                                                            'spack '
                                                                            'before '
                                                                            'running '
                                                                            'test '
                                                                            'via '
                                                                            '``spack '
                                                                            'test '
                                                                            'run``. '
                                                                            'If '
                                                                            'set '
                                                                            'to '
                                                                            '``True`` '
                                                                            'we '
                                                                            'will '
                                                                            'run '
                                                                            '``spack '
                                                                            'test '
                                                                            'remove '
                                                                            '-y`` '
                                                                            'which '
                                                                            'will '
                                                                            'remove '
                                                                            'all '
                                                                            'test '
                                                                            'suites.',
                                                             'type': 'boolean'},
                                            'results': {'additionalProperties': False,
```

(continues on next page)

(continued from previous page)

```
                                                    'anyOf': [{'required': ['specs
↪']},
                                                              {'required': ['suite
↪']},
                                                              {'required': ['specs',
                                                                            'suite
↪']}],
                                                    'description': 'View '
                                                                   'test '
                                                                   'results '
                                                                   'via '
                                                                   '``spack '
                                                                   'test '
                                                                   'results`` '
                                                                   'after '
                                                                   'running '
                                                                   'tests '
                                                                   'via '
                                                                   '``spack '
                                                                   'test '
                                                                   'run``. '
                                                                   'Results '
                                                                   'can '
                                                                   'be '
                                                                   'viewed '
                                                                   'using '
                                                                   'suitename '
                                                                   'or '
                                                                   'installed '
                                                                   'specs '
                                                                   'or '
                                                                   'both.',
                                                    'properties': {'option': {
↪'description': 'Pass '
                                                                             ␣
↪         'options '
                                                                             ␣
↪         'to '
                                                                             ␣
↪         '``spack '
                                                                             ␣
↪         'test '
                                                                             ␣
↪         'results``',
                                                                           'type
↪': 'string'},
                                                                   'specs': {'$ref
↪': 'definitions.schema.json#/definitions/list_of_strings',
↪'description': 'Report '
                                                                             ␣
↪        'result '
```

(continues on next page)

(continued from previous page)

```
                                                                                ⌟
↪        'by '
                                                                                ⌟
↪        'spec '
                                                                                ⌟
↪        'name '
                                                                                ⌟
↪        'by '
                                                                                ⌟
↪        'running '
                                                                                ⌟
↪        '``spack '
                                                                                ⌟
↪        'test '
                                                                                ⌟
↪        'run '
                                                                                ⌟
↪        '-- '
                                                                                ⌟
↪        '<specs>``.'},
                                                          'suite': {'$ref
↪': 'definitions.schema.json#/definitions/list_of_strings',
↪'description': 'Report '
                                                                                ⌟
↪        'results '
                                                                                ⌟
↪        'by  '
                                                                                ⌟
↪        'suite '
                                                                                ⌟
↪        'name '
                                                                                ⌟
↪        'by '
                                                                                ⌟
↪        'running '
                                                                                ⌟
↪        '``spack '
                                                                                ⌟
↪        'test '
                                                                                ⌟
↪        'results '
                                                                                ⌟
↪        '<suite>``.'}},
                                                     'type': 'object'},
                                          'run': {'additionalProperties': False,
                                                  'description': 'Run '
                                                                 'tests '
                                                                 'using '
                                                                 'spack '
                                                                 'via '
                                                                 '``spack '
```

(continues on next page)

(continued from previous page)

```
                                                                'test '
                                                                'run`` '
                                                                'command. '
                                                                'This '
                                                                'command '
                                                                'requires '
                                                                'specs '
                                                                'are '
                                                                'installed '
                                                                'in '
                                                                'your '
                                                                'spack '
                                                                'instance '
                                                                'prior '
                                                                'to '
                                                                'running '
                                                                'tests.',
                                                  'properties': {'option': {
↪'description': 'Pass '
                                                                                ␣
↪     'options '
                                                                                ␣
↪     'to '
                                                                                ␣
↪     '``spack '
                                                                                ␣
↪     'test '
                                                                                ␣
↪     'run``',
                                                                       'type':
↪'string'},
                                                                'specs': {'$ref':
↪'definitions.schema.json#/definitions/list_of_strings',
↪'description': 'List '
                                                                                ␣
↪    'of '
                                                                                ␣
↪    'specs '
                                                                                ␣
↪    'to '
                                                                                ␣
↪    'run '
                                                                                ␣
↪    'tests '
                                                                                ␣
↪    'by '
                                                                                ␣
↪    'running '
                                                                                ␣
↪    '``spack '
                                                                                ␣
↪    'test '
```

(continues on next page)

(continued from previous page)

```
                                                                                ␣
↪    'run '
                                                                                ␣
↪    '<specs>``.'}},
                                                 'required': ['specs'],
                                                 'type': 'object'}},
                              'required': ['run'],
                              'type': 'object'}},
    'description': 'The spack schema is referenced using ``type: spack`` '
                   'which is used for generating tests using spack '
                   'package manager',
    'properties': {'BB': {'$ref': 'definitions.schema.json#/definitions/BB'},
                   'DW': {'$ref': 'definitions.schema.json#/definitions/DW'},
                   'batch': {'$ref': 'definitions.schema.json#/definitions/batch'},
                   'bsub': {'$ref': 'definitions.schema.json#/definitions/bsub'},
                   'cobalt': {'$ref': 'definitions.schema.json#/definitions/cobalt'},
                   'description': {'$ref': 'definitions.schema.json#/definitions/
↪description'},
                   'env': {'$ref': 'definitions.schema.json#/definitions/env'},
                   'executor': {'$ref': 'definitions.schema.json#/definitions/executor'}
↪,
                   'executors': {'$ref': 'definitions.schema.json#/definitions/executors
↪'},
                   'metrics': {'$ref': 'definitions.schema.json#/definitions/metrics'},
                   'pbs': {'$ref': 'definitions.schema.json#/definitions/pbs'},
                   'post_cmds': {'description': 'Shell commands run after '
                                                'spack',
                                 'type': 'string'},
                   'pre_cmds': {'description': 'Shell commands run before '
                                               'spack',
                                'type': 'string'},
                   'sbatch': {'$ref': 'definitions.schema.json#/definitions/sbatch'},
                   'skip': {'$ref': 'definitions.schema.json#/definitions/skip'},
                   'spack': {'additionalProperties': False,
                             'description': 'Entry point to spack '
                                            'configuration',
                             'properties': {'compiler_find': {'description': 'Run '
                                                                             '``spack '
                                                                             'compiler '
                                                                             'find`` '
                                                                             'if '
                                                                             'set '
                                                                             'to '
                                                                             '``True``.
↪'
                                                                             'This '
                                                                             'is '
                                                                             'run '
                                                                             'right '
                                                                             'after '
                                                                             'sourcing '
                                                                             'spack '
```

(continues on next page)

(continued from previous page)

```
                                                    'startup '
                                                    'script.',
                                     'type': 'boolean'},
                          'env': {'$ref': '#definitions/env',
                                  'description': 'Manage '
                                                 'spack '
                                                 'environments '
                                                 'via '
                                                 '``spack '
                                                 'env`` '
                                                 'command'},
                          'install': {'$ref': '#definitions/install',
                                      'description': 'Install '
                                                     'spack '
                                                     'packages '
                                                     'by '
                                                     'running '
                                                     '``spack '
                                                     'install``. '},
                          'mirror': {'$ref': 'definitions.schema.json
↪#/definitions/env',
                                     'description': 'Add '
                                                    'mirror '
                                                    'by '
                                                    'running '
                                                    '``spack '
                                                    'mirror '
                                                    'add``'},
                          'root': {'type': 'string'},
                          'test': {'$ref': '#definitions/test',
                                   'description': 'Entry '
                                                  'point '
                                                  'to '
                                                  '``spack '
                                                  'test``'},
                          'verify_spack': {'default': True,
                                           'description': 'This '
                                                          'boolean '
                                                          'will '
                                                          'determine '
                                                          'if '
                                                          'we '
                                                          'need '
                                                          'to '
                                                          'check '
                                                          'for '
                                                          'file '
                                                          'existence '
                                                          'where '
                                                          'spack '
                                                          'is '
                                                          'cloned '
```

(continues on next page)

(continued from previous page)

```
                                                                    'via '
                                                                    '``root`` '
                                                                    'property '
                                                                    'and '
                                                                    'file '
                                                                    '**$SPACK_
↪ROOT/share/spack/setup-env.sh** '
                                                                    'exists. '
                                                                    'These '
                                                                    'checks '
                                                                    'can '
                                                                    'be '
                                                                    'disabled '
                                                                    'by '
                                                                    'setting '
                                                                    'this '
                                                                    'to '
                                                                    '``False`` '
                                                                    'which '
                                                                    'can '
                                                                    'be '
                                                                    'useful '
                                                                    'if '
                                                                    'you '
                                                                    'dont '
                                                                    'want '
                                                                    'buildtest '
                                                                    'to '
                                                                    'raise '
                                                                    'exception '
                                                                    'during '
                                                                    'test '
                                                                    'generation
↪'
                                                                    'process '
                                                                    'and '
                                                                    'test '
                                                                    'is '
                                                                    'skipped.',
                                                        'type': 'boolean'}},
                                'required': ['root'],
                                'type': 'object'},
                    'status': {'$ref': 'definitions.schema.json#/definitions/status'},
                    'tags': {'$ref': 'definitions.schema.json#/definitions/tags'},
                    'type': {'description': 'Select schema type to use '
                                            'when validating buildspec. '
                                            "This must be set to 'spack'",
                             'pattern': '^spack$',
                             'type': 'string'},
                    'vars': {'$ref': 'definitions.schema.json#/definitions/env'}},
    'required': ['type', 'executor', 'spack'],
    'title': 'spack schema version 1.0',
```

(continues on next page)

(continued from previous page)

```
     'type': 'object'}

On instance:
    {'batch': {'cpucount': '8', 'timelimit': '30'},
     'description': 'sbatch directives can be defined in spack schema',
     'executor': 'generic.local.(sh|bash)',
     'executors': {'generic.local.bash': {'sbatch': ['-N 8']},
                   'generic.local.sh': {'sbatch': ['-N 1']}},
     'post_cmd': 'rm -rf $SPACK_ROOT',
     'pre_cmds': 'cd /tmp\ngit clone https://github.com/spack/spack\n',
     'spack': {'env': {'activate': {'name': 'm4'},
                       'concretize': True,
                       'specs': ['m4']},
               'root': '/tmp/spack'},
     'tags': ['spack'],
     'type': 'spack'}
_______________________________________________________________________________________



/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/env_install.yml
_______________________________________________________________________________________
Additional properties are not allowed ('option' was unexpected)

Failed validating 'additionalProperties' in schema['properties']['spack']['properties'][
↪'install']:
    {'additionalProperties': False,
     'description': 'Install spack packages using ``spack install`` '
                    'command',
     'properties': {'options': {'description': 'Pass options to ``spack '
                                               'install`` command',
                                'type': 'string'},
                    'specs': {'$ref': 'definitions.schema.json#/definitions/list_of_
↪strings',
                              'description': 'List of specs to install '
                                             'using ``spack install`` '
                                             'command'}},
     'type': 'object'}

On instance['spack']['install']:
    {'option': '--keep-prefix'}
_______________________________________________________________________________________



/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/pbs/hostname.yml
_______________________________________________________________________________________
"[/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/pbs/hostname.yml]: Unable to find executor: generic.pbs.workq in ['generic.
↪local.bash', 'generic.local.sh', 'generic.local.csh', 'generic.local.zsh', 'generic.
↪local.python']"
```

(continues on next page)

(continued from previous page)

```
_____________________________________________________________________________________________



/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/pbs/batch.yml
_____________________________________________________________________________________________
"[/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/pbs/batch.yml]: Unable to find executor: generic.pbs.workq in ['generic.
↪local.bash', 'generic.local.sh', 'generic.local.csh', 'generic.local.zsh', 'generic.
↪local.python']"
_____________________________________________________________________________________________
```

Cache Summary - `buildtest buildspec summary`

The `buildtest buildspec summary` command can be used to provide a summary of the buildspec cache. This command can be used assuming your cache is built via `buildtest buildspec find`. Shown below is a summary of the cache file.

```
$ buildtest buildspec summary
Reading Buildspec Cache File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/buildspecs/cache.json


Search Paths: ['/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/tutorials', '/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/general_tests']
Total Valid Buildspecs:  65
Total Invalid Buildspecs:  8
Total Unique Tags:  19
Total Unique Executors:  5
Total Maintainers: 3
Unique Tags:  ['system', 'pass', 'compile', 'slurm', 'tutorials', 'ping', 'singularity',
↪'fail', 'python', 'storage', 'lsf', 'network', 'filesystem', 'cobalt', 'ssh', 'mac',
↪'configuration', 'spack', 'containers']
Unique Executors:  ['generic.local.bash', 'generic.local.(bash|sh)', 'generic.local.csh',
↪ 'generic.local.python', 'generic.local.sh']
Unique Maintainers: ['@shahzebsiddiqui', '@johndoe', '@bobsmith']


Tag Breakdowns
_______________________________


+---------------+---------+
| name          |   total |
+===============+=========+
| tutorials     |      49 |
+---------------+---------+
| system        |       9 |
+---------------+---------+
```

(continues on next page)

(continued from previous page)

```
| python         |       2 |
+----------------+---------+
| mac            |       2 |
+----------------+---------+
| fail           |       2 |
+----------------+---------+
| pass           |       2 |
+----------------+---------+
| network        |       2 |
+----------------+---------+
| ping           |       1 |
+----------------+---------+
| spack          |      12 |
+----------------+---------+
| compile        |      11 |
+----------------+---------+
| lsf            |      12 |
+----------------+---------+
| slurm          |      17 |
+----------------+---------+
| cobalt         |       7 |
+----------------+---------+
| filesystem     |       1 |
+----------------+---------+
| storage        |       1 |
+----------------+---------+
| ssh            |       1 |
+----------------+---------+
| configuration  |       1 |
+----------------+---------+
| containers     |       8 |
+----------------+---------+
| singularity    |       8 |
+----------------+---------+


Executor Breakdowns
_______________________________


+------------------------+---------+
| name                   |   total |
+========================+=========+
| generic.local.bash     |      78 |
+------------------------+---------+
| generic.local.sh       |      34 |
+------------------------+---------+
| generic.local.(bash|sh) |       4 |
+------------------------+---------+
| generic.local.csh      |       3 |
+------------------------+---------+
| generic.local.python   |       3 |
```

(continues on next page)

(continued from previous page)

```
+-------------------------+---------+


Test Breakdown by buildspecs
________________________________


+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| buildspec                                                                                 ␣
↪                                               |   total |
+===========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪skip_tests.yml                                 |       2 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪status_regex.yml                               |       2 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪metrics_regex.yml                              |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪executor_regex_script.yml                      |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪add_numbers.yml                                |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-hello.yml                               |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪shell_examples.yml                             |       5 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪shebang.yml                                    |       2 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪run_only_distro.yml                            |       2 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪metrics_variable.yml                           |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
```

(continues on next page)

(continued from previous page)

```
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪selinux.yml                                    |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪pass_returncode.yml                            |       4 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪sleep.yml                                      |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪csh_shell_examples.yml                         |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪tags_example.yml                               |       2 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪environment.yml                                |       3 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪hello_world.yml                                |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪maintainers_example.yml                        |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪vars.yml                                       |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪run_only_platform.yml                          |       2 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-shell.yml                               |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪runtime_status_test.yml                        |       5 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪root_user.yml                                  |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
```

(continues on next page)

(continued from previous page)

```
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_test.yml                          |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/env_create_directory.yml                |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/pre_post_cmds.yml                       |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/remove_environment_example.yml          |       2 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_test_specs.yml                    |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/concretize_m4.yml                       |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/env_create_manifest.yml                 |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/spack_sbatch.yml                        |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/mirror_example.yml                      |       2 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪spack/install_zlib.yml                        |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/executor_scheduler.yml                 |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/status_by_executors.yml                |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/multiple_executors.yml                 |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
```

(continues on next page)

(continued from previous page)

```
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/openmp_hello.yml                    |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/compiler_status_regex.yml           |       2 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/envvar_override.yml                 |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/custom_run.yml                      |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/compiler_exclude.yml                |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/gnu_hello_c.yml                     |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/vecadd.yml                          |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/gnu_hello_fortran.yml               |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/pre_post_build_run.yml              |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪compilers/metrics_openmp.yml                  |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/lsf/bugroup.yml                     |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/lsf/bmgroups.yml                    |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/lsf/bqueues.yml                     |       3 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
```

(continues on next page)

(continued from previous page)

```
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/lsf/lsinfo.yml                    |       4 |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/lsf/bhosts.yml                    |       3 |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/slurm/squeue.yml                  |       2 |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/slurm/sacctmgr.yml                |       4 |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/slurm/scontrol.yml                |       2 |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/slurm/sinfo.yml                   |       9 |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/cobalt/commands.yml               |       7 |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/disk_usage.yml            |       1 |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/systemd-default-target.yml |       1 |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/ssh_localhost.yml         |       1 |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/kernel_state.yml          |       1 |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/ulimits.yml               |       6 |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/containers/singularity/run.yml          |       1 |
+-------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
```

(continues on next page)

(continued from previous page)

```
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/containers/singularity/build.yml         |       3 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/containers/singularity/pull.yml          |       3 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/containers/singularity/inspect.yml       |       1 |
+-------------------------------------------------------------------------------------------
↪-----------------------------------------------+---------+
```

Validate Buildspecs - `buildtest buildspec validate`

buildtest can validate buildspecs through the `buildtest buildspec validate` command which provides analogous options for `buildtest build` for selecting buildspecs such as `-b`, `-e`, `-t` and `-e`. This command can be used to validate buildspecs with the JSON Schema which can be useful if you are writing a buildspec and want to validate the buildspec without running the test.

Shown below are the available command options.

```
$ buildtest buildspec validate --help
usage: buildtest [options] [COMMANDS] buildspec validate [-h] [-b BUILDSPEC] [-x␣
↪EXCLUDE] [-e EXECUTOR] [-t TAG]

optional arguments:
  -h, --help            show this help message and exit
  -b BUILDSPEC, --buildspec BUILDSPEC
                        Specify path to buildspec (file, or directory) to validate
  -x EXCLUDE, --exclude EXCLUDE
                        Specify path to buildspec to exclude (file or directory) during␣
↪validation
  -e EXECUTOR, --executor EXECUTOR
                        Specify buildspecs by executor name to validate
  -t TAG, --tag TAG     Specify buildspecs by tag name to validate
```

The *-b* option can be used to specify path to buildspec file or directory to validate buildspecs. If its a directory, buildtest will traverse all directories recursively and find any **.yml** file extensions and attempt to validate each buildspec. Shown below is an example output of what it may look like

```
$ buildtest buildspec validate -b tutorials/vars.yml
Processing buildspec: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/vars.yml
All buildspecs passed validation!!!
```

If buildtest detects an error during validation, the error message will be displayed to screen as we see in this example

```
$ buildtest buildspec validate -b tutorials/invalid_tags.yml

file:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/invalid_tags.yml
```

(continues on next page)

(continued from previous page)

```
_____________________________________________________________________________
['network', 'network'] is not valid under any of the given schemas

Failed validating 'oneOf' in schema['properties']['tags']:
    {'oneOf': [{'type': 'string'},
               {'$ref': '#/definitions/list_of_strings'}]}

On instance['tags']:
    ['network', 'network']


Processing buildspec: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/invalid_tags.yml
There were 1 buildspecs that failed validation
```

Similarly we can search buildspecs based on tags if you want to validate a group of buildspecs using the `-t` option. We can append `-t` option multiple times to search by multiple tag names. In this next example, we will validate all buildspecs for **python** and **pass** tags.

```
$ buildtest buildspec validate -t python -t pass
Processing buildspec: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/python-hello.yml
Processing buildspec: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/pass_returncode.yml
Processing buildspec: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/python-shell.yml
All buildspecs passed validation!!!
```

Finally we can also search by executors using the `-e` option which can be appended to search by multiple executors.

```
$ buildtest buildspec validate -e generic.local.csh
Processing buildspec: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/environment.yml
Processing buildspec: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/csh_shell_examples.yml
All buildspecs passed validation!!!
```

Edit buildspecs `buildtest edit`

The `buildtest edit` command can be used to edit buildspec with your preferred editor defined by environment **$EDITOR**, if this environment is not set buildtest will resort to `vim`. Once you make change, the file will be written back to disk and validated with the jsonschema. If it passes validation you will see a message such as follows:

```
$ buildtest edit tutorials/vars.yml
Writing file: /Users/siddiq90/Documents/GitHubDesktop/buildtest.tmp/tutorials/vars.yml
/Users/siddiq90/Documents/GitHubDesktop/buildtest.tmp/tutorials/vars.yml is valid
```

If there is an error during validation, buildtest will print the exception to stdout and it is your responsibility to fix the buildspec based on error message. In example below, the user provided an invalid value for `type` field.

```
$ buildtest edit tutorials/vars.yml
Writing file: /Users/siddiq90/Documents/GitHubDesktop/buildtest.tmp/tutorials/vars.yml
```

(continues on next page)

(continued from previous page)

```
Traceback (most recent call last):
  File "/Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest", line 17, in
↪<module>
    buildtest.main.main()
  File "/Users/siddiq90/Documents/GitHubDesktop/buildtest/buildtest/main.py", line 103,␣
↪in main
    edit_buildspec(args.buildspec, configuration)
  File "/Users/siddiq90/Documents/GitHubDesktop/buildtest/buildtest/cli/edit.py", line␣
↪23, in edit_buildspec
    BuildspecParser(buildspec, be)
  File "/Users/siddiq90/Documents/GitHubDesktop/buildtest/buildtest/buildsystem/parser.py
↪", line 74, in __init__
    self._validate()
  File "/Users/siddiq90/Documents/GitHubDesktop/buildtest/buildtest/buildsystem/parser.py
↪", line 185, in _validate
    self._check_schema_type(test)
  File "/Users/siddiq90/Documents/GitHubDesktop/buildtest/buildtest/buildsystem/parser.py
↪", line 101, in _check_schema_type
    raise BuildspecError(self.buildspec, msg)
buildtest.exceptions.BuildspecError: '[/Users/siddiq90/Documents/GitHubDesktop/buildtest.
↪tmp/tutorials/vars.yml]: type script123 is not known to buildtest.'
```

Show buildspec `buildtest buildspec show`

buildtest can display content of buildspec file given a test name via `buildtest buildspec show` command which expects a positional argument that is the name of test. This can be quick way to see content of buildspec without remembering the full path to the buildspec.

In this next example, we will instruct buildtest to show content of buildspec for test name *python_hello*.

```
$ buildtest buildspec show python_hello
version: "1.0"
buildspecs:
  python_hello:
    type: script
    description: Hello World python
    executor: generic.local.bash
    tags: python
    run: python hello.py



buildspec:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/python-hello.yml
```

There is bash completion for this command which will show list of test names available in the cache assuming you have run `buildtest buildspec find`. If you specify an invalid test name you will get an error followed by list of tests that are available in the cache

```
$ buildtest buildspec show XYZ123!
Traceback (most recent call last):
  File "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/bin/
↪buildtest", line 17, in <module>
```

(continues on next page)

(continued from previous page)

```
    buildtest.main.main()
  File "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/main.py", line 118, in main
    show_buildspecs(name=args.name, configuration=configuration)
  File "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/cli/buildspec.py", line 964, in show_buildspecs
    f"{name} not in cache. Please select one of the following test: {cache.get_names()}"
buildtest.exceptions.BuildTestError: "XYZ123! not in cache. Please select one of the␣
↪following test: ['skip', 'unskipped', 'status_regex_pass', 'status_regex_fail',
↪'metric_regex_example', 'executor_regex_script_schema', 'add_numbers', 'python_hello',
↪'_bin_sh_shell', '_bin_bash_shell', 'bash_shell', 'sh_shell', 'shell_options', 'bash_
↪login_shebang', 'bash_nonlogin_shebang', 'run_only_macos_distro', 'run_only_linux_
↪distro', 'metric_variable_assignment', 'selinux_disable', 'exit1_fail', 'exit1_pass',
↪'returncode_list_mismatch', 'returncode_int_match', 'sleep', 'csh_shell', 'string_tag',
↪ 'list_of_strings_tags', 'bash_env_variables', 'csh_env_declaration', 'tcsh_env_
↪declaration', 'hello_world', 'foo_bar', 'variables_bash', 'run_only_platform_darwin',
↪'run_only_platform_linux', 'circle_area', 'timelimit_min_max', 'timelimit_min',
↪'timelimit_max', 'timelimit_min_fail', 'timelimit_max_fail', 'run_only_as_root',
↪'spack_test', 'spack_env_directory', 'run_pre_post_commands', 'remove_environment_
↪automatically', 'remove_environment_explicit', 'spack_test_results_specs_format',
↪'concretize_m4_in_spack_env', 'spack_env_create_from_manifest', 'spack_sbatch_example',
↪ 'add_mirror', 'add_mirror_in_spack_env', 'install_zlib', 'executors_sbatch_declaration
↪', 'status_returncode_by_executors', 'executors_vars_env_declaration', 'openmp_hello_c_
↪example', 'default_status_regex', 'override_status_regex', 'override_environmentvars',
↪'custom_run_by_compilers', 'vecadd_gnu_exclude', 'hello_c', 'vecadd_gnu', 'hello_f',
↪'pre_post_build_run', 'metrics_variable_compiler', 'show_lsf_user_groups', 'show_host_
↪groups', 'show_lsf_queues', 'show_lsf_queues_formatted', 'show_lsf_queues_current_user
↪', 'show_lsf_configuration', 'show_lsf_models', 'show_lsf_resources', 'lsf_version',
↪'display_lsf_hosts', 'display_hosts_format', 'bhosts_version', 'current_user_queue',
↪'show_all_jobs', 'show_accounts', 'show_users', 'show_qos', 'show_tres', 'slurm_config
↪', 'show_partition', 'nodes_state_down', 'nodes_state_reboot', 'nodes_state_allocated',
↪ 'nodes_state_completing', 'nodes_state_idle', 'node_down_fail_list_reason', 'dead_
↪nodes', 'get_partitions', 'sinfo_version', 'qsub_version', 'qselect_version', 'cqsub_
↪version', 'qdel_version', 'qmove_version', 'show_jobs', 'show_queues', 'root_disk_usage
↪', 'systemd_default_target', 'ssh_localhost_remotecommand', 'kernel_swapusage',
↪'ulimit_filelock_unlimited', 'ulimit_cputime_unlimited', 'ulimit_stacksize_unlimited',
↪'ulimit_vmsize_unlimited', 'ulimit_filedescriptor_4096', 'ulimit_max_user_process_2048
↪', 'runImage', 'build_sif_from_dockerimage', 'build_sandbox_image', 'build_remoteimages
↪', 'pullImage_dockerhub', 'pullImage_sylabscloud', 'pullImage_shub', 'inspect_image']"
```

3.4.3 Query Test Report

buildtest keeps track of all tests and results in a JSON file. This file is read by **buildtest report** command to extract certain fields from JSON file and display them in table format. We use python tabulate library for pretty print data in tables. Shown below is command usage to query test reports.

```
$ buildtest report --help
usage: buildtest [options] [COMMANDS] report [-h] [--filter FILTER] [--format FORMAT] [--
↪helpfilter] [--helpformat]
                                             [--latest] [--oldest] [-n] [-r REPORT] [-t]
                                             ...
```

(continues on next page)

(continued from previous page)

```
optional arguments:
  -h, --help            show this help message and exit
  --filter FILTER       Filter report by filter fields. The filter fields must be a␣
↪key=value pair and multiple fields
                        can be comma separated in the following format: --filter␣
↪key1=val1,key2=val2 . For list of
                        filter fields run: --helpfilter.
  --format FORMAT       format field for printing purposes. For more details see --
↪helpformat for list of available
                        fields. Fields must be separated by comma (usage: --format
↪<field1>,<field2>,...)
  --helpfilter          List available filter fields to be used with --filter option
  --helpformat          List of available format fields
  --latest              Retrieve latest record of particular test
  --oldest              Retrieve oldest record of particular test
  -n, --no-header       Don't print headers column used with terse option (--terse).
  -r REPORT, --report REPORT
                        Specify a report file to read
  -t, --terse           Print output in machine readable format

subcommands:
  Fetch test results from report file and print them in table format


    clear               delete report file
    list                List all report files
    summary             Summarize test report
```

You may run `buildtest report` without any option, and buildtest will display **all** test results with default format fields. To see a list of all format fields, click *here*.

```
$ buildtest report
Reading report file: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/report.json

+------------------------------+----------+---------+--------------+--------------------
↪--+---------------------+-----------+--------------------+-----------------------------
↪-------------------------------------------------------------------------------------
↪-----------------+
| name                         | id       | state   |   returncode | starttime          ␣
↪  | endtime             |   runtime | tags               | buildspec                  ␣
↪                                                                                      ␣
↪                 |
+==============================+==========+=========+==============+====================+============
| variables_bash               | 1c4ba849 | PASS    |            0 | 2021/08/16␣
↪22:11:15 | 2021/08/16 22:11:15 |  0.010175 | tutorials          | /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/vars.yml            ␣
↪                         |
+------------------------------+----------+---------+--------------+--------------------
↪--+---------------------+-----------+--------------------+-----------------------------
↪-------------------------------------------------------------------------------------
↪-----------------+
```

(continues on next page)

(continued from previous page)

```
| variables_bash                  | 223864f7 | PASS    |            0 | 2021/08/16␣
↪22:11:44 | 2021/08/16 22:11:44 |  0.008019 | tutorials          | /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/vars.yml           ␣
↪                         |
+---------------------------------+----------+---------+--------------+-------------------
↪--+---------------------+-----------+--------------------+----------------------------
↪---------------------------------------------------------------------------------------
↪-----------------+
| exit1_fail                      | bdd8e11b | FAIL    |            1 | 2021/08/16␣
↪22:11:16 | 2021/08/16 22:11:16 |  0.005038 | tutorials fail     | /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/pass_returncode.yml ␣
↪                         |
+---------------------------------+----------+---------+--------------+-------------------
↪--+---------------------+-----------+--------------------+----------------------------
↪---------------------------------------------------------------------------------------
↪-----------------+
| exit1_fail                      | d2d34e26 | FAIL    |            1 | 2021/08/16␣
↪22:11:46 | 2021/08/16 22:11:46 |  0.004837 | tutorials fail     | /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/pass_returncode.yml ␣
↪                         |
+---------------------------------+----------+---------+--------------+-------------------
↪--+---------------------+-----------+--------------------+----------------------------
↪---------------------------------------------------------------------------------------
↪-----------------+
| exit1_fail                      | 91fe0aaf | FAIL    |            1 | 2021/08/16␣
↪22:11:46 | 2021/08/16 22:11:46 |  0.004752 | tutorials fail     | /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/pass_returncode.yml ␣
↪                         |
+---------------------------------+----------+---------+--------------+-------------------
↪--+---------------------+-----------+--------------------+----------------------------
↪---------------------------------------------------------------------------------------
↪-----------------+
| exit1_fail                      | 5544d8dc | FAIL    |            1 | 2021/08/16␣
↪22:11:50 | 2021/08/16 22:11:50 |  0.005175 | tutorials fail     | /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/pass_returncode.yml ␣
↪                         |
+---------------------------------+----------+---------+--------------+-------------------
↪--+---------------------+-----------+--------------------+----------------------------
↪---------------------------------------------------------------------------------------
↪-----------------+
| exit1_fail                      | 65bfeef1 | FAIL    |            1 | 2021/08/16␣
↪22:11:50 | 2021/08/16 22:11:50 |  0.004241 | tutorials fail     | /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/pass_returncode.yml ␣
↪                         |
+---------------------------------+----------+---------+--------------+-------------------
↪--+---------------------+-----------+--------------------+----------------------------
↪---------------------------------------------------------------------------------------
↪-----------------+
| exit1_pass                      | ad5aea49 | PASS    |            1 | 2021/08/16␣
↪22:11:16 | 2021/08/16 22:11:16 |  0.006459 | tutorials pass     | /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/pass_returncode.yml ␣
↪                         |
```

(continues on next page)

(continued from previous page)

```
...
```

Format Reports (`buildtest report --format`)

Available Format Fields (`buildtest report --helpformat`)

The **buildtest report** command displays a default format fields that can be changed using the `--format` option. The report file (JSON) contains many more fields and we expose some of the fields with the **–format** option. To see a list of available format fields you can run `buildtest report --helpformat`. This option will list all format fields with their description.

```
$ buildtest report --helpformat
Fields      Description
----------  ------------------------------------------------------------------
buildspec   Buildspec file
command     Command executed
compiler    Retrieve compiler used for test (applicable for compiler schema)
endtime     End Time for Test in date format
errfile     Error File
executor    Executor name
hostname    Retrieve hostname of machine where job was submitted from
full_id     Full qualified unique build identifier
id          Unique Build Identifier (abbreviated)
metrics     List all metrics if applicable
name        Name of test defined in buildspec
outfile     Output file
returncode  Return Code from Test Execution
runtime     Total runtime in seconds
schemafile  Schema file used for validation
starttime   Start Time of test in date format
state       Test State reported by buildtest (PASS/FAIL)
tags        Tag name
testroot    Root of test directory
testpath    Path to test
user        Get user who submitted job
```

Format Field Usage

The `--format` field are specified in comma separated format (i.e `--format <field1>,<field2>`). In this example we format table by fields `--format id,executor,state,returncode`.

```
$ buildtest report --format name,id,executor,state,returncode
Reading report file: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/report.json

+--------------------------------+----------+----------------------+---------+-----------
↪---+
| name                           | id       | executor             | state   | ␣
↪returncode |
```

(continues on next page)

(continued from previous page)

```
+================================+==========+======================+=========+==============+
| variables_bash                 | 1c4ba849 | generic.local.bash   | PASS    |            ␣
↪ 0 |
+--------------------------------+----------+----------------------+---------+-----------
↪---+
| variables_bash                 | 223864f7 | generic.local.bash   | PASS    |            ␣
↪ 0 |
+--------------------------------+----------+----------------------+---------+-----------
↪---+
| exit1_fail                     | bdd8e11b | generic.local.sh     | FAIL    |            ␣
↪ 1 |
+--------------------------------+----------+----------------------+---------+-----------
↪---+
| exit1_fail                     | d2d34e26 | generic.local.sh     | FAIL    |            ␣
↪ 1 |
+--------------------------------+----------+----------------------+---------+-----------
↪---+
| exit1_fail                     | 91fe0aaf | generic.local.sh     | FAIL    |            ␣
↪ 1 |
+--------------------------------+----------+----------------------+---------+-----------
↪---+
| exit1_fail                     | 5544d8dc | generic.local.sh     | FAIL    |            ␣
↪ 1 |
+--------------------------------+----------+----------------------+---------+-----------
↪---+
| exit1_fail                     | 65bfeef1 | generic.local.sh     | FAIL    |            ␣
↪ 1 |
+--------------------------------+----------+----------------------+---------+-----------
↪---+
| exit1_pass                     | ad5aea49 | generic.local.sh     | PASS    |            ␣
↪ 1 |
+--------------------------------+----------+----------------------+---------+-----------
↪---+
...
```

Filter Reports (`buildtest report --filter`)

The **buildtest report** command will display all tests results, which can be quite long depending on number of tests so therefore we need a mechanism to filter the test results. The `--filter` option can be used to filter out tests in the output based on filter fields. First, lets see the available filter fields by run `buildtest report --helpfilter` which shows a list of filter fields and their description.

```
$ buildtest report --helpfilter
Filter Fields    Description                Expected Value
---------------  -------------------------  ----------------
buildspec        Filter by buildspec file   FILE
name             Filter by test name        STRING
executor         Filter by executor name    STRING
state            Filter by test state       PASS/FAIL
tags             Filter tests by tag name   STRING
returncode       Filter tests by returncode INT
```

The `--filter` option expects arguments in **key=value** format. You can specify multiple filter delimited by comma. buildtest will treat multiple filters as logical **AND** operation. The filter option can be used with `--format` field. Let's see some examples to illustrate the point.

Filter by returncode (`--filter returncode`)

If you want to retrieve all tests with a given returncode, we can use the **returncode** property. For instance, let's retrieve all tests with returncode of 2 by setting `--filter returncode=2`.

```
$ buildtest report --filter returncode=2 --format=name,id,returncode
Reading report file: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/report.json

+--------------------------+----------+--------------+
| name                     | id       |   returncode |
+==========================+==========+==============+
| returncode_list_mismatch | dd25afaf |            2 |
+--------------------------+----------+--------------+
| returncode_list_mismatch | 504a0b7b |            2 |
+--------------------------+----------+--------------+
| returncode_list_mismatch | c5e18c4a |            2 |
+--------------------------+----------+--------------+
| returncode_list_mismatch | 0dc69200 |            2 |
+--------------------------+----------+--------------+
| returncode_list_mismatch | bb66d1f5 |            2 |
+--------------------------+----------+--------------+
```

Note: buildtest automatically converts returncode to integer when matching returncode, so `--filter returncode="2"` will work too

Filter by test name (`--filter name`)

If you want to filter by test name, use the **name** attribute in filter option. Let's assume we want to filter all tests by name `exit1_pass`, this can be achieved by setting filter field as follows: `--filter name=exit1_pass`. Shown below is an example using **name** filter field to filter test results.

```
$ buildtest report --filter name=exit1_pass --format=name,id,returncode,state
Reading report file: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/report.json

+------------+----------+--------------+---------+
| name       | id       |   returncode | state   |
+============+==========+==============+=========+
| exit1_pass | ad5aea49 |            1 | PASS    |
+------------+----------+--------------+---------+
| exit1_pass | f150bc31 |            1 | PASS    |
+------------+----------+--------------+---------+
| exit1_pass | e9a8bc57 |            1 | PASS    |
+------------+----------+--------------+---------+
| exit1_pass | a0c6f68f |            1 | PASS    |
```

(continues on next page)

(continued from previous page)

```
+------------+----------+--------------+---------+
| exit1_pass | 1e4c9d01 |            1 | PASS    |
+------------+----------+--------------+---------+
| exit1_pass | ae27ef4a |            1 | PASS    |
+------------+----------+--------------+---------+
```

Filter by buildspec (`--filter buildspec`)

Likewise, we can filter results by buildspec file using **buildspec** attribute via `--filter buildspec=<file>`. The **buildspec** attribute must resolve to a file path which can be relative or absolute path. buildtest will resolve path (absolute path) and find the appropriate tests that belong to the buildspec file. If file doesn't exist or is not found in cache it will raise an error.

```
$ buildtest report --filter buildspec=tutorials/python-hello.yml --format=name,id,state,
↪buildspec
Reading report file: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/report.json

+--------------+----------+---------+-------------------------------------------------------
↪-----------------------------------------------------+
| name         | id       | state   | buildspec                                             ␣
↪                                                     |
+==============+==========+=========+=======================================================================
| python_hello | 75d6ff53 | PASS    | /home/docs/checkouts/readthedocs.org/user_builds/
↪buildtest/checkouts/v0.10.2/tutorials/python-hello.yml |
+--------------+----------+---------+-------------------------------------------------------
↪-----------------------------------------------------+
| python_hello | 3af45be7 | PASS    | /home/docs/checkouts/readthedocs.org/user_builds/
↪buildtest/checkouts/v0.10.2/tutorials/python-hello.yml |
+--------------+----------+---------+-------------------------------------------------------
↪-----------------------------------------------------+
```

Filter by test state (`--filter state`)

If you want to filter results by test state, use the **state** property. This can be useful if you want to know all pass or failed tests. The state property expects value of `[PASS|FAIL]` since these are the two recorded test states marked by buildtest. We can also pass multiple filter fields for instance if we want to find all **FAIL** tests for executor **generic.local.sh** we can do the following.

```
$ buildtest report --filter state=FAIL,executor=generic.local.sh --format=name,id,state,
↪executor
Reading report file: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/report.json

+-------------------------------+----------+---------+------------------+
| name                          | id       | state   | executor         |
+===============================+==========+=========+==================+
| exit1_fail                    | bdd8e11b | FAIL    | generic.local.sh |
+-------------------------------+----------+---------+------------------+
```

(continues on next page)

(continued from previous page)

```
| exit1_fail                     | d2d34e26 | FAIL    | generic.local.sh |
+--------------------------------+----------+---------+------------------+
| exit1_fail                     | 91fe0aaf | FAIL    | generic.local.sh |
+--------------------------------+----------+---------+------------------+
| exit1_fail                     | 5544d8dc | FAIL    | generic.local.sh |
+--------------------------------+----------+---------+------------------+
| exit1_fail                     | 65bfeef1 | FAIL    | generic.local.sh |
+--------------------------------+----------+---------+------------------+
| returncode_list_mismatch       | dd25afaf | FAIL    | generic.local.sh |
+--------------------------------+----------+---------+------------------+
| returncode_list_mismatch       | 504a0b7b | FAIL    | generic.local.sh |
+--------------------------------+----------+---------+------------------+
| returncode_list_mismatch       | c5e18c4a | FAIL    | generic.local.sh |
+--------------------------------+----------+---------+------------------+
| returncode_list_mismatch       | 0dc69200 | FAIL    | generic.local.sh |
+--------------------------------+----------+---------+------------------+
| returncode_list_mismatch       | bb66d1f5 | FAIL    | generic.local.sh |
+--------------------------------+----------+---------+------------------+
| timelimit_min_fail             | 73a48836 | FAIL    | generic.local.sh |
+--------------------------------+----------+---------+------------------+
| timelimit_max_fail             | 1f869483 | FAIL    | generic.local.sh |
+--------------------------------+----------+---------+------------------+
| status_returncode_by_executors | 25ae782d | FAIL    | generic.local.sh |
+--------------------------------+----------+---------+------------------+
```

Filter Exception Cases

The `returncode` filter field expects an integer value, so if you try a non-integer returncode you will get the following message

```
$ buildtest report --filter returncode=1.5
Traceback (most recent call last):
  File "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/bin/
↪buildtest", line 17, in <module>
    buildtest.main.main()
  File "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/main.py", line 142, in main
    report_cmd(args)
  File "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/cli/report.py", line 570, in report_cmd
    report_file=args.report,
  File "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/cli/report.py", line 85, in __init__
    self._check_filter_fields()
  File "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/cli/report.py", line 119, in _check_filter_fields
    f"Invalid returncode:{self.filter[key]} must be an integer"
buildtest.exceptions.BuildTestError: 'Invalid returncode:1.5 must be an integer'
```

The `state` filter field expects value of `PASS` or `FAIL` so if you specify an invalid state you will get an error as follows.

```
$ buildtest report --filter state=UNKNOWN
filter argument 'state' must be 'PASS' or 'FAIL' got value UNKNOWN
```

The `buildspec` field expects a valid file path, it can be an absolute or relative path, buildtest will resolve absolute path and check if file exist and is in the report file. If it's an invalid file we get an error such as

```
$ buildtest report --filter buildspec=/path/to/invalid.yml
Invalid File Path for filter field 'buildspec': /path/to/invalid.yml
```

You may have a valid filepath for buildspec filter field such as `$BUILDTEST_ROOT/tutorials/invalid_executor.yml`, but there is no record of a test in the report cache because this test wasn't run. In this case you will get the following message.

```
$ buildtest report --filter buildspec=$BUILDTEST_ROOT/tutorials/invalid_executor.yml
buildspec file: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/tutorials/invalid_executor.yml not found in cache
```

Find Latest or Oldest test

We can search for oldest or latest test for any given test. This can be useful if you want to see first or last test run. If you want to retrieve the oldest test you can use `--oldest` option. buildtest will append tests, therefore last record in dictionary will be latest record, similarly first record is the oldest record.

Let's take a look at this example, we filter by test name `hello_f` which retrieves three entries. Now let's filter by oldest record by specifying **–oldest** option and it will retrieve the first record which is test id **349f3ada**.

```
$ buildtest report --filter name=hello_f --format name,id,starttime
 Reading Report File: /Users/siddiq90/.buildtest/report.json

 +---------+----------+---------------------+
 | name    | id       | starttime           |
 +=========+==========+=====================+
 | hello_f | 349f3ada | 2021/02/11 18:13:08 |
 +---------+----------+---------------------+
 | hello_f | ecd4a3f2 | 2021/02/11 18:13:18 |
 +---------+----------+---------------------+
 | hello_f | 5c87978b | 2021/02/11 18:13:33 |
 +---------+----------+---------------------+

 $ buildtest report --filter name=hello_f --format name,id,starttime --oldest
 Reading Report File: /Users/siddiq90/.buildtest/report.json

 +---------+----------+---------------------+
 | name    | id       | starttime           |
 +=========+==========+=====================+
 | hello_f | 349f3ada | 2021/02/11 18:13:08 |
 +---------+----------+---------------------+
```

If you want to retrieve the latest test result you can use `--latest` option which will retrieve the last record, in the same example we will retrieve test id *5c87978b*.

```
$ buildtest report --filter name=hello_f --format name,id,starttime --latest
Reading Report File: /Users/siddiq90/.buildtest/report.json
```

(continues on next page)

(continued from previous page)

```
+---------+----------+---------------------+
| name    | id       | starttime           |
+=========+==========+=====================+
| hello_f | 5c87978b | 2021/02/11 18:13:33 |
+---------+----------+---------------------+
```

You may combine **–oldest** and **–latest** options in same command, in this case buildtest will retrieve the first and last record of every test.

```
$ buildtest report --format name,id,starttime --oldest --latest | more
Reading Report File: /Users/siddiq90/.buildtest/report.json

+------------------------------+----------+---------------------+
| name                         | id       | starttime           |
+==============================+==========+=====================+
| variables_bash               | 750f48bc | 2021/02/11 18:13:03 |
+------------------------------+----------+---------------------+
| variables_bash               | 1bdfd403 | 2021/02/11 18:13:32 |
+------------------------------+----------+---------------------+
| ulimit_filelock_unlimited    | b7b852e4 | 2021/02/11 18:13:03 |
+------------------------------+----------+---------------------+
| ulimit_filelock_unlimited    | 56345a43 | 2021/02/11 18:13:18 |
+------------------------------+----------+---------------------+
```

Terse Output

If you would like to parse the result of `buildtest report`, you can use the `--terse` or `-t` option which will print the report in machine readable format that shows the name of each column followed by each entry. Each entry is delimited by PIPE symbol (`|`). The `--terse` option works with `--format` and `--filter` option. In this next example, we report all FAIL tests in terse output. The first line is the header of tables followed by output, if you want to disable output of header you can use `--no-header` option.

```
$ buildtest report --filter state=FAIL --format=name,id,state -t
name|id|state
exit1_fail|bdd8e11b|FAIL
exit1_fail|d2d34e26|FAIL
exit1_fail|91fe0aaf|FAIL
exit1_fail|5544d8dc|FAIL
exit1_fail|65bfeef1|FAIL
returncode_list_mismatch|dd25afaf|FAIL
returncode_list_mismatch|504a0b7b|FAIL
returncode_list_mismatch|c5e18c4a|FAIL
returncode_list_mismatch|0dc69200|FAIL
returncode_list_mismatch|bb66d1f5|FAIL
status_regex_fail|4a85e442|FAIL
timelimit_min_fail|73a48836|FAIL
timelimit_max_fail|1f869483|FAIL
status_returncode_by_executors|25ae782d|FAIL
ulimit_stacksize_unlimited|0e951b96|FAIL
ulimit_stacksize_unlimited|de1f6873|FAIL
```

(continues on next page)

(continued from previous page)

```
ulimit_filedescriptor_4096|c37071b3|FAIL
ulimit_filedescriptor_4096|6f0b9f41|FAIL
ulimit_max_user_process_2048|28118dbe|FAIL
ulimit_max_user_process_2048|7fc52728|FAIL
systemd_default_target|9061f933|FAIL
systemd_default_target|5ccc431b|FAIL
systemd_default_target|185f833c|FAIL
ssh_localhost_remotecommand|ce0e5732|FAIL
ssh_localhost_remotecommand|ce350fe9|FAIL
ssh_localhost_remotecommand|c5e27d66|FAIL
kernel_swapusage|18c8b2a2|FAIL
kernel_swapusage|168713a5|FAIL
kernel_swapusage|e0458d95|FAIL
list_of_strings_tags|b497ac17|FAIL
```

Report Summary (`buildtest report summary`)

The `buildtest report summary` command can be used to provide a summary of the test report with breakdown statistics of tests including all fail tests, number of tests by name, test runs and buildspecs in report file.

Shown below is an example output from the report summary.

```
$ buildtest report summary
Report:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪var/report.json
Total Tests: 79
Total Tests by Names:  37
Number of buildspecs in report:  22


                    Breakdown by Test
+--------------------------------+--------+--------+--------+
| name                           |   runs |   pass |   fail |
+================================+========+========+========+
| variables_bash                 |      2 |      2 |      0 |
+--------------------------------+--------+--------+--------+
| exit1_fail                     |      5 |      0 |      5 |
+--------------------------------+--------+--------+--------+
| exit1_pass                     |      6 |      6 |      0 |
+--------------------------------+--------+--------+--------+
| returncode_list_mismatch       |      5 |      0 |      5 |
+--------------------------------+--------+--------+--------+
| returncode_int_match           |      6 |      6 |      0 |
+--------------------------------+--------+--------+--------+
| status_regex_pass              |      1 |      1 |      0 |
+--------------------------------+--------+--------+--------+
| status_regex_fail              |      1 |      0 |      1 |
+--------------------------------+--------+--------+--------+
| timelimit_min_max              |      1 |      1 |      0 |
+--------------------------------+--------+--------+--------+
| timelimit_min                  |      1 |      1 |      0 |
```

(continues on next page)

(continued from previous page)

```
+--------------------------------+--------+--------+--------+
| timelimit_max                  |      1 |      1 |      0 |
+--------------------------------+--------+--------+--------+
| timelimit_min_fail             |      1 |      0 |      1 |
+--------------------------------+--------+--------+--------+
| timelimit_max_fail             |      1 |      0 |      1 |
+--------------------------------+--------+--------+--------+
| bash_login_shebang             |      1 |      1 |      0 |
+--------------------------------+--------+--------+--------+
| bash_nonlogin_shebang          |      1 |      1 |      0 |
+--------------------------------+--------+--------+--------+
| unskipped                      |      1 |      1 |      0 |
+--------------------------------+--------+--------+--------+
| metric_regex_example           |      1 |      1 |      0 |
+--------------------------------+--------+--------+--------+
| metric_variable_assignment     |      1 |      1 |      0 |
+--------------------------------+--------+--------+--------+
| executor_regex_script_schema   |      2 |      2 |      0 |
+--------------------------------+--------+--------+--------+
| executors_vars_env_declaration |      2 |      2 |      0 |
+--------------------------------+--------+--------+--------+
| executors_sbatch_declaration   |      2 |      2 |      0 |
+--------------------------------+--------+--------+--------+
| status_returncode_by_executors |      2 |      1 |      1 |
+--------------------------------+--------+--------+--------+
| root_disk_usage                |      3 |      3 |      0 |
+--------------------------------+--------+--------+--------+
| ulimit_filelock_unlimited      |      2 |      2 |      0 |
+--------------------------------+--------+--------+--------+
| ulimit_cputime_unlimited       |      2 |      2 |      0 |
+--------------------------------+--------+--------+--------+
| ulimit_stacksize_unlimited     |      2 |      0 |      2 |
+--------------------------------+--------+--------+--------+
| ulimit_vmsize_unlimited        |      2 |      2 |      0 |
+--------------------------------+--------+--------+--------+
| ulimit_filedescriptor_4096     |      2 |      0 |      2 |
+--------------------------------+--------+--------+--------+
| ulimit_max_user_process_2048   |      2 |      0 |      2 |
+--------------------------------+--------+--------+--------+
| systemd_default_target         |      3 |      0 |      3 |
+--------------------------------+--------+--------+--------+
| ssh_localhost_remotecommand    |      3 |      0 |      3 |
+--------------------------------+--------+--------+--------+
| kernel_swapusage               |      3 |      0 |      3 |
+--------------------------------+--------+--------+--------+
| string_tag                     |      1 |      1 |      0 |
+--------------------------------+--------+--------+--------+
| list_of_strings_tags           |      1 |      0 |      1 |
+--------------------------------+--------+--------+--------+
| circle_area                    |      5 |      5 |      0 |
+--------------------------------+--------+--------+--------+
| python_hello                   |      2 |      2 |      0 |
```

(continues on next page)

(continued from previous page)

```
+--------------------------------+--------+--------+--------+
| run_only_platform_linux        |      1 |      1 |      0 |
+--------------------------------+--------+--------+--------+
| hello_world                    |      1 |      1 |      0 |
+--------------------------------+--------+--------+--------+


                                    FAIL test
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| name                           | id       | executor           | state   | ␣
↪returncode |   runtime |
+================================+==========+====================+=========+==============+===========+
| exit1_fail                     | bdd8e11b | generic.local.sh   | FAIL    |           ␣
↪1 |  0.005038 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| exit1_fail                     | d2d34e26 | generic.local.sh   | FAIL    |           ␣
↪1 |  0.004837 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| exit1_fail                     | 91fe0aaf | generic.local.sh   | FAIL    |           ␣
↪1 |  0.004752 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| exit1_fail                     | 5544d8dc | generic.local.sh   | FAIL    |           ␣
↪1 |  0.005175 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| exit1_fail                     | 65bfeef1 | generic.local.sh   | FAIL    |           ␣
↪1 |  0.004241 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| returncode_list_mismatch       | dd25afaf | generic.local.sh   | FAIL    |           ␣
↪2 |  0.004326 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| returncode_list_mismatch       | 504a0b7b | generic.local.sh   | FAIL    |           ␣
↪2 |  0.004391 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| returncode_list_mismatch       | c5e18c4a | generic.local.sh   | FAIL    |           ␣
↪2 |  0.004253 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| returncode_list_mismatch       | 0dc69200 | generic.local.sh   | FAIL    |           ␣
↪2 |  0.004408 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| returncode_list_mismatch       | bb66d1f5 | generic.local.sh   | FAIL    |           ␣
↪2 |  0.006526 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
```

(continues on next page)

(continued from previous page)

```
| status_regex_fail              | 4a85e442 | generic.local.bash | FAIL    |           ␣
↪0 |  0.004481 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| timelimit_min_fail             | 73a48836 | generic.local.sh   | FAIL    |           ␣
↪0 |  2.00672  |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| timelimit_max_fail             | 1f869483 | generic.local.sh   | FAIL    |           ␣
↪0 |  3.0067   |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| status_returncode_by_executors | 25ae782d | generic.local.sh   | FAIL    |           ␣
↪0 |  0.004514 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| ulimit_stacksize_unlimited     | 0e951b96 | generic.local.bash | FAIL    |           ␣
↪0 |  0.004415 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| ulimit_stacksize_unlimited     | de1f6873 | generic.local.bash | FAIL    |           ␣
↪0 |  0.004314 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| ulimit_filedescriptor_4096     | c37071b3 | generic.local.bash | FAIL    |           ␣
↪0 |  0.00433  |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| ulimit_filedescriptor_4096     | 6f0b9f41 | generic.local.bash | FAIL    |           ␣
↪0 |  0.004223 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| ulimit_max_user_process_2048   | 28118dbe | generic.local.bash | FAIL    |           ␣
↪0 |  0.004334 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| ulimit_max_user_process_2048   | 7fc52728 | generic.local.bash | FAIL    |           ␣
↪0 |  0.004229 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| systemd_default_target         | 9061f933 | generic.local.bash | FAIL    |           ␣
↪1 |  0.005545 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| systemd_default_target         | 5ccc431b | generic.local.bash | FAIL    |           ␣
↪1 |  0.005941 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| systemd_default_target         | 185f833c | generic.local.bash | FAIL    |           ␣
↪1 |  0.005331 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
```

(continues on next page)

(continued from previous page)

```
| ssh_localhost_remotecommand    | ce0e5732 | generic.local.bash | FAIL    |         ␣
↪255 |  0.105284 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| ssh_localhost_remotecommand    | ce350fe9 | generic.local.bash | FAIL    |         ␣
↪255 |  0.00958  |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| ssh_localhost_remotecommand    | c5e27d66 | generic.local.bash | FAIL    |         ␣
↪255 |  0.010745 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| kernel_swapusage               | 18c8b2a2 | generic.local.bash | FAIL    |         ␣
↪127 |  0.005565 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| kernel_swapusage               | 168713a5 | generic.local.bash | FAIL    |         ␣
↪127 |  0.005197 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| kernel_swapusage               | e0458d95 | generic.local.bash | FAIL    |         ␣
↪127 |  0.00527  |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
| list_of_strings_tags           | b497ac17 | generic.local.bash | FAIL    |         ␣
↪127 |  0.005107 |
+--------------------------------+----------+--------------------+---------+-------------
↪-+-----------+
```

Inspect Tests Records via `buildtest inspect`

In previous examples we saw how we can retrieve test records using `buildtest report` which is printed in table format. We have limited the output to a limited fields however, if you want to analyze a particular, we have a separate command called `buildtest inspect` that can be used for inspecting a test record based on name or id. Shown below is the command usage for *buildtest inspect* command.

```
$ buildtest inspect --help
usage: buildtest [options] [COMMANDS] inspect [-h] [-r REPORT]  ...

optional arguments:
  -h, --help            show this help message and exit
  -r REPORT, --report REPORT
                        Specify a report file to load when inspecting test

subcommands:
  Inspect Test result based on Test ID or Test Name


    buildspec           Inspect a test based on buildspec
    id                  Specify a Test ID
    name                Specify name of test
```

(continues on next page)

(continued from previous page)

```
    query               Query fields from record
    list                List all test ids
```

You can report all test names and corresponding ids using `buildtest inspect list` which will be used for querying tests by name or id.

```
$ buildtest inspect list
+------------------------------+--------------------------------------+----------------
↪-------------------------------------------------------------------------------------
↪------------------------------+
| name                         | id                                   | buildspec     ␣
↪                                                                                    ␣
↪                             |
+==============================+======================================+================
| variables_bash               | 1c4ba849-bc6a-4989-8e43-06d38a332531 | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/vars.yml  ␣
↪                                  |
+------------------------------+--------------------------------------+----------------
↪-------------------------------------------------------------------------------------
↪------------------------------+
| variables_bash               | 223864f7-fc35-4d52-813e-85c053fab8c4 | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/vars.yml  ␣
↪                                  |
+------------------------------+--------------------------------------+----------------
↪-------------------------------------------------------------------------------------
↪------------------------------+
| exit1_fail                   | bdd8e11b-da11-4c13-899f-be68f43de3d7 | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/pass_
↪returncode.yml                          |
+------------------------------+--------------------------------------+----------------
↪-------------------------------------------------------------------------------------
↪------------------------------+
| exit1_fail                   | d2d34e26-960f-4231-99f3-5ad8da61caf3 | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/pass_
↪returncode.yml                          |
+------------------------------+--------------------------------------+----------------
↪-------------------------------------------------------------------------------------
↪------------------------------+
| exit1_fail                   | 91fe0aaf-3369-4006-853a-4369624c95f0 | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/pass_
↪returncode.yml                          |
+------------------------------+--------------------------------------+----------------
↪-------------------------------------------------------------------------------------
↪------------------------------+
| exit1_fail                   | 5544d8dc-90a9-4506-a76e-3bbe8fa83b3c | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/pass_
↪returncode.yml                          |
+------------------------------+--------------------------------------+----------------
↪-------------------------------------------------------------------------------------
↪------------------------------+
| exit1_fail                   | 65bfeef1-3735-41ce-8fda-1c954a2086d7 | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/pass_
↪returncode.yml                          |
```

(continues on next page)

(continued from previous page)

```
+------------------------------+--------------------------------------+----------------
↪-----------------------------------------------------------------------------------------
↪------------------------------+
| exit1_pass                   | ad5aea49-2402-4893-a813-da3718f84547 | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/pass_
↪returncode.yml                          |
+------------------------------+--------------------------------------+----------------
↪-----------------------------------------------------------------------------------------
↪------------------------------+
| exit1_pass                   | f150bc31-d94e-4932-977f-5067ebe28c90 | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/pass_
↪returncode.yml                          |
...
```

Inspecting Test by Name via `buildtest inspect name`

The `buildtest inspect name` expects a list of positional argument that correspond to name of test you want to query and buildtest will fetch the **last** record for each named test. Let's see an example to illustrate the point. We can see that each test is stored as a JSON format and buildtest keeps track of metadata for each test such as *user*, *hostname*, *command*, path to output and error file, content of test, state of test, returncode, etc... In this example, we will retrieve record for test name **circle_area** which will print the raw content of the test in JSON format.

```
$ buildtest inspect name circle_area
{
  "circle_area": {
    "id": "9b255d3f",
    "full_id": "9b255d3f-09f6-4b31-abbd-0f2cbb523d34",
    "description": "Calculate circle of area given a radius",
    "schemafile": "script-v1.0.schema.json",
    "executor": "generic.local.python",
    "compiler": null,
    "hostname": "build-14488818-project-280831-buildtest",
    "user": "docs",
    "testroot": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.python/python-shell/circle_area/9b255d3f",
    "testpath": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.python/python-shell/circle_area/9b255d3f/circle_area.sh",
    "stagedir": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.python/python-shell/circle_area/9b255d3f/stage",
    "command": "sh circle_area_build.sh",
    "outfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.python/python-shell/circle_area/9b255d3f/circle_area.out",
    "errfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.python/python-shell/circle_area/9b255d3f/circle_area.err",
    "buildspec_content": "version: \"1.0\"\nbuildspecs:\n  circle_area:\n    executor:␣
↪generic.local.python\n    type: script\n    shell: python\n    description: \
↪"Calculate circle of area given a radius\"\n    tags: [tutorials, python]\n    run: |\
↪n      import math\n      radius = 2\n      area = math.pi * radius * radius\n      ␣
↪print(\"Circle Radius \", radius)\n      print(\"Area of circle \", area)\n",
    "test_content": "#!/bin/bash\npython /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/circle_
↪area/9b255d3f/stage/circle_area.py",
```

(continues on next page)

(continued from previous page)


```
    "buildscript_content": "#!/bin/bash\n\n\n############# START VARIABLE DECLARATION ###
↪####################\nexport BUILDTEST_TEST_NAME=circle_area\nexport BUILDTEST_TEST_
↪ROOT=/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.python/python-shell/circle_area/9b255d3f\nexport BUILDTEST_
↪BUILDSPEC_DIR=/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/tutorials\nexport BUILDTEST_STAGE_DIR=/home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/circle_
↪area/9b255d3f/stage\nexport BUILDTEST_TEST_ID=9b255d3f-09f6-4b31-abbd-0f2cbb523d34\n###
↪########## END VARIABLE DECLARATION   ######################\n\n\n# source executor␣
↪startup script\nsource /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/executor/generic.local.python/before_script.sh\n# Run generated␣
↪script\n/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪var/tests/generic.local.python/python-shell/circle_area/9b255d3f/stage/circle_area.sh\n
↪# Get return code\nreturncode=$?\n# Exit with return code\nexit $returncode",
    "logpath": "/tmp/buildtest_dq1msjjf.log",
    "metrics": {},
    "tags": "tutorials python",
    "starttime": "2021/08/16 22:11:50",
    "endtime": "2021/08/16 22:11:50",
    "runtime": "0.043963",
    "state": "PASS",
    "returncode": "0",
    "output": "Circle Radius  2\nArea of circle  12.566370614359172\n",
    "error": "circle_area_build.sh: 14: circle_area_build.sh: source: not found\n",
    "job": {},
    "build_script": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.python/python-shell/circle_area/9b255d3f/
↪circle_area_build.sh"
  }
}
```


You can query multiple tests as positional arguments in the format: `buildtest inspect name <test1> <test2>` In this next example, we will retrieve test records for `bash_shell` and `python_hello`.


```
$ buildtest inspect name bash_shell python_hello
{
  "python_hello": {
    "id": "3af45be7",
    "full_id": "3af45be7-9173-4bd6-b555-f7d8f8380323",
    "description": "Hello World python",
    "schemafile": "script-v1.0.schema.json",
    "executor": "generic.local.bash",
    "compiler": null,
    "hostname": "build-14488818-project-280831-buildtest",
    "user": "docs",
    "testroot": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.bash/python-hello/python_hello/3af45be7",
    "testpath": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.bash/python-hello/python_hello/3af45be7/python_hello.sh",
    "stagedir": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.bash/python-hello/python_hello/3af45be7/stage",
    "command": "sh python_hello_build.sh",
```


(continues on next page)

(continued from previous page)

```
    "outfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.bash/python-hello/python_hello/3af45be7/python_hello.out",
    "errfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests/generic.local.bash/python-hello/python_hello/3af45be7/python_hello.err",
    "buildspec_content": "version: \"1.0\"\nbuildspecs:\n  python_hello:\n    type:␣
↪script\n    description: Hello World python\n    executor: generic.local.bash\n   ␣
↪tags: python\n    run: python hello.py\n\n",
    "test_content": "#!/bin/bash \n# Content of run section\npython hello.py",
    "buildscript_content": "#!/bin/bash\n\n\n############# START VARIABLE DECLARATION ###
↪####################\nexport BUILDTEST_TEST_NAME=python_hello\nexport BUILDTEST_TEST_
↪ROOT=/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.bash/python-hello/python_hello/3af45be7\nexport BUILDTEST_
↪BUILDSPEC_DIR=/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/tutorials\nexport BUILDTEST_STAGE_DIR=/home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.bash/python-hello/python_
↪hello/3af45be7/stage\nexport BUILDTEST_TEST_ID=3af45be7-9173-4bd6-b555-f7d8f8380323\n##
↪########### END VARIABLE DECLARATION   ######################\n\n\n# source executor␣
↪startup script\nsource /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/executor/generic.local.bash/before_script.sh\n# Run generated␣
↪script\n/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪var/tests/generic.local.bash/python-hello/python_hello/3af45be7/stage/python_hello.sh\n
↪# Get return code\nreturncode=$?\n# Exit with return code\nexit $returncode",
    "logpath": "/tmp/buildtest_mcl96yu0.log",
    "metrics": {},
    "tags": "python",
    "starttime": "2021/08/16 22:11:46",
    "endtime": "2021/08/16 22:11:46",
    "runtime": "0.043397",
    "state": "PASS",
    "returncode": "0",
    "output": "Hello World\n",
    "error": "python_hello_build.sh: 14: python_hello_build.sh: source: not found\n",
    "job": {},
    "build_script": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/python-hello/python_hello/3af45be7/
↪python_hello_build.sh"
  }
}
```

If you want to query all test records for a given name you can use the `--all` option which is applied to all positional arguments.

Inspect Test by buildspec via `buildtest inspect buildspec`

buildtest can fetch records based on buildspec via `buildtest inspect buildspec` which expects a list of buildspecs. By default, buildtest will fetch the latest record of each test, but if you want to fetch all records you can pass the `--all` option.

In example below we will fetch latest record for all tests in **tutorials/vars.yml**

```
$ buildtest inspect buildspec tutorials/vars.yml
{
```

(continues on next page)

(continued from previous page)


```
  "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/vars.yml": {
    "variables_bash": {
      "id": "223864f7",
      "full_id": "223864f7-fc35-4d52-813e-85c053fab8c4",
      "description": "Declare shell variables in bash",
      "schemafile": "script-v1.0.schema.json",
      "executor": "generic.local.bash",
      "compiler": null,
      "hostname": "build-14488818-project-280831-buildtest",
      "user": "docs",
      "testroot": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/vars/variables_bash/223864f7",
      "testpath": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/vars/variables_bash/223864f7/variables_bash.sh",
      "stagedir": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/vars/variables_bash/223864f7/stage",
      "command": "sh variables_bash_build.sh",
      "outfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/vars/variables_bash/223864f7/variables_bash.out",
      "errfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/vars/variables_bash/223864f7/variables_bash.err",
      "buildspec_content": "version: \"1.0\"\nbuildspecs:\n  variables_bash:\n    type:␣
↪script\n    executor: generic.local.bash\n    description: Declare shell variables in␣
↪bash\n    tags: [tutorials]\n    vars:\n      X: 1\n      Y: 2\n      literalstring: |\
↪n        \"this is a literal string ':' \"\n      singlequote: \"'singlequote'\"\n    ␣
↪ doublequote: \"\\\"doublequote\\\"\"\n      current_user: \"$(whoami)\"\n      files_
↪homedir: \"`find $HOME -type f -maxdepth 1`\"\n\n    run: |\n      echo \"$X+$Y=\" $((
↪$X+$Y))\n      echo $literalstring\n      echo $singlequote\n      echo $doublequote\n␣
↪      echo $current_user\n      echo $files_homedir",
      "test_content": "#!/bin/bash \n# Declare shell variables\nX=1\nY=2\nliteralstring=\
↪"this is a literal string ':' \"\n\nsinglequote='singlequote'\ndoublequote=\
↪"doublequote\"\ncurrent_user=$(whoami)\nfiles_homedir=`find $HOME -type f -maxdepth 1`\
↪n\n\n# Content of run section\necho \"$X+$Y=\" $(($X+$Y))\necho $literalstring\necho
↪$singlequote\necho $doublequote\necho $current_user\necho $files_homedir",
      "buildscript_content": "#!/bin/bash\n\n\n############## START VARIABLE DECLARATION #
↪#######################\nexport BUILDTEST_TEST_NAME=variables_bash\nexport BUILDTEST_
↪TEST_ROOT=/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪var/tests/generic.local.bash/vars/variables_bash/223864f7\nexport BUILDTEST_BUILDSPEC_
↪DIR=/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials\nexport BUILDTEST_STAGE_DIR=/home/docs/checkouts/readthedocs.org/user_builds/
↪buildtest/checkouts/v0.10.2/var/tests/generic.local.bash/vars/variables_bash/223864f7/
↪stage\nexport BUILDTEST_TEST_ID=223864f7-fc35-4d52-813e-85c053fab8c4\n##############␣
↪END VARIABLE DECLARATION   #######################\n\n\n# source executor startup␣
↪script\nsource /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/executor/generic.local.bash/before_script.sh\n# Run generated script\n/home/
↪docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.bash/vars/variables_bash/223864f7/stage/variables_bash.sh\n# Get return␣
↪code\nreturncode=$?\n# Exit with return code\nexit $returncode",
      "logpath": "/tmp/buildtest_c80lh443.log",
      "metrics": {},
      "tags": "tutorials",
```


(continues on next page)

(continued from previous page)

```
      "starttime": "2021/08/16 22:11:44",
      "endtime": "2021/08/16 22:11:44",
      "runtime": "0.008019",
      "state": "PASS",
      "returncode": "0",
      "output": "1+2= 3\nthis is a literal string ':'\nsinglequote\ndoublequote\ndocs\n/
↪home/docs/.bash_logout /home/docs/.bashrc /home/docs/.profile /home/docs/.wget-hsts\n",
      "error": "variables_bash_build.sh: 14: variables_bash_build.sh: source: not found\n
↪",
      "job": {},
      "build_script": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/vars/variables_bash/223864f7/variables_
↪bash_build.sh"
    }
  }
}
```

buildtest will report an error if an input buildspec is invalid filepath such as one below

```
$ buildtest inspect buildspec /tmp/buildspec.yml
buildspec: /tmp/buildspec.yml is not valid file
There are no buildspecs in cache based on input buildspecs: ['/tmp/buildspec.yml']
```

You can also pass multiple buildspes on the command line and fetch all records for a test. In example below we will fetch all records from tests **tutorials/hello_world/yml** and **tutorials/regex_status.yml**

```
$ buildtest inspect buildspec --all tutorials/vars.yml tutorials/status_regex.yml
{
  "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/vars.yml": {
    "variables_bash": [
      {
        "id": "1c4ba849",
        "full_id": "1c4ba849-bc6a-4989-8e43-06d38a332531",
        "description": "Declare shell variables in bash",
        "schemafile": "script-v1.0.schema.json",
        "executor": "generic.local.bash",
        "compiler": null,
        "hostname": "build-14488818-project-280831-buildtest",
        "user": "docs",
        "testroot": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/vars/variables_bash/1c4ba849",
        "testpath": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/vars/variables_bash/1c4ba849/variables_
↪bash.sh",
        "stagedir": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/vars/variables_bash/1c4ba849/stage",
        "command": "sh variables_bash_build.sh",
        "outfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/vars/variables_bash/1c4ba849/variables_bash.out",
        "errfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/vars/variables_bash/1c4ba849/variables_bash.err",
```

(continues on next page)

(continued from previous page)


```
        "buildspec_content": "version: \"1.0\"\nbuildspecs:\n  variables_bash:\n    ␣
↪type: script\n    executor: generic.local.bash\n    description: Declare shell␣
↪variables in bash\n    tags: [tutorials]\n    vars:\n      X: 1\n      Y: 2\n     ␣
↪literalstring: |\n        \"this is a literal string ':' \"\n      singlequote: \"
↪'singlequote'\"\n      doublequote: \"\\\"doublequote\\\"\"\n      current_user: \"
↪$(whoami)\"\n      files_homedir: \"`find $HOME -type f -maxdepth 1`\"\n\n    run: |\n␣
↪     echo \"$X+$Y=\" $(($X+$Y))\n      echo $literalstring\n      echo $singlequote\n ␣
↪    echo $doublequote\n      echo $current_user\n      echo $files_homedir",
        "test_content": "#!/bin/bash \n# Declare shell variables\nX=1\nY=2\
↪nliteralstring=\"this is a literal string ':' \"\n\nsinglequote='singlequote'\
↪ndoublequote=\"doublequote\"\ncurrent_user=$(whoami)\nfiles_homedir=`find $HOME -type␣
↪f -maxdepth 1`\n\n\n# Content of run section\necho \"$X+$Y=\" $(($X+$Y))\necho
↪$literalstring\necho $singlequote\necho $doublequote\necho $current_user\necho $files_
↪homedir",
        "buildscript_content": "#!/bin/bash\n\n\n############# START VARIABLE␣
↪DECLARATION ########################\nexport BUILDTEST_TEST_NAME=variables_bash\
↪nexport BUILDTEST_TEST_ROOT=/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/vars/variables_bash/1c4ba849\nexport␣
↪BUILDTEST_BUILDSPEC_DIR=/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials\nexport BUILDTEST_STAGE_DIR=/home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.bash/
↪vars/variables_bash/1c4ba849/stage\nexport BUILDTEST_TEST_ID=1c4ba849-bc6a-4989-8e43-
↪06d38a332531\n############# END VARIABLE DECLARATION   ########################\n\n\n#␣
↪source executor startup script\nsource /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/executor/generic.local.bash/before_script.sh\n#␣
↪Run generated script\n/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/vars/variables_bash/1c4ba849/stage/
↪variables_bash.sh\n# Get return code\nreturncode=$?\n# Exit with return code\nexit
↪$returncode",
        "logpath": "/tmp/buildtest_hr_5xctx.log",
        "metrics": {},
        "tags": "tutorials",
        "starttime": "2021/08/16 22:11:15",
        "endtime": "2021/08/16 22:11:15",
        "runtime": "0.010175",
        "state": "PASS",
        "returncode": "0",
        "output": "1+2= 3\nthis is a literal string ':'\nsinglequote\ndoublequote\ndocs\
↪n/home/docs/.bash_logout /home/docs/.bashrc /home/docs/.profile /home/docs/.wget-hsts\n
↪",
        "error": "variables_bash_build.sh: 14: variables_bash_build.sh: source: not␣
↪found\n",
        "job": {},
        "build_script": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/vars/variables_bash/1c4ba849/variables_
↪bash_build.sh"
      },
      {
        "id": "223864f7",
        "full_id": "223864f7-fc35-4d52-813e-85c053fab8c4",
        "description": "Declare shell variables in bash",
        "schemafile": "script-v1.0.schema.json",
```


(continues on next page)

(continued from previous page)


```
        "executor": "generic.local.bash",
        "compiler": null,
        "hostname": "build-14488818-project-280831-buildtest",
        "user": "docs",
        "testroot": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/vars/variables_bash/223864f7",
        "testpath": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/vars/variables_bash/223864f7/variables_
↪bash.sh",
        "stagedir": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/vars/variables_bash/223864f7/stage",
        "command": "sh variables_bash_build.sh",
        "outfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/vars/variables_bash/223864f7/variables_bash.out",
        "errfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/vars/variables_bash/223864f7/variables_bash.err",
        "buildspec_content": "version: \"1.0\"\nbuildspecs:\n  variables_bash:\n    ␣
↪type: script\n    executor: generic.local.bash\n    description: Declare shell␣
↪variables in bash\n    tags: [tutorials]\n    vars:\n      X: 1\n      Y: 2\n      ␣
↪literalstring: |\n        \"this is a literal string ':' \"\n      singlequote: \"
↪'singlequote'\"\n      doublequote: \"\\\"doublequote\\\"\"\n      current_user: \"
↪$(whoami)\"\n      files_homedir: \"`find $HOME -type f -maxdepth 1`\"\n\n    run: |\n␣
↪     echo \"$X+$Y=\" $(($X+$Y))\n      echo $literalstring\n      echo $singlequote\n ␣
↪    echo $doublequote\n      echo $current_user\n      echo $files_homedir",
        "test_content": "#!/bin/bash \n# Declare shell variables\nX=1\nY=2\
↪nliteralstring=\"this is a literal string ':' \"\n\nsinglequote='singlequote'\
↪ndoublequote=\"doublequote\"\ncurrent_user=$(whoami)\nfiles_homedir=`find $HOME -type␣
↪f -maxdepth 1`\n\n\n# Content of run section\necho \"$X+$Y=\" $(($X+$Y))\necho
↪$literalstring\necho $singlequote\necho $doublequote\necho $current_user\necho $files_
↪homedir",
        "buildscript_content": "#!/bin/bash\n\n\n############## START VARIABLE␣
↪DECLARATION ########################\nexport BUILDTEST_TEST_NAME=variables_bash\
↪nexport BUILDTEST_TEST_ROOT=/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/vars/variables_bash/223864f7\nexport␣
↪BUILDTEST_BUILDSPEC_DIR=/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials\nexport BUILDTEST_STAGE_DIR=/home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.bash/
↪vars/variables_bash/223864f7/stage\nexport BUILDTEST_TEST_ID=223864f7-fc35-4d52-813e-
↪85c053fab8c4\n############## END VARIABLE DECLARATION   ########################\n\n\n#␣
↪source executor startup script\nsource /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/executor/generic.local.bash/before_script.sh\n#␣
↪Run generated script\n/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/vars/variables_bash/223864f7/stage/
↪variables_bash.sh\n# Get return code\nreturncode=$?\n# Exit with return code\nexit
↪$returncode",
        "logpath": "/tmp/buildtest_c80lh443.log",
        "metrics": {},
        "tags": "tutorials",
        "starttime": "2021/08/16 22:11:44",
        "endtime": "2021/08/16 22:11:44",
        "runtime": "0.008019",
        "state": "PASS",
```


(continues on next page)

(continued from previous page)


```
        "returncode": "0",
        "output": "1+2= 3\nthis is a literal string ':'\nsinglequote\ndoublequote\ndocs\
↪n/home/docs/.bash_logout /home/docs/.bashrc /home/docs/.profile /home/docs/.wget-hsts\n
↪",
        "error": "variables_bash_build.sh: 14: variables_bash_build.sh: source: not␣
↪found\n",
        "job": {},
        "build_script": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/vars/variables_bash/223864f7/variables_
↪bash_build.sh"
      }
    ]
  },
  "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/status_regex.yml": {
    "status_regex_pass": [
      {
        "id": "9694871d",
        "full_id": "9694871d-54e1-4ac2-acac-73962899573d",
        "description": "Pass test based on regular expression",
        "schemafile": "script-v1.0.schema.json",
        "executor": "generic.local.bash",
        "compiler": null,
        "hostname": "build-14488818-project-280831-buildtest",
        "user": "docs",
        "testroot": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/status_regex/status_regex_pass/9694871d
↪",
        "testpath": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/status_regex/status_regex_pass/9694871d/
↪status_regex_pass.sh",
        "stagedir": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/status_regex/status_regex_pass/9694871d/
↪stage",
        "command": "sh status_regex_pass_build.sh",
        "outfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/status_regex/status_regex_pass/9694871d/status_
↪regex_pass.out",
        "errfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/status_regex/status_regex_pass/9694871d/status_
↪regex_pass.err",
        "buildspec_content": "version: \"1.0\"\nbuildspecs:\n  status_regex_pass:\n   ␣
↪executor: generic.local.bash\n    type: script\n    tags: [system]\n    description:␣
↪Pass test based on regular expression\n    run: echo \"PASS\"\n    status:\n     ␣
↪regex:\n        stream: stdout\n        exp: \"^(PASS)$\"\n\n  status_regex_fail:\n   ␣
↪executor: generic.local.bash\n    type: script\n    tags: [system]\n    description:␣
↪Pass test based on regular expression\n    run: echo \"FAIL\"\n    status:\n     ␣
↪regex:\n        stream: stdout\n        exp: \"^(123FAIL)$\"",
        "test_content": "#!/bin/bash \n# Content of run section\necho \"PASS\"",
        "buildscript_content": "#!/bin/bash\n\n\n############## START VARIABLE␣
↪DECLARATION ########################\nexport BUILDTEST_TEST_NAME=status_regex_pass\
↪nexport BUILDTEST_TEST_ROOT=/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/status_regex/status_regex_pass/9694871d\
↪nexport BUILDTEST_BUILDSPEC_DIR=/home/docs/checkouts/readthedocs.org/user_builds/
↪buildtest/checkouts/v0.10.2/tutorials\nexport BUILDTEST_STAGE_DIR=/home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.bash/
↪status_regex/status_regex_pass/9694871d/stage\nexport BUILDTEST_TEST_ID=9694871d-54e1-
↪4ac2-acac-73962899573d\n############## END VARIABLE DECLARATION   ######################
↪##\n\n\n# source executor startup script\nsource /home/docs/checkouts/readthedocs.org/
```


(continues on next page)

(continued from previous page)


```
        "logpath": "/tmp/buildtest_lywao4up.log",
        "metrics": {},
        "tags": "system",
        "starttime": "2021/08/16 22:11:16",
        "endtime": "2021/08/16 22:11:16",
        "runtime": "0.00478",
        "state": "PASS",
        "returncode": "0",
        "output": "PASS\n",
        "error": "status_regex_pass_build.sh: 14: status_regex_pass_build.sh: source:␣
↪not found\n",
        "job": {},
        "build_script": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/status_regex/status_regex_pass/9694871d/
↪status_regex_pass_build.sh"
      }
    ],
    "status_regex_fail": [
      {
        "id": "4a85e442",
        "full_id": "4a85e442-70e7-4125-9c41-35954b101cb5",
        "description": "Pass test based on regular expression",
        "schemafile": "script-v1.0.schema.json",
        "executor": "generic.local.bash",
        "compiler": null,
        "hostname": "build-14488818-project-280831-buildtest",
        "user": "docs",
        "testroot": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/status_regex/status_regex_fail/4a85e442
↪",
        "testpath": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/status_regex/status_regex_fail/4a85e442/
↪status_regex_fail.sh",
        "stagedir": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/status_regex/status_regex_fail/4a85e442/
↪stage",
        "command": "sh status_regex_fail_build.sh",
        "outfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/status_regex/status_regex_fail/4a85e442/status_
↪regex_fail.out",
        "errfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/status_regex/status_regex_fail/4a85e442/status_
↪regex_fail.err",
        "buildspec_content": "version: \"1.0\"\nbuildspecs:\n  status_regex_pass:\n    ␣
↪executor: generic.local.bash\n    type: script\n    tags: [system]\n    description:␣
↪Pass test based on regular expression\n    run: echo \"PASS\"\n    status:\n      ␣
↪regex:\n        stream: stdout\n        exp: \"^(PASS)$\"\n\n  status_regex_fail:\n    ␣
↪executor: generic.local.bash\n    type: script\n    tags: [system]\n    description:␣
↪Pass test based on regular expression\n    run: echo \"FAIL\"\n    status:\n      ␣
↪regex:\n        stream: stdout\n        exp: \"^(123FAIL)$\"",
        "test_content": "#!/bin/bash \n# Content of run section\necho \"FAIL\"",
        "buildscript_content": "#!/bin/bash\n\n\n############ START VARIABLE␣
↪DECLARATION ######################\nexport BUILDTEST_TEST_NAME=status_regex_fail\
↪nexport BUILDTEST_TEST_ROOT=/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/status_regex/status_regex_fail/4a85e442\
↪nexport BUILDTEST_BUILDSPEC_DIR=/home/docs/checkouts/readthedocs.org/user_builds/
↪buildtest/checkouts/v0.10.2/tutorials\nexport BUILDTEST_STAGE_DIR=/home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.bash/
↪status_regex/status_regex_fail/4a85e442/stage\nexport BUILDTEST_TEST_ID=4a85e442-70e7-
```


(continued on next page)

(continued from previous page)

```
        "logpath": "/tmp/buildtest_lywao4up.log",
        "metrics": {},
        "tags": "system",
        "starttime": "2021/08/16 22:11:16",
        "endtime": "2021/08/16 22:11:16",
        "runtime": "0.004481",
        "state": "FAIL",
        "returncode": "0",
        "output": "FAIL\n",
        "error": "status_regex_fail_build.sh: 14: status_regex_fail_build.sh: source:␣
↪not found\n",
        "job": {},
        "build_script": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.bash/status_regex/status_regex_fail/4a85e442/
↪status_regex_fail_build.sh"
      }
    ]
  }
}
```

If you pass a valid filepath but file is not in cache you will get an error as follows

```
$ buildtest inspect buildspec $BUILDTEST_ROOT/README.rst
Unable to find any buildspecs in cache, please specify one of the following buildspecs:
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪vars.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪pass_returncode.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪status_regex.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪runtime_status_test.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪shebang.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪skip_tests.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪metrics_regex.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪metrics_variable.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪executor_regex_script.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/multiple_executors.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/executor_scheduler.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/status_by_executors.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/disk_usage.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/ulimits.yml
```

(continues on next page)

(continued from previous page)

```
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/systemd-default-target.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/ssh_localhost.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/configuration/kernel_state.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪tags_example.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-shell.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-hello.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪run_only_platform.yml
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪hello_world.yml
```

Inspecting Test by ID via `buildtest inspect id`

The `buildtest inspect id` works similar to `buildtest inspect name` except that it operates on test id. This can be useful if you want to extract a particular test record and not see all test records at once.

You only need to specify a few characters and buildtest will resolve full test id if there is a match. The `buildtest inspect id` can operate on single or multiple ids if you want to specify multiple ids in single command you can do `buildtest inspect id <identifier1> <identifier2>`.

Let's see an example where we query a single test record. Notice, that we only specify a few characters **fee** and buildtest found a matching record **fee66c67-db4e-4d35-8c6d-28ac5cbbaba0**

```
$ buildtest inspect id fee
Reading Report File: /Users/siddiq90/.buildtest/report.json

{
  "fee66c67-db4e-4d35-8c6d-28ac5cbbaba0": {
    "id": "fee66c67",
    "full_id": "fee66c67-db4e-4d35-8c6d-28ac5cbbaba0",
    "schemafile": "script-v1.0.schema.json",
    "executor": "generic.local.bash",
    "compiler": null,
    "hostname": "DOE-7086392.local",
    "user": "siddiq90",
    "testroot": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.bash/
↪python-hello/python_hello/2",
    "testpath": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.bash/
↪python-hello/python_hello/2/stage/generate.sh",
    "stagedir": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.bash/
↪python-hello/python_hello/2/stage",
    "rundir": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.bash/
↪python-hello/python_hello/2/run",
    "command": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.bash/
↪python-hello/python_hello/2/stage/generate.sh",
    "outfile": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.bash/
↪python-hello/python_hello/2/run/python_hello.out",
```

(continues on next page)

(continued from previous page)


```
    "errfile": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.bash/
↪python-hello/python_hello/2/run/python_hello.err",
    "buildspec_content": "version: \"1.0\"\nbuildspecs:\n  python_hello:\n    type:␣
↪script\n    description: Hello World python\n    executor: generic.local.bash\n   ␣
↪tags: python\n    run: python hello.py\n\n",
    "test_content": "#!/bin/bash \nsource /Users/siddiq90/Documents/github/buildtest/var/
↪executors/generic.local.bash/before_script.sh\npython hello.py\nsource /Users/siddiq90/
↪Documents/github/buildtest/var/executors/generic.local.bash/after_script.sh",
    "tags": "python",
    "starttime": "2021/03/31 11:18:21",
    "endtime": "2021/03/31 11:18:21",
    "runtime": 0.104714,
    "state": "PASS",
    "returncode": 0,
    "output": "Hello World\n",
    "error": "",
    "job": null
  }
}
```


We can pass multiple IDs to `buildtest inspect id` and buildtest will retrieve test record if there is a match. You only need to specify a few characters to ensure we have a unique test ID and buildtest will retrieve the record.

```
$ buildtest inspect id 944 a76
 Reading Report File: /Users/siddiq90/.buildtest/report.json

 {
   "a76799db-f11e-4050-8dcb-8b147092c536": {
     "id": "a76799db",
     "full_id": "a76799db-f11e-4050-8dcb-8b147092c536",
     "schemafile": "script-v1.0.schema.json",
     "executor": "generic.local.bash",
     "compiler": null,
     "hostname": "DOE-7086392.local",
     "user": "siddiq90",
     "testroot": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.
↪bash/disk_usage/root_disk_usage/0",
     "testpath": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.
↪bash/disk_usage/root_disk_usage/0/stage/generate.sh",
     "stagedir": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.
↪bash/disk_usage/root_disk_usage/0/stage",
     "rundir": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.bash/
↪disk_usage/root_disk_usage/0/run",
     "command": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.bash/
↪disk_usage/root_disk_usage/0/stage/generate.sh",
     "outfile": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.bash/
↪disk_usage/root_disk_usage/0/run/root_disk_usage.out",
     "errfile": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.bash/
↪disk_usage/root_disk_usage/0/run/root_disk_usage.err",
     "buildspec_content": "version: \"1.0\"\nbuildspecs:\n  root_disk_usage:\n   ␣
↪executor: generic.local.bash\n    type: script\n    tags: [filesystem, storage]\n   ␣
↪description: Check root disk usage and report if it exceeds threshold\n    env:\n     ␣
↪threshold: 90\n    run: |\n      root_disk_usage=`df -a / | tail -n 1 |  awk '{print $5
↪'} | sed 's/[^0-9]*//g'`\n      # if root exceeds threshold\n      if [ \"$root_disk_
↪usage\" -gt \"$threshold\" ]; then\n        echo \"[WARNING] Root Disk Usage: $root_
↪disk_usage% exceeded threshold of $threshold%\"\n        exit 1\n      else\n
↪"[OK] Root disk is below threshold of $threshold%\"\n",
```

(continues on next page)

(continued from previous page)


```
    "test_content": "#!/bin/bash \nsource /Users/siddiq90/Documents/github/buildtest/
↪var/executors/generic.local.bash/before_script.sh\nexport threshold=90\nroot_disk_
↪usage=`df -a / | tail -n 1 |  awk '{print $5'} | sed 's/[^0-9]*//g'`\n# if root␣
↪exceeds threshold\nif [ \"$root_disk_usage\" -gt \"$threshold\" ]; then\n  echo \
↪"[WARNING] Root Disk Usage: $root_disk_usage% exceeded threshold of $threshold%\"\n ␣
↪exit 1\nfi\necho \"[OK] Root disk is below threshold of $threshold%\"\n\nsource /Users/
↪siddiq90/Documents/github/buildtest/var/executors/generic.local.bash/after_script.sh",
    "tags": "filesystem storage",
    "starttime": "2021/03/31 11:17:50",
    "endtime": "2021/03/31 11:17:50",
    "runtime": 0.114321,
    "state": "PASS",
    "returncode": 0,
    "output": "[OK] Root disk is below threshold of 90%\n",
    "error": "",
    "job": null
  },
  "944f6399-b82b-47f9-bb15-8f529dedd4e6": {
    "id": "944f6399",
    "full_id": "944f6399-b82b-47f9-bb15-8f529dedd4e6",
    "schemafile": "script-v1.0.schema.json",
    "executor": "generic.local.python",
    "compiler": null,
    "hostname": "DOE-7086392.local",
    "user": "siddiq90",
    "testroot": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.
↪python/python-shell/circle_area/0",
    "testpath": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.
↪python/python-shell/circle_area/0/stage/generate.sh",
    "stagedir": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.
↪python/python-shell/circle_area/0/stage",
    "rundir": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.
↪python/python-shell/circle_area/0/run",
    "command": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.
↪python/python-shell/circle_area/0/stage/generate.sh",
    "outfile": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.
↪python/python-shell/circle_area/0/run/circle_area.out",
    "errfile": "/Users/siddiq90/Documents/github/buildtest/var/tests/generic.local.
↪python/python-shell/circle_area/0/run/circle_area.err",
    "buildspec_content": "version: \"1.0\"\nbuildspecs:\n  circle_area:\n    executor:␣
↪generic.local.python\n    type: script\n    shell: python\n    description: \
↪"Calculate circle of area given a radius\"\n    tags: [tutorials, python]\n    run: |\
↪n      import math\n      radius = 2\n      area = math.pi * radius * radius\n     ␣
↪print(\"Circle Radius \", radius)\n      print(\"Area of circle \", area)\n",
    "test_content": "#!/bin/bash\nsource /Users/siddiq90/Documents/github/buildtest/var/
↪executors/generic.local.python/before_script.sh\npython /Users/siddiq90/Documents/
↪github/buildtest/var/tests/generic.local.python/python-shell/circle_area/0/stage/
↪circle_area.py\nsource /Users/siddiq90/Documents/github/buildtest/var/executors/
↪generic.local.python/after_script.sh",
    "tags": "tutorials python",
    "starttime": "2021/03/31 11:18:00",
    "endtime": "2021/03/31 11:18:00",
```


(continues on next page)

(continued from previous page)

```
    "runtime": 0.144171,
    "state": "PASS",
    "returncode": 0,
    "output": "Circle Radius  2\nArea of circle  12.566370614359172\n",
    "error": "",
    "job": null
  }
}
```

If you specify an invalid test id using `buildtest inspect id` you will get an error message as follows.

```
$ buildtest inspect id lad

Unable to find any test records based on id: ['lad'], please run 'buildtest inspect list
↪' to see list of ids.
```

You will see similar message if you specify an invalid test name using `buildtest inspect name` command.

Query Test Records via `buildtest inspect query`

The `buildtest inspect query` command can allow you to retrieve query certain fields from each test records that can be useful when you are inspecting a test. Currently, we can fetch content of output file, error file, testpath, and build script. Shown below are the list of available options for `buildtest inspect query`.

```
$ buildtest inspect query --help
usage: buildtest [options] [COMMANDS] inspect query [-h] [-b] [-d {first,last,all}] [-e]␣
↪[-o] [-t] [name [name ...]]

positional arguments:
  name                  Name of test

optional arguments:
  -h, --help            show this help message and exit
  -b, --buildscript     Print build script
  -d {first,last,all}, --display {first,last,all}
                        Determine how records are fetched, by default it will report the␣
↪last record of the test.
  -e, --error           Print error file
  -o, --output          Print output file
  -t, --testpath        Print content of testpath
```

The `buildtest inspect query` command expects positional arguments that are name of tests which you can get by running `buildtest inspect list`.

For instance, let's query the test `circle_area` by running the following:

```
$ buildtest inspect query circle_area
_______________________________ circle_area (ID: 9b255d3f-09f6-4b31-abbd-0f2cbb523d34) ___
↪____________________________
executor:  generic.local.python
description:  Calculate circle of area given a radius
state:  PASS
```

(continues on next page)

(continued from previous page)

```
returncode:  0
runtime:  0.043963
starttime:  2021/08/16 22:11:50
endtime:  2021/08/16 22:11:50
```

buildtest will display metadata for each test. By default, buildtest will report the latest record for each test that is specified as a positional argument. If you want to see all runs for a particular test you can use `-d all` or `--display all` which will report all records. By default, it will use `-d last` which reports the last record. You can retrieve the first record by running `-d first` which is the oldest record.

Now as you run test, you want to inspect the output file, this can be done by passing `-o` or `--output`. Let's take what we learned and see the following. In this command, we retrieve all records for `circle_area` and print content of output file

```
$ buildtest inspect query -d all -o circle_area
_____________________________ circle_area (ID: 0b6ab2ac-b532-4e7f-9a89-56cbc41ee998) ___
↪_____________________________
executor:  generic.local.python
description:  Calculate circle of area given a radius
state:  PASS
returncode:  0
runtime:  0.04527
starttime:  2021/08/16 22:11:46
endtime:  2021/08/16 22:11:46
************************* Start of Output File: /home/docs/checkouts/readthedocs.org/
↪user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/
↪circle_area/0b6ab2ac/circle_area.out ************************
Circle Radius  2
Area of circle  12.566370614359172

************************* End of Output File: /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/circle_
↪area/0b6ab2ac/circle_area.out ************************

_____________________________ circle_area (ID: c8374cbd-5f19-4d2f-9c6f-c80eaa9cd7b1) ___
↪_____________________________
executor:  generic.local.python
description:  Calculate circle of area given a radius
state:  PASS
returncode:  0
runtime:  0.043456
starttime:  2021/08/16 22:11:46
endtime:  2021/08/16 22:11:47
************************* Start of Output File: /home/docs/checkouts/readthedocs.org/
↪user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/
↪circle_area/c8374cbd/circle_area.out ************************
Circle Radius  2
Area of circle  12.566370614359172

************************* End of Output File: /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/circle_
↪area/c8374cbd/circle_area.out ************************
```

(continues on next page)

(continued from previous page)

```
_____________________________ circle_area (ID: a1ef3290-3ab6-47af-8e04-8e98f76788f8) ___
↪_____________________________
executor:  generic.local.python
description:  Calculate circle of area given a radius
state:  PASS
returncode:  0
runtime:  0.044541
starttime:  2021/08/16 22:11:50
endtime:  2021/08/16 22:11:50
************************ Start of Output File: /home/docs/checkouts/readthedocs.org/
↪user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/
↪circle_area/a1ef3290/circle_area.out ************************
Circle Radius  2
Area of circle  12.566370614359172

************************ End of Output File: /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/circle_
↪area/a1ef3290/circle_area.out ************************

_____________________________ circle_area (ID: 45c0e965-0b9e-427a-b684-0a2b7567fb8d) ___
↪_____________________________
executor:  generic.local.python
description:  Calculate circle of area given a radius
state:  PASS
returncode:  0
runtime:  0.043797
starttime:  2021/08/16 22:11:50
endtime:  2021/08/16 22:11:50
************************ Start of Output File: /home/docs/checkouts/readthedocs.org/
↪user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/
↪circle_area/45c0e965/circle_area.out ************************
Circle Radius  2
Area of circle  12.566370614359172

************************ End of Output File: /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/circle_
↪area/45c0e965/circle_area.out ************************

_____________________________ circle_area (ID: 9b255d3f-09f6-4b31-abbd-0f2cbb523d34) ___
↪_____________________________
executor:  generic.local.python
description:  Calculate circle of area given a radius
state:  PASS
returncode:  0
runtime:  0.043963
starttime:  2021/08/16 22:11:50
endtime:  2021/08/16 22:11:50
************************ Start of Output File: /home/docs/checkouts/readthedocs.org/
↪user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/
↪circle_area/9b255d3f/circle_area.out ************************
Circle Radius  2
Area of circle  12.566370614359172
```

(continues on next page)

(continued from previous page)

```
************************ End of Output File: /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/circle_
↪area/9b255d3f/circle_area.out ************************
```

If you want to see content of error file use the `-e` or `--error` flag. It would be useful to inspect content of build script and generated test, which can be retrieved using `--testpath` and `--buildscript`. Let's see query the first record of `circle_area` and report all of the content fields

```
$ buildtest inspect query -d first -o -e -t -b circle_area
_____________________________ circle_area (ID: 0b6ab2ac-b532-4e7f-9a89-56cbc41ee998) ___
↪_____________________________
executor:  generic.local.python
description:  Calculate circle of area given a radius
state:  PASS
returncode:  0
runtime:  0.04527
starttime:  2021/08/16 22:11:46
endtime:  2021/08/16 22:11:46
************************ Start of Output File: /home/docs/checkouts/readthedocs.org/
↪user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/
↪circle_area/0b6ab2ac/circle_area.out ************************
Circle Radius  2
Area of circle  12.566370614359172

************************ End of Output File: /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/circle_
↪area/0b6ab2ac/circle_area.out ************************

************************ Start of Error File:  /home/docs/checkouts/readthedocs.org/
↪user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/
↪circle_area/0b6ab2ac/circle_area.err ************************
circle_area_build.sh: 14: circle_area_build.sh: source: not found

************************ End of Error File:  /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/circle_
↪area/0b6ab2ac/circle_area.err ************************

************************ Start of Test Path:  /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/circle_
↪area/0b6ab2ac/circle_area.sh ************************
#!/bin/bash
python /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.python/python-shell/circle_area/0b6ab2ac/stage/circle_area.py
************************ End of Test Path:  /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/circle_
↪area/0b6ab2ac/circle_area.sh ************************

************************ Start of Build Script:  /home/docs/checkouts/readthedocs.org/
↪user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/
↪circle_area/0b6ab2ac/circle_area_build.sh ************************
#!/bin/bash
```

(continues on next page)

(continued from previous page)

```
############# START VARIABLE DECLARATION ########################
export BUILDTEST_TEST_NAME=circle_area
export BUILDTEST_TEST_ROOT=/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.python/python-shell/circle_area/0b6ab2ac
export BUILDTEST_BUILDSPEC_DIR=/home/docs/checkouts/readthedocs.org/user_builds/
↪buildtest/checkouts/v0.10.2/tutorials
export BUILDTEST_STAGE_DIR=/home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/tests/generic.local.python/python-shell/circle_area/0b6ab2ac/
↪stage
export BUILDTEST_TEST_ID=0b6ab2ac-b532-4e7f-9a89-56cbc41ee998
############# END VARIABLE DECLARATION   ########################


# source executor startup script
source /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪executor/generic.local.python/before_script.sh
# Run generated script
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.python/python-shell/circle_area/0b6ab2ac/stage/circle_area.sh
# Get return code
returncode=$?
# Exit with return code
exit $returncode
************************* End of Build Script:  /home/docs/checkouts/readthedocs.org/
↪user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.python/python-shell/
↪circle_area/0b6ab2ac/circle_area_build.sh ************************
```

We can query multiple tests using `buildtest inspect query` since each test is a positional argument. Any options specified to *buildtest inspect query* will be applied to all test. For instance, let's fetch the output the of test names `root_disk_usage` and `python_hello`

```
$ buildtest inspect query -o  root_disk_usage python_hello
_________________________________ root_disk_usage (ID: 0b5ef78e-e4ea-443f-8174-
↪4069d5182889) _________________________________
executor:  generic.local.bash
description:  Check root disk usage and report if it exceeds threshold
state:  PASS
returncode:  0
runtime:  0.011221
starttime:  2021/08/16 22:11:45
endtime:  2021/08/16 22:11:45
************************* Start of Output File: /home/docs/checkouts/readthedocs.org/
↪user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.bash/disk_usage/root_
↪disk_usage/0b5ef78e/root_disk_usage.out *************************
[OK] Root disk is below threshold of 90%

************************* End of Output File: /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.bash/disk_usage/root_disk_
↪usage/0b5ef78e/root_disk_usage.out ************************
```

(continues on next page)

(continued from previous page)

```
_____________________________ python_hello (ID: 3af45be7-9173-4bd6-b555-f7d8f8380323) __
↪_____________________________
executor:  generic.local.bash
description:  Hello World python
state:  PASS
returncode:  0
runtime:  0.043397
starttime:  2021/08/16 22:11:46
endtime:  2021/08/16 22:11:46
************************ Start of Output File: /home/docs/checkouts/readthedocs.org/
↪user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.bash/python-hello/
↪python_hello/3af45be7/python_hello.out ************************
Hello World

************************ End of Output File: /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.bash/python-hello/python_
↪hello/3af45be7/python_hello.out ************************
```

Using Alternate Report File

The `buildtest report` and `buildtest inspect` command will read from the report file tracked by buildtest which is stored in **$BUILDTEST_ROOT/var/report.json**. This single file can became an issue if you are running jobs through CI where you can potentially overwrite same file or if you want separate report files for each set of builds. Luckily we have an option to handle this using the `buildtest build -r /path/to/report` option which can be used to specify an alternate location to report file.

buildtest will write the report file in the desired location, then you can specify the path to report file via `buildtest report -r /path/to/report` and `buildtest inspect -r /path/to/report` to load the report file when reporting tests.

The report file must be valid JSON file that buildtest understands in order to use *buildtest report* and *buildtest inspect* command. Shown below are some examples using the alternate report file using `buildtest report` and `buildtest inspect` command.

```
$ buildtest report -r python.json --format name,id
Reading report file: /Users/siddiq90/Documents/GitHubDesktop/buildtest/docs/python.json

+--------------+----------+
| name         | id       |
+==============+==========+
| circle_area  | 6be6c404 |
+--------------+----------+
| python_hello | f21ba744 |
+--------------+----------+
```

```
$ buildtest inspect -r test.json name variables_bash
Reading Report File: /Users/siddiq90/Documents/GitHubDesktop/buildtest/test.json

{
  "variables_bash": [
    {
      "id": "cd0511ce",
```

(continues on next page)

(continued from previous page)


```
    "full_id": "cd0511ce-377e-4ed2-95f4-f244e5518732",
    "schemafile": "script-v1.0.schema.json",
    "executor": "generic.local.bash",
    "compiler": null,
    "hostname": "DOE-7086392.local",
    "user": "siddiq90",
    "testroot": "/Users/siddiq90/.buildtest/var/tests/generic.local.bash/vars/
↪variables_bash/1",
    "testpath": "/Users/siddiq90/.buildtest/var/tests/generic.local.bash/vars/
↪variables_bash/1/stage/generate.sh",
    "stagedir": "/Users/siddiq90/.buildtest/var/tests/generic.local.bash/vars/
↪variables_bash/1/stage",
    "rundir": "/Users/siddiq90/.buildtest/var/tests/generic.local.bash/vars/variables_
↪bash/1/run",
    "command": "/Users/siddiq90/.buildtest/var/tests/generic.local.bash/vars/variables_
↪bash/1/stage/generate.sh",
    "outfile": "/Users/siddiq90/.buildtest/var/tests/generic.local.bash/vars/variables_
↪bash/1/run/variables_bash.out",
    "errfile": "/Users/siddiq90/.buildtest/var/tests/generic.local.bash/vars/variables_
↪bash/1/run/variables_bash.err",
    "buildspec_content": "version: \"1.0\"\nbuildspecs:\n  variables_bash:\n    type:␣
↪script\n    executor: generic.local.bash\n    description: Declare shell variables in␣
↪bash\n    tags: [tutorials]\n    vars:\n      X: 1\n      Y: 2\n      literalstring: |\
↪n        \"this is a literal string ':' \"\n      singlequote: \"'singlequote'\"\n    ␣
↪ doublequote: \"\\\"doublequote\\\"\"\n      current_user: \"$(whoami)\"\n      files_
↪homedir: \"`find $HOME -type f -maxdepth 1`\"\n\n    run: |\n      echo \"$X+$Y=\" $((
↪$X+$Y))\n      echo $literalstring\n      echo $singlequote\n      echo $doublequote\n\
↪n      echo $current_user\n      echo $files_homedir",
    "test_content": "#!/bin/bash \nsource /Users/siddiq90/.buildtest/executor/generic.
↪local.bash/before_script.sh\nX=1\nY=2\nliteralstring=\"this is a literal string ':' \"\
↪n\nsinglequote='singlequote'\ndoublequote=\"doublequote\"\ncurrent_user=$(whoami)\
↪nfiles_homedir=`find $HOME -type f -maxdepth 1`\necho \"$X+$Y=\" $(($X+$Y))\necho
↪$literalstring\necho $singlequote\necho $doublequote\n\necho $current_user\necho
↪$files_homedir\nsource /Users/siddiq90/.buildtest/executor/generic.local.bash/after_
↪script.sh",
    "tags": "tutorials",
    "starttime": "2021/04/16 14:29:25",
    "endtime": "2021/04/16 14:29:25",
    "runtime": 0.213196,
    "state": "PASS",
    "returncode": 0,
    "output": "1+2= 3\nthis is a literal string ':'\nsinglequote\ndoublequote\
↪nsiddiq90\n/Users/siddiq90/buildtest_e7yxgttm.log /Users/siddiq90/.anyconnect /Users/
↪siddiq90/buildtest_utwigb8w.log /Users/siddiq90/.DS_Store /Users/siddiq90/.serverauth.
↪555 /Users/siddiq90/.CFUserTextEncoding /Users/siddiq90/.wget-hsts /Users/siddiq90/.
↪bashrc /Users/siddiq90/.zshrc /Users/siddiq90/.coverage /Users/siddiq90/.serverauth.
↪87055 /Users/siddiq90/buildtest_r7bck5zh.log /Users/siddiq90/.zsh_history /Users/
↪siddiq90/.lesshst /Users/siddiq90/calltracker.py /Users/siddiq90/.git-completion.bash /
↪Users/siddiq90/buildtest_wvjaaztp.log /Users/siddiq90/buildtest.log /Users/siddiq90/
↪darhan.log /Users/siddiq90/ascent.yml /Users/siddiq90/.cshrc /Users/siddiq90/buildtest_
↪nyq22whj.log /Users/siddiq90/github-tokens /Users/siddiq90/buildtest_ozb8b52z.log /
↪Users/siddiq90/.zcompdump /Users/siddiq90/buildtest_nab_ckph.log /Users/siddiq90/.
↪serverauth.543 /Users/siddiq90/.s.PGSQL.15007.lock /Users/siddiq90/.bash_profile /
↪Users/siddiq90/.Xauthority /Users/siddiq90/.python_history /Users/siddiq90/.gitconfig /
↪Users/siddiq90/output.txt /Users/siddiq90/.bash_history /Users/siddiq90/.viminfo\n",
```


(continues on next page)

(continued from previous page)


```
      "error": "",
      "job": null
    },
    {
      "id": "e0901505",
      "full_id": "e0901505-a66b-4c91-9b29-d027cb6fabb6",
      "schemafile": "script-v1.0.schema.json",
      "executor": "generic.local.bash",
      "compiler": null,
      "hostname": "DOE-7086392.local",
      "user": "siddiq90",
      "testroot": "/Users/siddiq90/.buildtest/var/tests/generic.local.bash/vars/
↪variables_bash/2",
      "testpath": "/Users/siddiq90/.buildtest/var/tests/generic.local.bash/vars/
↪variables_bash/2/stage/generate.sh",
      "stagedir": "/Users/siddiq90/.buildtest/var/tests/generic.local.bash/vars/
↪variables_bash/2/stage",
      "rundir": "/Users/siddiq90/.buildtest/var/tests/generic.local.bash/vars/variables_
↪bash/2/run",
      "command": "/Users/siddiq90/.buildtest/var/tests/generic.local.bash/vars/variables_
↪bash/2/stage/generate.sh",
      "outfile": "/Users/siddiq90/.buildtest/var/tests/generic.local.bash/vars/variables_
↪bash/2/run/variables_bash.out",
      "errfile": "/Users/siddiq90/.buildtest/var/tests/generic.local.bash/vars/variables_
↪bash/2/run/variables_bash.err",
      "buildspec_content": "version: \"1.0\"\nbuildspecs:\n  variables_bash:\n    type:␣
↪script\n    executor: generic.local.bash\n    description: Declare shell variables in␣
↪bash\n    tags: [tutorials]\n    vars:\n      X: 1\n      Y: 2\n      literalstring: |\
↪n        \"this is a literal string ':' \"\n      singlequote: \"'singlequote'\"\n    ␣
↪ doublequote: \"\\\"doublequote\\\"\"\n      current_user: \"$(whoami)\"\n      files_
↪homedir: \"`find $HOME -type f -maxdepth 1`\"\n\n    run: |\n      echo \"$X+$Y=\" $((
↪$X+$Y))\n      echo $literalstring\n      echo $singlequote\n      echo $doublequote\n\
↪n      echo $current_user\n      echo $files_homedir",
      "test_content": "#!/bin/bash \nsource /Users/siddiq90/.buildtest/executor/generic.
↪local.bash/before_script.sh\nX=1\nY=2\nliteralstring=\"this is a literal string ':' \"\
↪n\nsinglequote='singlequote'\ndoublequote=\"doublequote\"\ncurrent_user=$(whoami)\
↪nfiles_homedir=`find $HOME -type f -maxdepth 1`\necho \"$X+$Y=\" $(($X+$Y))\necho
↪$literalstring\necho $singlequote\necho $doublequote\n\necho $current_user\necho
↪$files_homedir\nsource /Users/siddiq90/.buildtest/executor/generic.local.bash/after_
↪script.sh",
      "tags": "tutorials",
      "starttime": "2021/04/16 14:29:58",
      "endtime": "2021/04/16 14:29:58",
      "runtime": 0.075224,
      "state": "PASS",
      "returncode": 0,
      "output": "1+2= 3\nthis is a literal string ':'\nsinglequote\ndoublequote\
↪nsiddiq90\n/Users/siddiq90/buildtest_e7yxgttm.log /Users/siddiq90/.anyconnect /Users/
↪siddiq90/buildtest_utwigb8w.log /Users/siddiq90/.DS_Store /Users/siddiq90/.serverauth.
↪555 /Users/siddiq90/.CFUserTextEncoding /Users/siddiq90/.wget-hsts /Users/siddiq90/.
↪bashrc /Users/siddiq90/.zshrc /Users/siddiq90/.coverage /Users/siddiq90/.serverauth.
↪87055 /Users/siddiq90/buildtest_r7bck5zh.log /Users/siddiq90/.zsh_history /Users/
↪siddiq90/.lesshst /Users/siddiq90/calltracker.py /Users/siddiq90/.git-completion.bash /
↪Users/siddiq90/buildtest_wvjaaztp.log /Users/siddiq90/buildtest.log /Users/siddiq90/
↪darhan.log /Users/siddiq90/ascent.yml /Users/siddiq90/.cshrc /Users/siddiq90/buildtest_
↪ryqzzwrj.log /Users/siddiq90/github-tokens /Users/siddiq90/buildtest_ozb8b52z.log /
↪Users/siddiq90/.zcompdump /Users/siddiq90/buildtest_nab_ckph.log /Users/siddiq90/.
↪serverauth.543 /Users/siddiq90/.s.PGSQL.15007.lock /Users/siddiq90/.bash_profile /
↪Users/siddiq90/.Xauthority /Users/siddiq90/.python_history /Users/siddiq90/.gitconfig /
```


(continued on next page)

(continued from previous page)

```
      "error": "",
      "job": null
    }
  ]
}
```

3.4.4 Additional Features

Accessing build history

buildtest keeps track of all builds (`buildtest build`) that can be retrieved using `buildtest history` command which can be useful when you want to analyze or troubleshoot past builds. The *buildtest history* command comes with two subcommands `buildtest history list` and `buildtest history query`.

If you want to list all builds you should run **buildtest history list** which will report a table style format of all builds with corresponding build ID to differentiate each build. Shown below is an example output. The build IDs start at **0** and increment as you run **buildtest build** command.

```
$ buildtest history list
+------+-----------------------------------------+--------+----------+--------------------
↪--+--------------+--------------+---------------+-------------+-------------+----------
↪----------------------------------------------------------------------------------------
↪----------------------------------------------------------------------------------------
↪-------------+
|   id | hostname                                | user   | system   | date                ␣
↪  |   pass_tests |   fail_tests |   total_tests |   pass_rate |   fail_rate | command ␣
↪                                                                                       ␣
↪                                                                                       ␣
↪             |
+======+=========================================+========+==========+=====================+===========
|    0 | build-14488818-project-280831-buildtest | docs   | generic  | 2021/08/16␣
↪22:11:15 |            1 |            0 |             1 |         100 |           0 | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/bin/
↪buildtest build -b /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/vars.yml |
+------+-----------------------------------------+--------+----------+--------------------
↪--+--------------+--------------+---------------+-------------+-------------+----------
↪----------------------------------------------------------------------------------------
↪----------------------------------------------------------------------------------------
↪-------------+
|    1 | build-14488818-project-280831-buildtest | docs   | generic  | 2021/08/16␣
↪22:11:16 |            2 |            2 |             4 |          50 |          50 | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/bin/
↪buildtest build -b tutorials/pass_returncode.yml                                      ␣
↪                             |
+------+-----------------------------------------+--------+----------+--------------------
↪--+--------------+--------------+---------------+-------------+-------------+----------
↪----------------------------------------------------------------------------------------
↪----------------------------------------------------------------------------------------
↪-------------+
|    2 | build-14488818-project-280831-buildtest | docs   | generic  | 2021/08/16␣
↪22:11:16 |            1 |            1 |             2 |          50 |          50 | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/bin/
↪buildtest build -b tutorials/status_regex.yml                                         ␣
```

(continues on next page)

(continued from previous page)

```
+------+-----------------------------------------+--------+----------+-------------------
↪--+--------------+--------------+---------------+-------------+-------------+----------
↪-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------
↪--------------+
|    3 | build-14488818-project-280831-buildtest | docs   | generic  | 2021/08/16␣
↪22:11:27 |            3 |            2 |             5 |          60 |          40 | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/bin/
↪buildtest build -b tutorials/runtime_status_test.yml                                  ␣
↪                             |
+------+-----------------------------------------+--------+----------+-------------------
↪--+--------------+--------------+---------------+-------------+-------------+----------
↪-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------
↪--------------+
|    4 | build-14488818-project-280831-buildtest | docs   | generic  | 2021/08/16␣
↪22:11:28 |            2 |            0 |             2 |         100 |           0 | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/bin/
↪buildtest build -b tutorials/shebang.yml                                              ␣
↪                             |
+------+-----------------------------------------+--------+----------+-------------------
↪--+--------------+--------------+---------------+-------------+-------------+----------
↪-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------
↪--------------+
|    5 | build-14488818-project-280831-buildtest | docs   | generic  | 2021/08/16␣
↪22:11:28 |            1 |            0 |             1 |         100 |           0 | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/bin/
↪buildtest build -b tutorials/skip_tests.yml                                           ␣
↪                             |
+------+-----------------------------------------+--------+----------+-------------------
↪--+--------------+--------------+---------------+-------------+-------------+----------
↪-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------
↪--------------+
|    6 | build-14488818-project-280831-buildtest | docs   | generic  | 2021/08/16␣
↪22:11:29 |            1 |            0 |             1 |         100 |           0 | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/bin/
↪buildtest build -b tutorials/metrics_regex.yml                                        ␣
↪                             |
+------+-----------------------------------------+--------+----------+-------------------
↪--+--------------+--------------+---------------+-------------+-------------+----------
↪-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------
↪--------------+
|    7 | build-14488818-project-280831-buildtest | docs   | generic  | 2021/08/16␣
↪22:11:29 |            1 |            0 |             1 |         100 |           0 | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/bin/
↪buildtest build -b tutorials/metrics_variable.yml                                     ␣
↪                             |
+------+-----------------------------------------+--------+----------+-------------------
↪--+--------------+--------------+---------------+-------------+-------------+----------
↪-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------
↪--------------+
```

(continues on next page)

(continued from previous page)

```
|    8 | build-14488818-project-280831-buildtest | docs   | generic  | 2021/08/16␣
↪22:11:30 |            2 |            0 |             2 |         100 |           0 | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/bin/
↪buildtest build -b tutorials/executor_regex_script.yml                          ␣
↪                            |
+------+-----------------------------------------+--------+----------+-------------------
↪--+--------------+--------------+---------------+-------------+-------------+----------
↪-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------
↪-------------+
|    9 | build-14488818-project-280831-buildtest | docs   | generic  | 2021/08/16␣
↪22:11:30 |            2 |            0 |             2 |         100 |           0 | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/bin/
↪buildtest build -b tutorials/script/multiple_executors.yml                      ␣
↪                            |
+------+-----------------------------------------+--------+----------+-------------------
↪--+--------------+--------------+---------------+-------------+-------------+----------
↪-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------
↪-------------+
|   10 | build-14488818-project-280831-buildtest | docs   | generic  | 2021/08/16␣
↪22:11:31 |            2 |            0 |             2 |         100 |           0 | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/bin/
↪buildtest build -b tutorials/script/executor_scheduler.yml                      ␣
↪                            |
+------+-----------------------------------------+--------+----------+-------------------
↪--+--------------+--------------+---------------+-------------+-------------+----------
↪-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------
↪-------------+
|   11 | build-14488818-project-280831-buildtest | docs   | generic  | 2021/08/16␣
↪22:11:31 |            1 |            1 |             2 |          50 |          50 | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/bin/
↪buildtest build -b tutorials/script/status_by_executors.yml                     ␣
↪                            |
+------+-----------------------------------------+--------+----------+-------------------
↪--+--------------+--------------+---------------+-------------+-------------+----------
↪-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------
↪-------------+
```

The `buildtest history query` command is particularly useful when you want to inspect a particular build. This command expects a *Build Identifier* which can be found by inspecting output column *id* in *buildtest history list*.

Shown below is an output of build ID 0 which reports relevant detail for the build such as input command, username, hostname, platform, date, etc…

```
$ buildtest history query 0
{
  "command": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/bin/buildtest build -b /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/vars.yml",
  "user": "docs",
```

(continues on next page)

(continued from previous page)


```
  "hostname": "build-14488818-project-280831-buildtest",
  "platform": "Linux",
  "date": "2021/08/16 22:11:15",
  "buildtest": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest",
  "python": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python",
  "python_version": "3.6.12",
  "testdir": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/tests",
  "configuration": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/buildtest/settings/config.yml",
  "system": "generic",
  "logpath": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.
↪2/var/.history/0/buildtest_hr_5xctx.log",
  "invalid_buildspecs": [],
  "buildspecs": {
    "detected": [
      "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/vars.yml"
    ],
    "included": [
      "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/vars.yml"
    ],
    "excluded": []
  },
  "test_summary": {
    "pass": "1",
    "fail": "0",
    "total": "1",
    "pass_rate": "100.000",
    "fail_rate": "0.000"
  },
  "builders": {
    "1c4ba849-bc6a-4989-8e43-06d38a332531": {
      "name": "variables_bash",
      "buildspec": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/tutorials/vars.yml",
      "tags": [
        "tutorials"
      ],
      "executors": "generic.local.bash",
      "state": "PASS",
      "returncode": 0,
      "runtime": 0.010175,
      "testpath": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/vars/variables_bash/1c4ba849/variables_bash.sh",
      "errfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/vars/variables_bash/1c4ba849/variables_bash.err",
      "outfile": "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/var/tests/generic.local.bash/vars/variables_bash/1c4ba849/variables_bash.out"
```


(continues on next page)

(continued from previous page)

```
    }
  }
}
```

buildtest schemas

buildtest uses JSON Schema for validating buildspecs and *buildtest configuration file*. You can use `buildtest schema` command to see the list of schemas supported by buildtest. The schema files are denoted by `.schema.json` file extension.

```
$ buildtest schema
global.schema.json
definitions.schema.json
settings.schema.json
compiler-v1.0.schema.json
spack-v1.0.schema.json
script-v1.0.schema.json
```

Shown below is the command usage of `buildtest schema`

```
$ buildtest schema --help
usage: buildtest [options] [COMMANDS] schema [-h] [-e] [-j] [-n Schema Name]

optional arguments:
  -h, --help            show this help message and exit
  -e, --example         Show schema examples
  -j, --json            Display json schema file
  -n Schema Name, --name Schema Name
                        show schema by name (e.g., script)
```

The json schemas are published at https://buildtesters.github.io/buildtest/ and we provide a command line interface to view schema files and examples. You must use the `--name` option to select a schema, for instance if you want to view the JSON Schema for **script-v1.0.schema.json** you can run the following:

```
buildtest schema --name script-v1.0.schema.json --json
```

Similarly, if you want to view example buildspecs for a schema use the `--example` option with a schema. For example to view all example schemas for **compiler-v1.0.schema.json** run the following:

```
buildtest schema --name compiler-v1.0.schema.json --example
```

To learn more about schema files and and examples click *here*.

Accessing buildtest documentation

We provide two command line options to access main documentation and schema docs. This will open a browser on your machine.

To access buildtest docs you can run:

```
buildtest docs
```

To access schema docs you can run:

```
buildtest schemadocs
```

Color Mode

buildtest will display output in color by default which can be configured on command line via `buildtest --color [on|off]` or via environment variable **BUILDTEST_COLOR**. You can disable color output via command argument``–color off`` or environment `BUILDTEST_COLOR=False`. If `--color on` is set with `BUILDTEST_COLOR=False`, the value of environment variable will be honored.

CDASH Integration

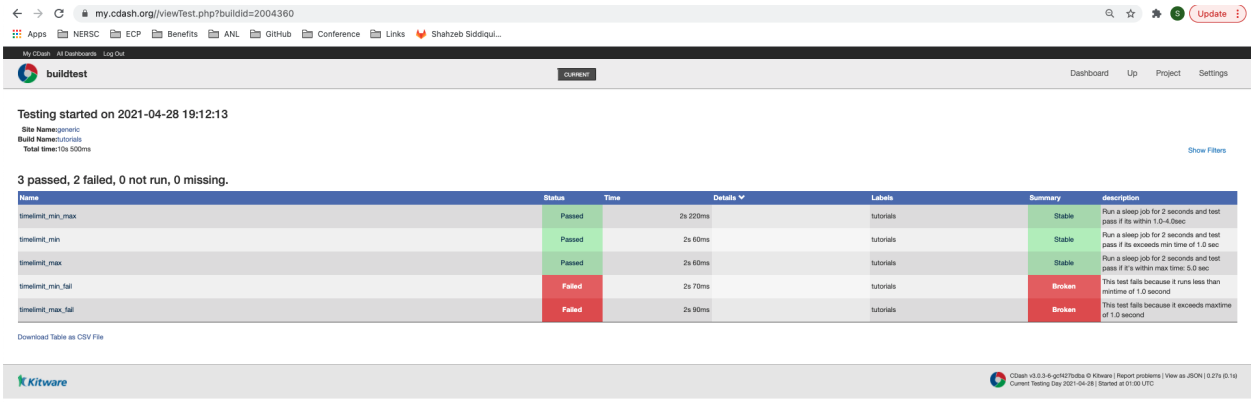
The `buildtest cdash` command is responsible for uploading tests to CDASH server. You will need to specify *CDASH Configuration* in your configuration file. Shown below is the command usage.

```
$ buildtest cdash --help
usage: buildtest [options] [COMMANDS] cdash [-h]  ...

optional arguments:
  -h, --help  show this help message and exit

subcommands:
  buildtest CDASH integeration


    view      Open CDASH project in webbrowser
    upload    Upload Test to CDASH server
```

The `buildtest cdash upload` command is responsible for uploading all tests in *report.json* into CDASH. You must specify a buildname when using **buildtest cdash upload** in this example we will specify a buildname called *tutorials*:

```
$ buildtest cdash upload tutorials
Reading configuration file:  /Users/siddiq90/Documents/GitHubDesktop/buildtest/buildtest/
↪settings/config.yml
Reading report file:  /Users/siddiq90/.buildtest/report.json
build name:  tutorials
site:  generic
stamp:  20210428-1512-Experimental
MD5SUM: d7651cb3fbdd19298b0188c441704c3a
PUT STATUS: 200
You can view the results at: https://my.cdash.org//viewTest.php?buildid=2004360
```

We can see the output of these tests in CDASH if we go to url https://my.cdash.org//viewTest.php?buildid=2004360



By default buildtest will read the report file in your **$HOME/.buildtest/report.json**, we can specify an alternate report file. First let's see the available help options for `buildtest cdash upload`.

```
$ buildtest cdash upload --help
usage: buildtest [options] [COMMANDS] cdash upload [-h] [-r REPORT] [--site SITE]␣
↪buildname

positional arguments:
  buildname             Specify Build Name reported in CDASH

optional arguments:
  -h, --help            show this help message and exit
  -r REPORT, --report REPORT
                        Path to report file to upload test results
  --site SITE           Specify site name reported in CDASH
```

We can pass an alternate report file using `-r` option when uploading tests to CDASH. This can be useful if you want to map test results to different buildnames in CDASH perhaps running a different subset of tests via `buildtest build --tags` and upload the test results with different buildname assuming you have different paths to report file.

Let's say we want to build all python tests using tags and store them in a report file which we want to push to CDASH with buildgroup name `python` we can do that as follows

```
$ buildtest build --tags python -r $BUILDTEST_ROOT/python.json


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:41
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build --tags python -r /home/docs/checkouts/readthedocs.org/user_builds/
↪buildtest/checkouts/v0.10.2/python.json
```

(continues on next page)

(continued from previous page)

```
+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-------------------------------------------------------------------------------------------
↪-----------------+
| Discovered Buildspecs                                                                    ␣
↪                 |
+===========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-shell.yml |
+-------------------------------------------------------------------------------------------
↪-----------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-hello.yml |
+-------------------------------------------------------------------------------------------
↪-----------------+
Discovered Buildspecs:  2
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  2

BREAKDOWN OF BUILDSPECS BY TAGS
---------------------------------
Detected Tag Names: ['python']
+-------------------------------------------------------------------------------------------
↪-----------------+
| python                                                                                   ␣
↪                 |
+===========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-shell.yml |
+-------------------------------------------------------------------------------------------
↪-----------------+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪python-hello.yml |
+-------------------------------------------------------------------------------------------
↪-----------------+



+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-----------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/python-shell.yml
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/python-hello.yml
```

(continues on next page)

(continued from previous page)

```
name          description
------------  -------------------------------------
circle_area   Calculate circle of area given a radius
python_hello  Hello World python

+----------------------+
| Stage: Building Test |
+----------------------+

 name         | id       | type   | executor             | tags                    |␣
↪testpath
--------------+----------+--------+----------------------+-------------------------+-----
↪-------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------
 circle_area  | a689fc7b | script | generic.local.python | ['tutorials', 'python'] | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.python/python-shell/circle_area/a689fc7b/circle_area_build.sh
 python_hello | c4fa9083 | script | generic.local.bash   | python                  | /
↪home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.bash/python-hello/python_hello/c4fa9083/python_hello_build.sh




+----------------------+
| Stage: Running Test |
+----------------------+

 name         | id       | executor             | status   |   returncode
--------------+----------+----------------------+----------+--------------
 circle_area  | a689fc7b | generic.local.python | PASS     |            0
 python_hello | c4fa9083 | generic.local.bash   | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 2/2 Percentage: 100.000%
Failed Tests: 0/2 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest__ykoxdes.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

Next we upload the tests using the `-r` option to specify the report file

```
$ buildtest cdash upload -r $BUILDTEST_ROOT/python.json python
```

(continues on next page)

(continued from previous page)

```
Reading configuration file:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Reading report file:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/python.json
build name:  python
site:  generic
stamp:  20210816-2211-Experimental
MD5SUM: e1bf5fd1954f1e37dbc930d5817e4a4d
PUT STATUS: 200
You can view the results at: https://my.cdash.org//viewTest.php?buildid=2053302
```

The `buildtest cdash view` command can be used to open CDASH project in a web browser using the command line. This feature assumes you have set the CDASH setting in your configuration file.

3.5 Configuring buildtest

3.5.1 Overview

We assume you are familiar with general concepts presented in *getting started* and your next step is to configure buildtest to run at your site. This guide will present you the necessary steps to get you started.

When you clone buildtest, we provide a *default configuration* that can be used to run on your laptop or workstation that supports Linux or Mac. The buildtest configuration uses a JSON schemafile settings.schema.json. for validating your configuration. We have published the schema guide for settings schema which you can find here.

Which configuration file does buildtest read?

buildtest will read configuration files in the following order:

- Command line `buildtest -c <config>.yml build`
- User Configuration - `$HOME/.buildtest/config.yml`
- Default Configuration - `$BUILDTEST_ROOT/buildtest/settings/config.yml`

Default Configuration

Buildtest comes with a default configuration that can be found at buildtest/settings/config.yml relative to root of repo. At the start of buildtest execution, buildtest will load the configuration file and validate the configuration with JSON schema `settings.schema.json`. If it's fails to validate, buildtest will raise an error.

We recommend you copy the default configuration as a template to configure buildtest for your site. To get started you should copy the file in `$HOME/.buildtest/config.yml`. Please run the following command:

```
$ cp $BUILDTEST_ROOT/buildtest/settings/config.yml $HOME/.buildtest/config.yml
```

Shown below is the default configuration provided by buildtest.

```
$ cat $BUILDTEST_ROOT/buildtest/settings/config.yml
system:
  generic:
```

(continues on next page)

(continued from previous page)

```
    # specify list of hostnames where buildtest can run for given system record
    hostnames: [".*"]

    # system description
    description: Generic System
    # specify module system used at your site (environment-modules, lmod)
    moduletool: N/A
    # boolean to determine if buildspecs provided in buildtest repo should be loaded in␣
↪buildspec cache
    load_default_buildspecs: True

    executors:
      # define local executors for running jobs locally
      local:
        bash:
          description: submit jobs on local machine using bash shell
          shell: bash

        sh:
          description: submit jobs on local machine using sh shell
          shell: sh

        csh:
          description: submit jobs on local machine using csh shell
          shell: csh

        zsh:
          description: submit jobs on local machine using zsh shell
          shell: zsh

        python:
          description: submit jobs on local machine using python shell
          shell: python

    # compiler block
    compilers:
      # regular expression to search for compilers based on module pattern. Used with
↪'buildtest config compilers find' to generate compiler instance
      # find:
      #  gcc: "^(gcc)"
      #  intel: "^(intel)"
      #  cray: "^(craype)"
      #  pgi: "^(pgi)"
      #  cuda: ^(cuda)"
      #  clang: "^(clang)"

      # declare compiler instance which can be site-specific. You can let 'buildtest␣
↪config compilers find' generate compiler section
      compiler:
        gcc:
          builtin_gcc:
            cc: gcc
```

(continues on next page)

(continued from previous page)

```
            fc: gfortran
            cxx: g++

    # location of log directory
    # logdir: /tmp/

    # specify location where buildtest will write tests
    # testdir: /tmp

    # specify one or more directory where buildtest should load buildspecs
    # buildspec_roots: []

    cdash:
      url: https://my.cdash.org/
      project: buildtest
      site: generic
      buildname: tutorials
```

As you can see the layout of configuration starts with keyword `system` which is used to define one or more systems. Your HPC site may contain more than one cluster, so you should define your clusters with meaningful names as this will impact when you reference *executors* in buildspecs. In this example, we define one cluster called `generic` which is a dummy cluster used for running tutorial examples. The **required** fields in the system scope are the following:

```
"required": ["executors", "moduletool", "load_default_buildspecs","hostnames", "compilers
↪"]
```

The `hostnames` field is a list of nodes that belong to the cluster where buildtest should be run. Generally, these hosts should be your login nodes in your cluster. buildtest will process **hostnames** field across all system entry using re.match until a hostname is found, if none is found we report an error.

In this example we defined two systems *machine*, *machine2* with the following hostnames.

```
system:
  machine1:
    hostnames:  ['loca$', '^1DOE']
  machine2:
    hostnames: ['BOB|JOHN']
```

In this example, none of the host entries match with hostname **DOE-7086392.local** so we get an error since buildtest needs to detect a system before proceeding.

```
buildtest.exceptions.BuildTestError: "Based on current system hostname: DOE-7086392.
↪local we cannot find a matching system  ['machine1', 'machine2'] based on current␣
↪hostnames: {'machine1': ['loca$', '^1DOE'], 'machine2': ['BOB|JOHN']} "
```

Let's assume you we have a system named `mycluster` that should run on nodes `login1`, `login2`, and `login3`. You can specify hostnames as follows.

```
system:
  mycluster:
    hostnames: ["login1", "login2", "login3"]
```

Alternately, you can use regular expression to condense this list

```
system:
  mycluster:
    hostnames: ["login[1-3]"]
```

Configuring Module Tool

You should configure the `moduletool` property to the module-system installed at your site. Valid options are the following:

```
# environment-modules
moduletool: environment-modules

# for lmod
moduletool: lmod

# specify N/A if you don't have modules
moduletool: N/A
```

buildspec roots

buildtest can discover buildspec using `buildspec_roots` keyword. This field is a list of directory paths to search for buildspecs. For example we clone the repo https://github.com/buildtesters/buildtest-cori at **$HOME/buildtest-cori** and assign this to **buildspec_roots** as follows:

```
buildspec_roots:
  - $HOME/buildtest-cori
```

This field is used with the `buildtest buildspec find` command. If you rebuild your buildspec cache via `--rebuild` option, buildtest will search for all buildspecs in directories specified by **buildspec_roots** property. buildtest will recursively find all **.yml** extension and validate each buildspec with appropriate schema.

Load Default Buildspecs

By default buildtest will add the `$BUILDTEST_ROOT/tutorials` and `$BUILDTEST_ROOT/general_tests` to search path when searching for buildspecs with `buildtest buildspec find` command. This can configured via `load_default_buildspecs` property which expects a boolean value.

By default we enable this property, however in practice you would want to disable this `load_default_buildspecs: False` if you only care about running your facility tests.

What is an executor?

An executor is responsible for running the test and capture output/error file and return code. An executor can be local executor which runs tests on local machine or batch executor that can be modelled as partition/queue. A batch executor is responsible for **dispatching** job, then **poll** job until its finish, and **gather** job metrics from scheduler.

Executor Declaration

The `executors` is a JSON *object*, that defines one or more executors. The executors are grouped by their type followed by executor name. In this example we define two local executors `bash`, `sh` and one slurm executor called `regular`:

```
system:
  generic:
    executors:
      local:
        bash:
          shell: bash
          description: bash shell
        sh:
          shell: sh
          description: sh shell
      slurm:
        regular:
          queue: regular
```

The **LocalExecutors** are defined in section *local* where each executor must be unique name and they are referenced in buildspec using `executor` field in the following format:

```
executor: <system>.<type>.<name>
```

For instance, if a buildspec wants to reference the LocalExecutor *bash* from the *generic* cluster, you would specify the following in the buildspec:

```
executor: generic.local.bash
```

In our example configuration, we defined a `bash` executor as follows:

```
executors:
  # define local executors for running jobs locally
  local:
    bash:
      description: submit jobs on local machine using bash shell
      shell: bash
```

The local executors requires the `shell` key which takes the pattern `"^(/bin/bash|/bin/sh|/bin/csh|/bin/tcsh|/bin/zsh|sh|bash|csh|tcsh|zsh|python).*"`. Any buildspec that references this executor will submit job using `bash` shell.

You can pass options to shell which will get passed into each job submission. For instance if you want all bash scripts to run in login shell you can specify `bash --login`:

```
executors:
  local:
    login_bash:
      shell: bash --login
```

Then you can reference this executor as `executor: generic.local.login_bash` and your tests will be submitted via `bash --login /path/to/test.sh`.

Once you define your executors, you can *query the executors* via `buildtest config executors` command.

Configuring test directory

The default location where tests are written is **$BUILDTEST_ROOT/var/tests** where $BUILDTEST_ROOT is the root of buildtest repo. You may specify `testdir` in your configuration to instruct where tests can be written. For instance, if you want to write tests in **/tmp** you can set the following:

```
testdir: /tmp
```

Alternately, one can specify test directory via `buildtest build --testdir <path>` which has highest precedence and overrides configuration and default value.

Configuring log path

You can configure where buildtest will write logs using `logdir` property. For example, in example below buildtest will write log files `$HOME/Documents/buildtest/var/logs`. buildtest will resolve variable expansion to get real path on filesystem.

```
# location of log directory
logdir: $HOME/Documents/buildtest/var/logs
```

`logdir` is not required field in configuration, if it's not specified then buildtest will write logs based on tempfile library which may vary based on platform (Linux, Mac).

The buildtest logs will start with **buildtest_** followed by random identifier with a **.log** extension.

buildtest will write the same log file in **$BUILDTEST_ROOT/buildtest.log** which can be used to fetch last build log. This can be convenient if you don't remember the directory path to log file.

before_script for executors

Often times, you may want to run a set of commands for a group of tests before running a test. We can do this using this using the `before_script` field which is defined in each executorthat is of string type that expects bash commands.

This can be demonstrated with an executor name **local.e4s** responsible for building E4S Testsuite

```
local:
  e4s:
    description: "E4S testsuite locally"
    shell: bash
    before_script: |
      cd $SCRATCH
      git clone https://github.com/E4S-Project/testsuite.git
      cd testsuite
      source /global/common/software/spackecp/luke-wyatt-testing/spack/share/spack/setup-
↪env.sh
      source setup.sh
```

The *e4s* executor attempts to clone E4S Testsuite in $SCRATCH and activate a spack environment and run the initialize script `source setup.sh`. buildtest will write a `before_script.sh` for every executor. This can be found in `var/executors` directory as shown below

```
$ tree var/executors/
var/executors/
|-- local.bash
```

(continues on next page)

(continued from previous page)

```
|   |-- before_script.sh
|-- local.e4s
|   |-- before_script.sh
|-- local.python
|   |-- before_script.sh
|-- local.sh
|   |-- before_script.sh


4 directories, 4 files
```

The `before_script` field is available for all executors and if its not specified the file will be empty. Every test will source these scripts for the appropriate executor.

Cori @ NERSC

Shown below is the configuration file used at Cori.

```
$ wget -q -O - https://raw.githubusercontent.com/buildtesters/buildtest-cori/devel/
↪config.yml 2>&1
system:
  gerty:
    hostnames:
    - gert01.nersc.gov
    load_default_buildspecs: false
    moduletool: environment-modules
    executors:
      local:
        bash:
          description: submit jobs on local machine using bash shell
          shell: bash
        sh:
          description: submit jobs on local machine using sh shell
          shell: sh
        csh:
          description: submit jobs on local machine using csh shell
          shell: csh
        python:
          description: submit jobs on local machine using python shell
          shell: python
    compilers:
      compiler:
        gcc:
          builtin_gcc:
            cc: /usr/bin/gcc
            cxx: /usr/bin/g++
            fc: /usr/bin/gfortran
    cdash:
      url: https://my.cdash.org
      project: buildtest-cori
      site: gerty
```

(continues on next page)

(continued from previous page)

```
perlmutter:
  hostnames:
  - login*
  load_default_buildspecs: false
  moduletool: lmod
  executors:
    defaults:
      pollinterval: 60
      launcher: sbatch
      max_pend_time: 90
    local:
      bash:
        description: submit jobs on local machine using bash shell
        shell: bash
      sh:
        description: submit jobs on local machine using sh shell
        shell: sh
      csh:
        description: submit jobs on local machine using csh shell
        shell: csh
      python:
        description: submit jobs on local machine using python shell
        shell: python
  compilers:
    find:
      gcc: ^(gcc)
    compiler:
      gcc:
        builtin_gcc:
          cc: /usr/bin/gcc
          cxx: /usr/bin/g++
          fc: /usr/bin/gfortran

  cdash:
    url: https://my.cdash.org
    project: buildtest-cori
    site: perlmutter
cori:
  hostnames:
  - cori*
  load_default_buildspecs: false
  moduletool: environment-modules
  cdash:
    url: https://my.cdash.org
    project: buildtest-cori
    site: cori
  executors:
    defaults:
      pollinterval: 30
      launcher: sbatch
      max_pend_time: 300
```

(continues on next page)

(continued from previous page)

```
    local:
      bash:
        description: submit jobs on local machine using bash shell
        shell: bash
      sh:
        description: submit jobs on local machine using sh shell
        shell: sh
      csh:
        description: submit jobs on local machine using csh shell
        shell: csh
      python:
        description: submit jobs on local machine using python shell
        shell: python
      e4s:
        description: E4S testsuite locally
        shell: bash
        before_script: |
          module load e4s/20.10
          cd $SCRATCH/testsuite
          source setup.sh

    slurm:
      haswell_debug:
        qos: debug
        cluster: cori
        options:
        - -C haswell
        description: debug queue on Haswell partition
      haswell_shared:
        qos: shared
        cluster: cori
        options:
        - -C haswell
        description: shared queue on Haswell partition
      haswell_regular:
        qos: normal
        cluster: cori
        options:
        - -C haswell
        description: normal queue on Haswell partition
      haswell_premium:
        qos: premium
        cluster: cori
        options:
        - -C haswell
        description: premium queue on Haswell partition
      knl_flex:
        description: overrun queue on KNL partition
        qos: overrun
        cluster: cori
        options:
        - -C knl
```

(continues on next page)

(continued from previous page)

```
        bigmem:
          description: bigmem jobs
          cluster: escori
          qos: bigmem
          max_pend_time: 300
        xfer:
          description: xfer qos jobs
          qos: xfer
          cluster: escori
          options:
          - -C haswell
        compile:
          description: compile qos jobs
          qos: compile
          cluster: escori
          options:
          - -N 1
        knl_debug:
          qos: debug
          cluster: cori
          options:
          - -C knl,quad,cache
          description: debug queue on KNL partition
        knl_regular:
          qos: normal
          cluster: cori
          options:
          - -C knl,quad,cache
          description: normal queue on KNL partition
        knl_premium:
          qos: premium
          cluster: cori
          options:
          - -C knl,quad,cache
          description: premium queue on KNL partition
        knl_low:
          qos: low
          cluster: cori
          options:
          - -C knl,quad,cache
          description: low queue on KNL partition
        knl_overrun:
          description: overrun queue on KNL partition
          qos: overrun
          cluster: cori
          options:
          - -C knl
          - --time-min=01:00:00
        gpu:
          description: submit jobs to GPU partition
          options:
          - -C gpu
```

(continues on next page)

(continued from previous page)

```
        cluster: escori
        max_pend_time: 300
      e4s:
        description: E4S runner
        cluster: cori
        max_pend_time: 20000
        options:
        - -q regular
        - -C knl
        - -t 10
        - -n 4
        before_script:  |
          module load e4s/20.10
          cd $SCRATCH/testsuite
          source setup.sh

  compilers:
    find:
      gcc: ^(gcc|PrgEnv-gnu)
      cray: ^(PrgEnv-cray)
      intel: ^(intel|PrgEnv-intel)
      cuda: ^(cuda/)
      upcxx: ^(upcxx)
    compiler:
      gcc:
        builtin_gcc:
          cc: /usr/bin/gcc
          cxx: /usr/bin/g++
          fc: /usr/bin/gfortran
        PrgEnv-gnu/6.0.5:
          cc: gcc
          cxx: g++
          fc: gfortran
          module:
            load:
            - PrgEnv-gnu/6.0.5
            purge: false
        PrgEnv-gnu/6.0.7:
          cc: gcc
          cxx: g++
          fc: gfortran
          module:
            load:
            - PrgEnv-gnu/6.0.7
            purge: false
        PrgEnv-gnu/6.0.9:
          cc: gcc
          cxx: g++
          fc: gfortran
          module:
            load:
            - PrgEnv-gnu/6.0.9
```

(continues on next page)

(continued from previous page)

```
      purge: false
    gcc/6.1.0:
      cc: gcc
      cxx: g++
      fc: gfortran
      module:
        load:
        - gcc/6.1.0
        purge: false
    gcc/7.3.0:
      cc: gcc
      cxx: g++
      fc: gfortran
      module:
        load:
        - gcc/7.3.0
        purge: false
    gcc/8.1.0:
      cc: gcc
      cxx: g++
      fc: gfortran
      module:
        load:
        - gcc/8.1.0
        purge: false
    gcc/8.2.0:
      cc: gcc
      cxx: g++
      fc: gfortran
      module:
        load:
        - gcc/8.2.0
        purge: false
    gcc/8.3.0:
      cc: gcc
      cxx: g++
      fc: gfortran
      module:
        load:
        - gcc/8.3.0
        purge: false
    gcc/9.3.0:
      cc: gcc
      cxx: g++
      fc: gfortran
      module:
        load:
        - gcc/9.3.0
        purge: false
    gcc/10.1.0:
      cc: gcc
      cxx: g++
```

(continues on next page)

(continued from previous page)

```
      fc: gfortran
      module:
        load:
        - gcc/10.1.0
        purge: false
    gcc/6.3.0:
      cc: gcc
      cxx: g++
      fc: gfortran
      module:
        load:
        - gcc/6.3.0
        purge: false
    gcc/8.1.1-openacc-gcc-8-branch-20190215:
      cc: gcc
      cxx: g++
      fc: gfortran
      module:
        load:
        - gcc/8.1.1-openacc-gcc-8-branch-20190215
        purge: false
  cray:
    PrgEnv-cray/6.0.5:
      cc: cc
      cxx: CC
      fc: ftn
      module:
        load:
        - PrgEnv-cray/6.0.5
        purge: false
    PrgEnv-cray/6.0.7:
      cc: cc
      cxx: CC
      fc: ftn
      module:
        load:
        - PrgEnv-cray/6.0.7
        purge: false
    PrgEnv-cray/6.0.9:
      cc: cc
      cxx: CC
      fc: ftn
      module:
        load:
        - PrgEnv-cray/6.0.9
        purge: false
  intel:
    PrgEnv-intel/6.0.5:
      cc: icc
      cxx: icpc
      fc: ifort
      module:
```

(continues on next page)

(continued from previous page)

```
      load:
      - PrgEnv-intel/6.0.5
      purge: false
  PrgEnv-intel/6.0.7:
    cc: icc
    cxx: icpc
    fc: ifort
    module:
      load:
      - PrgEnv-intel/6.0.7
      purge: false
  PrgEnv-intel/6.0.9:
    cc: icc
    cxx: icpc
    fc: ifort
    module:
      load:
      - PrgEnv-intel/6.0.9
      purge: false
  intel/19.0.3.199:
    cc: icc
    cxx: icpc
    fc: ifort
    module:
      load:
      - intel/19.0.3.199
      purge: false
  intel/19.1.2.254:
    cc: icc
    cxx: icpc
    fc: ifort
    module:
      load:
      - intel/19.1.2.254
      purge: false
  intel/16.0.3.210:
    cc: icc
    cxx: icpc
    fc: ifort
    module:
      load:
      - intel/16.0.3.210
      purge: false
  intel/17.0.1.132:
    cc: icc
    cxx: icpc
    fc: ifort
    module:
      load:
      - intel/17.0.1.132
      purge: false
  intel/17.0.2.174:
```

(continues on next page)

(continued from previous page)

```
      cc: icc
      cxx: icpc
      fc: ifort
      module:
        load:
        - intel/17.0.2.174
        purge: false
    intel/18.0.1.163:
      cc: icc
      cxx: icpc
      fc: ifort
      module:
        load:
        - intel/18.0.1.163
        purge: false
    intel/18.0.3.222:
      cc: icc
      cxx: icpc
      fc: ifort
      module:
        load:
        - intel/18.0.3.222
        purge: false
    intel/19.0.0.117:
      cc: icc
      cxx: icpc
      fc: ifort
      module:
        load:
        - intel/19.0.0.117
        purge: false
    intel/19.0.8.324:
      cc: icc
      cxx: icpc
      fc: ifort
      module:
        load:
        - intel/19.0.8.324
        purge: false
    intel/19.1.0.166:
      cc: icc
      cxx: icpc
      fc: ifort
      module:
        load:
        - intel/19.1.0.166
        purge: false
    intel/19.1.1.217:
      cc: icc
      cxx: icpc
      fc: ifort
      module:
```

(continues on next page)

(continued from previous page)

```
            load:
            - intel/19.1.1.217
            purge: false
        intel/19.1.2.275:
          cc: icc
          cxx: icpc
          fc: ifort
          module:
            load:
            - intel/19.1.2.275
            purge: false
        intel/19.1.3.304:
          cc: icc
          cxx: icpc
          fc: ifort
          module:
            load:
            - intel/19.1.3.304
            purge: false
      cuda:
        cuda/9.2.148:
          cc: nvcc
          cxx: nvcc
          fc: None
          module:
            load:
            - cuda/9.2.148
            purge: false
        cuda/10.0.130:
          cc: nvcc
          cxx: nvcc
          fc: None
          module:
            load:
            - cuda/10.0.130
            purge: false
        cuda/10.1.105:
          cc: nvcc
          cxx: nvcc
          fc: None
          module:
            load:
            - cuda/10.1.105
            purge: false
        cuda/10.1.168:
          cc: nvcc
          cxx: nvcc
          fc: None
          module:
            load:
            - cuda/10.1.168
            purge: false
```

(continues on next page)

(continued from previous page)

```
      cuda/10.1.243:
        cc: nvcc
        cxx: nvcc
        fc: None
        module:
          load:
          - cuda/10.1.243
          purge: false
      cuda/10.2.89:
        cc: nvcc
        cxx: nvcc
        fc: None
        module:
          load:
          - cuda/10.2.89
          purge: false
      cuda/11.0.2:
        cc: nvcc
        cxx: nvcc
        fc: None
        module:
          load:
          - cuda/11.0.2
          purge: false
      cuda/shifter:
        cc: nvcc
        cxx: nvcc
        fc: None
        module:
          load:
          - cuda/shifter
          purge: false
    upcxx:
      upcxx/2019.9.0:
        cc: upcxx
        cxx: upcxx
        fc: None
        module:
          load:
          - upcxx/2019.9.0
          purge: false
      upcxx/2020.3.0:
        cc: upcxx
        cxx: upcxx
        fc: None
        module:
          load:
          - upcxx/2020.3.0
          purge: false
      upcxx/2020.3.2:
        cc: upcxx
        cxx: upcxx
```

(continues on next page)

(continued from previous page)

```
    fc: None
    module:
      load:
      - upcxx/2020.3.2
      purge: false
  upcxx/2020.3.8-snapshot:
    cc: upcxx
    cxx: upcxx
    fc: None
    module:
      load:
      - upcxx/2020.3.8-snapshot
      purge: false
  upcxx/2020.10.0:
    cc: upcxx
    cxx: upcxx
    fc: None
    module:
      load:
      - upcxx/2020.10.0
      purge: false
  upcxx/2020.11.0:
    cc: upcxx
    cxx: upcxx
    fc: None
    module:
      load:
      - upcxx/2020.11.0
      purge: false
  upcxx/bleeding-edge:
    cc: upcxx
    cxx: upcxx
    fc: None
    module:
      load:
      - upcxx/bleeding-edge
      purge: false
  upcxx/nightly:
    cc: upcxx
    cxx: upcxx
    fc: None
    module:
      load:
      - upcxx/nightly
      purge: false
  upcxx-bupc-narrow/2019.9.0:
    cc: upcxx
    cxx: upcxx
    fc: None
    module:
      load:
      - upcxx-bupc-narrow/2019.9.0
```

(continues on next page)

(continued from previous page)

```
    purge: false
upcxx-bupc-narrow/2020.3.0:
  cc: upcxx
  cxx: upcxx
  fc: None
  module:
    load:
    - upcxx-bupc-narrow/2020.3.0
    purge: false
upcxx-bupc-narrow/2020.3.2:
  cc: upcxx
  cxx: upcxx
  fc: None
  module:
    load:
    - upcxx-bupc-narrow/2020.3.2
    purge: false
upcxx-bupc-narrow/2020.3.8-snapshot:
  cc: upcxx
  cxx: upcxx
  fc: None
  module:
    load:
    - upcxx-bupc-narrow/2020.3.8-snapshot
    purge: false
upcxx-bupc-narrow/2020.11.0:
  cc: upcxx
  cxx: upcxx
  fc: None
  module:
    load:
    - upcxx-bupc-narrow/2020.11.0
    purge: false
upcxx-bupc-narrow/bleeding-edge:
  cc: upcxx
  cxx: upcxx
  fc: None
  module:
    load:
    - upcxx-bupc-narrow/bleeding-edge
    purge: false
upcxx-cs267/2020.10.0:
  cc: upcxx
  cxx: upcxx
  fc: None
  module:
    load:
    - upcxx-cs267/2020.10.0
    purge: false
upcxx-extras/2020.3.0:
  cc: upcxx
  cxx: upcxx
```

(continues on next page)

(continued from previous page)

```
            fc: None
            module:
              load:
              - upcxx-extras/2020.3.0
              purge: false
          upcxx-extras/2020.3.8:
            cc: upcxx
            cxx: upcxx
            fc: None
            module:
              load:
              - upcxx-extras/2020.3.8
              purge: false
          upcxx-extras/master:
            cc: upcxx
            cxx: upcxx
            fc: None
            module:
              load:
              - upcxx-extras/master
              purge: false
```

Default Executor Settings

We can define default configurations for all executors using the `defaults` property.

```
executors:
  defaults:
    pollinterval: 10
    launcher: sbatch
    max_pend_time: 90
    account: nstaff
```

The *launcher* field is applicable for batch executors in this case, `launcher: sbatch` inherits **sbatch** as the job launcher for all slurm executors.

The `account: nstaff` will instruct buildtest to charge all jobs to account `nstaff` from Slurm Executors. The `account` option can be set in `defaults` field to all executors or defined per executor instance which overrides the default value.

Poll Interval

The `pollinterval` field is used to poll jobs at set interval in seconds when job is active in queue. The poll interval can be configured on command line using `buildtest build --poll-interval` which overrides the configuration value.

Note: `pollinterval`, `launcher` and `max_pend_time` have no effect on local executors.

Max Pend Time

The `max_pend_time` is **maximum** time job can be pending within an executor, if it exceeds the limit buildtest will cancel the job.

The **max_pend_time** option can be overridden per executor level for example the section below overrides the default to 300 seconds:

```
bigmem:
  description: bigmem jobs
  cluster: escori
  qos: bigmem
  max_pend_time: 300
```

The `max_pend_time` is used to cancel job only if job is pending in queue, it has no impact if job is running. buildtest starts a timer at job submission and every poll interval (`pollinterval` field) checks if job has exceeded **max_pend_time** only if job is pending. If job pendtime exceeds *max_pend_time* limit, buildtest will cancel job the job using the appropriate scheduler command like (`scancel`, `bkill`, `qdel`). Buildtestwill remove cancelled jobs from poll queue, in addition cancelled jobs won't be reported in test report.

For more details on *max_pend_time* click *here*.

Specifying QoS (Slurm)

At Cori, jobs are submitted via qos instead of partition so we model a slurm executor named by qos. The `qos` field instructs which Slurm QOS to use when submitting job. For example we defined a slurm executor named **haswell_debug** which will submit jobs to **debug** qos on the haswell partition as follows:

```
executors:
  slurm:
    haswell_debug:
      qos: debug
      cluster: cori
      options:
      - -C haswell
```

The `cluster` field specifies which slurm cluster to use (i.e `sbatch --clusters=<string>`). In-order to use `bigmem`, `xfer`, or `gpu` qos at Cori, we need to specify **escori** cluster (i.e `sbatch --clusters=escori`).

buildtest will detect slurm configuration and check qos, partition, cluster match with buildtest configuration. In addition, buildtest supports multi-cluster job submission and monitoring from remote cluster. This means if you specify `cluster` field buildtest will poll jobs using *sacct* with the cluster name as follows: `sacct -M <cluster>`.

The `options` field is use to specify any additional options to launcher (`sbatch`) on command line. For instance, `slurm.gpu` executor, we use the `options: -C gpu` to submit to Cori GPU cluster which requires `sbatch -M escori -C gpu`. Any additional **#SBATCH** options are defined in buildspec for more details see *batch scheduler support*.

PBS Executors

buildtest supports PBS scheduler which can be defined in the `executors` section. Shown below is an example configuration using one `pbs` executor named `workq`. The property `queue: workq` defines the name of PBS queue that is available in your system.

```
system:
  generic:
    hostnames: ['.*']

    moduletool: N/A
    load_default_buildspecs: True
    executors:
      defaults:
         pollinterval: 10
         launcher: qsub
         max_pend_time: 30
      pbs:
        workq:
          queue: workq
    compilers:
      compiler:
        gcc:
          default:
            cc: /usr/bin/gcc
            cxx: /usr/bin/g++
            fc: /usr/bin/gfortran
```

buildtest will detect the PBS queues in your system and determine if queues are active and enabled before submitting job to scheduler. buildtest will run `qstat -Q -f -F json` command to check for queue state which reports in JSON format and check if queue has the fields `enabled: "True"` or `started: "True"` set in the queue definition. If these values are not set, buildtest will raise an exception.

Shown below is an example with one queue **workq** that is `enabled` and `started`.

```
$ qstat -Q -f -F json
{
    "timestamp":1615924938,
    "pbs_version":"19.0.0",
    "pbs_server":"pbs",
    "Queue":{
        "workq":{
            "queue_type":"Execution",
            "total_jobs":0,
            "state_count":"Transit:0 Queued:0 Held:0 Waiting:0 Running:0 Exiting:0␣
↪Begun:0 ",
            "resources_assigned":{
                "mem":"0kb",
                "ncpus":0,
                "nodect":0
            },
            "hasnodes":"True",
            "enabled":"True",
            "started":"True"
```

(continues on next page)

(continued from previous page)

```
        }
    }
}
```

PBS Limitation

Note: Please note that buildtest PBS support relies on job history set because buildtest needs to query job after completion using *qstat -x*. This can be configured using `qmgr` by setting `set server job_history_enable=True`. For more details see section **13.15.5.1 Enabling Job History** in PBS 2020.1 Admin Guide

CDASH Configuration

buildtest can be configured to push test to CDASH. The default configuration file provides a CDASH configuration for buildtest project is the following.

```
cdash:
  url: https://my.cdash.org/
  project: buildtest
  site: generic
  buildname: tutorials
```

The cdash section can be summarized as follows:

- `url`: URL to CDASH server
- `project`: Project Name in CDASH server
- `site`: Site name that shows up in CDASH entry. This should be name of your system name
- `buildname`: Build Name that shows up in CDASH, this can be any name you want.

The cdash settings can be used with `buildtest cdash` command. For more details see *CDASH Integration*.

3.5.2 Defining Compilers at your site

buildtest provides a mechanism to declare compilers in your configuration file, this is defined in `compilers` top-level section. The compilers should reflect compilers installed at your site. The compilers are used if you are writing a buildspec with *compiler schema* that needs to reference a particular compiler. The compilers are declared within scope of a system since we assume compilers will vary across different HPC clusters.

Compiler Declaration

Shown below is a declaration of `builtin_gcc` provided by default.

```
compilers:
  compiler:
    gcc:
      builtin_gcc:
        cc: /usr/bin/gcc
        cxx: /usr/bin/g++
        fc: /usr/bin/gfortran
```

The compiler declaration is defined in section `compiler` followed by name of compiler in this case `gcc`. In the gcc section one can define all gnu compilers, which includes the name of the compiler in this example we call `builtin_gcc` as system compiler that defines C, C++ and Fortran compilers using `cc`, `cxx` and `fc`.

One can retrieve all compilers using `buildtest config compilers`, there are few options for this command.

```
$ buildtest config compilers --help
usage: buildtest [options] [COMMANDS] config compilers [-h] [-j] [-y]  ...

optional arguments:
  -h, --help  show this help message and exit
  -j, --json  List compiler details in JSON format
  -y, --yaml  List compiler details in YAML format

subcommands:
  Find new compilers and add them to detected compiler section


    find      Find compilers
```

buildtest can represent compiler output in JSON, YAML using the `--json` and `--yaml`. Shown below is an example output with these options:

```
$ buildtest config compilers --json
{
  "gcc": {
    "builtin_gcc": {
      "cc": "/usr/bin/gcc",
      "cxx": "/usr/bin/g++",
      "fc": "/usr/bin/gfortran"
    }
  }
}

$ buildtest config compilers --yaml
gcc:
  builtin_gcc:
    cc: /usr/bin/gcc
    cxx: /usr/bin/g++
    fc: /usr/bin/gfortran

$ buildtest config compilers
builtin_gcc
```

Detect Compilers (Experimental Feature)

buildtest can detect compilers based on modulefiles and generate compiler section that way you don't have to specify each compiler manually. This can be done via `buildtest config compilers find` command. Buildtest expects a key/value mapping when searching compiler names and regular expression using re.match for discovering compiler modules.

This can be demonstrated, by defining search pattern in the `find` section that expects a dictionary of key/value mapping between compiler names and their module names.

In example, below we define a pattern for gcc modules as `^(gcc)` which will find all modules that start with name *gcc*.

```
compilers:
  find:
    gcc: "^(gcc)"
  compiler:
    gcc:
      builtin:
        cc: /usr/bin/gcc
        cxx: /usr/bin/g++
        fc: /usr/bin/gfortran
```

In this system, we have two gcc modules installed via spack package manager, we will attempt to add both modules as compiler instance in buildtest.

```
$ module -t av gcc
/Users/siddiq90/projects/spack/share/spack/lmod/darwin-catalina-x86_64/Core:
gcc/9.3.0-n7p74fd
gcc/10.2.0-37fmsw7
```

Next we run `buildtest config compilers find` which will search all modules based on regular expression and add compilers in their respective group. In this example, buildtest automatically add `gcc/9.2.0-n7p74fd` and `gcc/10.2.0-37fmsw7` modules as compiler instance. Depending on the compiler group, buildtest will apply the compiler wrapper `cc`, `cxx`, `fc` however these can be updated manually. The module section is generated with the module to load. One can further tweak the module behavior along with purging or swap modules.

```
$ buildtest config compilers find
MODULEPATH: /Users/siddiq90/projects/spack/share/spack/lmod/darwin-catalina-x86_64/Core:/
↪usr/local/Cellar/lmod/8.4.12/modulefiles/Darwin:/usr/local/Cellar/lmod/8.4.12/
↪modulefiles/Core
Configuration File: /Users/siddiq90/.buildtest/config.yml
______________________________________________________________________________________
moduletool: lmod
load_default_buildspecs: true
executors:
  local:
    bash:
      description: submit jobs on local machine using bash shell
      shell: bash
    sh:
      description: submit jobs on local machine using sh shell
      shell: sh
    csh:
      description: submit jobs on local machine using csh shell
      shell: csh
```

(continues on next page)

(continued from previous page)

```
    python:
      description: submit jobs on local machine using python shell
      shell: python
compilers:
  find:
    gcc: ^(gcc)
    pgi: ^(pgi)
  compiler:
    gcc:
      builtin_gcc:
        cc: /usr/bin/gcc
        cxx: /usr/bin/g++
        fc: /usr/local/bin/gfortran
      gcc/9.3.0-n7p74fd:
        cc: gcc
        cxx: g++
        fc: gfortran
        module:
          load:
          - gcc/9.3.0-n7p74fd
          purge: false
      gcc/10.2.0-37fmsw7:
        cc: gcc
        cxx: g++
        fc: gfortran
        module:
          load:
          - gcc/10.2.0-37fmsw7
          purge: false


____________________________________________________________________________________
Updating settings file:  /Users/siddiq90/.buildtest/config.yml
```

This feature relies on module system (Lmod, environment-modules) to search modulefiles and one must specify **moduletool** property to indicate how buildtest will search modules. If `moduletool: lmod` is set, buildtest will rely on Lmod spider using Lmodule API to detect and test all modules. If `moduletool: environment-modules` is set, buildtest will retrieve modules using output of `module -t av`.

3.5.3 Command Line Interface to buildtest configuration

Once you have implemented your buildtest configuration, you can query the configuration details using `buildtest config` command. Shown below is the command usage.

```
$ buildtest config --help
usage: buildtest [options] [COMMANDS] config [-h]  ...

optional arguments:
  -h, --help  show this help message and exit

subcommands:
  Query information from buildtest configuration file
```

(continues on next page)

(continued from previous page)

```
    compilers
              Search compilers
    executors
              Query executors from buildtest configuration
    summary   Provide summary of buildtest settings.
    systems   List all available systems
    validate  Validate buildtest settings file with schema.
    view      View Buildtest Configuration File
```

Validate buildtest configuration

First thing you should do once you implement your configuration file is to make sure your configuration is valid with the schema. This can be achieved by running `buildtest config validate`. When you invoke this command, buildtest will load the configuration and attempt to validate the file with schema **settings.schema.json**. If validation is successful you will get the following message:

```
$ buildtest config validate
/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest/
↪settings/config.yml is valid
```

Note: If you defined a user setting (`~/.buildtest/config.yml`) buildtest will validate this file instead of default one.

If there is an error during validation, the output from **jsonschema.exceptions.ValidationError** will be displayed in terminal. For example the error below indicates that `moduletool` property was expecting one of the values [`environment-modules`, `lmod`, `N/A`] but it recieved a value of `none`:

```
$ buildtest config validate
Traceback (most recent call last):
  File "/Users/siddiq90/Documents/buildtest/bin/buildtest", line 17, in <module>
    buildtest.main.main()
  File "/Users/siddiq90/Documents/buildtest/buildtest/main.py", line 39, in main
    buildtest_configuration = check_settings(settings_file, retrieve_settings=True)
  File "/Users/siddiq90/Documents/buildtest/buildtest/config.py", line 41, in check_
↪settings
    validate(instance=user_schema, schema=config_schema)
  File "/Users/siddiq90/.local/share/virtualenvs/buildtest-1gHVG2Pd/lib/python3.7/site-
↪packages/jsonschema/validators.py", line 934, in validate
    raise error
jsonschema.exceptions.ValidationError: 'none' is not one of ['environment-modules', 'lmod
↪', 'N/A']

Failed validating 'enum' in schema['properties']['moduletool']:
    {'description': 'Specify modules tool used for interacting with '
                    '``module`` command. ',
     'enum': ['environment-modules', 'lmod', 'N/A'],
     'type': 'string'}
```

(continues on next page)

(continued from previous page)

```
On instance['moduletool']:
    'none'
```

View buildtest configuration

If you want to view buildtest configuration you can run `buildtest config view` which will print content of buildtest configuration.

```
$ buildtest config view
hostnames:
- .*
description: Generic System
moduletool: N/A
load_default_buildspecs: true
executors:
  local:
    bash:
      description: submit jobs on local machine using bash shell
      shell: bash
    sh:
      description: submit jobs on local machine using sh shell
      shell: sh
    csh:
      description: submit jobs on local machine using csh shell
      shell: csh
    zsh:
      description: submit jobs on local machine using zsh shell
      shell: zsh
    python:
      description: submit jobs on local machine using python shell
      shell: python
compilers:
  compiler:
    gcc:
      builtin_gcc:
        cc: gcc
        fc: gfortran
        cxx: g++
cdash:
  url: https://my.cdash.org/
  project: buildtest
  site: generic
  buildname: tutorials


____________________________________________________________________________________
Settings File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/buildtest/settings/config.yml
```

Note: `buildtest config view` will display contents of user buildtest settings `~/.buildtest/config.yml` if found, otherwise it will display the default configuration

View Executors

You can use the command `buildtest config executors` to view executors from buildtest configuration file. Shown below is the command usage

```
$ buildtest config executors --help
usage: buildtest [options] [COMMANDS] config executors [-h] [-j] [-y]

optional arguments:
  -h, --help  show this help message and exit
  -j, --json  View executor in JSON format
  -y, --yaml  View executors in YAML format
```

You can run `buildtest config executors` without any options and it will report a list of named executors that you would reference in buildspec using the `executor` property. If you prefer json or yaml format you can use `--json` or `--yaml` option.

```
$ buildtest config executors
generic.local.bash
generic.local.sh
generic.local.csh
generic.local.zsh
generic.local.python
```

View Registered Systems

Your buildtest configuration may compose of one or more systems since you can define multiple systems in a single configuration file to run buildtest for different HPC clusters. You can use `buildtest config systems` to report all system details defined in your configuration file. In this example below we should the `generic` system. If you have multiple entries, you will see one entry per system record.

```
$ buildtest config systems
+----------+----------------+-------------+--------------+
| system   | description    | hostnames   | moduletool   |
+==========+================+=============+==============+
| generic  | Generic System | ['.*']      | N/A          |
+----------+----------------+-------------+--------------+
```

Configuration Summary

You can get a summary of buildtest using `buildtest config summary`, this will display information from several sources into one single command along.

```
$ buildtest config summary
buildtest version:  0.10.2
buildtest Path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest


Machine Details
________________________________
Operating System:  ubuntu
```

(continues on next page)

(continued from previous page)

```
Hostname:  build-14488818-project-280831-buildtest
Machine:  x86_64
Processor:  x86_64
Python Path /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
Python Version: 3.6.12
User: docs


Buildtest Settings
______________________________________________________________________________________
Buildtest Settings: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/buildtest/settings/config.yml
Executors:  ['local.bash', 'local.sh', 'local.csh', 'local.zsh', 'local.python']
Buildspec Cache File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/buildspecs/cache.json


Buildtest Schemas
______________________________________________________________________________________
Available Schemas: ['script-v1.0.schema.json', 'compiler-v1.0.schema.json', 'global.
↪schema.json', 'settings.schema.json']
```

Example Configurations

buildtest provides a few example configurations for configuring buildtest this can be retrieved by running `buildtest schema -n settings.schema.json --examples` or short option (`-e`), which will validate each example with schema file `settings.schema.json`.

```
$ buildtest schema -n settings.schema.json -e
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/settings.schema.json/valid/slurm-example.yml
______________________________________________________________________________________
system:
  generic:
    hostnames: ['.*']

    moduletool: lmod
    load_default_buildspecs: True
    buildspec_roots:
      - $HOME/buildtest-cori
    testdir: /tmp/buildtest
    executors:
      defaults:
        pollinterval: 20
        launcher: sbatch
        max_pend_time: 30
        account: admin
      slurm:
        normal:
          options: ["-C haswell"]
```

(continues on next page)

(continued from previous page)

```
          qos: normal
          before_script: |
            time
            echo "commands run before job"

    compilers:
      compiler:
        gcc:
          default:
            cc: /usr/bin/gcc
            cxx: /usr/bin/g++
            fc: /usr/bin/gfortran
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/settings.schema.json/valid/cobalt-example.yml
--------------------------------------------------------------------------------
system:
  generic:
    hostnames: ['.*']

    moduletool: lmod
    load_default_buildspecs: True
    executors:
      defaults:
         launcher: qsub
         max_pend_time: 30

      cobalt:
        knl:
          queue: knl

        haswell:
          queue: haswell

    compilers:
      compiler:
        gcc:
          default:
            cc: /usr/bin/gcc
            cxx: /usr/bin/g++
            fc: /usr/bin/gfortran
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/settings.schema.json/valid/pbs-example.yml
--------------------------------------------------------------------------------
system:
  generic:
    hostnames: ['.*']

    moduletool: N/A
    load_default_buildspecs: True
    executors:
      defaults:
         pollinterval: 10
```

(continues on next page)

(continued from previous page)

```
         launcher: qsub
         max_pend_time: 30
      pbs:
        workq:
          queue: workq
    compilers:
      compiler:
        gcc:
          default:
            cc: /usr/bin/gcc
            cxx: /usr/bin/g++
            fc: /usr/bin/gfortran
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/settings.schema.json/valid/lsf-example.yml
--------------------------------------------------------------------------------
system:
  generic:
    hostnames: ['.*']

    moduletool: lmod
    load_default_buildspecs: False
    executors:
      defaults:
        pollinterval: 10
        launcher: bsub
        max_pend_time: 45
      lsf:
        batch:
          description: "LSF Executor name 'batch' that submits jobs to 'batch' queue"
          queue: batch
          account: developer
          options: ["-W 20"]
          before_script: |
            time
            echo "commands run before job"
        test:
          description: "LSF Executor name 'test' that submits jobs to 'test' queue"
          launcher: bsub
          queue: test
          account: qa
          options: ["-W 20"]
    compilers:
      compiler:
        gcc:
          default:
            cc: /usr/bin/gcc
            cxx: /usr/bin/g++
            fc: /usr/bin/gfortran
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/settings.schema.json/valid/local-executor.yml
--------------------------------------------------------------------------------
system:
```

(continues on next page)

(continued from previous page)

```
generic:
  hostnames: ['.*']

  logdir: $BUILDTEST_ROOT/logs
  testdir: $BUILDTEST_ROOT/tests

  moduletool: N/A
  load_default_buildspecs: False
  cdash:
    url: https://my.cdash.org
    project: buildtest
    site: laptop
  processor:
    numcpus: 8
    cores: 4
    threads_per_core: 2
    sockets: 1
    model: "Intel(R) Core(TM) i7-8569U CPU @ 2.80GHz"
  executors:
    local:
      bash:
        description: submit jobs on local machine using bash shell
        shell: bash
        before_script: |
          time
          echo "commands run before job"

      sh:
        description: submit jobs on local machine using sh shell
        shell: sh

      csh:
        description: submit jobs on local machine using csh shell
        shell: csh -x

      tcsh:
        description: submit jobs on local machine using tcsh shell
        shell: /bin/tcsh

      zsh:
        description: submit jobs on local machine using zsh shell
        shell: /bin/zsh

      python:
        description: submit jobs on local machine using python shell
        shell: python

  compilers:
    find:
      gcc: "^(gcc|GCC|PrgEnv-gnu)"
      intel: "^(intel|Intel|PrgEnv-intel)"
      cray: "^(cray|PrgEnv-cray)"
```

(continues on next page)

(continued from previous page)

```
    clang: "^(clang|Clang)"
    cuda: "^(cuda|CUDA)"
    pgi: "^(pgi|PGI|PrgEnv-pgi)"

  compiler:
    gcc:
      default:
        cc: /usr/bin/gcc
        cxx: /usr/bin/g++
        fc: /usr/bin/gfortran
      gcc@7.2.0:
        cc: 'cc'
        cxx: 'cxx'
        fc: 'fc'
        module:
          load:
          - gcc/7.2.0
    intel:
      intel@2019:
        cc: 'icc'
        cxx: 'icpc'
        fc: 'ifort'
        module:
          purge: True
          load:
          - gcc/7.2.0
          - intel/2019
    cray:
      craype@2.6.2:
        cc: 'cc'
        cxx: 'CC'
        fc: 'fc'
        module:
          load: [craype/2.6.2]
          swap: [PrgEnv-gnu, PrgEnv-cray]

    clang:
      clang@12.0.0:
        cc: 'clang'
        cxx: 'clang++'
        fc: 'None'
        module:
          load: [clang/12.0]
    cuda:
      cuda@11.0:
        cc: 'nvcc'
        cxx: 'nvcc'
        fc: 'None'
        module:
          load: [cuda/11.0]
    pgi:
      pgi@18.0:
```

(continues on next page)

(continued from previous page)

```
            cc: 'pgcc'
            cxx: 'pgc++'
            fc: 'pgfortran'
            module:
              load: [pgi/18.0]

File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/settings.schema.json/valid/combined_executor.yml
--------------------------------------------------------------------------------
system:
  generic:
    hostnames: ['.*']

    moduletool: N/A
    load_default_buildspecs: True
    executors:
      local:
        bash:
          description: submit jobs on local machine
          shell: bash -v

      slurm:
        haswell:
          launcher: sbatch
          options:
            - "-p haswell"
            - "-t 00:10"

      lsf:
        batch:
          launcher: bsub
          queue: batch
          options:
            - "-q batch"
            - "-t 00:10"
      cobalt:
        normal:
          launcher: qsub
          queue: normal
          options:
            - "-n 1"
            - "-t 10"

    compilers:
      compiler:
        gcc:
          default:
            cc: /usr/bin/gcc
            cxx: /usr/bin/g++
            fc: /usr/bin/gfortran
```

If you want to retrieve full json schema file for buildtest configuration you can run `buildtest schema -n settings.schema.json --json` or short option `-j`.

3.5.4 Site Examples

Ascent @ OLCF

Ascent is a training system for Summit at OLCF, which is using a IBM Load Sharing Facility (LSF) as their batch scheduler. Ascent has two queues **batch** and **test**. To declare LSF executors we define them under `lsf` section within the `executors` section.

The default launcher is *bsub* which can be defined under `defaults`. The `pollinterval` will poll LSF jobs every 10 seconds using `bjobs`. The `pollinterval` accepts a range between **10 - 300** seconds as defined in schema. In order to avoid polling scheduler excessively pick a number that is best suitable for your site

```
system:
  ascent:
    moduletool: lmod
    load_default_buildspecs: false
    executors:
      defaults:
        launcher: bsub
        pollinterval: 10
        max_pend_time: 60
        account: gen014ecpci
      local:
        bash:
          description: submit jobs on local machine using bash shell
          shell: bash
        sh:
          description: submit jobs on local machine using sh shell
          shell: sh
        csh:
          description: submit jobs on local machine using csh shell
          shell: csh
        python:
          description: submit jobs on local machine using python shell
          shell: python
      lsf:
        batch:
          queue: batch
        test:
          queue: test
    compilers:
      find:
        gcc: ^(gcc)
        pgi: ^(pgi)
        cuda: ^(cuda)
      compiler:
        gcc:
          builtin_gcc:
            cc: /usr/bin/gcc
            cxx: /usr/bin/g++
            fc: /usr/bin/gfortran
```

JLSE @ ANL

Joint Laboratory for System Evaluation (JLSE) provides a testbed of emerging HPC systems, the default scheduler is Cobalt, this is defined in the `cobalt` section defined in the executor field.

We set default launcher to qsub defined with `launcher: qsub`. This is inherited for all batch executors. In each cobalt executor the `queue` property will specify the queue name to submit job, for instance the executor `yarrow` with `queue: yarrow` will submit job using `qsub -q yarrow` when using this executor.

```
system:
  jlse:
    hostnames:
    - jlselogin*
    moduletool: environment-modules
    load_default_buildspecs: false
    executors:
      defaults:
        launcher: qsub
        pollinterval: 10
        max_pend_time: 300
      local:
        bash:
          description: submit jobs on local machine using bash shell
          shell: bash
        sh:
          description: submit jobs on local machine using sh shell
          shell: sh
        csh:
          description: submit jobs on local machine using csh shell
          shell: csh
        python:
          description: submit jobs on local machine using python shell
          shell: python
      cobalt:
        yarrow:
          queue: yarrow
        yarrow_debug:
          queue: yarrow_debug
        iris:
          queue: iris
        iris_debug:
          queue: iris_debug
```

3.6 Writing buildspecs

3.6.1 Buildspec Overview

What is a buildspec?

In buildtest, we refer to **buildspec** as a YAML file that defines your test that buildtest will parse using the provided schemas and build a shell script from the buildspec file. Every buildspec is validated with a global schema which you can find more if you click *here*.

Example

Let's start off with a simple example that declares two variables **X** and **Y** and prints the sum of X+Y.

```
version: "1.0"
buildspecs:
  add_numbers:
    type: script
    executor: generic.local.bash
    description: Add X+Y
    tags: [tutorials]
    vars:
      X: 1
      Y: 2
    run: echo "$X+$Y=" $(($X+$Y))
```

buildtest will validate the entire file with `global.schema.json`, the schema requires **version** and **buildspec** in order to validate file. The **buildspec** is where you define each test. The name of the test is **add_numbers**. The test requires a **type** field which is the sub-schema used to validate the test section. In this example `type: script` informs buildtest to use the *Script Schema* when validating test section.

Each subschema has a list of field attributes that are supported, for example the fields: **type**, **executor**, **vars** and **run** are all valid fields supported by the *script* schema. The **version** field informs which version of subschema to use. Currently all sub-schemas are at version `1.0` where buildtest will validate with a schema `script-v1.0.schema.json`. In future, we can support multiple versions of subschema for backwards compatibility.

Let's look at a more interesting example, shown below is a multi line run example using the *script* schema with test name called **systemd_default_target**, shown below is the content of test:

```
version: "1.0"
buildspecs:
  systemd_default_target:
    executor: generic.local.bash
    type: script
    tags: [system]
    description: check if default target is multi-user.target
    run: |
      if [ "multi-user.target" == `systemctl get-default` ]; then
        echo "multi-user is the default target";
        exit 0
      fi
      echo "multi-user is not the default target";
      exit 1
```

The test name **systemd_default_target** defined in **buildspec** section is validated with the following pattern `"^[A-Za-z_][A-Za-z0-9_]*$"`. This test will use the executor **generic.local.bash** which means it will use the Local Executor with an executor name *bash* defined in the buildtest settings. The default buildtest settings will provide a bash executor as follows:

```
system:
  generic:
    hostnames: ["localhost"]
    executors:
      local:
        bash:
```

(continues on next page)

(continued from previous page)

```
        description: submit jobs on local machine using bash shell
        shell: bash
```

The `shell: bash` indicates this executor will use *bash* to run the test scripts. To reference this executor use the format `<system>.<type>.<name>` in this case **generic.local.bash** refers to bash executor.

The `description` field is an optional key that can be used to provide a brief summary of the test. In this example we can a full multi-line run section, this is achieved in YAML using `run: |` followed by content of run section tab indented 2 spaces.

Script Schema

The script schema is used for writing simple scripts (bash, sh, python) in Buildspec. To use this schema you must set `type: script`. The `run` field is responsible for writing the content of test.

Shown below is schema header for script-v1.0.schema.json.

```
{
  "$id": "script-v1.0.schema.json",
  "$schema": "http://json-schema.org/draft-07/schema#",
  "title": "script schema version 1.0",
  "description": "The script schema is of ``type: script`` in sub-schema which is used␣
↪for running shell scripts",
  "type": "object",
  "required": ["type", "run", "executor"],
  "additionalProperties": false,
```

The `"type": "object"` means sub-schema is a JSON object where we define a list of key/value pair. The `"required"` field specifies a list of fields that must be specified in order to validate the Buildspec. In this example, `type`, `run`, and `executor` are required fields. The `additionalProperties: false` informs schema to reject any extra properties not defined in the schema.

The **executor** key is required for all sub-schemas which instructs buildtest which executor to use when running the test. The executors are defined in *Configuring buildtest*. In our *first example* we define variables using the `vars` property which is a Key/Value pair for variable assignment. The **run** section is required for script schema which defines the content of the test script.

For more details on script schema see schema docs at https://buildtesters.github.io/buildtest/

Declaring Environment Variables

You can define environment variables using the `env` property, this is compatible with shells: `bash`, `sh`, `zsh`, `csh` and `tcsh`. It does not work with `shell: python`. In example below we declare three tests using environment variable with default shell (bash), csh, and tcsh

```
version: "1.0"
buildspecs:
  bash_env_variables:
    executor: generic.local.bash
    description: Declare environment variables in default shell (bash)
    type: script
    env:
      FIRST_NAME: avocado
```

(continues on next page)

(continued from previous page)

```
    LAST_NAME: dinosaur
  tags: [tutorials]
  run: |
    hostname
    whoami
    echo $USER
    printf "${FIRST_NAME} ${LAST_NAME}\n"

csh_env_declaration:
  executor: generic.local.csh
  type: script
  description: "csh shell example to declare environment variables"
  shell: /bin/csh
  tags: [tutorials]
  env:
    SHELL_NAME: "csh"
  run: echo "This is running $SHELL_NAME"

tcsh_env_declaration:
  executor: generic.local.csh
  type: script
  description: "tcsh shell example to declare environment variables"
  shell: /bin/tcsh
  tags: [tutorials]
  env:
    path: "/usr/local/bin:$PATH"
  run: echo $path
```

This test can be run by issuing the following command: `buildtest build -b tutorials/environment.yml`. If we inspect one of the test script we will see that buildtest generates a build script that invokes the test using the shell wrapper */bin/csh* for the csh test and gets the returncode.

```
#!/bin/bash


############# START VARIABLE DECLARATION ########################
export BUILDTEST_TEST_NAME=csh_env_declaration
export BUILDTEST_TEST_ROOT=/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/
↪generic.local.csh/environment/csh_env_declaration/0
export BUILDTEST_BUILDSPEC_DIR=/Users/siddiq90/Documents/GitHubDesktop/buildtest/
↪tutorials
export BUILDTEST_STAGE_DIR=/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/
↪generic.local.csh/environment/csh_env_declaration/0/stage
export BUILDTEST_TEST_ID=501ec5d3-e614-4ae8-9c1e-4849ce340c76
############# END VARIABLE DECLARATION   ########################


# source executor startup script
source /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/executor/generic.local.csh/
↪before_script.sh
# Run generated script
/bin/csh /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.csh/
↪environment/csh_env_declaration/0/stage/csh_env_declaration.csh
```

(continues on next page)

(continued from previous page)

```
# Get return code
returncode=$?
# Exit with return code
exit $returncode
```

This generated test looks something like this

```
#!/bin/csh
# Declare environment variables
setenv SHELL_NAME csh


# Content of run section
echo "This is running $SHELL_NAME"
```

Environment variables are defined using `export` in bash, sh, zsh while csh and tcsh use `setenv`.

Declaring Variables

Variables can be defined using `vars` property, this is compatible with all shells except for `python`. The variables are defined slightly different in csh, tcsh as pose to bash, sh, and zsh. In example below we define tests with bash and csh.

In YAML strings can be specified with or without quotes however in bash, variables need to be enclosed in quotes `"` if you are defining a multi word string (`name="First Last"`).

If you need define a literal string it is recommended to use the literal block `|` that is a special character in YAML. If you want to specify `"` or `'` in string you can use the escape character `\` followed by any of the special character. In example below we define several variables such as **X**, **Y** that contain numbers, variable **literalstring** is a literal string processed by YAML. The variable **singlequote** and **doublequote** defines a variable with the special character `'` and `"`. The variables **current_user** and **files_homedir** store result of a shell command. This can be done using `var=$(<command>)` or `var=\`<command>\`` where `<command>` is a Linux command.

Note: You can use the escape character `\` to set special character, for instance you can declare a variable in string with quotes by using `\"`.

```
version: "1.0"
buildspecs:
  variables_bash:
    type: script
    executor: generic.local.bash
    description: Declare shell variables in bash
    tags: [tutorials]
    vars:
      X: 1
      Y: 2
      literalstring: |
        "this is a literal string ':' "
      singlequote: "'singlequote'"
      doublequote: "\"doublequote\""
      current_user: "$(whoami)"
      files_homedir: "`find $HOME -type f -maxdepth 1`"
```

(continues on next page)

(continued from previous page)

```
    run: |
      echo "$X+$Y=" $(($X+$Y))
      echo $literalstring
      echo $singlequote
      echo $doublequote
      echo $current_user
      echo $files_homedir
```

Next we build this test by running `buildtest build -b $BUILDTEST_ROOT/tutorials/vars.yml`.

```
$ buildtest build -b $BUILDTEST_ROOT/tutorials/vars.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:15
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/tutorials/vars.yml

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-------------------------------------------------------------------------------------------
↪---------+
| Discovered Buildspecs                                                                    ␣
↪         |
+==========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪vars.yml |
+-------------------------------------------------------------------------------------------
↪---------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+
```

(continues on next page)

(continued from previous page)

```
 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/vars.yml



name            description
--------------  ------------------------------
variables_bash  Declare shell variables in bash

+----------------------+
| Stage: Building Test |
+----------------------+

 name           | id       | type   | executor           | tags          | testpath
----------------+----------+--------+--------------------+---------------+---------------
↪-----------------------------------------------------------------------------------------
↪-------------------------------------------------------------
 variables_bash | 1c4ba849 | script | generic.local.bash | ['tutorials'] | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.
↪local.bash/vars/variables_bash/1c4ba849/variables_bash_build.sh




+----------------------+
| Stage: Running Test |
+----------------------+

 name           | id       | executor           | status   |   returncode
----------------+----------+--------------------+----------+--------------
 variables_bash | 1c4ba849 | generic.local.bash | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/1 Percentage: 100.000%
Failed Tests: 0/1 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_hr_5xctx.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

Let's check the generated script from the previous build, you will notice that buildtest will define the shell variables at top of script followed content defined in `run` section.

```
#!/bin/bash
# Declare shell variables
X=1
Y=2
literalstring="this is a literal string ':' "

singlequote='singlequote'
doublequote="doublequote"
current_user=$(whoami)
files_homedir=`find $HOME -type f -maxdepth 1`


# Content of run section
echo "$X+$Y=" $(($X+$Y))
echo $literalstring
echo $singlequote
echo $doublequote

echo $current_user
echo $files_homedir
```

Test Status

buildtest will record state of each test which can be `PASS` or `FAIL`. By default a 0 exit code is PASS and everything else is a FAIL. The `status` property can be used to determine how test will report its state. Currently, we can match state based on *returncode*, *runtime*, or *regular expression*.

Return Code Matching

buildtest can report PASS/FAIL based on returncode, by default a 0 exit code is PASS and everything else is FAIL. The returncode can be a list of exit codes to match. In this example we have four tests called `exit1_fail`, `exit1_pass`, `returncode_list_mismatch` and `returncode_int_match`. We expect **exit1_fail** and **returncode_mismatch** to `FAIL` while **exit1_pass** and **returncode_int_match** will `PASS`.

```
version: "1.0"
buildspecs:

  exit1_fail:
    executor: generic.local.sh
    type: script
    description: exit 1 by default is FAIL
    tags: [tutorials, fail]
    run: exit 1

  exit1_pass:
    executor: generic.local.sh
    type: script
    description: report exit 1 as PASS
    run: exit 1
    tags: [tutorials, pass]
    status:
```

(continues on next page)

(continued from previous page)

```
    returncode: [1]

  returncode_list_mismatch:
    executor: generic.local.sh
    type: script
    description: exit 2 failed since it failed to match returncode 1
    run: exit 2
    tags: [tutorials, fail]
    status:
      returncode: [1, 3]

  returncode_int_match:
    executor: generic.local.sh
    type: script
    description: exit 128 matches returncode 128
    run: exit 128
    tags: [tutorials, pass]
    status:
      returncode: 128
```

Let's build this test and pay close attention to the **status** column in output.

```
$ buildtest build -b tutorials/pass_returncode.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:16
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/pass_returncode.yml

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-------------------------------------------------------------------------------------------
↪--------------------+
| Discovered Buildspecs                                                                    ␣
↪                    |
+==========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪pass_returncode.yml |
```

(continues on next page)

(continued from previous page)

```
+-----------------------------------------------------------------------------------------
↪--------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-------------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/pass_returncode.yml



name                      description
------------------------  ------------------------------------------------
exit1_fail                exit 1 by default is FAIL
exit1_pass                report exit 1 as PASS
returncode_list_mismatch  exit 2 failed since it failed to match returncode 1
returncode_int_match      exit 128 matches returncode 128

+----------------------+
| Stage: Building Test |
+----------------------+

 name                      | id       | type   | executor         | tags                ␣
↪| testpath
--------------------------+----------+--------+------------------+----------------------
↪+-------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------
↪----------------
 exit1_fail                | bdd8e11b | script | generic.local.sh | ['tutorials', 'fail']␣
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/exit1_fail/bdd8e11b/exit1_fail_build.sh
 exit1_pass                | ad5aea49 | script | generic.local.sh | ['tutorials', 'pass']␣
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/exit1_pass/ad5aea49/exit1_pass_build.sh
 returncode_list_mismatch | dd25afaf | script | generic.local.sh | ['tutorials', 'fail']␣
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/returncode_list_mismatch/dd25afaf/returncode_
↪list_mismatch_build.sh
 returncode_int_match      | 5c7adc2f | script | generic.local.sh | ['tutorials', 'pass']␣
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/pass_returncode/returncode_int_match/5c7adc2f/returncode_int_
↪match_build.sh
```

(continues on next page)

(continued from previous page)

```
+----------------------+
| Stage: Running Test |
+----------------------+

 name                      | id       | executor         | status   |   returncode
---------------------------+----------+------------------+----------+--------------
 exit1_fail                | bdd8e11b | generic.local.sh | FAIL     |            1
 exit1_pass                | ad5aea49 | generic.local.sh | PASS     |            1
 returncode_list_mismatch  | dd25afaf | generic.local.sh | FAIL     |            2
 returncode_int_match      | 5c7adc2f | generic.local.sh | PASS     |          128

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 2/4 Percentage: 50.000%
Failed Tests: 2/4 Percentage: 50.000%


Writing Logfile to: /tmp/buildtest_gm0ptco9.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

The `returncode` field can be an integer or list of integers but it may not accept duplicate values. If you specify a list of exit codes, buildtest will check actual returncode with list of expected returncodes specified by *returncode* field.

Shown below are examples of invalid returncodes:

```
# empty list is not allowed
returncode: []

# floating point is not accepted in list
returncode: [1, 1.5]

# floating point not accepted
returncode: 1.5

# duplicates are not allowed
returncode: [1, 2, 5, 5]
```

Passing Test based on regular expression

buildtest can configure PASS/FAIL of test based on regular expression on output or error file. This can be useful if you are expecting a certain output from the test as pose to returncode check.

In this example we introduce, the `regex` field which is part of **status** that expects a regular expression via `exp`. The `stream` property must be **stdout** or **stderr** which indicates buildtest will read output or error file and apply regular expression. If there is a match, buildtest will record the test state as **PASS** otherwise it will be a **FAIL**. In this example, we have two tests that will apply regular expression on output file.

```yaml
version: "1.0"
buildspecs:
  status_regex_pass:
    executor: generic.local.bash
    type: script
    tags: [system]
    description: Pass test based on regular expression
    run: echo "PASS"
    status:
      regex:
        stream: stdout
        exp: "^(PASS)$"

  status_regex_fail:
    executor: generic.local.bash
    type: script
    tags: [system]
    description: Pass test based on regular expression
    run: echo "FAIL"
    status:
      regex:
        stream: stdout
        exp: "^(123FAIL)$"
```

Now if we run this test, we will see first test will pass while second one will fail even though the returncode is a 0. Take a close look at the **status** property

```
$ buildtest build -b tutorials/status_regex.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:16
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/status_regex.yml

+--------------------------------+
| Stage: Discovering Buildspecs |
+--------------------------------+

+-------------------------------------------------------------------------------------------
↪-----------------+
```

(continues on next page)

(continued from previous page)

```
| Discovered Buildspecs                                                                                                ␣
↪                  |
+======================================================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪status_regex.yml |
+----------------------------------------------------------------------------------------------------------------------
↪-----------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------------
↪-----------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/status_regex.yml



name               description
-----------------  -------------------------------------
status_regex_pass  Pass test based on regular expression
status_regex_fail  Pass test based on regular expression

+----------------------+
| Stage: Building Test |
+----------------------+

 name               | id       | type   | executor           | tags       | testpath
--------------------+----------+--------+--------------------+------------+---------------
↪-----------------------------------------------------------------------------------------
↪-----------------------------------------------------------------------
 status_regex_pass | 9694871d | script | generic.local.bash | ['system'] | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.
↪local.bash/status_regex/status_regex_pass/9694871d/status_regex_pass_build.sh
 status_regex_fail | 4a85e442 | script | generic.local.bash | ['system'] | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.
↪local.bash/status_regex/status_regex_fail/4a85e442/status_regex_fail_build.sh







+----------------------+
| Stage: Running Test |
+----------------------+

 name               | id       | executor           | status   |   returncode
```

(continues on next page)

(continued from previous page)

```
------------------+----------+--------------------+----------+--------------
 status_regex_pass | 9694871d | generic.local.bash | PASS     |            0
 status_regex_fail | 4a85e442 | generic.local.bash | FAIL     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/2 Percentage: 50.000%
Failed Tests: 1/2 Percentage: 50.000%


Writing Logfile to: /tmp/buildtest_lywao4up.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

Passing Test based on runtime

buildtest can determine state of test based on *runtime* property which is part of `status` object. This can be used if you want to control how test *PASS* or *FAIL* based on execution time of test. In example below we have five tests that make use of **runtime** property for passing a test. The runtime property support `min` and `max` property that can mark test pass based on minimum and maximum runtime. A test will pass if it's execution time is greater than `min` time and less than `max` time. If *min* is specified without *max* property the upperbound is not set, likewise *max* without *min* will pass if test is less than **max** time. The lower bound is not set, but test runtime will be greater than 0 sec.

In test **timelimit_min**, we sleep for 2 seconds and it will pass because minimum runtime is 1.0 seconds. Similarly, **timelimit_max** will pass because we sleep for 2 seconds with a max time of 5.0.

```
version: "1.0"
buildspecs:
  timelimit_min_max:
    type: script
    executor: generic.local.sh
    description: "Run a sleep job for 2 seconds and test pass if its within 1.0-3.0sec"
    tags: ["tutorials"]
    run: sleep 2
    status:
      runtime:
        min: 1.0
        max: 3.0


  timelimit_min:
    type: script
    executor: generic.local.sh
    description: "Run a sleep job for 2 seconds and test pass if its exceeds min time of␣
↪1.0 sec"
    tags: ["tutorials"]
    run: sleep 2
    status:
      runtime:
```

(continues on next page)

(continued from previous page)

```
      min: 1.0

  timelimit_max:
    type: script
    executor: generic.local.sh
    description: "Run a sleep job for 2 seconds and test pass if it's within max time: 5.
↪0 sec"
    tags: ["tutorials"]
    run: sleep 2
    status:
      runtime:
        max: 5.0


  timelimit_min_fail:
    type: script
    executor: generic.local.sh
    description: "This test fails because it runs less than mintime of 10 second"
    tags: ["tutorials"]
    run: sleep 2
    status:
      runtime:
        min: 10.0

  timelimit_max_fail:
    type: script
    executor: generic.local.sh
    description: "This test fails because it exceeds maxtime of 1.0 second"
    tags: ["tutorials"]
    run: sleep 3
    status:
      runtime:
        max: 1.0
```

```
$ buildtest build -b tutorials/runtime_status_test.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:16
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/runtime_status_test.yml
```

(continues on next page)

(continued from previous page)

```
+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-------------------------------------------------------------------------------------------
↪------------------------+
| Discovered Buildspecs                                                                    ␣
↪                        |
+==========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪runtime_status_test.yml |
+-------------------------------------------------------------------------------------------
↪------------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-----------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/runtime_status_test.yml



name                description
------------------  ------------------------------------------------------------------------
↪---------
timelimit_min_max   Run a sleep job for 2 seconds and test pass if its within 1.0-3.0sec
timelimit_min       Run a sleep job for 2 seconds and test pass if its exceeds min time␣
↪of 1.0 sec
timelimit_max       Run a sleep job for 2 seconds and test pass if it's within max time:␣
↪5.0 sec
timelimit_min_fail  This test fails because it runs less than mintime of 10 second
timelimit_max_fail  This test fails because it exceeds maxtime of 1.0 second

+----------------------+
| Stage: Building Test |
+----------------------+

 name                | id       | type   | executor         | tags          | testpath
---------------------+----------+--------+------------------+---------------+-------------
↪-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------
 timelimit_min_max   | 89cb57b0 | script | generic.local.sh | ['tutorials'] | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.
↪local.sh/runtime_status_test/timelimit_min_max/89cb57b0/timelimit_min_max_build.sh
```

(continues on next page)

(continued from previous page)

```
 timelimit_min      | 49ebb344 | script | generic.local.sh | ['tutorials'] | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.
↪local.sh/runtime_status_test/timelimit_min/49ebb344/timelimit_min_build.sh
 timelimit_max      | 9994ab40 | script | generic.local.sh | ['tutorials'] | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.
↪local.sh/runtime_status_test/timelimit_max/9994ab40/timelimit_max_build.sh
 timelimit_min_fail | 73a48836 | script | generic.local.sh | ['tutorials'] | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.
↪local.sh/runtime_status_test/timelimit_min_fail/73a48836/timelimit_min_fail_build.sh
 timelimit_max_fail | 1f869483 | script | generic.local.sh | ['tutorials'] | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.
↪local.sh/runtime_status_test/timelimit_max_fail/1f869483/timelimit_max_fail_build.sh




+----------------------+
| Stage: Running Test |
+----------------------+

 name                | id       | executor          | status   |   returncode
---------------------+----------+-------------------+----------+--------------
 timelimit_min_max   | 89cb57b0 | generic.local.sh | PASS     |            0
 timelimit_min       | 49ebb344 | generic.local.sh | PASS     |            0
 timelimit_max       | 9994ab40 | generic.local.sh | PASS     |            0
 timelimit_min_fail  | 73a48836 | generic.local.sh | FAIL     |            0
 timelimit_max_fail  | 1f869483 | generic.local.sh | FAIL     |            0

+-----------------------+
| Stage: Test Summary  |
+-----------------------+

Passed Tests: 3/5 Percentage: 60.000%
Failed Tests: 2/5 Percentage: 40.000%


Writing Logfile to: /tmp/buildtest_o2mihpac.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

If we look at the test results, we expect the first three tests **timelimit_min**, **timelimit_max**, **timelimit_min_max** will pass while the last two tests fail because it fails to comply with runtime property.

```
$ buildtest report --filter buildspec=tutorials/runtime_status_test.yml --format name,id,
↪state,runtime --latest
Reading report file: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/report.json

+--------------------+----------+---------+-----------+
| name               | id       | state   |   runtime |
+====================+==========+=========+===========+
```

(continues on next page)

(continued from previous page)

```
| timelimit_min_max  | 89cb57b0 | PASS    |   2.00656 |
+--------------------+----------+---------+-----------+
| timelimit_min      | 49ebb344 | PASS    |   2.00674 |
+--------------------+----------+---------+-----------+
| timelimit_max      | 9994ab40 | PASS    |   2.00676 |
+--------------------+----------+---------+-----------+
| timelimit_min_fail | 73a48836 | FAIL    |   2.00672 |
+--------------------+----------+---------+-----------+
| timelimit_max_fail | 1f869483 | FAIL    |   3.0067  |
+--------------------+----------+---------+-----------+
```

Defining Tags

The `tags` field can be used to classify tests which can be used to organize tests or if you want to *Building By Tags* (`buildtest build --tags <TAGNAME>`). Tags can be defined as a string or list of strings. In this example, the test `string_tag` defines a tag name **network** while test `list_of_strings_tags` define a list of tags named `network` and `ping`.

```
version: "1.0"
buildspecs:
  string_tag:
    type: script
    executor: generic.local.bash
    description: tags can be a string
    tags: network
    run: hostname

  list_of_strings_tags:
    type: script
    executor: generic.local.bash
    description: tags can be a list of strings
    tags: [network, ping]
    run: ping -c 4 www.google.com
```

Each item in tags must be a string and no duplicates are allowed, for example in this test, we define a duplicate tag **network** which is not allowed.

```
version: "1.0"
buildspecs:
  duplicate_string_tags:
    type: script
    executor: generic.local.bash
    description: duplicate strings in tags list is not allowed
    tags: [network, network]
    run: hostname
```

If we run this test and inspect the logs we will see an error message in schema validation:

```
2020-09-29 10:56:43,175 [parser.py:179 - _validate() ] - [INFO] Validating test -
↪'duplicate_string_tags' with schemafile: script-v1.0.schema.json
2020-09-29 10:56:43,175 [buildspec.py:397 - parse_buildspecs() ] - [ERROR] ['network',
↪'network'] is not valid under any of the given schemas
```

(continues on next page)

(continued from previous page)

```
Failed validating 'oneOf' in schema['properties']['tags']:
    {'oneOf': [{'type': 'string'},
               {'$ref': '#/definitions/list_of_strings'}]}

On instance['tags']:
    ['network', 'network']
```

If tags is a list, it must contain one item, therefore an empty list (i.e `tags: []`) is invalid.

Customize Shell

Shell Type

buildtest will default to `bash` shell when running test, but we can configure shell option using the `shell` field. The shell field is defined in schema as follows:

```
"shell": {
  "type": "string",
  "description": "Specify a shell launcher to use when running jobs. This sets the␣
↪shebang line in your test script. The ``shell`` key can be used with ``run`` section␣
↪to describe content of script and how its executed",
  "pattern": "^(/bin/bash|/bin/sh|/bin/csh|/bin/tcsh|/bin/
↪zsh|bash|sh|csh|tcsh|zsh|python).*"
},
```

The shell pattern is a regular expression where one can specify a shell name along with shell options. The shell will configure the shebang in the test-script. In this example, we illustrate a few tests using different shell field.

```
version: "1.0"
buildspecs:
  _bin_sh_shell:
    executor: generic.local.sh
    type: script
    description: "/bin/sh shell example"
    shell: /bin/sh
    tags: [tutorials]
    run: "bzip2 --help"

  _bin_bash_shell:
    executor: generic.local.bash
    type: script
    description: "/bin/bash shell example"
    shell: /bin/bash
    tags: [tutorials]
    run: "bzip2 -h"

  bash_shell:
    executor: generic.local.bash
    type: script
    description: "bash shell example"
```

(continues on next page)

(continued from previous page)

```
    shell: bash
    tags: [tutorials]
    run: "echo $SHELL"

  sh_shell:
    executor: generic.local.sh
    type: script
    description: "sh shell example"
    shell: sh
    tags: [tutorials]
    run: "echo $SHELL"

  shell_options:
    executor: generic.local.sh
    type: script
    description: "shell options"
    shell: "sh -x"
    tags: [tutorials]
    run: |
      echo $SHELL
      hostname
```

The generated test-script for buildspec **_bin_sh_shell** will specify shebang **/bin/sh** because we specified `shell: /bin/sh`:

```
#!/bin/sh
# Content of run section
bzip2 --help
```

If you don't specify a shell path such as `shell: sh`, then buildtest will resolve path by looking in $PATH and build the shebang line.

In test **shell_options** we specify `shell: "sh -x"`, buildtest will tack on the shell options into the called script as follows:

```
#!/bin/bash


############## START VARIABLE DECLARATION ##########################
export BUILDTEST_TEST_NAME=shell_options
export BUILDTEST_TEST_ROOT=/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/
↪generic.local.sh/shell_examples/shell_options/0
export BUILDTEST_BUILDSPEC_DIR=/Users/siddiq90/Documents/GitHubDesktop/buildtest/
↪tutorials
export BUILDTEST_STAGE_DIR=/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/
↪generic.local.sh/shell_examples/shell_options/0/stage
export BUILDTEST_TEST_ID=95c11f54-bbb1-4154-849d-44313e4417c2
############## END VARIABLE DECLARATION   ##########################


# source executor startup script
source /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/executor/generic.local.sh/
↪before_script.sh
```

(continues on next page)

(continued from previous page)

```
# Run generated script
sh -x /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.sh/shell_
↪examples/shell_options/0/stage/shell_options.sh
# Get return code
returncode=$?
# Exit with return code
exit $returncode
```

If you prefer **csh** or **tcsh** for writing scripts just set `shell: csh` or `shell: tcsh`, note you will need to match this with appropriate executor. For now use `executor: generic.local.csh` to run your csh/tcsh scripts. In this example below we define a script using csh, take note of `run` section we can write csh style.

```
version: "1.0"
buildspecs:
  csh_shell:
    executor: generic.local.csh
    type: script
    description: "csh shell example"
    shell: csh
    tags: [tutorials]
    vars:
      file: "/etc/csh.cshrc"
    run: |
      if (-e $file) then
        echo "$file file found"
      else
        echo "$file file not found"
        exit 1
      endif
```

Customize Shebang

You may customize the shebang line in testscript using `shebang` field. This takes precedence over the `shell` property which automatically detects the shebang based on shell path.

In next example we have two tests **bash_login_shebang** and **bash_nonlogin_shebang** which tests if shell is Login or Non-Login. The `#!/bin/bash -l` indicates we want to run in login shell and expects an output of `Login Shell` while test **bash_nonlogin_shebang** should run in default behavior which is non-login shell and expects output `Not Login Shell`. We match this with regular expression with stdout stream.

```
version: "1.0"
buildspecs:
  bash_login_shebang:
    type: script
    executor: generic.local.bash
    shebang: "#!/bin/bash -l"
    description: customize shebang line with bash login shell
    tags: tutorials
    run: shopt -q login_shell && echo 'Login Shell' || echo 'Not Login Shell'
    status:
      regex:
```

(continues on next page)

(continued from previous page)

```
        exp: "^Login Shell$"
        stream: stdout

  bash_nonlogin_shebang:
    type: script
    executor: generic.local.bash
    shebang: "#!/bin/bash"
    description: customize shebang line with default bash (nonlogin) shell
    tags: tutorials
    run: shopt -q login_shell && echo 'Login Shell' || echo 'Not Login Shell'
    status:
      regex:
        exp: "^Not Login Shell$"
        stream: stdout
```

Now let's run this test as we see the following.

```
$ buildtest build -b tutorials/shebang.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:28
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/shebang.yml

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-------------------------------------------------------------------------------------------
↪------------+
| Discovered Buildspecs                                                                    ␣
↪            |
+==========================================================================================================+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪shebang.yml |
+-------------------------------------------------------------------------------------------
↪------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
```

(continues on next page)

(continued from previous page)

```
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-------------------------------------------------
↪-------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/shebang.yml



name                   description
---------------------  ------------------------------------------------------------
bash_login_shebang     customize shebang line with bash login shell
bash_nonlogin_shebang  customize shebang line with default bash (nonlogin) shell

+----------------------+
| Stage: Building Test |
+----------------------+

 name                   | id       | type   | executor           | tags      | testpath
------------------------+----------+--------+--------------------+-----------+------------
↪-------------------------------------------------------------------------------------------
↪-----------------------------------------------------------------------------
 bash_login_shebang    | d903904f | script | generic.local.bash | tutorials | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.
↪local.bash/shebang/bash_login_shebang/d903904f/bash_login_shebang_build.sh
 bash_nonlogin_shebang | 6148b7d5 | script | generic.local.bash | tutorials | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.
↪local.bash/shebang/bash_nonlogin_shebang/6148b7d5/bash_nonlogin_shebang_build.sh




+----------------------+
| Stage: Running Test |
+----------------------+

 name                   | id       | executor           | status   |   returncode
------------------------+----------+--------------------+----------+--------------
 bash_login_shebang    | d903904f | generic.local.bash | PASS     |            0
 bash_nonlogin_shebang | 6148b7d5 | generic.local.bash | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 2/2 Percentage: 100.000%
```

(continues on next page)

(continued from previous page)

```
Failed Tests: 0/2 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_1jjs5yz6.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

If we look at the generated test for **bash_login_shebang** we see the shebang line is passed into the script:

```
#!/bin/bash -l
# Content of run section
shopt -q login_shell && echo 'Login Shell' || echo 'Not Login Shell'
```

Python Shell

You can use **script** schema to write python scripts using the **run** property. This can be achieved if you use the `generic.local.python` executor assuming you have this defined in your buildtest configuration.

Here is a python example calculating area of circle

```
version: "1.0"
buildspecs:
  circle_area:
    executor: generic.local.python
    type: script
    shell: python
    description: "Calculate circle of area given a radius"
    tags: [tutorials, python]
    run: |
      import math
      radius = 2
      area = math.pi * radius * radius
      print("Circle Radius ", radius)
      print("Area of circle ", area)
```

The `shell: python` will let us write python script in the `run` section. The `tags` field can be used to classify test, the field expects an array of string items.

Note: Python scripts are very picky when it comes to formatting, in the `run` section if you are defining multiline python script you must remember to use 2 space indent to register multiline string. buildtest will extract the content from run section and inject in your test script. To ensure proper formatting for a more complex python script you may be better off writing a python script in separate file and call it in `run` section.

Skipping test

By default, buildtest will run all tests defined in `buildspecs` section, if you want to skip a test use the `skip` field which expects a boolean value. Shown below is an example test.

```
version: "1.0"
buildspecs:
  skip:
    type: script
    executor: generic.local.bash
    description: This test is skipped
    skip: Yes
    tags: [tutorials]
    run: hostname

  unskipped:
    type: script
    executor: generic.local.bash
    description: This test is not skipped
    skip: No
    tags: [tutorials]
    run: hostname
```

The first test **skip** will be ignored by buildtest because `skip: true` is defined while **unskipped** will be processed as usual.

Note: YAML and JSON have different representation for boolean. For json schema valid values are `true` and `false` see https://json-schema.org/understanding-json-schema/reference/boolean.html however YAML has many more representation for boolean see https://yaml.org/type/bool.html. You may use any of the YAML boolean, however it's best to stick with json schema values `true` and `false`.

Here is an example build, notice message `[skip] test is skipped` during the build stage

```
$ buildtest build -b tutorials/skip_tests.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:28
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/skip_tests.yml
```

(continues on next page)

(continued from previous page)

```
+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-----------------------------------------------------------------------------------------------
↪---------------+
| Discovered Buildspecs                                                                         
↪               |
+=============================================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪skip_tests.yml |
+-----------------------------------------------------------------------------------------------
↪---------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1
[skip](/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪tutorials/skip_tests.yml): test is skipped.

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/skip_tests.yml



name       description
---------  ------------------------
unskipped  This test is not skipped

+----------------------+
| Stage: Building Test |
+----------------------+

 name      | id       | type   | executor           | tags          | testpath
-----------+----------+--------+--------------------+---------------+--------------------
↪-----------------------------------------------------------------------------------------
↪-------------------------------------------------
 unskipped | 34017be8 | script | generic.local.bash | ['tutorials'] | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.
↪local.bash/skip_tests/unskipped/34017be8/unskipped_build.sh




+----------------------+
```

(continues on next page)

(continued from previous page)

```
| Stage: Running Test |
+---------------------+

 name      | id       | executor           | status   |   returncode
-----------+----------+--------------------+----------+--------------
 unskipped | 34017be8 | generic.local.bash | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/1 Percentage: 100.000%
Failed Tests: 0/1 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_mbgquk8p.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

Defining Metrics

buildtest provides a method to define test metrics in the buildspecs which can be used to store arbitrary content from the output/error file into named metric. A metric is defined using the `metrics` property where each element under the **metrics** property is the name of the metric which must be a unique name. A metric can apply regular expression on stdout, stderr like in this example below. The metrics are captured in the test report which can be queried via `buildtest report` or `buildtest inspect`. Shown below is an example where we define two metrics named `hpcg_rating` and `hpcg_state`.

```yaml
version: "1.0"
buildspecs:
  metric_regex_example:
    executor: generic.local.sh
    type: script
    description: capture result metric from output
    run: echo "HPCG result is VALID with a GFLOP/s rating of=63.6515"
    tags: tutorials
    metrics:
      hpcg_rating:
        regex:
          exp: 'rating of=(\d+\.\d+)$'
          stream: stdout

      hpcg_state:
        regex:
          exp: '(VALID)'
          stream: stdout
```

The metrics will not impact behavior of test, it will only impact the test report. By default a metric will be an empty dictionary if there is no `metrics` property. If we fail to match a regular expression, the metric will be defined as an empty string.

Note: If your regular expression contains an escape character \ you must surround your string in single quotes ' as pose to double quotes "

Let's build this test.

```
$ buildtest build -b tutorials/metrics_regex.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:29
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/metrics_regex.yml

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-------------------------------------------------------------------------------------------
↪------------------+
| Discovered Buildspecs                                                                    
↪                  |
+==========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪metrics_regex.yml |
+-------------------------------------------------------------------------------------------
↪------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-------------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/metrics_regex.yml
```

(continues on next page)

(continued from previous page)

```
name                  description
--------------------  --------------------------------
metric_regex_example  capture result metric from output

+----------------------+
| Stage: Building Test |
+----------------------+

 name                  |         id | type   | executor          | tags      | testpath
-----------------------+------------+--------+-------------------+-----------+-------------
↪-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------
 metric_regex_example | 8.0576e+14 | script | generic.local.sh | tutorials | /home/docs/
↪checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/generic.
↪local.sh/metrics_regex/metric_regex_example/80576e10/metric_regex_example_build.sh




+----------------------+
| Stage: Running Test |
+----------------------+

 name                  |         id | executor          | status   |   returncode
-----------------------+------------+-------------------+----------+--------------
 metric_regex_example | 8.0576e+14 | generic.local.sh | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/1 Percentage: 100.000%
Failed Tests: 0/1 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest__foh42mm.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

We can query the metrics via `buildtest report` which will display all metrics as a comma separted **Key/Value** pair. We can use `buildtest report --format metrics` to extract all metrics for a test. Internally, we store the metrics as a dictionary but when we print them out via `buildtest report` we join them together into a single string. Shown below is the metrics for the previous build.

```
$ buildtest report --filter buildspec=tutorials/metrics_regex.yml --format name,metrics
Reading report file: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/report.json

+----------------------+--------------------------------------------------+
```

(continues on next page)

(continued from previous page)

```
| name                 | metrics                                                |
+======================+========================================================+
| metric_regex_example | hpcg_rating=rating of=63.6515,hpcg_state=VALID |
+----------------------+--------------------------------------------------------+
```

You can define a metric based on *variables* or *environment variables* which requires you have set `vars` or `env` property in the buildspec. The `vars` and `env` is a property under the metric name that can be used to reference name of variable or environment variable. If you reference an invalid name, buildtest will assign the metric an empty string. In this next example, we define two metrics `gflop` and `foo` that are assigned to variable `GFLOPS` and environment variable `FOO`.

```
version: "1.0"
buildspecs:
  metric_variable_assignment:
    executor: generic.local.sh
    type: script
    description: capture result metric based on variables and environment variable
    vars:
      GFLOPS: "63.6515"
    env:
      FOO: BAR
    run: |
      echo $GFLOPS
      echo $FOO
    tags: tutorials
    metrics:
       gflops:
         vars: "GFLOPS"
       foo:
         env: "FOO"
```

Now let's build the test.

```
$ buildtest build -b tutorials/metrics_variable.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:29
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/metrics_variable.yml
```

(continues on next page)

(continued from previous page)

```
+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-----------------------------------------------------------------------------------------------
↪---------------------+
| Discovered Buildspecs                                                                        ␣
↪                     |
+=============================================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪metrics_variable.yml |
+-----------------------------------------------------------------------------------------------
↪---------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------------
↪-------------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/metrics_variable.yml



name                        description
--------------------------  ------------------------------------------------------------------
↪----
metric_variable_assignment  capture result metric based on variables and environment␣
↪variable

+----------------------+
| Stage: Building Test |
+----------------------+

 name                        | id       | type   | executor         | tags      | testpath
-----------------------------+----------+--------+------------------+-----------+---------
↪-----------------------------------------------------------------------------------------------
↪-----------------------------------------------------------------------------------------------
↪-----------
 metric_variable_assignment | 855a60a1 | script | generic.local.sh | tutorials | /home/
↪docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/metrics_variable/metric_variable_assignment/855a60a1/metric_variable_
↪assignment_build.sh
```

(continues on next page)

(continued from previous page)

```
+---------------------+
| Stage: Running Test |
+---------------------+

 name                        | id       | executor         | status   |   returncode
-----------------------------+----------+------------------+----------+--------------
 metric_variable_assignment | 855a60a1 | generic.local.sh | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/1 Percentage: 100.000%
Failed Tests: 0/1 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_luemuu3q.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

Now if we query the previous test, we will see the two metrics `gflops` and `foo` are captured in the test.

```
$ buildtest report --filter buildspec=tutorials/metrics_variable.yml --format name,
↪metrics
Reading report file: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/report.json

+----------------------------+------------------------+
| name                        | metrics                |
+============================+========================+
| metric_variable_assignment | gflops=63.6515,foo=BAR |
+----------------------------+------------------------+
```

You can also define metrics with the *compiler schema* which works slightly different when it comes to variable and environment assignment. Since you can define `vars` and `env` in `defaults` or `config` section. Let's take a look at this next example where we compile an openmp code that will use the *OMP_NUM_THREADS* environment as the metric that is assigned to name `openmp_threads`. Since we have defined `OMP_NUM_THREADS` under the `defaults` and `config` section we will use the environment variable that corresponds to each compiler.

```yaml
version: "1.0"
buildspecs:
  metrics_variable_compiler:
    type: compiler
    description: define metrics with compiler schema
    executor: generic.local.bash
    tags: [tutorials, compile]
    source: "src/hello_omp.c"
    compilers:
      name: ["^(builtin_gcc|gcc)"]
      default:
        gcc:
```

(continues on next page)

(continued from previous page)

```
        cflags: -fopenmp
        env:
          OMP_NUM_THREADS: 4
    config:
      builtin_gcc:
        env:
          OMP_NUM_THREADS: 1
      gcc/9.3.0-n7p74fd:
        env:
          OMP_NUM_THREADS: 2

  metrics:
    openmp_threads:
      env: "OMP_NUM_THREADS"
```

Note: This test uses a custom site configuration that defines gcc multiple compilers.

Let's build this test as follows

```
$ buildtest -c config/laptop.yml build -b tutorials/compilers/metrics_openmp.yml


User:  siddiq90
Hostname:  DOE-7086392.local
Platform:  Darwin
Current Time:  2021/07/24 00:14:33
buildtest path: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest
buildtest version:  0.10.0
python path: /Users/siddiq90/.local/share/virtualenvs/buildtest-KLOcDrW0/bin/python
python version:  3.7.3
Test Directory:  /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests
Configuration File:  /Users/siddiq90/Documents/GitHubDesktop/buildtest/config/laptop.yml
Command: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest -c config/
↪laptop.yml build -b tutorials/compilers/metrics_openmp.yml

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-----------------------------------------------------------------------------------------
↪--+
| Discovered Buildspecs                                                                  ␣
↪  |
+=========================================================================================+
| /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/compilers/metrics_openmp.
↪yml |
+-----------------------------------------------------------------------------------------
↪--+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1
```

(continues on next page)

(continued from previous page)

```
+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile                | validstate   | buildspec
---------------------------+--------------+-----------------------------------------
↪-----------------------------------------
 compiler-v1.0.schema.json | True         | /Users/siddiq90/Documents/GitHubDesktop/
↪buildtest/tutorials/compilers/metrics_openmp.yml



name                       description
-------------------------  ----------------------------------
metrics_variable_compiler  define metrics with compiler schema
metrics_variable_compiler  define metrics with compiler schema
metrics_variable_compiler  define metrics with compiler schema

+----------------------+
| Stage: Building Test |
+----------------------+




 name                      | id       | type     | executor           | tags
↪        | compiler           | testpath
---------------------------+----------+----------+--------------------+------------------
↪--------+--------------------+-------------------------------------------------------------
↪-------------------------------------------------------------------------------------------
↪---------------
 metrics_variable_compiler | e45976b8 | compiler | generic.local.bash | ['tutorials',
↪'compile'] | builtin_gcc        | /Users/siddiq90/Documents/GitHubDesktop/buildtest/
↪var/tests/generic.local.bash/metrics_openmp/metrics_variable_compiler/11/metrics_
↪variable_compiler_build.sh
 metrics_variable_compiler | 8bc71f19 | compiler | generic.local.bash | ['tutorials',
↪'compile'] | gcc/9.3.0-n7p74fd   | /Users/siddiq90/Documents/GitHubDesktop/buildtest/
↪var/tests/generic.local.bash/metrics_openmp/metrics_variable_compiler/12/metrics_
↪variable_compiler_build.sh
 metrics_variable_compiler | 7127eb46 | compiler | generic.local.bash | ['tutorials',
↪'compile'] | gcc/10.2.0-37fmsw7 | /Users/siddiq90/Documents/GitHubDesktop/buildtest/
↪var/tests/generic.local.bash/metrics_openmp/metrics_variable_compiler/13/metrics_
↪variable_compiler_build.sh

+----------------------+
| Stage: Running Test |
+----------------------+

 name                      | id       | executor           | status    |   returncode
---------------------------+----------+--------------------+-----------+--------------
```

(continues on next page)

(continued from previous page)

```
 metrics_variable_compiler | e45976b8 | generic.local.bash | FAIL     |          127
 metrics_variable_compiler | 8bc71f19 | generic.local.bash | PASS     |            0
 metrics_variable_compiler | 7127eb46 | generic.local.bash | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 2/3 Percentage: 66.667%
Failed Tests: 1/3 Percentage: 33.333%


Writing Logfile to: /Users/siddiq90/buildtest/buildtest_0a04808e.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /Users/siddiq90/
↪Documents/GitHubDesktop/buildtest/buildtest.log
```

Now if we filter the results, notice that `builtin_gcc` got metrics `openmp_threads=1` since that is the value set under the `builtin_gcc` compiler instance under the `config` section. The `gcc/9.3.0-n7p74fd` compiler got value of **2** because we have an entry defined under the `config` section while `gcc/10.2.0-37fmsw7` compiler got the value of **4** from the `default` section that is inherited for all gcc compilers.

```
$ buildtest report --filter buildspec=tutorials/compilers/metrics_openmp.yml --format␣
↪name,compiler,metrics
Reading report file: /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/report.json

+---------------------------+--------------------+------------------+
| name                      | compiler           | metrics          |
+===========================+====================+==================+
| metrics_variable_compiler | builtin_gcc        | openmp_threads=1 |
+---------------------------+--------------------+------------------+
| metrics_variable_compiler | gcc/9.3.0-n7p74fd  | openmp_threads=2 |
+---------------------------+--------------------+------------------+
| metrics_variable_compiler | gcc/10.2.0-37fmsw7 | openmp_threads=4 |
+---------------------------+--------------------+------------------+
```

Running test across multiple executors

The *executor* property can support regular expression to search for compatible executors, this can be used if you want to run a test across multiple executors. In buildtest, we use re.fullmatch with the input pattern defined by **executor** property against a list of available executors defined in configuration file. You can retrieve a list of executors by running `buildtest config executors`.

In example below we will run this test on *generic.local.bash* and *generic.local.sh* executor based on the regular expression.

```
version: "1.0"
buildspecs:
  executor_regex_script_schema:
    type: script
    executor: 'generic.local.(bash|sh)'
    description: regular expression test with executor using script schema
```

(continues on next page)

(continued from previous page)

```
    tags: [tutorials]
    run: date
```

If we build this test, notice that there are two tests, one for each executor.

```
$ buildtest build -b tutorials/executor_regex_script.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:30
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/executor_regex_script.yml

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-----------------------------------------------------------------------------------------
↪--------------------------+
| Discovered Buildspecs                                                                  ␣
↪                          |
+=========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪executor_regex_script.yml |
+-----------------------------------------------------------------------------------------
↪--------------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-----------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/executor_regex_script.yml
```

(continues on next page)

(continued from previous page)

```
name                           description
-----------------------------  ------------------------------------------------------------
executor_regex_script_schema  regular expression test with executor using script schema
executor_regex_script_schema  regular expression test with executor using script schema

+----------------------+
| Stage: Building Test |
+----------------------+

 name                           | id       | type   | executor           | tags          |␣
↪testpath
------------------------------+----------+--------+--------------------+---------------+-
↪-------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------
↪------------------------------
 executor_regex_script_schema | 02116ef3 | script | generic.local.bash | ['tutorials'] |␣
↪/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.bash/executor_regex_script/executor_regex_script_schema/02116ef3/
↪executor_regex_script_schema_build.sh
 executor_regex_script_schema | c82a1376 | script | generic.local.sh   | ['tutorials'] |␣
↪/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/executor_regex_script/executor_regex_script_schema/c82a1376/executor_
↪regex_script_schema_build.sh




+----------------------+
| Stage: Running Test |
+----------------------+

 name                           | id       | executor           | status   |   returncode
------------------------------+----------+--------------------+----------+--------------
 executor_regex_script_schema | 02116ef3 | generic.local.bash | PASS     |            0
 executor_regex_script_schema | c82a1376 | generic.local.sh   | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 2/2 Percentage: 100.000%
Failed Tests: 0/2 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_cpkeytrs.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

Multiple Executors

Note: This feature is in active development

Note: This feature is compatible with `type: script` and `type: spack`.

The `executors` property can be used to define executor specific configuration for each test, currently this field can be used with *vars*, *env* , scheduler directives: `sbatch`, `bsub`, `pbs`, `cobalt` and *cray burst buffer/data warp*. The `executors` field is a JSON object that expects name of executor followed by property set per executor. In this next example, we define variables `X`, `Y` and environment `SHELL` based on executors **generic.local.sh** and **generic.local.bash**.

```
version: "1.0"
buildspecs:
  executors_vars_env_declaration:
    type: script
    executor: 'generic.local.(bash|sh)'
    description: Declaring env and vars by executors section
    tags: [tutorials]
    run: |
      echo "X:" $X
      echo "Y:" $Y
      echo $SHELL

    executors:
      generic.local.bash:
        vars:
          X: 1
          Y: 3
        env:
          SHELL: bash
      generic.local.sh:
        vars:
          X: 2
          Y: 4
        env:
          SHELL: sh
```

Let's build this test.

```
$ buildtest build -b tutorials/script/multiple_executors.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:30
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
```

(continues on next page)

(continued from previous page)

```
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/script/multiple_executors.yml

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-------------------------------------------------------------------------------------------
↪------------------------------+
| Discovered Buildspecs                                                                     ␣
↪                              |
+===========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/multiple_executors.yml |
+-------------------------------------------------------------------------------------------
↪------------------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-------------------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/script/multiple_executors.yml



name                            description
------------------------------  ----------------------------------------
executors_vars_env_declaration  Declaring env and vars by executors section
executors_vars_env_declaration  Declaring env and vars by executors section

+----------------------+
| Stage: Building Test |
+----------------------+

 name                            | id       | type    | executor           | tags         ␣
↪| testpath
---------------------------------+----------+---------+--------------------+---------------
↪+-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------
↪---------------------------------
```

(continues on next page)

(continued from previous page)

```
 executors_vars_env_declaration | cdb315cc | script | generic.local.bash | ['tutorials']␣
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.bash/multiple_executors/executors_vars_env_declaration/cdb315cc/
↪executors_vars_env_declaration_build.sh
 executors_vars_env_declaration | 1ed6c3a9 | script | generic.local.sh   | ['tutorials']␣
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/multiple_executors/executors_vars_env_declaration/1ed6c3a9/
↪executors_vars_env_declaration_build.sh




+----------------------+
| Stage: Running Test |
+----------------------+

 name                             | id       | executor            | status   |   returncode
----------------------------------+----------+---------------------+----------+-------------
↪-
 executors_vars_env_declaration | cdb315cc | generic.local.bash | PASS     |            0
 executors_vars_env_declaration | 1ed6c3a9 | generic.local.sh   | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 2/2 Percentage: 100.000%
Failed Tests: 0/2 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_jzdcnk6b.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

Now let's look at the generated content of the test as follows. We will see that buildtest will set **X=1**, **Y=3** and **SHELL=bash** for `generic.local.bash` and **X=2**, **Y=4** and **SHELL=sh** for `generic.local.sh`

```
$ buildtest inspect query -d all -t executors_vars_env_declaration
_____________________________ executors_vars_env_declaration (ID: cdb315cc-0842-4e46-
↪b362-b087bfbb412a) _____________________________
executor:  generic.local.bash
description:  Declaring env and vars by executors section
state:  PASS
returncode:  0
runtime:  0.004827
starttime:  2021/08/16 22:11:30
endtime:  2021/08/16 22:11:30
************************* Start of Test Path:  /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.bash/multiple_executors/
↪executors_vars_env_declaration/cdb315cc/executors_vars_env_declaration.sh␣
↪************************
```

(continues on next page)

(continued from previous page)

```
#!/bin/bash
# Declare environment variables
export SHELL=bash


# Declare environment variables
export X=1
export Y=3


# Content of run section
echo "X:" $X
echo "Y:" $Y
echo $SHELL

************************* End of Test Path:  /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.bash/multiple_executors/
↪executors_vars_env_declaration/cdb315cc/executors_vars_env_declaration.sh␣
↪*************************

_________________________________ executors_vars_env_declaration (ID: 1ed6c3a9-04f0-4438-
↪9f24-437515703cee) _________________________________
executor:  generic.local.sh
description:  Declaring env and vars by executors section
state:  PASS
returncode:  0
runtime:  0.004515
starttime:  2021/08/16 22:11:30
endtime:  2021/08/16 22:11:30
************************* Start of Test Path:  /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.sh/multiple_executors/
↪executors_vars_env_declaration/1ed6c3a9/executors_vars_env_declaration.sh␣
↪*************************
#!/bin/bash
# Declare environment variables
export SHELL=sh


# Declare environment variables
export X=2
export Y=4


# Content of run section
echo "X:" $X
echo "Y:" $Y
echo $SHELL

************************* End of Test Path:  /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.sh/multiple_executors/
↪executors_vars_env_declaration/1ed6c3a9/executors_vars_env_declaration.sh␣
↪*************************
```

Scheduler Directives

We can also define scheduler directives based on executor type, in this example we define `sbatch` property per executor type. Note that `sbatch` property in the `executors` section will override the `sbatch` property defined in the top-level file otherwise it will use the default.

```
version: "1.0"
buildspecs:
  executors_sbatch_declaration:
    type: script
    executor: 'generic.local.(bash|sh)'
    description: Declaring env and vars by executors section
    tags: [tutorials]
    run: hostname
    sbatch: ["-N 4"]
    executors:
      generic.local.bash:
        sbatch: ["-n 4", "-N 1", "-t 30"]
      generic.local.sh:
        sbatch: ["-n 8", "-N 1", "-t 60"]
```

```
$ buildtest build -b tutorials/script/executor_scheduler.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:31
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/script/executor_scheduler.yml

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-------------------------------------------------------------------------------------------
↪------------------------------+
| Discovered Buildspecs                                                                    
↪                              |
+==========================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/executor_scheduler.yml |
+-------------------------------------------------------------------------------------------
↪------------------------------+
```

(continues on next page)

(continued from previous page)

```
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-------------------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/script/executor_scheduler.yml



name                           description
-----------------------------  ----------------------------------------
executors_sbatch_declaration  Declaring env and vars by executors section
executors_sbatch_declaration  Declaring env and vars by executors section

+----------------------+
| Stage: Building Test |
+----------------------+

 name                           | id       | type   | executor           | tags          |␣
↪testpath
-------------------------------+----------+--------+--------------------+---------------+-
↪-----------------------------------------------------------------------------------------
↪-----------------------------------------------------------------------------------------
↪---------------------------
 executors_sbatch_declaration | d33871db | script | generic.local.bash | ['tutorials'] |␣
↪/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.bash/executor_scheduler/executors_sbatch_declaration/d33871db/executors_
↪sbatch_declaration_build.sh
 executors_sbatch_declaration | 9a9f6981 | script | generic.local.sh   | ['tutorials'] |␣
↪/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/tests/
↪generic.local.sh/executor_scheduler/executors_sbatch_declaration/9a9f6981/executors_
↪sbatch_declaration_build.sh




+----------------------+
| Stage: Running Test |
+----------------------+

 name                           | id       | executor           | status   |   returncode
-------------------------------+----------+--------------------+----------+--------------
 executors_sbatch_declaration | d33871db | generic.local.bash | PASS     |            0
 executors_sbatch_declaration | 9a9f6981 | generic.local.sh   | PASS     |            0
```

(continues on next page)

(continued from previous page)

```
+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 2/2 Percentage: 100.000%
Failed Tests: 0/2 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_19xdl5sa.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

If we inspect this test, we will see each each test have different `#SBATCH` directives for each test based on the `sbatch` property defined in the `executors` field.

```
$ buildtest inspect query -d all -t executors_sbatch_declaration
_________________________________ executors_sbatch_declaration (ID: d33871db-d62c-4e49-9cef-
↪52d1d7ad4da4) _________________________________
executor:  generic.local.bash
description:  Declaring env and vars by executors section
state:  PASS
returncode:  0
runtime:  0.005778
starttime:  2021/08/16 22:11:31
endtime:  2021/08/16 22:11:31
************************* Start of Test Path:  /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.bash/executor_scheduler/
↪executors_sbatch_declaration/d33871db/executors_sbatch_declaration.sh␣
↪*************************
#!/bin/bash
####### START OF SCHEDULER DIRECTIVES #######
#SBATCH -n 4
#SBATCH -N 1
#SBATCH -t 30
#SBATCH --job-name=executors_sbatch_declaration
#SBATCH --output=executors_sbatch_declaration.out
#SBATCH --error=executors_sbatch_declaration.err
####### END OF SCHEDULER DIRECTIVES   #######
# Content of run section
hostname
************************* End of Test Path:  /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.bash/executor_scheduler/
↪executors_sbatch_declaration/d33871db/executors_sbatch_declaration.sh␣
↪*************************

_________________________________ executors_sbatch_declaration (ID: 9a9f6981-a969-4739-b8d3-
↪6671110c9760) _________________________________
executor:  generic.local.sh
description:  Declaring env and vars by executors section
state:  PASS
returncode:  0
```

(continues on next page)

(continued from previous page)

```
runtime:  0.005351
starttime:  2021/08/16 22:11:31
endtime:  2021/08/16 22:11:31
************************ Start of Test Path:  /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.sh/executor_scheduler/
↪executors_sbatch_declaration/9a9f6981/executors_sbatch_declaration.sh␣
↪************************
#!/bin/bash
####### START OF SCHEDULER DIRECTIVES #######
#SBATCH -n 8
#SBATCH -N 1
#SBATCH -t 60
#SBATCH --job-name=executors_sbatch_declaration
#SBATCH --output=executors_sbatch_declaration.out
#SBATCH --error=executors_sbatch_declaration.err
####### END OF SCHEDULER DIRECTIVES   #######
# Content of run section
hostname
************************ End of Test Path:  /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/var/tests/generic.local.sh/executor_scheduler/
↪executors_sbatch_declaration/9a9f6981/executors_sbatch_declaration.sh␣
↪************************
```

Cray Burst Buffer and Data Warp

You can also define `BB` and `DW` directives in the `executors` field to override cray burst buffer and data warp settings per executor. buildtest will use the fields `BB` and `DW` and insert the `#BB` and `#DW` directives in the job script. For more details see *Cray Burst Buffer & Data Warp*.

```
version: "1.0"
buildspecs:
  create_burst_buffer_multiple_executors:
    type: script
    executor: "generic.local.(sh|bash)"
    sbatch: ["-N 1", "-t 10", "-C knl"]
    description: Create a burst buffer for multiple executors
    tags: [jobs]
    executors:
      generic.local.sh:
        BB:
          - create_persistent name=buffer1 capacity=10GB access_mode=striped type=scratch
        DW:
          - persistentdw name=buffer1
      generic.local.bash:
        BB:
        - create_persistent name=buffer2 capacity=10GB access_mode=striped type=scratch
        DW:
          - persistentdw name=buffer2
    run: hostname
```

Status and Metrics Field

The *status* and *metrics* field are supported in `executors` which can be defined within the named executor. In this next example, we will define *generic.local.bash* to match test based on returncode **0** or **2** and define metrics named `firstname` that is assigned the value from variable **FIRST**. The second test using *generic.local.sh* will match returncode of **1** and define a metrics named `lastname` that will store the value defined by variable **LAST**.

```
version: "1.0"
buildspecs:
  status_returncode_by_executors:
    type: script
    executor: "generic.local.(bash|sh)"
    description: define status and metrics per executor type.
    tags: [tutorials]
    vars:
      FIRST: Michael
      LAST: Jackson
    run: echo "my name is $FIRST $LAST"

    executors:
      generic.local.bash:
        status:
          returncode: [0, 2]
        metrics:
          firstname:
            vars: "FIRST"
      generic.local.sh:
        status:
          returncode: 1
        metrics:
          lastname:
            vars: "LAST"
```

Now let's run this test and we will see the test using **generic.local.sh** will fail because we have a returncode mismatch even though both tests got a 0 returncode as its actual value.

```
$ buildtest build -b tutorials/script/status_by_executors.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:31
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
```

(continues on next page)

(continued from previous page)

```
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/script/status_by_executors.yml

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+------------------------------------------------------------------------------------
↪------------------------------+
| Discovered Buildspecs
↪                              |
+====================================================================================
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪script/status_by_executors.yml |
+------------------------------------------------------------------------------------
↪------------------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+--------------------------+
| Stage: Parsing Buildspecs |
+--------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-------------------------------------------------------------------
 script-v1.0.schema.json | True         | /home/docs/checkouts/readthedocs.org/user_
↪builds/buildtest/checkouts/v0.10.2/tutorials/script/status_by_executors.yml



name                            description
------------------------------  ---------------------------------------------
status_returncode_by_executors  define status and metrics per executor type.
status_returncode_by_executors  define status and metrics per executor type.

+----------------------+
| Stage: Building Test |
+----------------------+

 name                            | id       | type   | executor           | tags
↪| testpath
--------------------------------+----------+--------+--------------------+---------------
↪+-------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------------------
↪----------------------------------
 status_returncode_by_executors | c196beec | script | generic.local.bash | ['tutorials']
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.bash/status_by_executors/status_returncode_by_executors/c196beec/
↪status_returncode_by_executors_build.sh
 status_returncode_by_executors | 25ae782d | script | generic.local.sh   | ['tutorials']
↪| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/
↪tests/generic.local.sh/status_by_executors/status_returncode_by_executors/25ae782d/
↪status_returncode_by_executors_build.sh
```

(continues on next page)

(continued from previous page)

```
+---------------------+
| Stage: Running Test |
+---------------------+

 name                            | id       | executor           | status   |   returncode
---------------------------------+----------+--------------------+----------+-------------
↪-
 status_returncode_by_executors | c196beec | generic.local.bash | PASS     |            0
 status_returncode_by_executors | 25ae782d | generic.local.sh   | FAIL     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/2 Percentage: 50.000%
Failed Tests: 1/2 Percentage: 50.000%


Writing Logfile to: /tmp/buildtest_trnt4sk7.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /home/docs/checkouts/
↪readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/buildtest.log
```

Now let's see the test results by inspecting the metrics field using `buildtest report`. We see one test has the metrics name **firstname=Michael** and second test has **lastname=Jackson**.

```
$ buildtest report --format id,name,metrics --filter name=status_returncode_by_executors
Reading report file: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/var/report.json

+----------+---------------------------------+-------------------+
| id       | name                            | metrics           |
+==========+=================================+===================+
| c196beec | status_returncode_by_executors | firstname=Michael |
+----------+---------------------------------+-------------------+
| 25ae782d | status_returncode_by_executors | lastname=Jackson  |
+----------+---------------------------------+-------------------+
```

run_only

The `run_only` property is used for running test given a specific condition has met. For example, you may want a test to run only if its particular system (Linux, Darwin), operating system, scheduler, etc...

run_only - user

buildtest will skip test if any of the conditions are not met. Let's take an example in this buildspec we define a test name **run_only_as_root** that requires **root** user to run test. The **run_only** is a property of key/value pairs and **user** is one of the field. buildtest will only build & run test if current user matches `user` field. We detect current user using `$USER` and match with input field `user`. buildtest will skip test if there is no match.

```
version: "1.0"
buildspecs:
  run_only_as_root:
    description: "This test will only run if current user is root"
    executor: generic.local.bash
    type: script
    tags: ["tutorials"]
    run_only:
      user: root
    run: echo $USER
```

Now if we run this test we see buildtest will skip test **run_only_as_root** because current user is not root.

```
$ buildtest build -b tutorials/root_user.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:32
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b tutorials/root_user.yml

+--------------------------------+
| Stage: Discovering Buildspecs |
+--------------------------------+

+-------------------------------------------------------------------------------------------
↪--------------+
| Discovered Buildspecs                                                                    ␣
↪              |
```

(continues on next page)

(continued from previous page)

```
+=============================================================================================================+
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/tutorials/
↪root_user.yml |
+-------------------------------------------------------------------------------------------
↪--------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1
[run_only_as_root][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/tutorials/root_user.yml]: test is skipped because this test is expected to run␣
↪as user: root but detected user: None.
No buildspecs to process because there are no valid buildspecs
```

run_only - platform

Similarly, we can run test if it matches target platform. In this example we have two tests **run_only_platform_darwin** and **run_only_platform_linux** that are run if target platform is Darwin or Linux. This is configured using `platform` field which is a property of `run_only` object. buildtest will match target platform using platform.system() with field **platform**, if there is no match buildtest will skip test. In this test, we define a python shell using `shell: python` and run `platform.system()`. We expect the output of each test to have **Darwin** and **Linux** which we match with stdout using regular expression.

```yaml
version: "1.0"
buildspecs:
  run_only_platform_darwin:
    description: "This test will only run if target platform is Darwin"
    executor: generic.local.python
    type: script
    tags: ["tutorials"]
    run_only:
      platform: Darwin
    shell: python
    run: |
      import platform
      print(platform.system())
    status:
      regex:
        stream: stdout
        exp: "^Darwin$"

  run_only_platform_linux:
    description: "This test will only run if target platform is Linux"
    executor: generic.local.python
    type: script
    tags: ["tutorials"]
    run_only:
      platform: Linux
    shell: python
    run: |
      import platform
      print(platform.system())
```

(continues on next page)

(continued from previous page)

```
    status:
      regex:
        stream: stdout
        exp: "^Linux"
```

This test was ran on a MacOS (Darwin) so we expect test **run_only_platform_linux** to be skipped.

```
$ buildtest build -b tutorials/run_only_platform.yml


User:  siddiq90
Hostname:  DOE-7086392.local
Platform:  Darwin
Current Time:  2021/07/06 18:54:27
buildtest path: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest
buildtest version:  0.9.6
python path: /Users/siddiq90/.local/share/virtualenvs/buildtest-KLOcDrW0/bin/python
python version:  3.7.3
Test Directory:  /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests
Configuration File:  /Users/siddiq90/Documents/GitHubDesktop/buildtest/buildtest/
↪settings/config.yml
Command: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest build -b␣
↪tutorials/run_only_platform.yml

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-------------------------------------------------------------------------------------+
| Discovered Buildspecs                                                               |
+=====================================================================================+
| /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/run_only_platform.yml |
+-------------------------------------------------------------------------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1
[run_only_platform_linux][/Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/
↪run_only_platform.yml]: test is skipped because this test is expected to run on␣
↪platform: Linux but detected platform: Darwin.

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-----------------------------------
 script-v1.0.schema.json | True         | /Users/siddiq90/Documents/GitHubDesktop/
↪buildtest/tutorials/run_only_platform.yml
```

(continues on next page)

(continued from previous page)

```
name                      description
------------------------  ------------------------------------------------------
run_only_platform_darwin  This test will only run if target platform is Darwin

+----------------------+
| Stage: Building Test |
+----------------------+

 name                      | id       | type   | executor             | tags          |␣
↪testpath
---------------------------+----------+--------+----------------------+---------------+---
↪-------------------------------------------------------------------------------------------
↪-------------------------------------------------------------------------
 run_only_platform_darwin | 964e3016 | script | generic.local.python | ['tutorials'] | /
↪Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.python/run_
↪only_platform/run_only_platform_darwin/3/run_only_platform_darwin_build.sh




+---------------------+
| Stage: Running Test |
+---------------------+

 name                      | id       | executor             | status   |   returncode
---------------------------+----------+----------------------+----------+--------------
 run_only_platform_darwin | 964e3016 | generic.local.python | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/1 Percentage: 100.000%
Failed Tests: 0/1 Percentage: 0.000%


Writing Logfile to: /var/folders/1m/_jjv09h17k37mkktwnmbkmj0002t_q/T/buildtest__md43sa1.
↪log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /Users/siddiq90/
↪Documents/GitHubDesktop/buildtest/buildtest.log
```

run_only - scheduler

buildtest can run test if a particular scheduler is available. In this example, we introduce a new field `scheduler` that is part of `run_only` property. This field expects one of the following values: [`lsf`, `slurm`, `cobalt`, `pbs`] and buildtest will check if target system supports detects the scheduler. In this example we require **lsf** scheduler because this test runs **bmgroup** which is a LSF binary.

Note: buildtest assumes scheduler binaries are available in $PATH, if no scheduler is found buildtest sets this to an empty list

---

```
version: "1.0"
buildspecs:
  show_host_groups:
    type: script
    executor: generic.local.bash
    description: Show information about host groups using bmgroup
    tags: lsf
    run_only:
      scheduler: lsf
    run: bmgroup
```

If we build this test on a target system without LSF notice that buildtest skips test **show_host_groups**.

```
$ buildtest build -b general_tests/sched/lsf/bmgroups.yml


User:  docs
Hostname:  build-14488818-project-280831-buildtest
Platform:  Linux
Current Time:  2021/08/16 22:11:32
buildtest path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/bin/buildtest
buildtest version:  0.10.2
python path: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/envs/v0.10.2/bin/
↪python
python version:  3.6.12
Test Directory:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.
↪10.2/var/tests
Configuration File:  /home/docs/checkouts/readthedocs.org/user_builds/buildtest/
↪checkouts/v0.10.2/buildtest/settings/config.yml
Command: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪bin/buildtest build -b general_tests/sched/lsf/bmgroups.yml

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-----------------------------------------------------------------------------------------
↪---------------------------+
| Discovered Buildspecs                                                                  ␣
↪                            |
+=========================================================================================
```

(continues on next page)

(continued from previous page)

```
| /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/general_
↪tests/sched/lsf/bmgroups.yml |
+-------------------------------------------------------------------------------------
↪---------------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1
[show_host_groups][/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/
↪v0.10.2/general_tests/sched/lsf/bmgroups.yml]: test is skipped because ['run_only'][
↪'scheduler'] got value: lsf but detected scheduler: [].
No buildspecs to process because there are no valid buildspecs
```

run_only - linux_distro

buildtest can run test if it matches a Linux distro, this is configured using `linux_distro` field that is a list of Linux distros that is returned via distro.id(). In this example, we run test only if host distro is `darwin`.

```
version: "1.0"
buildspecs:
  run_only_macos_distro:
    type: script
    executor: generic.local.bash
    description: "Run test only if distro is darwin."
    tags: [mac]
    run_only:
      linux_distro:
        - darwin
    run: uname
    status:
      regex:
        stream: stdout
        exp: "^Darwin$"

  run_only_linux_distro:
    type: script
    executor: generic.local.bash
    description: "Run test only if distro is CentOS."
    tags: [mac]
    run_only:
      linux_distro:
        - centos
    run: uname
```

This test will run successfully because this was ran on a Mac OS (darwin) system.

```
$ buildtest build -b tutorials/run_only_distro.yml


User:  siddiq90
Hostname:  DOE-7086392.local
Platform:  Darwin
```

(continues on next page)

(continued from previous page)

```
Current Time:  2021/07/06 18:54:28
buildtest path: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest
buildtest version:  0.9.6
python path: /Users/siddiq90/.local/share/virtualenvs/buildtest-KLOcDrW0/bin/python
python version:  3.7.3
Test Directory:  /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests
Configuration File:  /Users/siddiq90/Documents/GitHubDesktop/buildtest/buildtest/
↪settings/config.yml
Command: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest build -b␣
↪tutorials/run_only_distro.yml

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-------------------------------------------------------------------------------+
| Discovered Buildspecs                                                         |
+===============================================================================+
| /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/run_only_distro.yml |
+-------------------------------------------------------------------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1
[run_only_linux_distro][/Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/run_
↪only_distro.yml]: test is skipped because this test is expected to run on linux␣
↪distro: ['centos'] but detected linux distro: darwin.

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-------------------------------------------------
↪---------------------------------
 script-v1.0.schema.json | True         | /Users/siddiq90/Documents/GitHubDesktop/
↪buildtest/tutorials/run_only_distro.yml



name                   description
---------------------  ---------------------------------
run_only_macos_distro  Run test only if distro is darwin.

+----------------------+
| Stage: Building Test |
+----------------------+

 name                   | id       | type   | executor           | tags    | testpath
------------------------+----------+--------+--------------------+---------+--------------
↪-------------------------------------------------------------------------------------
↪-----------------------------------------------
 run_only_macos_distro | 9d4d0d97 | script | generic.local.bash | ['mac'] | /Users/
↪siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.bash/run_only_
↪distro/run_only_macos_distro/0/run_only_macos_distro_build.sh
```

(continued on next page)

(continued from previous page)

```
+---------------------+
| Stage: Running Test |
+---------------------+

 name                  | id       | executor           | status   |   returncode
-----------------------+----------+--------------------+----------+--------------
 run_only_macos_distro | 9d4d0d97 | generic.local.bash | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/1 Percentage: 100.000%
Failed Tests: 0/1 Percentage: 0.000%


Writing Logfile to: /var/folders/1m/_jjv09h17k37mkktwnmbkmj0002t_q/T/buildtest_6asbja74.
↪log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /Users/siddiq90/
↪Documents/GitHubDesktop/buildtest/buildtest.log
```

3.6.2 Global Schema

The global schema is validated with for all buildspecs is the top-level schema when defining a buildspec file.

Please refer to Global Schema Documentation that provides a summary .

Schema Definition

Shown below is the start of the schema definition for **global.schema.json**

```
{
  "$id": "global.schema.json",
  "$schema": "http://json-schema.org/draft-07/schema#",
  "title": "global schema",
  "description": "buildtest global schema is validated for all buildspecs. The global␣
↪schema defines top-level structure of buildspec and defintions that are inherited for␣
↪sub-schemas",
  "type": "object",
  "required": ["version","buildspecs"],
  "additionalProperties": false,
```

This schema requires that every buildspec should have `version` and `buildspecs` fields. The version key is required to lookup an a sub-schema using the `type` field. The `buildspecs` is the start of test declaration.

Example Buildspec

```
version: "1.0"
buildspecs:
  hello_world:
    executor: generic.local.bash
    type: script
    tags: tutorials
    description: "hello world example"
    run: echo "hello world!"
maintainers:
- "@shahzebsiddiqui"
```

The field `version` `buildspecs` and `maintainers` are validated with **global.schema.json** using jsonschema.validate method. The test section within `hello_world` is validated by sub-schema by looking up schema based on `type` field.

Every sub-schema requires **type** field in this case, `type: script` informs buildtest to validate with the *Script Schema*. All type schemas have a version, currently buildtest supports **1.0** version for all type schemas. The `version: "1.0"` is used to select the version of the sub-schema, in this example we validate with the schema script-v1.0.schema.json.

To understand how buildtest validates the buildspec see *parsing buildspecs*.

Maintainers

The `maintainers` is an optional field that can be used to specify a list of test maintainers for a given buildspec. The **maintainers** property is used by buildtest to report *buildspecs by maintainers* when querying buildspec cache. You can also *filter buildspecs* by maintainers during building via `buildtest build --filter maintainers=<NAME>` if one wants to filter tests

In this example, we have two maintainers `@johndoe` and `@bobsmith`. The maintainers is a list of strings but must be unique names, generally this can be your name or preferably a github or gitlab handle.

```
version: "1.0"
buildspecs:
  foo_bar:
    type: script
    executor: generic.local.sh
    tags: tutorials
    description: "prints variable $FOO"
    vars:
      FOO: BAR
    run: echo $FOO

maintainers:
  - "@johndoe"
  - "@bobsmith"
```

Test Names

The **buildspecs** property is a JSON object that defines one or more test. This is defined in JSON as follows:

```
"buildspecs": {
  "type": "object",
   "description": "This section is used to define one or more tests (buildspecs). Each␣
↪test must be unique name",
   "propertyNames": {
      "pattern": "^[A-Za-z_.][A-Za-z0-9_.]*$",
      "maxLength": 32
   }
}
```

The test names take the following pattern `"^[A-Za-z_.][A-Za-z0-9_.]*$"` and limited to 32 characters. In previous example, the test name is **hello_world**. You must have unique testname in your **buildspecs** section, otherwise you will have an invalid buildspec file. The `description` field is used to document the test and limited to 80 characters.

Note: We refer to the entire YAML content as **buildspec file**, this is not to be confused with the **buildspecs** field.

Buildspec Structure

Shown below is an overview of buildspec file. In this diagram we define one test within `buildspecs` property named `systemd_default_target`. This test is using the script schema defined by `type: script`. The `executor` property is a required property that determines how test is run. The executors are defined in buildtest configuration see *Configuring buildtest* for more details.

The `run` property is used for defining content of script, this can a shell-script (bash,csh) or python script.

```
version: "1.0"                                                    Schema Version
buildspecs:                                                       Declaration of tests
  systemd_default_target:                                         Name of Test
    executor: generic.local.bash                                  Name of Executor
    type: script                                                  Schema Type
    tags: [system]                                                Tag Name
    description: check if default target is multi-user.target     Description of Test
    run: |
      if [ "multi-user.target" == `systemctl get-default` ]; then
        echo "multi-user is the default target";
        exit 0                                                    Script
      fi
      echo "multi-user is not the default target";
      exit 1
```

Please proceed to *Buildspec Overview* to learn more about buildspecs.

3.6.3 Compiler Schema

The compiler schema is used for compilation of programs, currently we support single source file compilation. In order to use the compiler schema you must set `type: compiler` in your sub-schema. See compiler schema docs

Compilation Examples

We assume the reader has basic understanding of *Global Schema* validation. Shown below is the schema header definition for compiler-v1.0.schema.json:

```
{
  "$id": "compiler-v1.0.schema.json",
  "$schema": "http://json-schema.org/draft-07/schema#",
  "title": "compiler schema version 1.0",
  "description": "The compiler schema is of ``type: compiler`` in sub-schema which is␣
↪used for compiling and running programs",
  "type": "object",
  "required": [
    "type",
    "source",
    "compilers",
    "executor"
  ],
```

The required fields for compiler schema are **type**, **compilers**, **source** and **executor**.

Shown below is a test name `hello_f` that compiles Fortran code with GNU compiler.

```
version: "1.0"
buildspecs:
  hello_f:
    type: compiler
    description: "Hello World Fortran Compilation"
    executor: generic.local.bash
    tags: [tutorials, compile]
    source: "src/hello.f90"
    compilers:
      name: ["^(builtin_gcc)$"]
      default:
        gcc:
          fflags: -Wall
```

The `source` property is used to specify input program for compilation, this can be a file relative to buildspec file or an absolute path. In this example the source file `src/hello.f90` is relative to buildspec file. The `compilers` section specifies compiler configuration, the `name` field is required property which is used to search compilers based on regular expression. In this example we use the **builtin_gcc** compiler as regular expression which is the system gcc compiler provided by buildtest. The `default` section specifies default compiler configuration applicable to a specific compiler group.

Shown below is an example build for the buildspec example

```
$ buildtest build -b tutorials/compilers/gnu_hello_fortran.yml
```

(continues on next page)

(continued from previous page)

```
User:  siddiq90
Hostname:  DOE-7086392.local
Platform:  Darwin
Current Time:  2021/07/06 18:54:28
buildtest path: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest
buildtest version:  0.9.6
python path: /Users/siddiq90/.local/share/virtualenvs/buildtest-KLOcDrW0/bin/python
python version:  3.7.3
Test Directory:  /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests
Configuration File:  /Users/siddiq90/Documents/GitHubDesktop/buildtest/buildtest/
↪settings/config.yml
Command: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest build -b␣
↪tutorials/compilers/gnu_hello_fortran.yml

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-----------------------------------------------------------------------------------------------
↪-----+
| Discovered Buildspecs                                                                        ␣
↪     |
+==============================================================================================+
| /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/compilers/gnu_hello_
↪fortran.yml |
+-----------------------------------------------------------------------------------------------
↪-----+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile                | validstate   | buildspec
---------------------------+--------------+-----------------------------------------------
↪-----------------------------------------------
 compiler-v1.0.schema.json | True         | /Users/siddiq90/Documents/GitHubDesktop/
↪buildtest/tutorials/compilers/gnu_hello_fortran.yml



name     description
-------  -------------------------------
hello_f  Hello World Fortran Compilation

+----------------------+
| Stage: Building Test |
+----------------------+
```

(continues on next page)

(continued from previous page)

```
 name    | id       | type     | executor           | tags                      |␣
↪compiler    | testpath
---------+----------+----------+--------------------+---------------------------+---------
↪----+-----------------------------------------------------------------------------------------
↪-----------------------------------------
 hello_f | 5e3d8b5f | compiler | generic.local.bash | ['tutorials', 'compile'] | builtin_
↪gcc | /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.bash/
↪gnu_hello_fortran/hello_f/1/hello_f_build.sh

+----------------------+
| Stage: Running Test |
+----------------------+

 name    | id       | executor           | status   |   returncode
---------+----------+--------------------+----------+--------------
 hello_f | 5e3d8b5f | generic.local.bash | FAIL     |          127

+-----------------------+
| Stage: Test Summary  |
+-----------------------+

Passed Tests: 0/1 Percentage: 0.000%
Failed Tests: 1/1 Percentage: 100.000%


Writing Logfile to: /var/folders/1m/_jjv09h17k37mkktwnmbkmj0002t_q/T/buildtest_ycbz5z6n.
↪log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /Users/siddiq90/
↪Documents/GitHubDesktop/buildtest/buildtest.log
```

The generated test for test name **hello_f** is the following:

```
#!/bin/bash


# name of executable
_EXEC=hello.f90.exe
# Compilation Line
gfortran -o $_EXEC /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/compilers/
↪src/hello.f90


# Run executable
./$_EXEC
```

buildtest will use compiler wrappers specified in your settings to build the test, however these values can be overridden in buildspec file which will be discussed later.

The `builtin_gcc` compiler is defined below this can be retrieved by running `buildtest config compilers`. The `-y` will display compilers in YAML format.

```
$ buildtest config compilers -y
gcc:
  builtin_gcc:
    cc: /usr/bin/gcc
    cxx: /usr/bin/g++
    fc: /usr/bin/gfortran
```

buildtest will compile and run the code depending on the compiler flags. buildtest, will detect the file extension of source file (`source` property) to detect programming language and finally generate the appropriate C, C++, or Fortran compilation based on language detected. In this example, buildtest detects a **.f90** file extension and determines this is a Fortran program.

Shown below is the file extension table buildtest uses for determining the programming language.

Table 1: File Extension Language Mapping

Language	File Extension
C	.c
C++	.cc .cxx .cpp .c++
Fortran	.f90 .F90 .f95 .f .F .FOR .for .FTN .ftn

Compiler Selection

buildtest selects compiler based on `name` property which is a list of regular expression applied for available compilers defined in buildtest configuration. In example below we select all compilers with regular expression `^(builtin_gcc|gcc)` that is specified in line `name: ["^(builtin_gcc|gcc)"]`

```
version: "1.0"
buildspecs:
  vecadd_gnu:
    type: compiler
    description: Vector Addition example with GNU compiler
    tags: [tutorials, compile]
    executor: generic.local.bash
    source: src/vecAdd.c
    compilers:
      name: ["^(builtin_gcc|gcc)"]
      default:
        gcc:
          cflags: -fopenacc
          ldflags: -lm
```

Currently, we have 3 compilers defined in buildtest settings, shown below is a listing of all compilers. We used `buildtest config compilers find` to *detect compilers*.

```
$ buildtest config compilers
builtin_gcc
gcc/9.3.0-n7p74fd
gcc/10.2.0-37fmsw7
```

Note: This example may vary on your machine depending on compilers available via `module` command.

We expect buildtest to select all three compilers based on our regular expression. In the following build, notice we have three tests for `vecadd_gnu` one for each compiler:

```
$ buildtest build -b tutorials/compilers/vecadd.yml


User:  siddiq90
Hostname:  DOE-7086392.local
Platform:  Darwin
Current Time:  2021/06/10 21:52:32
buildtest path: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest
buildtest version:  0.9.5
python path: /Users/siddiq90/.local/share/virtualenvs/buildtest-KLOcDrW0/bin/python
python version:  3.7.3
Test Directory:  /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests
Configuration File:  /Users/siddiq90/.buildtest/config.yml
Command: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest build -b␣
↪tutorials/compilers/vecadd.yml

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-------------------------------------------------------------------------------------+
| Discovered Buildspecs                                                               |
+=====================================================================================+
| /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/compilers/vecadd.yml |
+-------------------------------------------------------------------------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile                | validstate   | buildspec
---------------------------+--------------+-----------------------------------------------
↪-------------------------------------
 compiler-v1.0.schema.json | True         | /Users/siddiq90/Documents/GitHubDesktop/
↪buildtest/tutorials/compilers/vecadd.yml



name        description
----------  ----------------------------------------
vecadd_gnu  Vector Addition example with GNU compiler
vecadd_gnu  Vector Addition example with GNU compiler
vecadd_gnu  Vector Addition example with GNU compiler

+----------------------+
| Stage: Building Test |
+----------------------+
```

(continues on next page)

(continued from previous page)

```
 name       | id       | type     | executor           | tags                       |␣
↪compiler           | testpath
-----------+----------+----------+--------------------+----------------------------+------
↪--------------+-------------------------------------------------------------------------
↪-----------------------------------------------
 vecadd_gnu | 6f6b16e1 | compiler | generic.local.bash | ['tutorials', 'compile'] |␣
↪builtin_gcc        | /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/
↪generic.local.bash/vecadd/vecadd_gnu/2/vecadd_gnu_build.sh
 vecadd_gnu | a76dd163 | compiler | generic.local.bash | ['tutorials', 'compile'] | gcc/
↪9.3.0-n7p74fd  | /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.
↪local.bash/vecadd/vecadd_gnu/3/vecadd_gnu_build.sh
 vecadd_gnu | 82360702 | compiler | generic.local.bash | ['tutorials', 'compile'] | gcc/
↪10.2.0-37fmsw7 | /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.
↪local.bash/vecadd/vecadd_gnu/4/vecadd_gnu_build.sh

+----------------------+
| Stage: Running Test |
+----------------------+

 name       | id       | executor           | status   |   returncode
------------+----------+--------------------+----------+--------------
 vecadd_gnu | 6f6b16e1 | generic.local.bash | PASS     |            0
 vecadd_gnu | a76dd163 | generic.local.bash | PASS     |            0
 vecadd_gnu | 82360702 | generic.local.bash | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 3/3 Percentage: 100.000%
Failed Tests: 0/3 Percentage: 0.000%


Writing Logfile to: /Users/siddiq90/buildtest/buildtest_b0jwyoyv.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /Users/siddiq90/
↪Documents/GitHubDesktop/buildtest/buildtest.log
```

buildtest will use compiler settings including module configuration from buildtest settings (`config.yml`). In example below we show the compiler definitions for the three gcc compilers. The `module` section is the declaration of modules to load, by default we disable purge (`purge: False`) which instructs buildtest to not insert `module purge`. The `load` is a list of modules to load via `module load`.

Shown below is the compiler configuration.

```
compilers:
  find:
    gcc: ^(gcc)
  compiler:
    gcc:
      builtin_gcc:
```

(continues on next page)

(continued from previous page)

```
        cc: gcc
        fc: gfortran
        cxx: g++
      gcc/9.3.0-n7p74fd:
        cc: gcc
        cxx: g++
        fc: gfortran
        module:
          load:
          - gcc/9.3.0-n7p74fd
          purge: false
      gcc/10.2.0-37fmsw7:
        cc: gcc
        cxx: g++
        fc: gfortran
        module:
          load:
          - gcc/10.2.0-37fmsw7
          purge: false
```

If we take a closer look at the generated test we see the *module load* command in the test script.

```
#!/bin/bash


# name of executable
_EXEC=vecAdd.c.exe
# Loading modules
module load gcc/10.2.0-37fmsw7
# Compilation Line
gcc -fopenacc -o $_EXEC /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/
↪compilers/src/vecAdd.c -lm


# Run executable
./$_EXEC
```

```
#!/bin/bash


# name of executable
_EXEC=vecAdd.c.exe
# Loading modules
module load gcc/9.3.0-n7p74fd
# Compilation Line
gcc -fopenacc -o $_EXEC /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/
↪compilers/src/vecAdd.c -lm


# Run executable
./$_EXEC
```

Excluding Compilers

The `exclude` property is part of compilers section which allows one to exclude compilers upon discovery by `name` field. The exclude property is a list of compiler names that will be removed from test generation which is done prior to build phase. buildtest will exclude any compilers specified in `exclude` if they were found based on regular expression in `name` field. In this example, we slightly modified previous example by excluding `gcc/10.2.0-37fmsw7` compiler. This is specified by `exclude: [gcc/10.2.0-37fmsw7]`.

```
version: "1.0"
buildspecs:
  vecadd_gnu_exclude:
    type: compiler
    description: Vector Addition example with GNU compilers but exclude gcc@10.2.0
    tags: [tutorials, compile]
    executor: generic.local.bash
    source: src/vecAdd.c
    compilers:
      name: ["^(gcc)"]
      exclude: [gcc/10.2.0-37fmsw7]
      default:
        gcc:
          cflags: -fopenacc
          ldflags: -lm
```

Notice when we build this test, buildtest will exclude **gcc/10.2.0-37fmsw7** compiler and test is not created during build phase.

```
$ buildtest build -b tutorials/compilers/compiler_exclude.yml


User:  siddiq90
Hostname:  DOE-7086392.local
Platform:  Darwin
Current Time:  2021/06/10 21:56:11
buildtest path: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest
buildtest version:  0.9.5
python path: /Users/siddiq90/.local/share/virtualenvs/buildtest-KLOcDrW0/bin/python
python version:  3.7.3
Test Directory:  /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests
Configuration File:  /Users/siddiq90/.buildtest/config.yml
Command: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest build -b␣
↪tutorials/compilers/compiler_exclude.yml

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-----------------------------------------------------------------------------------------------
↪----+
| Discovered Buildspecs                                                                        ␣
↪     |
+=============================================================================================+
| /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/compilers/compiler_exclude.
↪yml |
```

(continues on next page)

(continued from previous page)

```
+-------------------------------------------------------------------------------------------
↪----+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1
Excluding compiler: gcc/10.2.0-37fmsw7 from test generation

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile                | validstate   | buildspec
---------------------------+--------------+-------------------------------------------
↪---------------------------------------------
 compiler-v1.0.schema.json | True         | /Users/siddiq90/Documents/GitHubDesktop/
↪buildtest/tutorials/compilers/compiler_exclude.yml



name                description
------------------  ------------------------------------------------------------------
vecadd_gnu_exclude  Vector Addition example with GNU compilers but exclude gcc@10.2.0

+----------------------+
| Stage: Building Test |
+----------------------+



 name                | id       | type     | executor           | tags                ␣
↪ | compiler          | testpath
--------------------+----------+----------+--------------------+-------------------------
↪-+--------------------+-----------------------------------------------------------------
↪-----------------------------------------------------------------
 vecadd_gnu_exclude | a7373d09 | compiler | generic.local.bash | ['tutorials', 'compile
↪'] | gcc/9.3.0-n7p74fd | /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/
↪generic.local.bash/compiler_exclude/vecadd_gnu_exclude/0/vecadd_gnu_exclude_build.sh

+----------------------+
| Stage: Running Test |
+----------------------+

 name                | id       | executor           | status   |   returncode
--------------------+----------+--------------------+----------+--------------
 vecadd_gnu_exclude | a7373d09 | generic.local.bash | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/1 Percentage: 100.000%
Failed Tests: 0/1 Percentage: 0.000%
```

(continues on next page)

(continued from previous page)

```
Writing Logfile to: /Users/siddiq90/buildtest/buildtest_4szlay_j.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /Users/siddiq90/
↪Documents/GitHubDesktop/buildtest/buildtest.log
```

Compiler Defaults and Override Default Settings

Sometimes you may want to set default compiler flags (**cflags**, **fflags**, **cxxflags**), preprocessor (**cppflags**) or linker flags (**ldflags**) for compiler group (gcc, intel, pgi, etc…). This can be achieved using the `default` property that is part of **compilers** section.

The `default` field is organized into compiler groups, in example below we set default C compiler flags (`cflags: -O1`). In addition, we can override default settings using the `config` property where one must specify the compiler name to override. In example below we can override compiler settings for `gcc/9.3.0-n7p74fd` to use `-O2` and `gcc/10.2.0-37fmsw7` to use `-O3` for **cflags** .

```
version: "1.0"
buildspecs:
  hello_c:
    type: compiler
    description: "Hello World C Compilation"
    executor: generic.local.bash
    tags: [tutorials, compile]
    source: "src/hello.c"
    compilers:
      name: ["^(builtin_gcc|gcc)"]
      default:
        gcc:
          cflags: -O1
      config:
        gcc/9.3.0-n7p74fd:
          cflags: -O2
        gcc/10.2.0-37fmsw7:
          cflags: -O3
```

Next we run this test, and we get three tests for test name **hello_c**.

```
$ buildtest build -b tutorials/compilers/gnu_hello_c.yml


User:  siddiq90
Hostname:  DOE-7086392.local
Platform:  Darwin
Current Time:  2021/06/10 22:00:08
buildtest path: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest
buildtest version:  0.9.5
python path: /Users/siddiq90/.local/share/virtualenvs/buildtest-KLOcDrW0/bin/python
python version:  3.7.3
Test Directory:  /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests
Configuration File:  /Users/siddiq90/.buildtest/config.yml
Command: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest build -b␣
↪tutorials/compilers/gnu_hello_c.yml
```

(continues on next page)

(continued from previous page)

```
+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-----------------------------------------------------------------------------------------+
| Discovered Buildspecs                                                                   |
+=========================================================================================+
| /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/compilers/gnu_hello_c.yml |
+-----------------------------------------------------------------------------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile                | validstate   | buildspec
---------------------------+--------------+-----------------------------------------
↪---------------------------------------
 compiler-v1.0.schema.json | True         | /Users/siddiq90/Documents/GitHubDesktop/
↪buildtest/tutorials/compilers/gnu_hello_c.yml



name     description
-------  -------------------------
hello_c  Hello World C Compilation
hello_c  Hello World C Compilation
hello_c  Hello World C Compilation

+----------------------+
| Stage: Building Test |
+----------------------+



 name    | id       | type     | executor           | tags                      |␣
↪compiler           | testpath
---------+----------+----------+--------------------+---------------------------+---------
↪-----------+-------------------------------------------------------------------------------
↪-----------------------------------------
 hello_c | afa92b9d | compiler | generic.local.bash | ['tutorials', 'compile'] | builtin_
↪gcc        | /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.
↪bash/gnu_hello_c/hello_c/2/hello_c_build.sh
 hello_c | 498010d3 | compiler | generic.local.bash | ['tutorials', 'compile'] | gcc/9.3.
↪0-n7p74fd  | /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.
↪bash/gnu_hello_c/hello_c/3/hello_c_build.sh
 hello_c | ee753488 | compiler | generic.local.bash | ['tutorials', 'compile'] | gcc/10.
↪2.0-37fmsw7 | /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.
↪local.bash/gnu_hello_c/hello_c/4/hello_c_build.sh
```

(continues on next page)

(continued from previous page)

```
+----------------------+
| Stage: Running Test |
+----------------------+

 name    | id       | executor           | status   |   returncode
---------+----------+--------------------+----------+--------------
 hello_c | afa92b9d | generic.local.bash | PASS     |            0
 hello_c | 498010d3 | generic.local.bash | PASS     |            0
 hello_c | ee753488 | generic.local.bash | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 3/3 Percentage: 100.000%
Failed Tests: 0/3 Percentage: 0.000%


Writing Logfile to: /Users/siddiq90/buildtest/buildtest_dtyx0ags.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /Users/siddiq90/
↪Documents/GitHubDesktop/buildtest/buildtest.log



Writing Logfile to: /private/tmp/buildtest/buildtest_hh9k7vm6.log
```

If we inspect the following test, we see the compiler flags are associated with the compiler. The test below is for *builtin_gcc* which use the default `-O1` compiler flag as shown below.

```
#!/bin/bash


# name of executable
_EXEC=hello.c.exe
# Compilation Line
gcc -O1 -o $_EXEC /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/compilers/
↪src/hello.c


# Run executable
./$_EXEC
```

The test for **gcc/10.2.0-37fmsw7** and **gcc/9.3.0-n7p74fd** have cflags `-O3` and `-O2` set in their respective tests.

```
#!/bin/bash


# name of executable
_EXEC=hello.c.exe
# Loading modules
module load gcc/10.2.0-37fmsw7
```

(continues on next page)

(continued from previous page)

```
# Compilation Line
gcc -O3 -o $_EXEC /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/compilers/
↪src/hello.c


# Run executable
./$_EXEC
```

```
#!/bin/bash


# name of executable
_EXEC=hello.c.exe
# Loading modules
module load gcc/9.3.0-n7p74fd
# Compilation Line
gcc -O2 -o $_EXEC /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/compilers/
↪src/hello.c


# Run executable
./$_EXEC
```

Setting environment variables

Environment variables can be set using `env` property which is a list of key/value pair to assign environment variables. This property can be used in `default` section within a compiler group. In example below we have an OpenMP Hello World example in C where we define *OMP_NUM_THREADS* environment variable which controls number of OpenMP threads to use when running program. In this example we use 2 threads for all gcc compiler group

```
version: "1.0"
buildspecs:
  openmp_hello_c_example:
    type: compiler
    description: OpenMP Hello World C example
    executor: generic.local.bash
    tags: [tutorials, compile]
    source: "src/hello_omp.c"
    compilers:
      name: ["^(gcc)"]
      default:
        gcc:
          cflags: -fopenmp
          env:
            OMP_NUM_THREADS: 2
```

Shown below is one of the generated test and notice that buildtest will set environment variable **OMP_NUM_THREADS**.

```
#!/bin/bash

```

(continues on next page)

(continued from previous page)

```

# name of executable
_EXEC=hello_omp.c.exe
# Declare environment variables
export OMP_NUM_THREADS=2


# Loading modules
module load gcc/10.2.0-37fmsw7
# Compilation Line
gcc -fopenmp -o $_EXEC /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/
↪compilers/src/hello_omp.c


# Run executable
./$_EXEC
```

Similarly, one can define environment variables at the compiler level in `config` section. buildtest will override value defined in `default` section. In this example, we make slight modification to the test, so that `gcc/10.2.0-37fmsw7` will use 4 threads when running program. This will override the default value of 2.

```yaml
version: "1.0"
buildspecs:
  override_environmentvars:
    type: compiler
    description: override default environment variables
    executor: generic.local.bash
    tags: [tutorials, compile]
    source: "src/hello_omp.c"
    compilers:
      name: ["^(gcc)"]
      default:
        gcc:
          cflags: -fopenmp
          env:
            OMP_NUM_THREADS: 2
      config:
        gcc/10.2.0-37fmsw7:
          env:
            OMP_NUM_THREADS: 4
```

Next we build this test as follows:

```
$ buildtest build -b tutorials/compilers/envvar_override.yml


User:  siddiq90
Hostname:  DOE-7086392.local
Platform:  Darwin
Current Time:  2021/06/10 22:04:19
buildtest path: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest
buildtest version:  0.9.5
```

(continues on next page)

(continued from previous page)

```
python path: /Users/siddiq90/.local/share/virtualenvs/buildtest-KLOcDrW0/bin/python
python version:  3.7.3
Test Directory:  /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests
Configuration File:  /Users/siddiq90/.buildtest/config.yml
Command: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest build -b␣
↪tutorials/compilers/envvar_override.yml

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+

+-----------------------------------------------------------------------------------------------
↪---+
| Discovered Buildspecs                                                                        ␣
↪    |
+=============================================================================================+
| /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/compilers/envvar_override.
↪yml |
+-----------------------------------------------------------------------------------------------
↪---+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile                | validstate   | buildspec
---------------------------+--------------+-----------------------------------------------
↪-----------------------------------------------
 compiler-v1.0.schema.json | True         | /Users/siddiq90/Documents/GitHubDesktop/
↪buildtest/tutorials/compilers/envvar_override.yml



name                      description
------------------------  -------------------------------------
override_environmentvars  override default environment variables
override_environmentvars  override default environment variables

+----------------------+
| Stage: Building Test |
+----------------------+



 name                     | id       | type     | executor           | tags              ␣
↪       | compiler           | testpath
--------------------------+----------+----------+--------------------+-------------------
↪-------+--------------------+-----------------------------------------------------------------
↪-----------------------------------------------------------------------------------------
↪------------
```

(continues on next page)

(continued from previous page)

```
 override_environmentvars | 72619a4b | compiler | generic.local.bash | ['tutorials',
↪'compile'] | gcc/9.3.0-n7p74fd  | /Users/siddiq90/Documents/GitHubDesktop/buildtest/
↪var/tests/generic.local.bash/envvar_override/override_environmentvars/0/override_
↪environmentvars_build.sh
 override_environmentvars | 31098506 | compiler | generic.local.bash | ['tutorials',
↪'compile'] | gcc/10.2.0-37fmsw7 | /Users/siddiq90/Documents/GitHubDesktop/buildtest/
↪var/tests/generic.local.bash/envvar_override/override_environmentvars/1/override_
↪environmentvars_build.sh

+----------------------+
| Stage: Running Test |
+----------------------+

 name                      | id       | executor            | status   |   returncode
---------------------------+----------+---------------------+----------+--------------
 override_environmentvars | 72619a4b | generic.local.bash | PASS     |            0
 override_environmentvars | 31098506 | generic.local.bash | PASS     |            0

+-----------------------+
| Stage: Test Summary  |
+-----------------------+

Passed Tests: 2/2 Percentage: 100.000%
Failed Tests: 0/2 Percentage: 0.000%


Writing Logfile to: /Users/siddiq90/buildtest/buildtest_p3wdnl1t.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /Users/siddiq90/
↪Documents/GitHubDesktop/buildtest/buildtest.log
```

Now let's inspect the test by running `buildtest inspect name` and we notice there are two test records for *override_environmentvars* using **gcc/9.3.0-n7p74fd** and **gcc/10.2.0-37fmsw7**.

```
$ buildtest inspect name override_environmentvars
Reading Report File: /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/report.json

{
  "override_environmentvars": [
    {
      "id": "72619a4b",
      "full_id": "72619a4b-3ed2-489c-aebd-2e0cacbf2d6a",
      "description": "override default environment variables",
      "schemafile": "compiler-v1.0.schema.json",
      "executor": "generic.local.bash",
      "compiler": "gcc/9.3.0-n7p74fd",
      "hostname": "DOE-7086392.local",
      "user": "siddiq90",
      "testroot": "/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.
↪local.bash/envvar_override/override_environmentvars/0",
      "testpath": "/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.
↪local.bash/envvar_override/override_environmentvars/0/stage/override_environmentvars.sh
↪",
```

(continues on next page)

(continued from previous page)


```
      "stagedir": "/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.bash/envvar_override/override_environmentvars/0/stage",
      "command": "sh override_environmentvars_build.sh",
      "outfile": "/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.bash/envvar_override/override_environmentvars/0/override_environmentvars.out",
      "errfile": "/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.bash/envvar_override/override_environmentvars/0/override_environmentvars.err",
      "buildspec_content": "version: \"1.0\"\nbuildspecs:\n  override_environmentvars:\n    type: compiler\n    description: override default environment variables\n    executor: generic.local.bash\n    tags: [tutorials, compile]\n    source: \"src/hello_omp.c\"\n    compilers:\n      name: [\"^(gcc)\"]\n      default:\n        gcc:\n          cflags: -fopenmp\n          env:\n            OMP_NUM_THREADS: 2\n          config:\n        gcc/10.2.0-37fmsw7:\n          env:\n            OMP_NUM_THREADS: 4",
      "test_content": "#!/bin/bash \n_EXEC=hello_omp.c.exe\nexport OMP_NUM_THREADS=2\nmodule load gcc/9.3.0-n7p74fd\ngcc -fopenmp -o $_EXEC /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/compilers/src/hello_omp.c\n./$_EXEC",
      "logpath": "/Users/siddiq90/buildtest/buildtest_p3wdnl1t.log",
      "tags": "tutorials compile",
      "starttime": "2021/06/10 22:04:19",
      "endtime": "2021/06/10 22:04:20",
      "runtime": 0.727095,
      "state": "PASS",
      "returncode": 0,
      "output": "Hello World from thread = 0\nHello World from thread = 1\n",
      "error": "The following have been reloaded with a version change:\n  1) gcc/10.2.0-37fmsw7 => gcc/9.3.0-n7p74fd\n",
      "job": null,
      "build_script": "/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.bash/envvar_override/override_environmentvars/0/override_environmentvars_build.sh"
    },
    {
      "id": "31098506",
      "full_id": "31098506-2bbf-4a50-8386-2fcd5bcddff5",
      "description": "override default environment variables",
      "schemafile": "compiler-v1.0.schema.json",
      "executor": "generic.local.bash",
      "compiler": "gcc/10.2.0-37fmsw7",
      "hostname": "DOE-7086392.local",
      "user": "siddiq90",
      "testroot": "/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.bash/envvar_override/override_environmentvars/1",
      "testpath": "/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.bash/envvar_override/override_environmentvars/1/stage/override_environmentvars.sh",
      "stagedir": "/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.bash/envvar_override/override_environmentvars/1/stage",
      "command": "sh override_environmentvars_build.sh",
      "outfile": "/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.bash/envvar_override/override_environmentvars/1/override_environmentvars.out",
      "errfile": "/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/generic.local.bash/envvar_override/override_environmentvars/1/override_environmentvars.err",
```


(continues on next page)

(continued from previous page)

```
50      "buildspec_content": "version: \"1.0\"\nbuildspecs:\n  override_environmentvars:\n␣
↪   type: compiler\n    description: override default environment variables\n   ␣
↪executor: generic.local.bash\n    tags: [tutorials, compile]\n    source: \"src/hello_
↪omp.c\"\n    compilers:\n      name: [\"^(gcc)\"]\n      default:\n        gcc:\n     ␣
↪     cflags: -fopenmp\n          env:\n            OMP_NUM_THREADS: 2\n      config:\n ␣
↪       gcc/10.2.0-37fmsw7:\n          env:\n            OMP_NUM_THREADS: 4",
51      "test_content": "#!/bin/bash \n_EXEC=hello_omp.c.exe\nexport OMP_NUM_THREADS=4\
↪nmodule load gcc/10.2.0-37fmsw7\ngcc -fopenmp -o $_EXEC /Users/siddiq90/Documents/
↪GitHubDesktop/buildtest/tutorials/compilers/src/hello_omp.c\n./$_EXEC",
52      "logpath": "/Users/siddiq90/buildtest/buildtest_p3wdnl1t.log",
53      "tags": "tutorials compile",
54      "starttime": "2021/06/10 22:04:20",
55      "endtime": "2021/06/10 22:04:20",
56      "runtime": 0.482645,
57      "state": "PASS",
58      "returncode": 0,
59      "output": "Hello World from thread = 1\nHello World from thread = 3\nHello World␣
↪from thread = 2\nHello World from thread = 0\n",
60      "error": "",
61      "job": null,
62      "build_script": "/Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests/
↪generic.local.bash/envvar_override/override_environmentvars/1/override_environmentvars_
↪build.sh"
63    }
64  ]
65 }
```

Tweak how test are passed

The `status` property can be used to determine how buildtest will pass the test. By default, buildtest will use returncode to determine if test `PASS` or `FAIL` with exitcode 0 as PASS and anything else is FAIL.

Sometimes, it may be useful check output of test to determine using regular expression. This can be done via `status` property. In this example, we define two tests, the first one defines `status` property in the default **gcc** group. This means all compilers that belong to gcc group will be matched with the regular expression.

In second example we override the status `regex` property for **gcc/10.2.0-37fmsw7**. We expect the test to produce an output of `final result:  1.000000` so we expect one failure from **gcc/10.2.0-37fmsw7**.

```yaml
version: "1.0"
buildspecs:
  default_status_regex:
    type: compiler
    description: Regular expression check in stdout for gcc group
    tags: [tutorials, compile]
    executor: generic.local.bash
    source: src/vecAdd.c
    compilers:
      name: ["^(gcc)"]
      default:
        gcc:
          cflags: -fopenacc
```

(continues on next page)

(continued from previous page)

```
        ldflags: -lm
        status:
          regex:
            stream: stdout
            exp: "^final result: 1.000000$"

override_status_regex:
  type: compiler
  description: Override regular expression for compiler gcc/10.2.0-37fmsw7
  tags: [tutorials, compile]
  executor: generic.local.bash
  source: src/vecAdd.c
  compilers:
    name: ["^(gcc)"]
    default:
      gcc:
        cflags: -fopenacc
        ldflags: -lm
        status:
          regex:
            stream: stdout
            exp: "^final result: 1.000000$"
    config:
      gcc/10.2.0-37fmsw7:
        status:
          regex:
            stream: stdout
            exp: "^final result: 0.99$"
```

If we build this test, notice that test id **9320ca41** failed which corresponds to `gcc/10.2.0-37fmsw7` compiler test. The test fails because it fails to pass on regular expression even though we have a returncode of 0.

```
$ buildtest build -b tutorials/compilers/compiler_status_regex.yml


User:  siddiq90
Hostname:  DOE-7086392.local
Platform:  Darwin
Current Time:  2021/06/10 22:08:03
buildtest path: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest
buildtest version:  0.9.5
python path: /Users/siddiq90/.local/share/virtualenvs/buildtest-KLOcDrW0/bin/python
python version:  3.7.3
Test Directory:  /Users/siddiq90/Documents/GitHubDesktop/buildtest/var/tests
Configuration File:  /Users/siddiq90/.buildtest/config.yml
Command: /Users/siddiq90/Documents/GitHubDesktop/buildtest/bin/buildtest build -b␣
↪tutorials/compilers/compiler_status_regex.yml

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

```

(continues on next page)

(continued from previous page)

```
+-------------------------------------------------------------------------------------------
↪---------+
| Discovered Buildspecs                                                                    ␣
↪         |
+==========================================================================================+
| /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/compilers/compiler_status_
↪regex.yml |
+-------------------------------------------------------------------------------------------
↪---------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile                | validstate   | buildspec
---------------------------+--------------+-----------------------------------------------
↪-------------------------------------------------
 compiler-v1.0.schema.json | True         | /Users/siddiq90/Documents/GitHubDesktop/
↪buildtest/tutorials/compilers/compiler_status_regex.yml



name                   description
---------------------  ------------------------------------------------------------
default_status_regex   Regular expression check in stdout for gcc group
default_status_regex   Regular expression check in stdout for gcc group
override_status_regex  Override regular expression for compiler gcc/10.2.0-37fmsw7
override_status_regex  Override regular expression for compiler gcc/10.2.0-37fmsw7

+----------------------+
| Stage: Building Test |
+----------------------+



 name                   | id       | type     | executor           | tags                ␣
↪    | compiler           | testpath
-----------------------+----------+----------+--------------------+----------------------
↪----+--------------------+-------------------------------------------------------------------
↪-------------------------------------------------------------------------------------------
↪---------
 default_status_regex  | a023a2c2 | compiler | generic.local.bash | ['tutorials',
↪'compile'] | gcc/9.3.0-n7p74fd  | /Users/siddiq90/Documents/GitHubDesktop/buildtest/
↪var/tests/generic.local.bash/compiler_status_regex/default_status_regex/0/default_
↪status_regex_build.sh
 default_status_regex  | 155865c3 | compiler | generic.local.bash | ['tutorials',
↪'compile'] | gcc/10.2.0-37fmsw7 | /Users/siddiq90/Documents/GitHubDesktop/buildtest/
↪var/tests/generic.local.bash/compiler_status_regex/default_status_regex/1/default_
↪status_regex_build.sh
```

(continues on next page)

(continued from previous page)

```
 override_status_regex | 3411bddf | compiler | generic.local.bash | ['tutorials',
↪'compile'] | gcc/9.3.0-n7p74fd  | /Users/siddiq90/Documents/GitHubDesktop/buildtest/
↪var/tests/generic.local.bash/compiler_status_regex/override_status_regex/0/override_
↪status_regex_build.sh
 override_status_regex | 295310a4 | compiler | generic.local.bash | ['tutorials',
↪'compile'] | gcc/10.2.0-37fmsw7 | /Users/siddiq90/Documents/GitHubDesktop/buildtest/
↪var/tests/generic.local.bash/compiler_status_regex/override_status_regex/1/override_
↪status_regex_build.sh

+----------------------+
| Stage: Running Test |
+----------------------+

 name                   | id       | executor            | status   |   returncode
------------------------+----------+---------------------+----------+--------------
 default_status_regex   | a023a2c2 | generic.local.bash | PASS     |            0
 default_status_regex   | 155865c3 | generic.local.bash | PASS     |            0
 override_status_regex | 3411bddf | generic.local.bash | PASS     |            0
 override_status_regex | 295310a4 | generic.local.bash | FAIL     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 3/4 Percentage: 75.000%
Failed Tests: 1/4 Percentage: 25.000%


Writing Logfile to: /Users/siddiq90/buildtest/buildtest_hp7_gpbn.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /Users/siddiq90/
↪Documents/GitHubDesktop/buildtest/buildtest.log
```

Single Test Multiple Compilers

It's possible to run single test across multiple compilers (gcc, intel, cray, etc...). In the next example, we will build an OpenMP reduction test using gcc, intel and cray compilers. In this test, we use `name` field to select compilers that start with **gcc**, **intel** and **PrgEnv-cray** as compiler names. The `default` section is organized by compiler groups which inherits compiler flags for all compilers. OpenMP flag for gcc, intel and cray differ for instance one must use `-fopenmp` for gcc, `--qopenmp` for intel and `-h omp` for cray.

```
version: "1.0"
buildspecs:
  reduction:
    type: compiler
    executor: local.bash
    source: src/reduction.c
    description: OpenMP reduction example using gcc, intel and cray compiler
    tags: [openmp]
    compilers:
      name: ["^(gcc|intel|PrgEnv-cray)"]
      default:
```

(continues on next page)

(continued from previous page)

```
        all:
          env:
            OMP_NUM_THREADS: 4
        gcc:
          cflags: -fopenmp
        intel:
          cflags: -qopenmp
        cray:
          cflags: -h omp
```

In this example *OMP_NUM_THREADS* environment variable under the `all` section which will be used for all compiler groups. This example was built on Cori, we expect this test to run against every gcc, intel and PrgEnv-cray compiler module:

```
$ buildtest build -b buildspecs/apps/openmp/reduction.yml


User:  siddiq90
Hostname:  cori02
Platform:  Linux
Current Time:  2021/06/11 08:42:54
buildtest path: /global/homes/s/siddiq90/github/buildtest/bin/buildtest
buildtest version:  0.9.5
python path: /global/homes/s/siddiq90/.conda/envs/buildtest/bin/python
python version:  3.8.8
Test Directory:  /global/u1/s/siddiq90/github/buildtest/var/tests
Configuration File:  /global/u1/s/siddiq90/.buildtest/config.yml
Command: /global/homes/s/siddiq90/github/buildtest/bin/buildtest build -b buildspecs/
↪apps/openmp/reduction.yml

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-------------------------------------------------------------------------------------+
| Discovered Buildspecs                                                               |
+=====================================================================================+
| /global/u1/s/siddiq90/github/buildtest-cori/buildspecs/apps/openmp/reduction.yml |
+-------------------------------------------------------------------------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile                | validstate   | buildspec
---------------------------+--------------+-----------------------------------------------
↪-------------------------------------
 compiler-v1.0.schema.json | True         | /global/u1/s/siddiq90/github/buildtest-cori/
↪buildspecs/apps/openmp/reduction.yml
```

(continues on next page)

(continued from previous page)

```



name       description
---------  ---------------------------------------------------------------
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler
reduction  OpenMP reduction example using gcc, intel, PrgEnv-cray compiler

+----------------------+
| Stage: Building Test |
+----------------------+



 name      | id       | type     | executor        | tags       | compiler              ␣
↪                  | testpath
-----------+----------+----------+-----------------+------------+------------------------
↪------------------+-----------------------------------------------------------------------
↪---------------------------------------
 reduction | fd93fdcb | compiler | cori.local.bash | ['openmp'] | gcc/6.1.0             ␣
↪                  | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/25/reduction_build.sh
 reduction | 43737191 | compiler | cori.local.bash | ['openmp'] | gcc/7.3.0             ␣
↪                  | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/26/reduction_build.sh
 reduction | 6e2e95cd | compiler | cori.local.bash | ['openmp'] | gcc/8.1.0             ␣
↪                  | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/27/reduction_build.sh
 reduction | c48a8d8d | compiler | cori.local.bash | ['openmp'] | gcc/8.2.0             ␣
↪                  | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/28/reduction_build.sh
```

(continues on next page)

(continued from previous page)

```
reduction | a6201c48 | compiler | cori.local.bash | ['openmp'] | gcc/8.3.0              ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/29/reduction_build.sh
reduction | aa06b1be | compiler | cori.local.bash | ['openmp'] | gcc/9.3.0              ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/30/reduction_build.sh
reduction | 02b8e7aa | compiler | cori.local.bash | ['openmp'] | gcc/10.1.0             ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/31/reduction_build.sh
reduction | bd9abd7e | compiler | cori.local.bash | ['openmp'] | gcc/6.3.0              ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/32/reduction_build.sh
reduction | 9409a86f | compiler | cori.local.bash | ['openmp'] | gcc/8.1.1-openacc-gcc-
↪8-branch-20190215 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/33/reduction_build.sh
reduction | b9700a0f | compiler | cori.local.bash | ['openmp'] | PrgEnv-cray/6.0.5      ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/34/reduction_build.sh
reduction | a605c970 | compiler | cori.local.bash | ['openmp'] | PrgEnv-cray/6.0.7      ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/35/reduction_build.sh
reduction | 9ef915a9 | compiler | cori.local.bash | ['openmp'] | PrgEnv-cray/6.0.9      ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/36/reduction_build.sh
reduction | 4f9e4242 | compiler | cori.local.bash | ['openmp'] | intel/19.0.3.199       ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/37/reduction_build.sh
reduction | e37befed | compiler | cori.local.bash | ['openmp'] | intel/19.1.2.254       ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/38/reduction_build.sh
reduction | 1e9b0ab5 | compiler | cori.local.bash | ['openmp'] | intel/16.0.3.210       ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/39/reduction_build.sh
reduction | 4e6d6f8a | compiler | cori.local.bash | ['openmp'] | intel/17.0.1.132       ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/40/reduction_build.sh
reduction | ad1e44af | compiler | cori.local.bash | ['openmp'] | intel/17.0.2.174       ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/41/reduction_build.sh
reduction | 49acf44b | compiler | cori.local.bash | ['openmp'] | intel/18.0.1.163       ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/42/reduction_build.sh
reduction | 4192750c | compiler | cori.local.bash | ['openmp'] | intel/18.0.3.222       ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/43/reduction_build.sh
reduction | 06584529 | compiler | cori.local.bash | ['openmp'] | intel/19.0.0.117       ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/44/reduction_build.sh
reduction | 82fd9bab | compiler | cori.local.bash | ['openmp'] | intel/19.0.8.324       ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/45/reduction_build.sh
reduction | 6140e8b4 | compiler | cori.local.bash | ['openmp'] | intel/19.1.0.166       ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/46/reduction_build.sh
```

(continues on next page)

(continued from previous page)

```
 reduction | ac509e2e | compiler | cori.local.bash | ['openmp'] | intel/19.1.1.217      ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/47/reduction_build.sh
 reduction | 9c39818e | compiler | cori.local.bash | ['openmp'] | intel/19.1.2.275      ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/48/reduction_build.sh
 reduction | 2cb3acd1 | compiler | cori.local.bash | ['openmp'] | intel/19.1.3.304      ␣
↪                 | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.local.bash/
↪reduction/reduction/49/reduction_build.sh

+---------------------+
| Stage: Running Test |
+---------------------+

 name      | id       | executor        | status   |   returncode
-----------+----------+-----------------+----------+--------------
 reduction | fd93fdcb | cori.local.bash | PASS     |            0
 reduction | 43737191 | cori.local.bash | PASS     |            0
 reduction | 6e2e95cd | cori.local.bash | PASS     |            0
 reduction | c48a8d8d | cori.local.bash | PASS     |            0
 reduction | a6201c48 | cori.local.bash | PASS     |            0
 reduction | aa06b1be | cori.local.bash | PASS     |            0
 reduction | 02b8e7aa | cori.local.bash | PASS     |            0
 reduction | bd9abd7e | cori.local.bash | PASS     |            0
 reduction | 9409a86f | cori.local.bash | PASS     |            0
 reduction | b9700a0f | cori.local.bash | PASS     |            0
 reduction | a605c970 | cori.local.bash | PASS     |            0
 reduction | 9ef915a9 | cori.local.bash | PASS     |            0
 reduction | 4f9e4242 | cori.local.bash | PASS     |            0
 reduction | e37befed | cori.local.bash | PASS     |            0
 reduction | 1e9b0ab5 | cori.local.bash | PASS     |            0
 reduction | 4e6d6f8a | cori.local.bash | PASS     |            0
 reduction | ad1e44af | cori.local.bash | PASS     |            0
 reduction | 49acf44b | cori.local.bash | PASS     |            0
 reduction | 4192750c | cori.local.bash | PASS     |            0
 reduction | 06584529 | cori.local.bash | PASS     |            0
 reduction | 82fd9bab | cori.local.bash | PASS     |            0
 reduction | 6140e8b4 | cori.local.bash | PASS     |            0
 reduction | ac509e2e | cori.local.bash | PASS     |            0
 reduction | 9c39818e | cori.local.bash | PASS     |            0
 reduction | 2cb3acd1 | cori.local.bash | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 25/25 Percentage: 100.000%
Failed Tests: 0/25 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_sq87154s.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /global/homes/s/
↪siddiq90/github/buildtest/buildtest.log
```

(continues on next page)

(continued from previous page)

If we inspect one of these tests from each compiler group (gcc, intel) we will see OMP_NUM_THREADS is set in all tests along with the appropriate compiler flag.

```
#!/bin/bash
_EXEC=reduction.c.exe
export OMP_NUM_THREADS=4
module load intel/19.1.3.304
icc -qopenmp -o $_EXEC /global/u1/s/siddiq90/github/buildtest-cori/buildspecs/apps/
↪openmp/src/reduction.c
./$_EXEC
```

```
#!/bin/bash
_EXEC=reduction.c.exe
export OMP_NUM_THREADS=4
module load gcc/6.1.0
gcc -fopenmp -o $_EXEC /global/u1/s/siddiq90/github/buildtest-cori/buildspecs/apps/
↪openmp/src/reduction.c
./$_EXEC
```

Customize Run Line

buildtest will define variable `_EXEC` in the job script that can be used to reference the generated binary. By default, buildtest will run the program standalone, but sometimes you may want to customize how job is run. This may include passing arguments or running binary through a job/mpi launcher. The `run` property expects user to specify how to launch program. buildtest will change directory to the called script before running executable. The compiled executable will be present in local directory which can be accessed via `./$_EXEC`. In example below we pass arguments `1 3 5` for gcc group and `100 200` for compiler `gcc/10.2.0-37fmsw7`.

```
version: "1.0"
buildspecs:
  custom_run_by_compilers:
    type: compiler
    description: Customize binary launch based on compiler
    executor: generic.local.bash
    tags: [tutorials, compile]
    source: "src/argc.c"
    compilers:
      name: ["^(builtin_gcc|gcc)"]
      default:
        gcc:
          run: ./$_EXEC 1 3 5
      config:
        gcc/10.2.0-37fmsw7:
          run: ./$_EXEC 100 120
```

If we build this test and see generated test, we notice buildtest customized the run line for launching binary. buildtest will directly replace content in `run` section into the shell-script. If no `run` field is specified buildtest will run the binary in standalone mode (`./$_EXEC`).

```
#!/bin/bash


# name of executable
_EXEC=argc.c.exe
# Loading modules
module load gcc/10.2.0-37fmsw7
# Compilation Line
gcc -o $_EXEC /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/compilers/src/
↪argc.c


# Run executable
./$_EXEC 100 120
```

MPI Example

In this example we run a MPI Laplace code using 4 process on a KNL node using the `intel/19.1.2.254` compiler. This test is run on Cori through batch queue system. We can define **#SBATCH** parameters using `sbatch` property. This program is compiled using `mpiicc` wrapper this can be defined using `cc` parameter.

Currently, buildtest cannot detect if program is serial or MPI to infer appropriate compiler wrapper. If `cc` wasn't specified, buildtest would infer *icc* as compiler wrapper for C program. This program is run using `srun` job launcher, we can control how test is executed using the `run` property. This test required we swap intel modules and load *impi/2020* module.

```
version: "1.0"
buildspecs:
  laplace_mpi:
    type: compiler
    description: Laplace MPI code in C
    executor: slurm.knl_debug
    tags: ["mpi"]
    source: src/laplace_mpi.c
    compilers:
      name: ["^(intel/19.1.2.254)$"]
      default:
        all:
          sbatch: ["-N 1", "-n 4"]
          run: srun -n 4 $_EXEC
        intel:
          cc: mpiicc
          cflags: -O3
      config:
        intel/19.1.2.254:
          module:
            load: [impi/2020]
            swap: [intel, intel/19.1.2.254]
```

Shown below is a sample build for this buildspec, buildtest will dispatch and poll job until its complete.

```
$ buildtest build -b buildspecs/apps/mpi/laplace_mpi.yml


User:  siddiq90
Hostname:  cori02
Platform:  Linux
Current Time:  2021/06/11 09:11:16
buildtest path: /global/homes/s/siddiq90/github/buildtest/bin/buildtest
buildtest version:  0.9.5
python path: /global/homes/s/siddiq90/.conda/envs/buildtest/bin/python
python version:  3.8.8
Test Directory:  /global/u1/s/siddiq90/github/buildtest/var/tests
Configuration File:  /global/u1/s/siddiq90/.buildtest/config.yml
Command: /global/homes/s/siddiq90/github/buildtest/bin/buildtest build -b buildspecs/
↪apps/mpi/laplace_mpi.yml

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-------------------------------------------------------------------------------------+
| Discovered Buildspecs                                                               |
+=====================================================================================+
| /global/u1/s/siddiq90/github/buildtest-cori/buildspecs/apps/mpi/laplace_mpi.yml |
+-------------------------------------------------------------------------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile                | validstate   | buildspec
---------------------------+--------------+-----------------------------------------------
↪-----------------------------------
 compiler-v1.0.schema.json | True         | /global/u1/s/siddiq90/github/buildtest-cori/
↪buildspecs/apps/mpi/laplace_mpi.yml



name         description
-----------  --------------------
laplace_mpi  Laplace MPI code in C

+----------------------+
| Stage: Building Test |
+----------------------+



 name        | id       | type     | executor             | tags    | compiler         |␣
↪testpath
```

(continues on next page)

(continued from previous page)

```
------------+----------+----------+---------------------+---------+------------------+-
↪-------------------------------------------------------------------------------------
↪------------------------------
 laplace_mpi | a6087b86 | compiler | cori.slurm.knl_debug | ['mpi'] | intel/19.1.2.254 |␣
↪/global/u1/s/siddiq90/github/buildtest/var/tests/cori.slurm.knl_debug/laplace_mpi/
↪laplace_mpi/0/laplace_mpi_build.sh

+---------------------+
| Stage: Running Test |
+---------------------+

[laplace_mpi] JobID: 43308598 dispatched to scheduler
 name        | id       | executor             | status   |   returncode
-------------+----------+----------------------+----------+--------------
 laplace_mpi | a6087b86 | cori.slurm.knl_debug | N/A      |           -1


Polling Jobs in 30 seconds
__________________________________________
Job Queue: [43308598]


Pending Jobs
__________________________________________


+-------------+----------------------+----------+-----------+
|    name     |       executor       |  jobID   | jobstate  |
+-------------+----------------------+----------+-----------+
| laplace_mpi | cori.slurm.knl_debug | 43308598 | COMPLETED |
+-------------+----------------------+----------+-----------+


Polling Jobs in 30 seconds
__________________________________________
Job Queue: []


Completed Jobs
__________________________________________


+-------------+----------------------+----------+-----------+
|    name     |       executor       |  jobID   | jobstate  |
+-------------+----------------------+----------+-----------+
| laplace_mpi | cori.slurm.knl_debug | 43308598 | COMPLETED |
+-------------+----------------------+----------+-----------+

+-------------------------------------------+
| Stage: Final Results after Polling all Jobs |
+-------------------------------------------+
```

(continues on next page)

(continued from previous page)

```
 name        | id       | executor              | status   |   returncode
-------------+----------+-----------------------+----------+--------------
 laplace_mpi | a6087b86 | cori.slurm.knl_debug | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/1 Percentage: 100.000%
Failed Tests: 0/1 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_wgptyp8v.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /global/homes/s/
↪siddiq90/github/buildtest/buildtest.log
```

The generated test is as follows, note that buildtest will insert the #SBATCH directives at the top of script, and `module load` are done before `module swap` command.

```
#!/bin/bash
#SBATCH -N 1
#SBATCH -n 4
#SBATCH --job-name=laplace_mpi
#SBATCH --output=laplace_mpi.out
#SBATCH --error=laplace_mpi.err
_EXEC=laplace_mpi.c.exe
module load impi/2020
module swap intel intel/19.1.2.254
mpiicc -O3 -o $_EXEC /global/u1/s/siddiq90/github/buildtest-cori/buildspecs/apps/mpi/src/
↪laplace_mpi.c
srun -n 4 $_EXEC
```

The master script that buildtest will invoke is the following, notice that our generated script (shown above) is invoked via *sbatch* with its options. The options `sbatch -q debug --clusters=cori -C knl,quad,cache` was inserted by our executor configuration. We add the `--parsable` option for Slurm jobs in order to get the JobID when this script is invoked so that buildtest can poll the job.

```
#!/bin/bash
source /global/u1/s/siddiq90/github/buildtest/var/executor/cori.slurm.knl_debug/before_
↪script.sh
sbatch --parsable -q debug --clusters=cori -C knl,quad,cache /global/u1/s/siddiq90/
↪github/buildtest/var/tests/cori.slurm.knl_debug/laplace_mpi/laplace_mpi/0/stage/
↪laplace_mpi.sh
returncode=$?
exit $returncode
```

Pre/Post sections for build and run section

The compiler schema comes with `pre_build`, `post_build`, `pre_run` and `post_run` fields where you can insert commands before and after `build` or `run` section. The **build** section is where we compile code, and **run** section is where compiled binary is executed.

Shown below is an example buildspec with pre/post section.

```
version: "1.0"
buildspecs:
  pre_post_build_run:
    type: compiler
    description: example using pre_build, post_build, pre_run, post_run example
    executor: generic.local.bash
    tags: [tutorials, compile]
    source: "src/hello.c"
    compilers:
      name: ["^(builtin_gcc)$"]
      default:
        gcc:
          cflags: -Wall
        all:
          pre_build: |
            echo "This is a pre-build section"
            gcc --version
          post_build: |
            echo "This is post-build section"
          pre_run: |
            echo "This is pre-run section"
            export FOO=BAR
          post_run: |
            echo "This is post-run section"
```

The format of the test structure is as follows.

```
#!{shebang path} -- defaults to #!/bin/bash depends on executor name (local.bash, local.
↪sh)
{job directives} -- sbatch or bsub field
{environment variables} -- env field
{variable declaration} -- vars field
{module commands} -- modules field

{pre build commands} -- pre_build field
{compile program} -- build field
{post build commands} -- post_build field

{pre run commands} -- pre_run field
{run executable} -- run field
{post run commands} -- post_run field
```

The generated test for this buildspec is the following:

```
#!/bin/bash
```

(continues on next page)

(continued from previous page)

```
# name of executable
_EXEC=hello.c.exe
### START OF PRE BUILD SECTION ###
echo "This is a pre-build section"
gcc --version

### END OF PRE BUILD SECTION   ###


# Compilation Line
gcc -Wall -o $_EXEC /Users/siddiq90/Documents/GitHubDesktop/buildtest/tutorials/
↪compilers/src/hello.c


### START OF POST BUILD SECTION ###
echo "This is post-build section"

### END OF POST BUILD SECTION ###


### START OF PRE RUN SECTION ###
echo "This is pre-run section"
export FOO=BAR

### END OF PRE RUN SECTION   ###


# Run executable
./$_EXEC


### START OF POST RUN SECTION ###
echo "This is post-run section"

### END OF POST RUN SECTION   ###
```

3.6.4 Spack Schema

Note: This feature is in active development.

buildtest can generate tests for the spack package manager which can be used if you want to install or test packages as part of a repeatable process. You must set `type: spack` property in buildspec to use the spack schema for validating the buildspec test. Currently, we have spack-v1.0.schema.json JSON schema that defines the structure of how tests are to be written in buildspec. Shown below is the schema header. The **required** properties are `type`, `executor` and `spack`.

```
"$id": "spack-v1.0.schema.json",
"$schema": "http://json-schema.org/draft-07/schema#",
```

(continues on next page)

(continued from previous page)

```
"title": "spack schema version 1.0",
"description": "The spack schema is referenced using ``type: spack`` which is used for␣
↪generating tests using spack package manager",
"type": "object",
"required": [
  "type",
  "executor",
  "spack"
],
```

Install Specs

Let's start off with a simple example where we create a test that can `spack install zlib`. Shown below is a test named **install_zlib**. The **spack** keyword is a JSON object, in this test we define the root of spack using the `root` keyword which informs buildtest where spack is located. buildtest will automatically check the path and source the startup script. The `install` field is a JSON object that contains a `specs` property which is a list of strings types that are name of spack packages to install. Each item in the `specs` property will be added as a separate `spack install` command.

The schema is designed to mimic spack commands which will be clear with more examples.

```
version: "1.0"
buildspecs:
  install_zlib:
    type: spack
    executor: generic.local.sh
    description: "Install zlib"
    tags: [spack]
    spack:
      root: $HOME/spack
      install:
        specs: ['zlib']
```

If you build this test and inspect the generated script, buildtest will source spack startup script - **source $SPACK_ROOT/share/spack/setup-env.sh** based on the `root` property. In this example, we have spack cloned in **$HOME/spack** which is **/Users/siddiq90/spack** and buildtest will find the startup script which is in `share/spack/setup-env.sh`.

```
#!/bin/bash
source /Users/siddiq90/spack/share/spack/setup-env.sh
spack install  zlib
```

Spack Environment

buildtest can generate scripts to make use of spack environments which can be useful if you want to install or test specs in an isolated environment.

Currently, we can create spack environment (`spack env create`) via name, directory and manifest file (`spack.yaml`, `spack.lock`) and pass any options to **spack env create** command. Furthermore, we can activate existing spack environment via name or directory using `spack env activate` and pass options to the command. buildtest can remove spack environments automatically before creating spack environment or one can explicitly specify by name.

Activate Spack Environment

In this next example, we will activate an existing environment `m4` and add spec for **m4** and concretize the spack environment. The `env` is an object that mimics the `spack env` command. The `activate` field maps to `spack env activate` command. The **name** property is of `type: string` which is name of spack environment you want to activate. The `specs` property in **env** section maps to `spack add <specs` instead of `spack install`.

The property `concretize: true` will run `spack concretize` command that is only available as part of the `env` object since this command is only applicable in spack environments.

```
version: "1.0"
buildspecs:
  concretize_m4_in_spack_env:
    type: spack
    executor: generic.local.sh
    description: "Concretize m4 in a spack environment named m4"
    tags: [spack]
    spack:
      root: $HOME/spack
      env:
        specs:
          - 'm4'
        activate:
          name: m4
        concretize: true
```

If we build this test and inspect the generated test we see that spack will activate a spack environment **m4**, add specs in spack environment via `spack add m4` and concretize the environment. The `concretize` is a boolean type, if its `true` we will run `spack concretize -f`, if its `false` this command will not be in script.

```
#!/bin/bash
source /Users/siddiq90/spack/share/spack/setup-env.sh
spack env activate  m4
spack add m4
spack concretize -f
```

If we inspect the output file we see that m4 was concretized in the spack environment.

```
==> Package m4 was already added to m4
==> Concretized m4
[+]  volmsbn  m4@1.4.19%apple-clang@11.0.3+sigsegv arch=darwin-bigsur-skylake
[+]  bc6kuc4      ^libsigsegv@2.13%apple-clang@11.0.3 arch=darwin-bigsur-skylake
```

Create a Spack Environment by name

In this next example, we will create a spack environment named `m4_zlib` that will install *m4* and *zlib* spec. The **create** field is a JSON object that maps to `spack env create` command which can pass some arguments in the form of key/value pairs. The `name` property in **create** section is used to create a spack environment by name.

The `compiler_find: true` is a boolean that determines if we need to find compilers in spack via `spack compiler find`. This can be useful if you need to find compilers so spack can install specs with a preferred compiler otherwise spack may have issues concretizing or install specs. buildtest will run **spack compiler find** after sourcing spack.

Note: The `compiler_find` option may not be useful if your compilers are already defined in one of your configuration scopes or `spack.yaml` that is part of your spack environment.

The `option` field can pass any command line arguments to `spack install` command and this field is available for other properties.

```yaml
version: "1.0"
buildspecs:
  install_m4_zlib_in_spack_env:
    type: spack
    executor: generic.local.sh
    description: "Install m4 and zlib in a spack environment named m4_zlib"
    tags: [spack]
    spack:
      root: $HOME/spack
      compiler_find: true
      env:
        create:
          name: 'm4_zlib'
        specs:
          - 'm4'
          - 'zlib'
        activate:
          name: m4_zlib
        concretize: true
      install:
        option: '--keep-prefix'
```

If we build this test and see generated test we see that buildtest will create a spack environment *m4_zlib* and activate the environment, add **m4** and **zlib**, concretize the environment and install the specs.

```
#!/bin/bash
source /Users/siddiq90/spack/share/spack/setup-env.sh
spack compiler find
spack env create  m4_zlib
spack env activate  m4_zlib
spack add m4
spack add zlib
spack concretize -f
spack install --keep-prefix
```

Now let's examine the output of this test, shown below is the summary of this test, as you can see we have successfully installed **m4** and **zlib** in a spack environment `m4_zlib`.

```
==> Found no new compilers
==> Compilers are defined in the following files:
    /Users/siddiq90/.spack/darwin/compilers.yaml
==> Updating view at /Users/siddiq90/spack/var/spack/environments/m4_zlib/.spack-env/view
==> Created environment 'm4_zlib' in /Users/siddiq90/spack/var/spack/environments/m4_zlib
==> You can activate this environment with:
==>   spack env activate m4_zlib
==> Adding m4 to environment m4_zlib
==> Adding zlib to environment m4_zlib
==> Concretized m4
[+]  volmsbn  m4@1.4.19%apple-clang@11.0.3+sigsegv arch=darwin-bigsur-skylake
[+]  bc6kuc4      ^libsigsegv@2.13%apple-clang@11.0.3 arch=darwin-bigsur-skylake
==> Concretized zlib
 -   2hw3hzd  zlib@1.2.11%apple-clang@11.0.3+optimize+pic+shared arch=darwin-bigsur-
↪skylake
==> Updating view at /Users/siddiq90/spack/var/spack/environments/m4_zlib/.spack-env/view
==> Installing environment m4_zlib
==> Installing zlib-1.2.11-2hw3hzdfy7e2ndzojgqoq472m5flsloj
==> No binary for zlib-1.2.11-2hw3hzdfy7e2ndzojgqoq472m5flsloj found: installing from␣
↪source
==> Fetching https://mirror.spack.io/_source-cache/archive/c3/
↪c3e5e9fdd5004dcb542feda5ee4f0ff0744628baf8ed2dd5d66f8ca1197cb1a1.tar.gz
==> No patches needed for zlib
==> zlib: Executing phase: 'install'
==> zlib: Successfully installed zlib-1.2.11-2hw3hzdfy7e2ndzojgqoq472m5flsloj
  Fetch: 0.84s.  Build: 6.98s.  Total: 7.82s.
[+] /Users/siddiq90/spack/opt/spack/darwin-bigsur-skylake/apple-clang-11.0.3/zlib-1.2.11-
↪2hw3hzdfy7e2ndzojgqoq472m5flsloj
==> Updating view at /Users/siddiq90/spack/var/spack/environments/m4_zlib/.spack-env/view
```

Creating Spack Environment from Directory

We can create spack environment from a directory using the `dir` property that is available as part of `create` and `activate` field. In this next example we create a spack environment in our $HOME directory and concretize **m4** in the spack environment

```
version: "1.0"
buildspecs:
  spack_env_directory:
    type: spack
    executor: generic.local.sh
    description: "Concretize m4 in a spack environment named m4"
    tags: [spack]
    spack:
      root: $HOME/spack
      env:
        create:
          dir: $HOME/spack-envs/m4
        activate:
          dir: $HOME/spack-envs/m4
        specs:
```

(continues on next page)

(continued from previous page)

```
        - 'm4'
      concretize: true
```

When creating spack environment using directory, buildtest will automatically add the `-d` option which is required when creating spack environments. However, one can also pass this using the `option` field. Shown below is the generated script for the above test.

```
#!/bin/bash
source /Users/siddiq90/spack/share/spack/setup-env.sh
spack env create  -d /Users/siddiq90/spack-envs/m4
spack env activate  -d /Users/siddiq90/spack-envs/m4
spack add m4
spack concretize -f
```

buildtest will create environment first followed by activating the spack environment.

Create Spack Environment from Manifest File (spack.yaml, spack.lock)

Spack can create environments from *spack.yaml* or *spack.lock* which can be used if you have a spack configuration that works for your system and want to write a buildspec. While creating a spack environment, you can use the `manifest` property to specify path to your `spack.yaml` or `spack.lock`.

Note: buildtest will not enforce that manifest names be **spack.yaml** or **spack.lock** since spack allows one to create spack environment from arbitrary name so long as it is a valid spack configuration.

Shown below is an example buildspec that generates a test from a manifest file. The `manifest` property is of `type: string` and this is only available as part of `create` property.

```
version: "1.0"
buildspecs:
  spack_env_create_from_manifest:
    type: spack
    executor: generic.local.sh
    description: "Create spack environment from spack.yaml"
    tags: [spack]
    spack:
      root: $HOME/spack
      env:
        create:
          name: 'manifest_example'
          manifest: "$BUILDTEST_ROOT/tutorials/spack/example/spack.yaml"
        activate:
          name: 'manifest_example'
        concretize: true
```

If we build this test and inspect the generated script we see `spack env create` command will create an environment **manifest_example** using the manifest file that we provided.

```
#!/bin/bash
source /Users/siddiq90/spack/share/spack/setup-env.sh
spack env create  manifest_example /Users/siddiq90/Documents/GitHubDesktop/buildtest/
↪tutorials/spack/example/spack.yaml
```

(continues on next page)

(continued from previous page)

```
spack env activate  manifest_example
spack concretize -f
```

Removing Spack Environments

buildtest can remove spack environments which can be used if you are periodically running the same test where one is creating the same environment. buildtest can automatically remove spack environment using the property `remove_environment` which will remove the environment before creating it with same name. This field is part of the `create` field and only works if one is creating spack environments by name.

Alternately, buildtest provides the `rm` field which can be used for removing environment explicitly. In the `rm` field, the `name` is a required field which is the name of the spack environment to remove. The `name` field is of `type: string` Shown below are two example tests where we remove spack environment using the **remove_environment** and **rm** field.

```
version: "1.0"
buildspecs:
  remove_environment_automatically:
    type: spack
    executor: generic.local.sh
    description: "remove spack environment automatically before creating a new␣
↪environment"
    tags: [spack]
    spack:
      root: $HOME/spack
      env:
        create:
          remove_environment: true
          name: remove_environment
        activate:
          name: remove_environment
        specs:
          - 'bzip2'
        concretize: true

  remove_environment_explicit:
    type: spack
    executor: generic.local.sh
    description: "remove spack environment explicitly using the 'rm' property"
    tags: [spack]
    spack:
      root: $HOME/spack
      env:
        rm:
          name: dummy
        create:
          name: dummy
        activate:
          name: dummy
        specs:
          - 'bzip2'
        concretize: true
```

If we look at the generated test, we notice that spack will remove environments names: **remove_environment**, **dummy**.

```
#!/bin/bash
source /Users/siddiq90/spack/share/spack/setup-env.sh
spack env rm -y remove_environment
spack env create  remove_environment
spack env activate  remove_environment
spack add bzip2
spack concretize -f
```

```
#!/bin/bash
source /Users/siddiq90/spack/share/spack/setup-env.sh
spack env rm -y dummy
spack env create  dummy
spack env activate  dummy
spack add bzip2
spack concretize -f
```

Pre and Post Commands

The spack schema supports ability to write arbitrary shell script content using the `pre_cmds` and `post_cmds` field that are of `type: string` and buildtest will insert the content into the test exactly as it is defined by these two fields.

In this next example, we will test an installation of *zlib* by cloning spack from upstream and use `pre_cmds` field to specify where we will clone spack. In this example, we will clone spack under **/tmp**. Since we don't have a valid root of spack since test hasn't been run, we can ignore check for spack paths by specifying `verify_spack: false` which informs buildtest to skip spack path check. Generally, buildtest will raise an exception if path specified by `root` is invalid and if `$SPACK_ROOT/share/spack/setup-env.sh` doesn't exist since this is the file that must be sourced.

The `pre_cmds` are shell commands that are run before sourcing spack, whereas the `post_cmds` are run at the very end of the script. In the *post_cmds*, we will `spack find` that will be run after `spack install`. We remove spack root (`$SPACK_ROOT`) so that this test can be rerun again.

```
version: "1.0"
buildspecs:
  run_pre_post_commands:
    type: spack
    executor: generic.local.sh
    description: "Install zlib"
    tags: [spack]
    pre_cmds: |
      cd /tmp
      git clone https://github.com/spack/spack
    spack:
      root: /tmp/spack
      verify_spack: false
      install:
        specs: ['zlib']
    post_cmds: |
      spack find
      rm -rf $SPACK_ROOT
```

If we build this test and inspect the generated script we see the following

```
#!/bin/bash


######## START OF PRE COMMANDS ########
cd /tmp
git clone https://github.com/spack/spack

######## END OF PRE COMMANDS   ########


source /private/tmp/spack/share/spack/setup-env.sh
spack install  zlib


######## START OF POST COMMANDS ########
spack find
rm -rf $SPACK_ROOT
######## END OF POST COMMANDS   ########
```

If we inspect the output, we see that *zlib* is installed as shown in output from `spack find`

```
==> Installing zlib-1.2.11-2hw3hzdfy7e2ndzojgqoq472m5flsloj
==> No binary for zlib-1.2.11-2hw3hzdfy7e2ndzojgqoq472m5flsloj found: installing from␣
↪source
==> Fetching https://mirror.spack.io/_source-cache/archive/c3/
↪c3e5e9fdd5004dcb542feda5ee4f0ff0744628baf8ed2dd5d66f8ca1197cb1a1.tar.gz
==> No patches needed for zlib
==> zlib: Executing phase: 'install'
==> zlib: Successfully installed zlib-1.2.11-2hw3hzdfy7e2ndzojgqoq472m5flsloj
  Fetch: 0.50s.  Build: 5.90s.  Total: 6.40s.
[+] /private/tmp/spack/opt/spack/darwin-bigsur-skylake/apple-clang-11.0.3/zlib-1.2.11-
↪2hw3hzdfy7e2ndzojgqoq472m5flsloj
-- darwin-bigsur-skylake / apple-clang@11.0.3 --------------------
zlib@1.2.11
```

Specifying Scheduler Directives

The spack schema supports all of the *scheduler scheduler directives* such as `sbatch`, `bsub`, `pbs`, `cobalt`, and `batch` property in the buildspec.

The directives are applied at top of script. Shown below is a toy example that will define directives using **sbatch** and **batch** property. Note, this test won't submit job to scheduler since we are not using the a slurm executor.

```
version: "1.0"
buildspecs:
  spack_sbatch_example:
    type: spack
    executor: generic.local.sh
    description: "sbatch directives can be defined in spack schema"
    tags: [spack]
    sbatch: ["-N 1"]
    batch:
```

(continues on next page)

(continued from previous page)

```
      cpucount: "8"
      timelimit: "30"
    spack:
      root: $HOME/spack
      env:
        specs:
          - 'm4'
        activate:
          name: m4
        concretize: true
```

buildtest will generate the shell script with the job directives and set the name, output and error files based on name of test. If we build this test, and inspect the generated test we see that **#SBATCH** directives are written based on the **sbatch** and **batch** field.

```
#!/bin/bash

####### START OF SCHEDULER DIRECTIVES #######
#SBATCH -N 1
#SBATCH --ntasks=8
#SBATCH --time=30
#SBATCH --job-name=spack_sbatch_example
#SBATCH --output=spack_sbatch_example.out
#SBATCH --error=spack_sbatch_example.err
####### END OF SCHEDULER DIRECTIVES   #######


source /Users/siddiq90/spack/share/spack/setup-env.sh
spack env activate  m4
spack add m4
spack concretize -f
```

You can define *multiple executors* in your buildspec with spack schema via `executors`. This can be useful if you need to specify different scheduler directives based on executor type since your executor will map to a queue.

Shown below is an example buildspec that will specify `sbatch` directives for `generic.local.sh` and `generic.local.bash`

```
version: "1.0"
buildspecs:
  spack_sbatch_multi_executors:
    type: spack
    executor: "generic.local.(sh|bash)"
    description: "sbatch directives can be defined in spack schema"
    tags: [spack]
    batch:
      cpucount: "8"
      timelimit: "30"
    executors:
      generic.local.sh:
        sbatch: ["-N 1"]
      generic.local.bash:
        sbatch: ["-N 8"]
```

(continues on next page)

(continued from previous page)

```
    pre_cmds: |
      cd /tmp
      git clone https://github.com/spack/spack
    spack:
      root: /tmp/spack
      env:
        specs:
          - 'm4'
        activate:
          name: m4
        concretize: true
    post_cmd: rm -rf $SPACK_ROOT
```

Configuring Spack Mirrors

We can add mirrors in the spack instance or spack environment using the `mirror` property which is available in the `spack` and `env` section. If the `mirrror` property is part of the `env` section, the mirror will be added to spack environment. The `mirror` is an object that expects a Key/Value pair where the key is the name of mirror and value is location of the spack mirror.

In this next example, we will define a mirror name **e4s** that points to https://cache.e4s.io as the mirror location. Internally, this translates to `spack mirror add e4s https://cache.e4s.io` command.

```
version: "1.0"
buildspecs:
  add_mirror:
    type: spack
    executor: generic.local.sh
    description: Declare spack mirror
    tags: [spack]
    spack:
      root: $HOME/spack
      mirror:
        e4s: https://cache.e4s.io
    post_cmds: |
      spack mirror list


  add_mirror_in_spack_env:
    type: spack
    executor: generic.local.sh
    description: Declare spack mirror in spack environment
    tags: [spack]
    spack:
      root: $HOME/spack
      env:
        create:
          name: spack_mirror
        activate:
          name: spack_mirror
        mirror:
```

(continues on next page)

(continued from previous page)

```
        e4s: https://cache.e4s.io
    post_cmds: |
      spack mirror list
```

If we look at the generated script for both tests, we see that mirror is added for both tests. Note that one can have mirrors defined in their `spack.yaml` or one of the configuration scopes defined by spack.

```
#!/bin/bash
source /Users/siddiq90/spack/share/spack/setup-env.sh
spack mirror add e4s https://cache.e4s.io


######## START OF POST COMMANDS ########
spack mirror list
######## END OF POST COMMANDS   ########
```

```
#!/bin/bash
source /Users/siddiq90/spack/share/spack/setup-env.sh
spack env create  spack_mirror
spack env activate  spack_mirror
spack mirror add e4s https://cache.e4s.io


######## START OF POST COMMANDS ########
spack mirror list
######## END OF POST COMMANDS   ########
```

Spack Test

Note: `spack test` requires version 0.16.0 or higher in order to use this feature.

buildtest can run tests using `spack test run` that can be used for testing installed specs with tests provided by spack. In order to run tests, you need to declare the `test` section which is of `type: object` in JSON and `run` is a required property. The `run` section maps to `spack test run` that is responsible for running tests for a list of specs that are specified using the `specs` property.

Upon running the tests, we can retrieve results using `spack test results` which is configured using the `results` property. The **results** property expects one to specify the `specs` or `suite` or both in order to retrieve results.

The `suite` property is used to retrieve test results based on suite name, whereas `specs` property can be used to retrieve based on spec format. Both properties are a list of string types.

In example below we install *bzip2* and run the test using `spack test run bzip2`.

```
version: "1.0"
buildspecs:
  spack_test:
    type: spack
    executor: generic.local.sh
    description: "Install bzip2 and run spack test and report results"
    tags: [spack]
```

(continues on next page)

(continued from previous page)

```
    pre_cmds: |
      cd /tmp
      git clone https://github.com/spack/spack
    spack:
      root: /tmp/spack
      verify_spack: false
      install:
        specs: ['bzip2']
      test:
        run:
          specs: ['bzip2']
        results:
          suite: ['bzip2']

    post_cmds: |
      spack find
      rm -rf $SPACK_ROOT
```

If we look at the generated test, buildtest will automatically set `--alias` option to define name of suite, otherwise spack will generate a random text for suitename which you won't know at time of writing test that is required by `spack test results` to fetch the results.

```
#!/bin/bash


######## START OF PRE COMMANDS ########
cd /tmp
git clone https://github.com/spack/spack spack

######## END OF PRE COMMANDS   ########


source /private/tmp/spack-test-no-env/share/spack/setup-env.sh
spack install  bzip2
spack test run  --alias bzip2 bzip2
spack test results  bzip2


######## START OF POST COMMANDS ########
spack find
rm -rf $SPACK_ROOT
######## END OF POST COMMANDS   ########
```

Shown below is the example output of this test.

```
==> libiconv: Executing phase: 'configure'
==> libiconv: Executing phase: 'build'
==> libiconv: Executing phase: 'install'
==> libiconv: Successfully installed libiconv-1.16-xgemfyqy3gsdz3lk7wy3ejudfaksja4x
  Fetch: 1.54s.  Build: 33.03s.  Total: 34.57s.
[+] /private/tmp/spack/opt/spack/darwin-bigsur-skylake/apple-clang-11.0.3/libiconv-1.16-
↪xgemfyqy3gsdz3lk7wy3ejudfaksja4x
```

(continues on next page)

(continued from previous page)

```
==> Installing diffutils-3.7-3dfrh6li733xxcenwyjhwyta7xkh3udq
==> No binary for diffutils-3.7-3dfrh6li733xxcenwyjhwyta7xkh3udq found: installing from␣
↪source
==> Fetching https://mirror.spack.io/_source-cache/archive/b3/
↪b3a7a6221c3dc916085f0d205abf6b8e1ba443d4dd965118da364a1dc1cb3a26.tar.xz
==> No patches needed for diffutils
==> diffutils: Executing phase: 'autoreconf'
==> diffutils: Executing phase: 'configure'
==> diffutils: Executing phase: 'build'
==> diffutils: Executing phase: 'install'
==> diffutils: Successfully installed diffutils-3.7-3dfrh6li733xxcenwyjhwyta7xkh3udq
  Fetch: 1.32s.  Build: 52.35s.  Total: 53.67s.
[+] /private/tmp/spack/opt/spack/darwin-bigsur-skylake/apple-clang-11.0.3/diffutils-3.7-
↪3dfrh6li733xxcenwyjhwyta7xkh3udq
==> Installing bzip2-1.0.8-avjwvsoaivuflugopwk4ap7rffhejxzu
==> No binary for bzip2-1.0.8-avjwvsoaivuflugopwk4ap7rffhejxzu found: installing from␣
↪source
==> Fetching https://mirror.spack.io/_source-cache/archive/ab/
↪ab5a03176ee106d3f0fa90e381da478ddae405918153cca248e682cd0c4a2269.tar.gz
==> Ran patch() for bzip2
==> bzip2: Executing phase: 'install'
==> bzip2: Successfully installed bzip2-1.0.8-avjwvsoaivuflugopwk4ap7rffhejxzu
  Fetch: 1.42s.  Build: 1.84s.  Total: 3.26s.
[+] /private/tmp/spack/opt/spack/darwin-bigsur-skylake/apple-clang-11.0.3/bzip2-1.0.8-
↪avjwvsoaivuflugopwk4ap7rffhejxzu
==> Spack test bzip2
==> Testing package bzip2-1.0.8-avjwvso
==> Results for test suite 'bzip2':
==>   bzip2-1.0.8-avjwvso PASSED
-- darwin-bigsur-skylake / apple-clang@11.0.3 --------------------
bzip2@1.0.8
diffutils@3.7
libiconv@1.16
```

We can search for test results using the spec format instead of suite name. In the `results` property we can use `specs` field instead of `suite` property to specify a list of spec names to run. In spack, you can retrieve the results using `spack test results -- <spec>`, note that double dash `--` is in front of spec name. We can pass options to `spack test results` using the **option** property which is available for `results` and `run` property. Currently, spack will write test results in `$HOME/.spack/tests` and we can use `spack test remove` to clear all test results. This can be done in buildspec using the `remove_tests` field which is a boolean. If this is set to **True** buildtest will run `spack test remove -y` to remove all test suites before running the tests.

```
version: "1.0"
buildspecs:
  spack_test_results_specs_format:
    type: spack
    executor: generic.local.sh
    description: "Run spack test results with spec format"
    tags: [spack]
    pre_cmds: |
      cd /tmp
      git clone https://github.com/spack/spack
```

(continues on next page)

(continued from previous page)

```
    spack:
      root: /tmp/spack
      verify_spack: false
      install:
        specs: ['bzip2']
      test:
        remove_tests: true
        run:
          specs: ['bzip2']
        results:
          option: '-l'
          specs: ['bzip2']
    post_cmds: |
      spack find
      rm -rf $SPACK_ROOT
```

In the generated test, we see that buildtest will remove all testsuites using `spack test remove -y` and query results based on spec format. The options are passed into `spack test results` based on the `option` field specified under the `results` section.

```
#!/bin/bash


######## START OF PRE COMMANDS ########
cd /tmp
git clone https://github.com/spack/spack

######## END OF PRE COMMANDS   ########


source /private/tmp/spack/share/spack/setup-env.sh
spack install  bzip2
spack test remove -y
spack test run  --alias bzip2 bzip2
spack test results -l -- bzip2


######## START OF POST COMMANDS ########
spack find
rm -rf $SPACK_ROOT
######## END OF POST COMMANDS   ########
```

3.6.5 Batch Scheduler Support

Slurm

buildtest can submit jobs to Slurm assuming you have slurm executors defined in your configuration file. The `SlurmExecutor` class is responsible for managing slurm jobs which will perform the following action

1. Check slurm binary `sbatch` and `sacct`.
2. Dispatch Job and acquire job ID using `sacct`.
3. Poll all slurm jobs until all have finished
4. Gather Job results once job is complete via `sacct`.

buildtest will dispatch slurm jobs and poll all jobs until all jobs are complete. If job is in **PENDING** or **RUNNING** state, then buildtest will keep polling at a set interval defined by `pollinterval` setting in buildtest. Once job is not in **PENDING** or **RUNNING** stage, buildtest will gather job results and wait until all jobs have finished.

In this example we have a slurm executor `cori.slurm.knl_debug`, in addition we can specify **#SBATCH** directives using `sbatch` field. The sbatch field is a list of string types, buildtest will insert **#SBATCH** directive in front of each value.

Shown below is an example buildspec

```
version: "1.0"
buildspecs:
  slurm_metadata:
    description: Get metadata from compute node when submitting job
    type: script
    executor: cori.slurm.knl_debug
    tags: [jobs]
    sbatch:
      - "-t 00:05"
      - "-N 1"
    run: |
      export SLURM_JOB_NAME="firstjob"
      echo "jobname:" $SLURM_JOB_NAME
      echo "slurmdb host:" $SLURMD_NODENAME
      echo "pid:" $SLURM_TASK_PID
      echo "submit host:" $SLURM_SUBMIT_HOST
      echo "nodeid:" $SLURM_NODEID
      echo "partition:" $SLURM_JOB_PARTITION
```

buildtest will add the `#SBATCH` directives at top of script followed by content in the `run` section. Shown below is the example test content. Every slurm will insert `#SBATCH --job-name`, `#SBATCH --output` and `#SBATCH --error` line which is determined by the name of the test.

```
#!/bin/bash
#SBATCH -t 00:05
#SBATCH -N 1
#SBATCH --job-name=slurm_metadata
#SBATCH --output=slurm_metadata.out
#SBATCH --error=slurm_metadata.err
export SLURM_JOB_NAME="firstjob"
echo "jobname:" $SLURM_JOB_NAME
echo "slurmdb host:" $SLURMD_NODENAME
```

(continues on next page)

(continued from previous page)

```
echo "pid:" $SLURM_TASK_PID
echo "submit host:" $SLURM_SUBMIT_HOST
echo "nodeid:" $SLURM_NODEID
echo "partition:" $SLURM_JOB_PARTITION
```

The `cori.slurm.knl_debug` executor in our configuration file is defined as follows

```
system:
  cori:
    executors:
      slurm:
        knl_debug:
          qos: debug
          cluster: cori
          options:
          - -C knl,quad,cache
          description: debug queue on KNL partition
```

With this setting, any buildspec test that use `cori.slurm.knl_debug` executor will result in the following launch option: `sbatch --qos debug --clusters=cori -C knl,quad,cache </path/to/script.sh>`.

Unlike the LocalExecutor, the **Run Stage**, will dispatch the slurm job and poll until job is completed. Once job is complete, it will gather the results and terminate. In Run Stage, buildtest will mark test status as `N/A` because job is submitted to scheduler and pending in queue. In order to get job result, we need to wait until job is complete then we gather results and determine test state. buildtest keeps track of all buildspecs, testscripts to be run and their results. A test using LocalExecutor will run test in **Run Stage** and returncode will be retrieved and status can be calculated immediately. For Slurm Jobs, buildtest dispatches the job and process next job. buildtest will show output of all tests after **Polling Stage** with test results of all tests. A slurm job with exit code 0 will be marked with status `PASS`.

Shown below is an example build for this test

```
$ buildtest build -b buildspecs/jobs/metadata.yml


User:  siddiq90
Hostname:  cori02
Platform:  Linux
Current Time:  2021/06/11 09:24:44
buildtest path: /global/homes/s/siddiq90/github/buildtest/bin/buildtest
buildtest version:  0.9.5
python path: /global/homes/s/siddiq90/.conda/envs/buildtest/bin/python
python version:  3.8.8
Test Directory:  /global/u1/s/siddiq90/github/buildtest/var/tests
Configuration File:  /global/u1/s/siddiq90/.buildtest/config.yml
Command: /global/homes/s/siddiq90/github/buildtest/bin/buildtest build -b buildspecs/
↪jobs/metadata.yml

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+------------------------------------------------------------------------------+
| Discovered Buildspecs                                                        |
```

(continues on next page)

(continued from previous page)

```
+=============================================================================+
| /global/u1/s/siddiq90/github/buildtest-cori/buildspecs/jobs/metadata.yml |
+-----------------------------------------------------------------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪-------------------------
 script-v1.0.schema.json | True         | /global/u1/s/siddiq90/github/buildtest-cori/
↪buildspecs/jobs/metadata.yml



name            description
--------------  ------------------------------------------------
slurm_metadata  Get metadata from compute node when submitting job

+----------------------+
| Stage: Building Test |
+----------------------+

 name           | id       | type   | executor             | tags     | testpath
----------------+----------+--------+----------------------+----------+------------------
↪-----------------------------------------------------------------------------------------
↪-----------------
 slurm_metadata | 722b3291 | script | cori.slurm.knl_debug | ['jobs'] | /global/u1/s/
↪siddiq90/github/buildtest/var/tests/cori.slurm.knl_debug/metadata/slurm_metadata/0/
↪slurm_metadata_build.sh



+----------------------+
| Stage: Running Test |
+----------------------+

[slurm_metadata] JobID: 43308838 dispatched to scheduler
 name           | id       | executor             | status   |   returncode
----------------+----------+----------------------+----------+--------------
 slurm_metadata | 722b3291 | cori.slurm.knl_debug | N/A      |           -1


Polling Jobs in 30 seconds
_________________________________________
Job Queue: [43308838]
```

(continues on next page)

(continued from previous page)

```
Pending Jobs
________________________________________


+----------------+----------------------+----------+-----------+
|      name      |       executor       |  jobID   | jobstate  |
+----------------+----------------------+----------+-----------+
| slurm_metadata | cori.slurm.knl_debug | 43308838 | COMPLETED |
+----------------+----------------------+----------+-----------+


Polling Jobs in 30 seconds
________________________________________
Job Queue: []


Completed Jobs
________________________________________


+----------------+----------------------+----------+-----------+
|      name      |       executor       |  jobID   | jobstate  |
+----------------+----------------------+----------+-----------+
| slurm_metadata | cori.slurm.knl_debug | 43308838 | COMPLETED |
+----------------+----------------------+----------+-----------+

+-----------------------------------------------+
| Stage: Final Results after Polling all Jobs |
+-----------------------------------------------+

 name           | id       | executor             | status   |   returncode
----------------+----------+----------------------+----------+--------------
 slurm_metadata | 722b3291 | cori.slurm.knl_debug | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/1 Percentage: 100.000%
Failed Tests: 0/1 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_u8ehladd.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /global/homes/s/
↪siddiq90/github/buildtest/buildtest.log
```

The **SlurmExecutor** class is responsible for processing slurm job that may include: dispatch, poll, gather, or cancel job. The SlurmExecutor will gather job metrics via sacct using the following format fields: **Account**, **AllocNodes**, **AllocTRES**, **ConsumedEnergyRaw**, **CPUTimeRaw**, **Elapsed**, **End**, **ExitCode**, **JobID**, **JobName**, **NCPUS**, **NNodes**, **QOS**, **ReqGRES**, **ReqMem**, **ReqNodes**, **ReqTRES**, **Start**, **State**, **Submit**, **UID**, **User**, **WorkDir**. For a complete list of format fields see `sacct -e`. For now, we support only these fields of interest for reporting purpose.

buildtest can check status based on Slurm Job State, this is defined by `State` field in sacct. In next example, we introduce

field `slurm_job_state` which is part of `status` field. This field expects one of the following values: `[COMPLETED, FAILED, OUT_OF_MEMORY, TIMEOUT ]` This is an example of simulating fail job by expecting a return code of 1 with job state of `FAILED`.

```
version: "1.0"
buildspecs:
  wall_timeout:
    type: script
    executor: cori.slurm.debug
    sbatch: [ "-t 2", "-C haswell", "-n 1"]
    run: sleep 300
    status:
      slurm_job_state: "TIMEOUT"
```

If we run this test, buildtest will mark this test as `PASS` because the slurm job state matches with expected result defined by field `slurm_job_state`. This job will be TIMEOUT because we requested 2 mins while this job will sleep 300sec (5min).

```
   Completed Jobs
_______________________________________


+--------------+--------------------------+----------+----------+
|     name     |         executor         |  jobID   | jobstate |
+--------------+--------------------------+----------+----------+
| wall_timeout | cori.slurm.haswell_debug | 43309265 | TIMEOUT  |
+--------------+--------------------------+----------+----------+

+-----------------------------------------------+
| Stage: Final Results after Polling all Jobs |
+-----------------------------------------------+

 name         | id       | executor                 | status   |   returncode
--------------+----------+--------------------------+----------+--------------
 wall_timeout | 3b43850c | cori.slurm.haswell_debug | PASS     |            0

+----------------------+
| Stage: Test Summary  |
+----------------------+

Passed Tests: 1/1 Percentage: 100.000%
Failed Tests: 0/1 Percentage: 0.000%


Writing Logfile to: /tmp/buildtest_k6h246yx.log
A copy of logfile can be found at $BUILDTEST_ROOT/buildtest.log -  /global/homes/s/
↪siddiq90/github/buildtest/buildtest.log
```

If you examine the logfile `buildtest.log` you will see an entry of `sacct` command run to gather results followed by list of field and value output:

```
2021-06-11 09:52:27,826 [slurm.py:292 -  poll() ] - [DEBUG] Querying JobID: '43309265' ␣
↪Job State by running: 'sacct -j 43309265 -o State -n -X -P --clusters=cori'
2021-06-11 09:52:27,826 [slurm.py:296 -  poll() ] - [DEBUG] JobID: '43309265' job␣
↪state:TIMEOUT
```

(continues on next page)

(continued from previous page)

LSF

buildtest can support job submission to IBM Spectrum LSF if you have defined LSF executors in your configuration file.

The `bsub` property can be used to specify **#BSUB** directive into job script. This example will use the executor `ascent.lsf.batch` executor that was defined in buildtest configuration.

```
version: "1.0"
buildspecs:
  hostname:
    type: script
    executor: ascent.lsf.batch
    bsub: [ "-W 10",  "-nnodes 1"]

    run: jsrun hostname
```

The LSFExecutor poll jobs and retrieve job state using `bjobs -noheader -o 'stat' <JOBID>`. The LSFExecutor will poll job so long as they are in **PEND** or **RUN** state. Once job is not in any of the two states, LSFExecutor will gather job results. buildtest will retrieve the following format fields using `bjobs`: **job_name**, **stat**, **user**, **user_group**, **queue**, **proj_name**, **pids**, **exit_code**, **from_host**, **exec_host**, **submit_time**, **start_time**, **finish_time**, **nthreads**, **exec_home**, **exec_cwd**, **output_file**, **error_file** to get job record.

PBS

buildtest can support job submission to PBS Pro or OpenPBS scheduler. Assuming you have configured *PBS Executors* in your configuration file you can submit jobs to the PBS executor by selecting the appropriate pbs executor via `executor` property in buildspec. The `#PBS` directives can be specified using `pbs` field which is a list of PBS options that get inserted at top of script. Shown below is an example buildspec using the *script* schema.

```
version: "1.0"
buildspecs:
  pbs_sleep:
    type: script
    executor: generic.pbs.workq
    pbs: ["-l nodes=1", "-l walltime=00:02:00"]
    run: sleep 10
```

buildtest will poll PBS jobs using `qstat -x -f -F json <jobID>` until job is finished. Note that we use **-x** option to retrieve finished jobs which is required inorder for buildtest to detect job state upon completion. Please see *PBS Limitation* to ensure your PBS cluster supports job history.

Shown below is an example build of the buildspec using PBS scheduler.

```
[pbsuser@pbs buildtest]$ buildtest build -b general_tests/sched/pbs/hostname.yml

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+
```

(continues on next page)

(continued from previous page)

```
Discovered Buildspecs:

/tmp/Documents/buildtest/general_tests/sched/pbs/hostname.yml

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile               | validstate   | buildspec
--------------------------+--------------+-----------------------------------------------
↪---------------
 script-v1.0.schema.json | True         | /tmp/Documents/buildtest/general_tests/sched/
↪pbs/hostname.yml

+----------------------+
| Stage: Building Test |
+----------------------+

 name      | id       | type    | executor          | tags    | testpath
-----------+----------+---------+-------------------+---------+----------------------------
↪-------------------------------------------------------------------
 pbs_sleep | 2adfc3c1 | script | generic.pbs.workq |         | /tmp/Documents/buildtest/
↪var/tests/generic.pbs.workq/hostname/pbs_sleep/3/stage/generate.sh



+----------------------+
| Stage: Running Test  |
+----------------------+

[pbs_sleep] JobID: 40.pbs dispatched to scheduler
 name      | id       | executor          | status    |   returncode | testpath
-----------+----------+-------------------+-----------+--------------+--------------------
↪-------------------------------------------------------------------------
 pbs_sleep | 2adfc3c1 | generic.pbs.workq | N/A       |           -1 | /tmp/Documents/
↪buildtest/var/tests/generic.pbs.workq/hostname/pbs_sleep/3/stage/generate.sh


Polling Jobs in 10 seconds
_________________________________________
Job Queue: ['40.pbs']


Completed Jobs
_________________________________________



| name    | executor    | jobID    | jobstate    |
```

(continues on next page)

(continued from previous page)

```
Pending Jobs
________________________________________


| name      | executor          | jobID   | jobstate   |
| pbs_sleep | generic.pbs.workq | 40.pbs  | R          |


Polling Jobs in 10 seconds
________________________________________
Job Queue: ['40.pbs']

Completed Jobs
________________________________________


| name   | executor   | jobID   | jobstate   |


Pending Jobs
________________________________________


| name      | executor          | jobID   | jobstate   |
| pbs_sleep | generic.pbs.workq | 40.pbs  | F          |


Polling Jobs in 10 seconds
________________________________________
Job Queue: []

Completed Jobs
________________________________________


| name      | executor          | jobID   | jobstate   |
| pbs_sleep | generic.pbs.workq | 40.pbs  | F          |
```

(continues on next page)

(continued from previous page)

```
Pending Jobs
------------------------------------------


| name    | executor    | jobID    | jobstate    |



+---------------------------------------------+
| Stage: Final Results after Polling all Jobs |
+---------------------------------------------+

 name       | id       | executor           | status    |   returncode | testpath
------------+----------+--------------------+-----------+--------------+--------------------
↪-------------------------------------------------------------------------
 pbs_sleep | 2adfc3c1 | generic.pbs.workq | PASS      |            0 | /tmp/Documents/
↪buildtest/var/tests/generic.pbs.workq/hostname/pbs_sleep/3/stage/generate.sh

+----------------------+
| Stage: Test Summary  |
+----------------------+

Executed 1 tests
Passed Tests: 1/1 Percentage: 100.000%
Failed Tests: 0/1 Percentage: 0.000%



Writing Logfile to: /tmp/buildtest_mu285m58.log
```

buildtest will preserve the job record from `qstat -x -f -F json <jobID>` in the test report if job was complete. If we take a look at the test result using **buildtest inspect** you will see the `job` section is prepopulated from the JSON record provided by **qstat**.

```
[pbsuser@pbs buildtest]$ buildtest inspect id 2adfc3c1
{
  "id": "2adfc3c1",
  "full_id": "2adfc3c1-1c81-43d0-a151-6fa1a9818eb4",
  "testroot": "/tmp/Documents/buildtest/var/tests/generic.pbs.workq/hostname/pbs_sleep/3
↪",
  "testpath": "/tmp/Documents/buildtest/var/tests/generic.pbs.workq/hostname/pbs_sleep/3/
↪stage/generate.sh",
  "stagedir": "/tmp/Documents/buildtest/var/tests/generic.pbs.workq/hostname/pbs_sleep/3/
↪stage",
  "rundir": "/tmp/Documents/buildtest/var/tests/generic.pbs.workq/hostname/pbs_sleep/3/
↪run",
  "command": "qsub -q workq /tmp/Documents/buildtest/var/tests/generic.pbs.workq/
↪hostname/pbs_sleep/3/stage/generate.sh",
```

(continues on next page)

(continued from previous page)


```
  "outfile": "/tmp/Documents/buildtest/var/tests/generic.pbs.workq/hostname/pbs_sleep/3/stage/pbs_sleep.o40",
  "errfile": "/tmp/Documents/buildtest/var/tests/generic.pbs.workq/hostname/pbs_sleep/3/stage/pbs_sleep.e40",
  "schemafile": "script-v1.0.schema.json",
  "executor": "generic.pbs.workq",
  "tags": "",
  "starttime": "Wed Mar 17 20:36:48 2021",
  "endtime": "Wed Mar 17 20:36:48 2021",
  "runtime": "00:00:10",
  "state": "PASS",
  "returncode": 0,
  "output": "",
  "error": "",
  "job": {
    "timestamp": 1616013438,
    "pbs_version": "19.0.0",
    "pbs_server": "pbs",
    "Jobs": {
      "40.pbs": {
        "Job_Name": "pbs_sleep",
        "Job_Owner": "pbsuser@pbs",
        "resources_used": {
          "cpupercent": 0,
          "cput": "00:00:00",
          "mem": "5620kb",
          "ncpus": 1,
          "vmem": "25632kb",
          "walltime": "00:00:10"
        },
        "job_state": "F",
        "queue": "workq",
        "server": "pbs",
        "Checkpoint": "u",
        "ctime": "Wed Mar 17 20:36:48 2021",
        "Error_Path": "pbs:/tmp/Documents/buildtest/var/tests/generic.pbs.workq/hostname/pbs_sleep/3/stage/pbs_sleep.e40",
        "exec_host": "pbs/0",
        "exec_vnode": "(pbs:ncpus=1)",
        "Hold_Types": "n",
        "Join_Path": "n",
        "Keep_Files": "n",
        "Mail_Points": "a",
        "mtime": "Wed Mar 17 20:36:58 2021",
        "Output_Path": "pbs:/tmp/Documents/buildtest/var/tests/generic.pbs.workq/hostname/pbs_sleep/3/stage/pbs_sleep.o40",
        "Priority": 0,
        "qtime": "Wed Mar 17 20:36:48 2021",
        "Rerunable": "True",
        "Resource_List": {
          "ncpus": 1,
          "nodect": 1,
```


(continues on next page)

(continued from previous page)

```
          "nodes": 1,
          "place": "scatter",
          "select": "1:ncpus=1",
          "walltime": "00:02:00"
        },
        "stime": "Wed Mar 17 20:36:48 2021",
        "session_id": 7154,
        "jobdir": "/home/pbsuser",
        "substate": 92,
        "Variable_List": {
          "PBS_O_HOME": "/home/pbsuser",
          "PBS_O_LANG": "en_US.utf8",
          "PBS_O_LOGNAME": "pbsuser",
          "PBS_O_PATH": "/tmp/Documents/buildtest/bin:/tmp/Documents/github/buildtest/
↪bin:/usr/local/bin:/bin:/usr/bin:/usr/local/sbin:/usr/sbin:/opt/pbs/bin:/home/pbsuser/.
↪local/bin:/home/pbsuser/bin",
          "PBS_O_MAIL": "/var/spool/mail/pbsuser",
          "PBS_O_SHELL": "/bin/bash",
          "PBS_O_WORKDIR": "/tmp/Documents/buildtest/var/tests/generic.pbs.workq/
↪hostname/pbs_sleep/3/stage",
          "PBS_O_SYSTEM": "Linux",
          "PBS_O_QUEUE": "workq",
          "PBS_O_HOST": "pbs"
        },
        "comment": "Job run at Wed Mar 17 at 20:36 on (pbs:ncpus=1) and finished",
        "etime": "Wed Mar 17 20:36:48 2021",
        "run_count": 1,
        "Stageout_status": 1,
        "Exit_status": 0,
        "Submit_arguments": "-q workq /tmp/Documents/buildtest/var/tests/generic.pbs.
↪workq/hostname/pbs_sleep/3/stage/generate.sh",
        "history_timestamp": 1616013418,
        "project": "_pbs_project_default"
      }
    }
  }
}



Output File
_______________________________




Error File
_______________________________
```

(continues on next page)

(continued from previous page)

```
Test Content
_________________________________
#!/bin/bash
#PBS -l nodes=1
#PBS -l walltime=00:02:00
#PBS -N pbs_sleep
source /tmp/Documents/buildtest/var/executors/generic.pbs.workq/before_script.sh
sleep 10
source /tmp/Documents/buildtest/var/executors/generic.pbs.workq/after_script.sh



buildspec:  /tmp/Documents/buildtest/general_tests/sched/pbs/hostname.yml
_________________________________
version: "1.0"
buildspecs:
  pbs_sleep:
    type: script
    executor: generic.pbs.workq
    pbs: ["-l nodes=1", "-l walltime=00:02:00"]
    run: sleep 10
```

You can use `batch` property to define schedule configuration that is translated into **#PBS** directives. To learn more about *batch* property see *Scheduler Agnostic Configuration*.

In this example we show how one can use `batch` property with the PBS executor instead of using `pbs` property. You may specify `batch` and `pbs` property to define PBS directives. This example will allocate 1 node, 1 cpu, 500mb memory with 2min timelimit and send email notification.

```
version: "1.0"
buildspecs:
  pbs_sleep:
    type: script
    executor: generic.pbs.workq
    batch:
      nodecount: "1"
      cpucount: "1"
      memory: "500mb"
      email-address: "shahzebmsiddiqui@gmail.com"
      timelimit: "00:02:00"
    run: sleep 15
```

buildtest will translate the `batch` property into `#PBS` directives if their is an equivalent option. Shown below is the generated test using the *batch* property.

```
#!/bin/bash
#PBS -l nodes=1
#PBS -l ncpus=1
#PBS -l mem=500mb
#PBS -WMail_Users=shahzebmsiddiqui@gmail.com
#PBS -l walltime=00:02:00
#PBS -N pbs_sleep
source /tmp/Documents/buildtest/var/executors/generic.pbs.workq/before_script.sh
```

(continues on next page)

(continued from previous page)

```
sleep 15
source /tmp/Documents/buildtest/var/executors/generic.pbs.workq/after_script.sh
```

Cobalt

Cobalt is a job scheduler developed by Argonne National Laboratory that runs on compute resources and IBM BlueGene series. Cobalt resembles PBS in terms of command line interface such as `qsub`, `qacct` however they slightly differ in their behavior.

Cobalt support has been tested on JLSE and Theta system. Cobalt directives are specified using `#COBALT` this can be specified using `cobalt` property which accepts a list of strings. Shown below is an example using cobalt property.

```
version: "1.0"
buildspecs:
  yarrow_hostname:
    executor: jlse.cobalt.yarrow
    type: script
    cobalt: ["-n 1", "--proccount 1", "-t 10"]
    run: hostname
```

In this example, we allocate 1 node with 1 processor for 10min. This is translated into the following job script.

```
#!/usr/bin/bash
#COBALT -n 1
#COBALT --proccount 1
#COBALT -t 10
#COBALT --jobname yarrow_hostname
source /home/shahzebsiddiqui/buildtest/var/executors/cobalt.yarrow/before_script.sh
hostname
source /home/shahzebsiddiqui/buildtest/var/executors/cobalt.yarrow/after_script.sh
```

Let's run this test and notice the job states.

```
$ buildtest build -b yarrow_hostname.yml

+-------------------------------+
| Stage: Discovering Buildspecs |
+-------------------------------+


Discovered Buildspecs:

/home/shahzebsiddiqui/jlse_tests/yarrow_hostname.yml

+----------------------------+
| Stage: Parsing Buildspecs |
+----------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪------
 script-v1.0.schema.json | True         | /home/shahzebsiddiqui/jlse_tests/yarrow_
↪hostname.yml
```

(continues on next page)

(continued from previous page)

```
+----------------------+
| Stage: Building Test |
+----------------------+

 name             | id       | type    | executor      | tags    | testpath
------------------+----------+---------+---------------+---------+--------------------------
↪-------------------------------------------------------------------------------------
 yarrow_hostname | f86b93f6 | script | cobalt.yarrow |         | /home/shahzebsiddiqui/
↪buildtest/var/tests/cobalt.yarrow/yarrow_hostname/yarrow_hostname/3/stage/generate.sh

+----------------------+
| Stage: Running Test  |
+----------------------+

[yarrow_hostname] JobID: 284752 dispatched to scheduler
 name             | id       | executor      | status    |   returncode | testpath
------------------+----------+---------------+-----------+--------------+------------------
↪-------------------------------------------------------------------------------------------
↪----
 yarrow_hostname | f86b93f6 | cobalt.yarrow | N/A       |           -1 | /home/
↪shahzebsiddiqui/buildtest/var/tests/cobalt.yarrow/yarrow_hostname/yarrow_hostname/3/
↪stage/generate.sh


Polling Jobs in 10 seconds
_____________________________________
builder: yarrow_hostname in None
[yarrow_hostname]: JobID 284752 in starting state


Polling Jobs in 10 seconds
_____________________________________
builder: yarrow_hostname in starting
[yarrow_hostname]: JobID 284752 in starting state


Polling Jobs in 10 seconds
_____________________________________
builder: yarrow_hostname in starting
[yarrow_hostname]: JobID 284752 in running state


Polling Jobs in 10 seconds
_____________________________________
builder: yarrow_hostname in running
[yarrow_hostname]: JobID 284752 in exiting state


Polling Jobs in 10 seconds
_____________________________________
builder: yarrow_hostname in done
```

(continues on next page)

(continued from previous page)

```
+----------------------------------------------+
| Stage: Final Results after Polling all Jobs |
+----------------------------------------------+

 name             | id       | executor      | status   |   returncode | testpath
------------------+----------+---------------+----------+--------------+------------------
↪-------------------------------------------------------------------------------------------
↪----
 yarrow_hostname | f86b93f6 | cobalt.yarrow | PASS     |          0   | /home/
↪shahzebsiddiqui/buildtest/var/tests/cobalt.yarrow/yarrow_hostname/yarrow_hostname/3/
↪stage/generate.sh

+----------------------+
| Stage: Test Summary  |
+----------------------+

Executed 1 tests
Passed Tests: 1/1 Percentage: 100.000%
Failed Tests: 0/1 Percentage: 0.000%
```

When job starts, Cobalt will write a cobalt log file `<JOBID>.cobaltlog` which is provided by scheduler for troubleshooting. The output and error file are generated once job finishes. Cobalt job progresses through job state `starting` –> `pending` –> `running` –> `exiting`. buildtest will capture Cobalt job details using `qstat -lf <JOBID>` and this is updated in the report file.

buildtest will poll job at set interval, where we run `qstat --header State <JobID>` to check state of job, if job is finished then we gather results. Once job is finished, qstat will not be able to poll job this causes an issue where buildtest can't poll job since qstat will not return anything. This is a transient issue depending on when you poll job, generally at ALCF qstat will not report existing job within 30sec after job is terminated. buildtest will assume if it's able to poll job and is in *exiting* stage that job is complete, if its unable to retrieve this state we check for output and error file. If file exists we assume job is complete and buildtest will gather the results.

buildtest will determine exit code by parsing cobalt log file, the file contains a line such as

```
Thu Nov 05 17:29:30 2020 +0000 (UTC) Info: task completed normally with an exit code of␣
↪0; initiating job cleanup and removal
```

qstat has no job record for capturing returncode so buildtest must rely on Cobalt Log file.:

Scheduler Agnostic Configuration

The `batch` field can be used for specifying scheduler agnostic configuration based on your scheduler. buildtest will translate the input into the appropriate script directive supported by the scheduler. Shown below is a translation table for the **batch** field

Table 2: Batch Translation Table

Field	Slurm	LSF	PBS	Cobalt
account	`--account`	`-P`	`project`	`--project`
begin	`--begin`	`-b`	**N/A**	**N/A**
cpucount	`--ntasks`	`-n`	`-l ncpus`	`--proccount`
email-address	`--mail-user`	`-u`	`-WMail_Users`	`--notify`
exclusive	`--exclusive=user`	`-x`	**N/A**	**N/A**
memory	`--mem`	`-M`	`-l mem`	**N/A**
network	`--network`	`-network`	**N/A**	**N/A**
nodecount	`--nodes`	`-nnodes`	`-l nodes`	`--nodecount`
qos	`--qos`	**N/A**	**N/A**	**N/A**
queue	`--partition`	`-q`	`-q`	`--queue`
tasks-per-core	`--ntasks-per-core`	**N/A**	**N/A**	**N/A**
tasks-per-node	`--ntasks-per-node`	**N/A**	**N/A**	**N/A**
tasks-per-socket	`--ntasks-per-socket`	**N/A**	**N/A**	**N/A**
timelimit	`--time`	`-W`	`-l walltime`	`--time`

In this example, we rewrite the LSF buildspec to use `batch` instead of `bsub` field.

```
version: "1.0"
buildspecs:
  hostname:
    type: script
    executor: ascent.lsf.batch
    batch:
      timelimit: "10"
      nodecount: "1"
    run: jsrun hostname
```

buildtest will translate the batch field into #BSUB directive as you can see in the generated test. buildtest will automatically name the job based on the testname therefore you will see that buildtest will insert `#BSUB -J`, `#BSUB -o` and `#BSUB -e` directives in the test.

```
#!/usr/bin/bash
#BSUB -W 10
#BSUB -nnodes 1
#BSUB -J hostname
#BSUB -o hostname.out
#BSUB -e hostname.err
jsrun hostname
```

In next example we use `batch` field with on a Slurm cluster that submits a sleep job as follows.

```
version: "1.0"
buildspecs:
  sleep:
    type: script
```

(continues on next page)

(continued from previous page)

```
    executor: cori.slurm.knl_debug
    description: sleep 2 seconds
    tags: [tutorials]
    batch:
      nodecount: "1"
      cpucount: "1"
      timelimit: "5"
      memory: "5MB"
      exclusive: true

    vars:
      SLEEP_TIME: 2
    run: sleep $SLEEP_TIME
```

The `exclusive` field is used for getting exclusive node access, this is a boolean instead of string. You can instruct buildtest to stop after build phase by using `--stage=build` which will build the script but not run it. If we inspect the generated script we see the following.

```
#!/bin/bash
#SBATCH --nodes=1
#SBATCH --ntasks=1
#SBATCH --time=5
#SBATCH --mem=5MB
#SBATCH --exclusive=user
SLEEP_TIME=2
sleep $SLEEP_TIME
```

The `batch` property can translate some fields into #COBALT directives. buildtest will support fields that are applicable with scheduler. Shown below is an example with 1 node using 10min that runs hostname using executor *jlse.cobalt.iris*.

```
version: "1.0"
buildspecs:
  iris_hostname:
    executor: jlse.cobalt.iris
    type: script
    batch:
      nodecount: "1"
      timelimit: "10"
    run: hostname
```

If we build the buildspec and inspect the testscript we see the following.

```
#!/usr/bin/bash
#COBALT --nodecount 1
#COBALT --time 10
#COBALT --jobname iris_hostname
hostname
```

The first two lines `#COBALT --nodecount 1` and `#COBALT --time 10` are translated based on input from *batch* field. buildtest will automatically add `#COBALT --jobname` based on the name of the test.

You may leverage `batch` with `sbatch`, `bsub`, or `cobalt` field to specify your job directives. If a particular field is not available in `batch` property then utilize `sbatch`, `bsub`, `cobalt` field to fill in rest of the arguments.

Jobs exceeds *max_pend_time*

Recall from *Configuring buildtest* that *max_pend_time* will cancel jobs if job exceed timelimit. buildtest will start a timer for each job right after job submission and keep track of time duration, and if job is in **pending** state and it exceeds *max_pend_time*, then job will be cancelled.

We can also override *max_pend_time* configuration via command line `--max-pend-time`. To demonstrate, here is an example where job was cancelled after job was pending and exceeds *max_pend_time*. Note that cancelled job is not reported in final output nor updated in report hence it won't be present in the report (`buildtest report`). In this example, we only had one test so upon job cancellation we found there was no tests to report hence, buildtest will terminate after run stage.

```
$ buildtest build -b buildspecs/queues/shared.yml --max-pend-time 15 --poll-interval 5 -k


User:  siddiq90
Hostname:  cori08
Platform:  Linux
Current Time:  2021/06/11 13:31:46
buildtest path: /global/homes/s/siddiq90/github/buildtest/bin/buildtest
buildtest version:  0.9.5
python path: /global/homes/s/siddiq90/.conda/envs/buildtest/bin/python
python version:  3.8.8
Test Directory:  /global/u1/s/siddiq90/github/buildtest/var/tests
Configuration File:  /global/u1/s/siddiq90/.buildtest/config.yml
Command: /global/homes/s/siddiq90/github/buildtest/bin/buildtest build -b buildspecs/
↪queues/shared.yml --max-pend-time 15 --poll-interval 5 -k

+------------------------------+
| Stage: Discovering Buildspecs |
+------------------------------+

+-------------------------------------------------------------------------------+
| Discovered Buildspecs                                                         |
+===============================================================================+
| /global/u1/s/siddiq90/github/buildtest-cori/buildspecs/queues/shared.yml |
+-------------------------------------------------------------------------------+
Discovered Buildspecs:  1
Excluded Buildspecs:  0
Detected Buildspecs after exclusion:  1

+---------------------------+
| Stage: Parsing Buildspecs |
+---------------------------+

 schemafile              | validstate   | buildspec
-------------------------+--------------+-----------------------------------------------
↪--------------------------
 script-v1.0.schema.json | True         | /global/u1/s/siddiq90/github/buildtest-cori/
↪buildspecs/queues/shared.yml


name                        description
```

(continues on next page)

(continued from previous page)

```
-------------------------  ------------------------------------------
shared_qos_haswell_hostname  run hostname through shared qos on Haswell

+----------------------+
| Stage: Building Test |
+----------------------+

 name                         | id       | type    | executor                  | tags      ␣
↪                    | testpath
------------------------------+----------+---------+---------------------------+-----------
↪--------------------+-------------------------------------------------------------------------
↪-----------------------------------------------------------------------------
 shared_qos_haswell_hostname | 94b2de5d | script | cori.slurm.haswell_shared | ['queues',
↪ 'jobs', 'reframe'] | /global/u1/s/siddiq90/github/buildtest/var/tests/cori.slurm.
↪haswell_shared/shared/shared_qos_haswell_hostname/2/shared_qos_haswell_hostname_build.
↪sh



+----------------------+
| Stage: Running Test |
+----------------------+

[shared_qos_haswell_hostname] JobID: 43313766 dispatched to scheduler
 name                         | id       | executor                  | status    |  ␣
↪returncode
------------------------------+----------+---------------------------+----------+---------
↪-----
 shared_qos_haswell_hostname | 94b2de5d | cori.slurm.haswell_shared | N/A       |        ␣
↪  -1


Polling Jobs in 5 seconds
_________________________________________
Job Queue: [43313766]


Pending Jobs
_________________________________________


+----------------------------+---------------------------+----------+----------+
|            name            |         executor          |  jobID   | jobstate |
+----------------------------+---------------------------+----------+----------+
| shared_qos_haswell_hostname | cori.slurm.haswell_shared | 43313766 | PENDING  |
+----------------------------+---------------------------+----------+----------+


Polling Jobs in 5 seconds
_________________________________________
Job Queue: [43313766]

```

(continues on next page)

(continued from previous page)

```
Pending Jobs
_________________________________________


+----------------------------+---------------------------+----------+----------+
|            name            |         executor          |  jobID   | jobstate |
+----------------------------+---------------------------+----------+----------+
| shared_qos_haswell_hostname | cori.slurm.haswell_shared | 43313766 | PENDING  |
+----------------------------+---------------------------+----------+----------+


Polling Jobs in 5 seconds
_________________________________________
Job Queue: [43313766]


Pending Jobs
_________________________________________


+----------------------------+---------------------------+----------+----------+
|            name            |         executor          |  jobID   | jobstate |
+----------------------------+---------------------------+----------+----------+
| shared_qos_haswell_hostname | cori.slurm.haswell_shared | 43313766 | PENDING  |
+----------------------------+---------------------------+----------+----------+


Polling Jobs in 5 seconds
_________________________________________
Cancelling Job because duration time: 21.177340 sec exceeds max pend time: 15 sec
Job Queue: [43313766]


Pending Jobs
_________________________________________


+----------------------------+---------------------------+----------+-----------+
|            name            |         executor          |  jobID   | jobstate  |
+----------------------------+---------------------------+----------+-----------+
| shared_qos_haswell_hostname | cori.slurm.haswell_shared | 43313766 | CANCELLED |
+----------------------------+---------------------------+----------+-----------+


Polling Jobs in 5 seconds
_________________________________________
Job Queue: []
Cancelled Tests:
shared_qos_haswell_hostname
After polling all jobs we found no valid builders to process
```

Cray Burst Buffer & Data Warp

For Cray systems, you may want to stage-in or stage-out into your burst buffer this can be configured using the `#DW` directive. For a list of data warp examples see section on DataWarp Job Script Commands

In buildtest we support properties `BB` and `DW` which is a list of job directives that get inserted as **#BW** and **#DW** into the test script. To demonstrate let's start off with an example where we create a persistent burst buffer named `databuffer` of size 10GB striped. We access the burst buffer using the *DW* directive. Finally we cd into the databuffer and write a 5GB random file.

Note: BB and DW directives are generated after scheduler directives. The `#BB` comes before `#DW`. buildtest will automatically add the directive **#BB** and **#DW** when using properties BB and DW

```
version: "1.0"
buildspecs:
  create_burst_buffer:
    type: script
    executor: cori.slurm.debug
    batch:
      nodecount: "1"
      timelimit: "5"
      cpucount: "1"
    sbatch: ["-C knl"]
    description: Create a burst buffer
    tags: [jobs]
    BB:
      - create_persistent name=databuffer capacity=10GB access_mode=striped type=scratch
    DW:
      - persistentdw name=databuffer
    run: |
      cd $DW_PERSISTENT_STRIPED_databuffer
      pwd
      dd if=/dev/urandom of=random.txt bs=1G count=5 iflags=fullblock
      ls -lh $DW_PERSISTENT_STRIPED_databuffer/
```

Next we run this test and inspect the generated test we will see that `#BB` and `#DW` directives are inserted after the scheduler directives

```
#!/bin/bash
#SBATCH --nodes=1
#SBATCH --time=5
#SBATCH --ntasks=1
#SBATCH --job-name=create_burst_buffer
#SBATCH --output=create_burst_buffer.out
#SBATCH --error=create_burst_buffer.err
#BB create_persistent name=databuffer capacity=10GB access_mode=striped type=scratch
#DW persistentdw name=databuffer
cd $DW_PERSISTENT_STRIPED_databuffer
pwd
dd if=/dev/urandom of=random.txt bs=1G count=5 iflag=fullblock
ls -lh $DW_PERSISTENT_STRIPED_databuffer
```

We can confirm their is an active burst buffer by running the following

```
$ scontrol show burst | grep databuffer
    Name=databuffer CreateTime=2020-10-29T13:06:21 Pool=wlm_pool Size=20624MiB␣
↪State=allocated UserID=siddiq90(92503)
```

3.6.6 Buildtest Schemas

Schema Naming Convention

All schema files use the file extension **.schema.json** to distinguish itself as a json schema definition from an ordinary json file. The schema files are located in buildtest/schemas directory.

Schema Examples

The schema examples are great way to help write your buildspecs and help you understand the edge cases that can lead to an invalid buildspec. The schema examples are used in buildtest regression test for validating the schemas. We expose the examples through buildtest client so its accessible for everyone.

In order to view an example you can run:

```
buildtest schema -n <schema> --example
```

Definition Schema

This schema is used for declaring definitions that need to be reused in multiple schemas. We use `$ref` keyword to reference definitions from this file.

Schema Content

```
$ buildtest schema -n definitions.schema.json --json
{
  "$id": "definitions.schema.json",
  "$schema": "http://json-schema.org/draft-07/schema#",
  "title": "JSON Schema Definitions File. ",
  "description": "This file is used for declaring definitions that are referenced from␣
↪other schemas",
  "definitions": {
    "list_of_strings": {
      "type": "array",
      "uniqueItems": true,
      "minItems": 1,
      "items": {
        "type": "string"
      }
    },
    "string_or_list": {
      "oneOf": [
        {
          "type": "string"
        },
```

(continues on next page)

(continued from previous page)

```
        {
          "$ref": "#/definitions/list_of_strings"
        }
      ]
    },
    "list_of_ints": {
      "type": "array",
      "uniqueItems": true,
      "minItems": 1,
      "items": {
        "type": "integer"
      }
    },
    "int_or_list": {
      "oneOf": [
        {
          "type": "integer"
        },
        {
          "$ref": "#/definitions/list_of_ints"
        }
      ]
    },
    "regex": {
      "type": "object",
      "description": "Perform regular expression search using ``re.search`` python␣
↪module on stdout/stderr stream for reporting if test ``PASS``. ",
      "required": [
        "stream",
        "exp"
      ],
      "additionalProperties": false,
      "properties": {
        "stream": {
          "type": "string",
          "enum": [
            "stdout",
            "stderr"
          ],
          "description": "The stream field can be stdout or stderr. buildtest will read␣
↪the output or error stream after completion of test and check if regex matches in␣
↪stream"
        },
        "exp": {
          "type": "string",
          "description": "Specify a regular expression to run with input stream␣
↪specified by ``stream`` field. buildtest uses re.search when performing regex"
        }
      }
    },
    "env": {
      "type": "object",
```

(continues on next page)

(continued from previous page)

```
      "description": "One or more key value pairs for an environment (key=value)",
      "minItems": 1,
      "items": {
        "type": "object",
        "minItems": 1,
        "propertyNames": {
          "pattern": "^[A-Za-z_][A-Za-z0-9_]*$"
        }
      }
    },
    "description": {
      "type": "string",
      "description": "The ``description`` field is used to document what the test is␣
↪doing",
      "maxLength": 80
    },
    "tags": {
      "description": "Classify tests using a tag name, this can be used for categorizing␣
↪test and building tests using ``--tags`` option",
      "$ref": "#/definitions/string_or_list"
    },
    "skip": {
      "type": "boolean",
      "description": "The ``skip`` is a boolean field that can be used to skip tests␣
↪during builds. By default buildtest will build and run all tests in your buildspec␣
↪file, if ``skip: True`` is set it will skip the buildspec."
    },
    "executor": {
      "type": "string",
      "description": "Select one of the executor name defined in your configuration file␣
↪(``config.yml``). Every buildspec must have an executor which is responsible for␣
↪running job. "
    },
    "metrics_field": {
      "type": "object",
      "additionalProperties": false,
      "properties": {
        "regex": {
          "$ref": "#/definitions/regex"
        },
        "vars": {
          "type": "string",
          "description": "Assign value to metric based on variable name"
        },
        "env": {
          "type": "string",
          "description": "Assign value to metric based on environment variable"
        }
      }
    },
    "metrics": {
      "type": "object",
```

(continues on next page)

(continued from previous page)

```
      "description": "This field is used for defining one or more metrics that is␣
↪recorded for each test. A metric must have a unique name which is recorded in the test␣
↪metadata.",
      "patternProperties": {
        "^.*$": {
          "$ref": "#/definitions/metrics_field",
          "description": "Name of metric"
        }
      }
    },
    "run_only": {
      "type": "object",
      "description": "A set of conditions to specify when running tests. All conditions␣
↪must pass in order to process test.",
      "additionalProperties": false,
      "properties": {
        "scheduler": {
          "type": "string",
          "description": "Test will run only if scheduler is available. We assume␣
↪binaries are available in $PATH",
          "enum": [
            "lsf",
            "slurm",
            "cobalt",
            "pbs"
          ]
        },
        "user": {
          "type": "string",
          "description": "Test will run only if current user matches this field,␣
↪otherwise test will be skipped"
        },
        "platform": {
          "type": "string",
          "description": "This test will run if target system is Linux or Darwin. We␣
↪check target system using ``platform.system()`` and match with input field",
          "enum": [
            "Linux",
            "Darwin"
          ]
        },
        "linux_distro": {
          "type": "array",
          "description": "Specify a list of Linux Distros to check when processing test.␣
↪If target system matches one of input field, test will be processed.",
          "uniqueItems": true,
          "minItems": 1,
          "items": {
            "type": "string",
            "enum": [
              "darwin",
              "ubuntu",
```

(continues on next page)

(continued from previous page)

```
              "debian",
              "rhel",
              "centos",
              "fedora",
              "sles",
              "opensuse",
              "amazon",
              "arch"
            ]
          }
        }
      }
    },
    "batch": {
      "type": "object",
      "description": "The ``batch`` field is used to specify scheduler agnostic␣
↪directives that are translated to #SBATCH or #BSUB based on your scheduler. This is an␣
↪experimental feature that supports a subset of scheduler parameters.",
      "additionalProperties": false,
      "properties": {
        "account": {
          "type": "string",
          "description": "Specify Account to charge job"
        },
        "begintime": {
          "type": "string",
          "description": "Specify begin time when job will start allocation"
        },
        "cpucount": {
          "type": "string",
          "description": "Specify number of CPU to allocate"
        },
        "email-address": {
          "type": "string",
          "description": "Email Address to notify on Job State Changes"
        },
        "exclusive": {
          "type": "boolean",
          "description": "Specify if job needs to run in exclusive mode"
        },
        "memory": {
          "type": "string",
          "description": "Specify Memory Size for Job"
        },
        "network": {
          "type": "string",
          "description": "Specify network resource requirement for job"
        },
        "nodecount": {
          "type": "string",
          "description": "Specify number of Nodes to allocate"
        },
```

(continues on next page)

(continued from previous page)

```
        "qos": {
          "type": "string",
          "description": "Specify Quality of Service (QOS)"
        },
        "queue": {
          "type": "string",
          "description": "Specify Job Queue"
        },
        "tasks-per-core": {
          "type": "string",
          "description": "Request number of tasks to be invoked on each core. "
        },
        "tasks-per-node": {
          "type": "string",
          "description": "Request number of tasks to be invoked on each node. "
        },
        "tasks-per-socket": {
          "type": "string",
          "description": "Request the maximum tasks to be invoked on each socket. "
        },
        "timelimit": {
          "type": "string",
          "description": "Specify Job timelimit"
        }
      }
    },
    "status": {
      "type": "object",
      "description": "The status section describes how buildtest detects PASS/FAIL on␣
↪test. By default returncode 0 is a PASS and anything else is a FAIL, however buildtest␣
↪can support other types of PASS/FAIL conditions.",
      "additionalProperties": false,
      "properties": {
        "slurm_job_state": {
          "type": "string",
          "enum": [
            "COMPLETED",
            "FAILED",
            "OUT_OF_MEMORY",
            "TIMEOUT"
          ],
          "description": "This field can be used for checking Slurm Job State, if there␣
↪is a match buildtest will report as ``PASS`` "
        },
        "returncode": {
          "description": "Specify a list of returncodes to match with script's exit code.
↪ buildtest will PASS test if script's exit code is found in list of returncodes. You␣
↪must specify unique numbers as list and a minimum of 1 item in array",
          "$ref": "#/definitions/int_or_list"
        },
        "regex": {
          "$ref": "#/definitions/regex",
```

(continues on next page)

(continued from previous page)

```
          "description": "Determine state (PASS/FAIL) of test based on regular␣
↪expression on output or error stream"
        },
        "runtime": {
          "type": "object",
          "description": "The runtime section will pass test based on min and max values␣
↪and compare with actual runtime. ",
          "properties": {
            "min": {
              "type": "number",
              "minimum": 0,
              "description": "Specify a minimum runtime in seconds. The test will PASS␣
↪if actual runtime exceeds min time."
            },
            "max": {
              "type": "number",
              "minimum": 0,
              "description": "Specify a maximum runtime in seconds. The test will PASS␣
↪if actual runtime is less than max time"
            }
          }
        }
      }
    },
    "BB": {
      "$ref": "#/definitions/list_of_strings",
      "description": "Create burst buffer space, this specifies #BB options in your test.
↪"
    },
    "DW": {
      "$ref": "#/definitions/list_of_strings",
      "description": "Specify Data Warp option (#DW) when using burst buffer."
    },
    "sbatch": {
      "$ref": "#/definitions/list_of_strings",
      "description": "This field is used for specifying #SBATCH options in test script."
    },
    "bsub": {
      "$ref": "#/definitions/list_of_strings",
      "description": "This field is used for specifying #BSUB options in test script."
    },
    "cobalt": {
      "$ref": "#/definitions/list_of_strings",
      "description": "This field is used for specifying #COBALT options in test script."
    },
    "pbs": {
      "$ref": "#/definitions/list_of_strings",
      "description": "This field is used for specifying #PBS directives in test script."
    },
    "executors": {
      "type": "object",
      "description": "Define executor specific configuration",
```

(continues on next page)

(continued from previous page)

```
      "patternProperties": {
        "description": "Name of executor to override configuration",
        "^.*$": {
          "additionalProperties": false,
          "properties": {
            "env": {
              "$ref": "#/definitions/env"
            },
            "vars": {
              "$ref": "#/definitions/env"
            },
            "sbatch": {
              "$ref": "#/definitions/list_of_strings"
            },
            "bsub": {
              "$ref": "#/definitions/list_of_strings"
            },
            "pbs": {
              "$ref": "#/definitions/list_of_strings"
            },
            "cobalt": {
              "$ref": "#/definitions/list_of_strings"
            },
            "BB": {
              "$ref": "#/definitions/BB"
            },
            "DW": {
              "$ref": "#/definitions/DW"
            },
            "status": {
              "$ref": "#/definitions/status"
            },
            "metrics": {
              "$ref": "#/definitions/metrics"
            }
          }
        }
      }
    }
  }
}
```

Settings Schema

This schema defines how *buildtest configuration* file is validated.

Schema Content

```
$ buildtest schema -n settings.schema.json --json
{
  "$id": "settings.schema.json",
  "$schema": "http://json-schema.org/draft-07/schema#",
  "title": "buildtest configuration schema",
  "type": "object",
  "required": [
    "system"
  ],
  "additionalProperties": false,
  "properties": {
    "system": {
      "type": "object",
      "patternProperties": {
        "^.*$": {
          "$ref": "#/definitions/system"
        }
      }
    }
  },
  "definitions": {
    "system": {
      "required": [
        "executors",
        "moduletool",
        "load_default_buildspecs",
        "hostnames",
        "compilers"
      ],
      "additionalProperties": false,
      "type": "object",
      "properties": {
        "hostnames": {
          "type": "array",
          "description": "Specify a list of hostnames to check where buildtest can run␣
↪for the given system record",
          "items": {
            "type": "string"
          }
        },
        "description": {
          "type": "string",
          "description": "system description field"
        },
        "buildspec_roots": {
          "type": "array",
```

(continues on next page)

(continued from previous page)

```
          "items": {
            "type": "string"
          },
          "description": "Specify a list of directory paths to search buildspecs. This␣
↪field can be used with ``buildtest buildspec find`` to rebuild buildspec cache or␣
↪build tests using ``buildtest build`` command"
        },
        "load_default_buildspecs": {
          "type": "boolean",
          "description": "Specify whether buildtest should automatically load ␣
↪buildspecs provided in buildtest repo into buildspec cache"
        },
        "testdir": {
          "type": "string",
          "description": "Specify full path to test directory where buildtest will write␣
↪tests."
        },
        "logdir": {
          "type": "string",
          "description": "Specify location where buildtest will write log files"
        },
        "moduletool": {
          "type": "string",
          "description": "Specify modules tool used for interacting with ``module``␣
↪command. ",
          "enum": [
            "environment-modules",
            "lmod",
            "N/A"
          ]
        },
        "processor": {
          "type": "object",
          "description": "Specify processor information",
          "additionalProperties": false,
          "properties": {
            "numcpus": {
              "type": "integer",
              "minimum": 1,
              "description": "Specify Total Number of CPUs"
            },
            "sockets": {
              "type": "integer",
              "minimum": 1,
              "description": "Specify Number of CPU Sockets"
            },
            "cores": {
              "type": "integer",
              "minimum": 1,
              "description": "Specify Number of Physical Cores"
            },
            "threads_per_core": {
```

(continues on next page)

(continued from previous page)

```
              "type": "integer",
              "minimum": 1,
              "description": "Specify Threads per Core"
            },
            "core_per_socket": {
              "type": "integer",
              "minimum": 1,
              "description": "Specify Cores per Socket"
            },
            "model": {
              "type": "string",
              "description": "Specify Processor Model"
            },
            "arch": {
              "type": "string",
              "description": "Specify processor architecture"
            },
            "vendor": {
              "type": "string",
              "description": "Vendor Name"
            }
          }
        },
        "compilers": {
          "type": "object",
          "description": "Declare compiler section for defining system compilers that␣
↪can be referenced in buildspec.",
          "additionalProperties": false,
          "properties": {
            "find": {
              "type": "object",
              "additionalProperties": false,
              "description": "Find compilers by specifying regular expression that is␣
↪applied to modulefile names",
              "properties": {
                "gcc": {
                  "type": "string",
                  "description": "Specify a regular expression to search for gcc␣
↪compilers from your module stack"
                },
                "intel": {
                  "type": "string",
                  "description": "Specify a regular expression to search for intel␣
↪compilers from your module stack"
                },
                "cray": {
                  "type": "string",
                  "description": "Specify a regular expression to search for cray␣
↪compilers from your module stack"
                },
                "clang": {
                  "type": "string",
```

(continues on next page)

(continued from previous page)

```
                  "description": "Specify a regular expression to search for clang␣
↪compilers from your module stack"
                },
                "cuda": {
                  "type": "string",
                  "description": "Specify a regular expression to search for cuda␣
↪compilers from your module stack"
                },
                "pgi": {
                  "type": "string",
                  "description": "Specify a regular expression to search for pgi␣
↪compilers from your module stack"
                },
                "upcxx": {
                  "type": "string",
                  "description": "Specify a regular expression to search for upcxx␣
↪compilers from your module stack"
                }
              }
            },
            "compiler": {
              "type": "object",
              "additionalProperties": false,
              "description": "Start of compiler declaration",
              "properties": {
                "gcc": {
                  "description": "Declaration of one or more GNU compilers where we␣
↪define C, C++ and Fortran compiler. The GNU compiler wrapper are ``gcc``, ``g++`` and␣
↪``gfortran``. ",
                  "type": "object",
                  "patternProperties": {
                    "^.*$": {
                      "$ref": "#/definitions/compiler_section"
                    }
                  }
                },
                "intel": {
                  "description": "Declaration of one or more Intel compilers where we␣
↪define C, C++ and Fortran compiler. The Intel compiler wrapper are ``icc``, ``icpc``␣
↪and ``ifort``. ",
                  "type": "object",
                  "patternProperties": {
                    "^.*$": {
                      "$ref": "#/definitions/compiler_section"
                    }
                  }
                },
                "cray": {
                  "description": "Declaration of one or more Cray compilers where we␣
↪define C, C++ and Fortran compiler. The Cray compiler wrapper are ``cc``, ``CC`` and␣
↪``ftn``.",
                  "type": "object",
```

(continues on next page)

(continued from previous page)

```
                  "patternProperties": {
                    "^.*$": {
                      "$ref": "#/definitions/compiler_section"
                    }
                  }
                },
                "pgi": {
                  "description": "Declaration of one or more PGI compilers where we␣
↪define C, C++ and Fortran compiler. The PGI compiler wrapper are ``pgcc``, ``pgc++``␣
↪and ``pgfortran``.",
                  "type": "object",
                  "patternProperties": {
                    "^.*$": {
                      "$ref": "#/definitions/compiler_section"
                    }
                  }
                },
                "clang": {
                  "description": "Declaration of one or more Clang compilers where we␣
↪define C, C++ compiler. The Clang compiler wrapper are ``clang``, ``clang++``.",
                  "type": "object",
                  "patternProperties": {
                    "^.*$": {
                      "$ref": "#/definitions/compiler_section"
                    }
                  }
                },
                "cuda": {
                  "description": "Declaration of one or more Cuda compilers where we␣
↪define C compiler. The Cuda compiler wrapper is ``nvcc``. ",
                  "type": "object",
                  "patternProperties": {
                    "^.*$": {
                      "$ref": "#/definitions/compiler_section"
                    }
                  }
                },
                "upcxx": {
                  "description": "Declaration of one or more UPCXX compilers where we␣
↪define C, C++ compiler. The UPCXX compiler wrapper are ``upcxx``.",
                  "type": "object",
                  "patternProperties": {
                    "^.*$": {
                      "$ref": "#/definitions/compiler_section"
                    }
                  }
                }
              }
            }
          }
        },
        "executors": {
```

(continues on next page)

(continued from previous page)

```
          "type": "object",
          "additionalProperties": false,
          "description": "The executor section is used for declaring your executors that␣
↪are responsible for running jobs. The executor section can be ``local``, ``lsf``,␣
↪``slurm``, ``cobalt``. The executors are referenced in buildspec using ``executor``␣
↪field.",
          "properties": {
            "defaults": {
              "type": "object",
              "description": "Specify default executor settings for all executors",
              "additionalProperties": false,
              "properties": {
                "pollinterval": {
                  "type": "integer",
                  "description": "Specify poll interval in seconds after job submission,␣
↪where buildtest will sleep and poll all jobs for job states. This field can be␣
↪configured based on your preference. Excessive polling every few seconds can result in␣
↪system degradation. ",
                  "minimum": 10,
                  "maximum": 300,
                  "default": 30
                },
                "launcher": {
                  "type": "string",
                  "enum": [
                    "sbatch",
                    "bsub",
                    "qsub"
                  ],
                  "description": "Specify batch launcher to use when submitting jobs,␣
↪this is applicable for LSF and Slurm Executors."
                },
                "max_pend_time": {
                  "$ref": "#/definitions/max_pend_time"
                },
                "account": {
                  "$ref": "#/definitions/account"
                }
              }
            },
            "local": {
              "type": "object",
              "description": "The ``local`` section is used for declaring local␣
↪executors for running jobs on local machine",
              "patternProperties": {
                "^.*$": {
                  "$ref": "#/definitions/local"
                }
              }
            },
            "lsf": {
              "type": "object",
```

(continues on next page)

(continued from previous page)

```
              "description": "The ``lsf`` section is used for declaring LSF executors␣
↪for running jobs using LSF scheduler",
              "patternProperties": {
                "^.*$": {
                  "$ref": "#/definitions/lsf"
                }
              }
            },
            "slurm": {
              "type": "object",
              "description": "The ``slurm`` section is used for declaring Slurm␣
↪executors for running jobs using Slurm scheduler",
              "patternProperties": {
                "^.*$": {
                  "$ref": "#/definitions/slurm"
                }
              }
            },
            "cobalt": {
              "type": "object",
              "description": "The ``cobalt`` section is used for declaring Cobalt␣
↪executors for running jobs using Cobalt scheduler",
              "patternProperties": {
                "^.*$": {
                  "$ref": "#/definitions/cobalt"
                }
              }
            },
            "pbs": {
              "type": "object",
              "description": "The ``pbs`` section is used for declaring PBS executors␣
↪for running jobs using PBS scheduler",
              "patternProperties": {
                "^.*$": {
                  "$ref": "#/definitions/pbs"
                }
              }
            }
          }
        },
        "cdash": {
          "type": "object",
          "description": "Specify CDASH configuration used to upload tests via
↪'buildtest cdash' command",
          "required": [
            "url",
            "project",
            "site"
          ],
          "properties": {
            "url": {
              "type": "string",
```

(continues on next page)

(continued from previous page)

```
              "description": "Url to CDASH server"
            },
            "project": {
              "type": "string",
              "description": "Name of CDASH project"
            },
            "site": {
              "type": "string",
              "description": "Site Name reported in CDASH"
            }
          }
        }
      }
    },
    "cc": {
      "description": "Specify path to C compiler wrapper. You may specify a compiler␣
↪wrapper such as ``gcc`` assuming its in $PATH or you can use ``modules`` property to␣
↪resolve path to compiler wrapper.",
      "type": "string"
    },
    "cxx": {
      "type": "string",
      "description": "Specify path to C++ compiler wrapper. You may specify a compiler␣
↪wrapper such as ``g++`` assuming its in $PATH or you can use ``modules`` property to␣
↪resolve path to compiler wrapper."
    },
    "fc": {
      "type": "string",
      "description": "Specify path to Fortran compiler wrapper. You may specify a␣
↪compiler wrapper such as ``gfortran`` assuming its in $PATH or you can use ``modules``␣
↪property to resolve path to compiler wrapper."
    },
    "compiler_section": {
      "description": "A compiler section is composed of ``cc``, ``cxx`` and ``fc``␣
↪wrapper these are required when you need to specify compiler wrapper.",
      "type": "object",
      "additionalProperties": false,
      "required": [
        "cc",
        "cxx",
        "fc"
      ],
      "properties": {
        "cc": {
          "$ref": "#/definitions/cc"
        },
        "cxx": {
          "$ref": "#/definitions/cxx"
        },
        "fc": {
          "$ref": "#/definitions/fc"
        },
```

(continues on next page)

(continued from previous page)

```
        "module": {
          "$ref": "#/definitions/module"
        }
      }
    },
    "unique_string_array": {
      "type": "array",
      "uniqueItems": true,
      "items": {
        "type": "string"
      }
    },
    "module": {
      "type": "object",
      "additionalProperties": false,
      "properties": {
        "purge": {
          "type": "boolean",
          "description": "Run ``module purge`` if purge is set"
        },
        "load": {
          "$ref": "definitions.schema.json#/definitions/list_of_strings",
          "description": "Load one or more modules via ``module load``"
        },
        "swap": {
          "description": "Swap modules using ``module swap``. The swap property expects␣
↪2 unique modules.",
          "type": "array",
          "uniqueItems": true,
          "minItems": 2,
          "maxItems": 2,
          "items": {
            "type": "string"
          }
        }
      }
    },
    "script": {
      "type": "array",
      "additionalProperties": false,
      "items": {
        "type": "string"
      }
    },
    "max_pend_time": {
      "type": "integer",
      "description": "Cancel job if it is still pending in queue beyond max_pend_time",
      "minimum": 10,
      "default": 90
    },
    "account": {
      "type": "string",
```

(continues on next page)

(continued from previous page)

```
      "description": "Specify Job Account for charging resources"
    },
    "local": {
      "type": "object",
      "description": "An instance object of local executor",
      "additionalProperties": false,
      "required": [
        "shell"
      ],
      "properties": {
        "description": {
          "type": "string",
          "description": "description field for documenting your executor"
        },
        "shell": {
          "type": "string",
          "description": "Specify the shell launcher you want to use when running tests␣
↪locally",
          "pattern": "^(/bin/bash|/bin/sh|/bin/csh|/bin/tcsh|/bin/
↪zsh|sh|bash|csh|tcsh|zsh|python).*"
        },
        "before_script": {
          "#ref": "#/definitions/script"
        }
      }
    },
    "slurm": {
      "type": "object",
      "additionalProperties": false,
      "description": "An instance object of slurm executor",
      "properties": {
        "description": {
          "type": "string",
          "description": "description field for documenting your executor"
        },
        "launcher": {
          "type": "string",
          "enum": [
            "sbatch"
          ],
          "description": "Specify the slurm batch scheduler to use. This overrides the␣
↪default ``launcher`` field. This must be ``sbatch``. "
        },
        "options": {
          "type": "array",
          "items": {
            "type": "string"
          },
          "description": "Specify any other options for ``sbatch`` used by this executor␣
↪for running all jobs."
        },
        "cluster": {
```

(continues on next page)

(continued from previous page)

```
          "type": "string",
          "description": "Specify the slurm cluster you want to use ``-M <cluster>``"
        },
        "partition": {
          "type": "string",
          "description": "Specify the slurm partition you want to use ``-p <partition>``"
        },
        "qos": {
          "type": "string",
          "description": "Specify the slurm qos you want to use ``-q <qos>``"
        },
        "before_script": {
          "description": "The ``before_script`` section can be used to specify commands␣
↪before start of test. The script will be sourced in active shell.",
          "#ref": "#/definitions/script"
        },
        "after_script": {
          "description": "The ``after_script`` section can be used to specify commands␣
↪at end of test. The script will be sourced in active shell.",
          "#ref": "#/definitions/script"
        },
        "max_pend_time": {
          "description": "overrides default ``max_pend_time`` value",
          "$ref": "#/definitions/max_pend_time"
        },
        "account": {
          "description": "overrides default ``account`` value",
          "$ref": "#/definitions/account"
        }
      }
    },
    "lsf": {
      "type": "object",
      "description": "An instance object of lsf executor",
      "additionalProperties": false,
      "required": [
        "queue"
      ],
      "properties": {
        "description": {
          "type": "string",
          "description": "description field for documenting your executor"
        },
        "launcher": {
          "type": "string",
          "enum": [
            "bsub"
          ],
          "description": "Specify the lsf batch scheduler to use. This overrides the␣
↪default ``launcher`` field. It must be ``bsub``. "
        },
        "options": {
```

(continues on next page)

(continued from previous page)

```
          "type": "array",
          "items": {
            "type": "string"
          },
          "description": "Specify any options for ``bsub`` for this executor when␣
↪running all jobs associated to this executor"
        },
        "queue": {
          "type": "string",
          "description": "Specify the lsf queue you want to use ``-q <queue>``"
        },
        "before_script": {
          "description": "The ``before_script`` section can be used to specify commands␣
↪before start of test. The script will be sourced in active shell.",
          "#ref": "#/definitions/script"
        },
        "after_script": {
          "description": "The ``after_script`` section can be used to specify commands␣
↪at end of test. The script will be sourced in active shell.",
          "#ref": "#/definitions/script"
        },
        "max_pend_time": {
          "description": "overrides default ``max_pend_time`` value",
          "$ref": "#/definitions/max_pend_time"
        },
        "account": {
          "description": "overrides default ``account`` value",
          "$ref": "#/definitions/account"
        }
      }
    },
    "cobalt": {
      "type": "object",
      "description": "An instance object of cobalt executor",
      "additionalProperties": false,
      "required": [
        "queue"
      ],
      "properties": {
        "description": {
          "type": "string",
          "description": "description field for documenting your executor"
        },
        "launcher": {
          "type": "string",
          "enum": [
            "qsub"
          ],
          "description": "Specify the cobalt batch scheduler to use. This overrides the␣
↪default ``launcher`` field. It must be ``qsub``. "
        },
        "options": {
```

(continues on next page)

(continued from previous page)

```
          "type": "array",
          "items": {
            "type": "string"
          },
          "description": "Specify any options for ``qsub`` for this executor when␣
↪running all jobs associated to this executor"
        },
        "queue": {
          "type": "string",
          "description": "Specify the lsf queue you want to use ``-q <queue>``"
        },
        "before_script": {
          "description": "The ``before_script`` section can be used to specify commands␣
↪before start of test. The script will be sourced in active shell.",
          "#ref": "#/definitions/script"
        },
        "after_script": {
          "description": "The ``after_script`` section can be used to specify commands␣
↪at end of test. The script will be sourced in active shell.",
          "#ref": "#/definitions/script"
        },
        "max_pend_time": {
          "description": "overrides default ``max_pend_time`` value",
          "$ref": "#/definitions/max_pend_time"
        },
        "account": {
          "description": "overrides default ``account`` value",
          "$ref": "#/definitions/account"
        }
      }
    },
    "pbs": {
      "type": "object",
      "description": "An instance object of cobalt executor",
      "additionalProperties": false,
      "required": [
        "queue"
      ],
      "properties": {
        "description": {
          "type": "string",
          "description": "description field for documenting your executor"
        },
        "launcher": {
          "type": "string",
          "enum": [
            "qsub"
          ],
          "description": "Specify the pbs batch scheduler to use. This overrides the␣
↪default ``launcher`` field. It must be ``qsub``. "
        },
        "options": {
```

(continues on next page)

(continued from previous page)

```
          "type": "array",
          "items": {
            "type": "string"
          },
          "description": "Specify any options for ``qsub`` for this executor when␣
↪running all jobs associated to this executor"
        },
        "queue": {
          "type": "string",
          "description": "Specify the lsf queue you want to use ``-q <queue>``"
        },
        "before_script": {
          "description": "The ``before_script`` section can be used to specify commands␣
↪before start of test. The script will be sourced in active shell.",
          "#ref": "#/definitions/script"
        },
        "after_script": {
          "description": "The ``after_script`` section can be used to specify commands␣
↪at end of test. The script will be sourced in active shell.",
          "#ref": "#/definitions/script"
        },
        "max_pend_time": {
          "description": "overrides default ``max_pend_time`` value",
          "$ref": "#/definitions/max_pend_time"
        },
        "account": {
          "description": "overrides default ``account`` value",
          "$ref": "#/definitions/account"
        }
      }
    }
  }
}
```

Schema Examples

```
$ buildtest schema -n settings.schema.json --example
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/settings.schema.json/valid/slurm-example.yml
--------------------------------------------------------------------------------
system:
  generic:
    hostnames: ['.*']

    moduletool: lmod
    load_default_buildspecs: True
    buildspec_roots:
      - $HOME/buildtest-cori
    testdir: /tmp/buildtest
    executors:
```

(continues on next page)

(continued from previous page)

```
      defaults:
        pollinterval: 20
        launcher: sbatch
        max_pend_time: 30
        account: admin
      slurm:
        normal:
          options: ["-C haswell"]
          qos: normal
          before_script: |
            time
            echo "commands run before job"

    compilers:
      compiler:
        gcc:
          default:
            cc: /usr/bin/gcc
            cxx: /usr/bin/g++
            fc: /usr/bin/gfortran
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/settings.schema.json/valid/cobalt-example.yml
--------------------------------------------------------------------------------
system:
  generic:
    hostnames: ['.*']

    moduletool: lmod
    load_default_buildspecs: True
    executors:
      defaults:
         launcher: qsub
         max_pend_time: 30

      cobalt:
        knl:
          queue: knl

        haswell:
          queue: haswell

    compilers:
      compiler:
        gcc:
          default:
            cc: /usr/bin/gcc
            cxx: /usr/bin/g++
            fc: /usr/bin/gfortran
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/settings.schema.json/valid/pbs-example.yml
--------------------------------------------------------------------------------
system:
```

(continues on next page)

(continued from previous page)

```
  generic:
    hostnames: ['.*']

    moduletool: N/A
    load_default_buildspecs: True
    executors:
      defaults:
         pollinterval: 10
         launcher: qsub
         max_pend_time: 30
      pbs:
        workq:
          queue: workq
    compilers:
      compiler:
        gcc:
          default:
            cc: /usr/bin/gcc
            cxx: /usr/bin/g++
            fc: /usr/bin/gfortran
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/settings.schema.json/valid/lsf-example.yml
--------------------------------------------------------------------------------
system:
  generic:
    hostnames: ['.*']

    moduletool: lmod
    load_default_buildspecs: False
    executors:
      defaults:
        pollinterval: 10
        launcher: bsub
        max_pend_time: 45
      lsf:
        batch:
          description: "LSF Executor name 'batch' that submits jobs to 'batch' queue"
          queue: batch
          account: developer
          options: ["-W 20"]
          before_script: |
            time
            echo "commands run before job"
        test:
          description: "LSF Executor name 'test' that submits jobs to 'test' queue"
          launcher: bsub
          queue: test
          account: qa
          options: ["-W 20"]
    compilers:
      compiler:
        gcc:
```

(continues on next page)

(continued from previous page)

```
          default:
            cc: /usr/bin/gcc
            cxx: /usr/bin/g++
            fc: /usr/bin/gfortran
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/settings.schema.json/valid/local-executor.yml
________________________________________________________________________________
system:
  generic:
    hostnames: ['.*']

    logdir: $BUILDTEST_ROOT/logs
    testdir: $BUILDTEST_ROOT/tests

    moduletool: N/A
    load_default_buildspecs: False
    cdash:
      url: https://my.cdash.org
      project: buildtest
      site: laptop
    processor:
      numcpus: 8
      cores: 4
      threads_per_core: 2
      sockets: 1
      model: "Intel(R) Core(TM) i7-8569U CPU @ 2.80GHz"
    executors:
      local:
        bash:
          description: submit jobs on local machine using bash shell
          shell: bash
          before_script: |
            time
            echo "commands run before job"

        sh:
          description: submit jobs on local machine using sh shell
          shell: sh

        csh:
          description: submit jobs on local machine using csh shell
          shell: csh -x

        tcsh:
          description: submit jobs on local machine using tcsh shell
          shell: /bin/tcsh

        zsh:
          description: submit jobs on local machine using zsh shell
          shell: /bin/zsh

        python:
```

(continues on next page)

(continued from previous page)

```
    description: submit jobs on local machine using python shell
    shell: python

compilers:
  find:
    gcc: "^(gcc|GCC|PrgEnv-gnu)"
    intel: "^(intel|Intel|PrgEnv-intel)"
    cray: "^(cray|PrgEnv-cray)"
    clang: "^(clang|Clang)"
    cuda: "^(cuda|CUDA)"
    pgi: "^(pgi|PGI|PrgEnv-pgi)"

  compiler:
    gcc:
      default:
        cc: /usr/bin/gcc
        cxx: /usr/bin/g++
        fc: /usr/bin/gfortran
      gcc@7.2.0:
        cc: 'cc'
        cxx: 'cxx'
        fc: 'fc'
        module:
          load:
          - gcc/7.2.0
    intel:
      intel@2019:
        cc: 'icc'
        cxx: 'icpc'
        fc: 'ifort'
        module:
          purge: True
          load:
          - gcc/7.2.0
          - intel/2019
    cray:
      craype@2.6.2:
        cc: 'cc'
        cxx: 'CC'
        fc: 'fc'
        module:
          load: [craype/2.6.2]
          swap: [PrgEnv-gnu, PrgEnv-cray]

    clang:
      clang@12.0.0:
        cc: 'clang'
        cxx: 'clang++'
        fc: 'None'
        module:
          load: [clang/12.0]
    cuda:
```

(continues on next page)

(continued from previous page)

```
          cuda@11.0:
            cc: 'nvcc'
            cxx: 'nvcc'
            fc: 'None'
            module:
              load: [cuda/11.0]
        pgi:
          pgi@18.0:
            cc: 'pgcc'
            cxx: 'pgc++'
            fc: 'pgfortran'
            module:
              load: [pgi/18.0]

File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/settings.schema.json/valid/combined_executor.yml
________________________________________________________________________________
system:
  generic:
    hostnames: ['.*']

    moduletool: N/A
    load_default_buildspecs: True
    executors:
      local:
        bash:
          description: submit jobs on local machine
          shell: bash -v

      slurm:
        haswell:
          launcher: sbatch
          options:
            - "-p haswell"
            - "-t 00:10"

      lsf:
        batch:
          launcher: bsub
          queue: batch
          options:
            - "-q batch"
            - "-t 00:10"
      cobalt:
        normal:
          launcher: qsub
          queue: normal
          options:
            - "-n 1"
            - "-t 10"

    compilers:
```

(continues on next page)

(continued from previous page)

```
    compiler:
      gcc:
        default:
          cc: /usr/bin/gcc
          cxx: /usr/bin/g++
          fc: /usr/bin/gfortran
```

Global Schema

This schema is used for validating buildspec file and validates outer level structure of test. This is referred as *Global Schema*

Schema Content

```
$ buildtest schema -n global.schema.json --json
{
  "$id": "global.schema.json",
  "$schema": "http://json-schema.org/draft-07/schema#",
  "title": "global schema",
  "description": "buildtest global schema is validated for all buildspecs. The global␣
↪schema defines top-level structure of buildspec and defintions that are inherited for␣
↪sub-schemas",
  "type": "object",
  "required": [
    "version",
    "buildspecs"
  ],
  "additionalProperties": false,
  "properties": {
    "version": {
      "type": "string",
      "description": "The semver version of the schema to use (x.x)."
    },
    "maintainers": {
      "type": "array",
      "description": "One or more maintainers or aliases",
      "uniqueItems": true,
      "minItems": 1,
      "items": {
        "type": "string"
      }
    },
    "buildspecs": {
      "type": "object",
      "description": "This section is used to define one or more tests (buildspecs).␣
↪Each test must be unique name",
      "propertyNames": {
        "pattern": "^[A-Za-z_.][A-Za-z0-9_.]*$",
        "maxLength": 32
```

(continues on next page)

(continued from previous page)

```
      }
    }
  }
}
```

Schema Examples

```
$ buildtest schema -n global.schema.json --example
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/global.schema.json/valid/examples.yml
--------------------------------------------------------------------------------
version: "1.0"

buildspecs:
  # testing all caps
  ABCDEFGHIJKLMNOPQRSTUVWXYZ:
    type: script
    run: "hostname"

  # testing all lowercase letters
  abcdefghijklmnopqrstuvwxyz:
    type: script
    run: "hostname"

  # testing '_' in beginning followed by all numbers
  _0123456789:
    type: script
    run: "hostname"

  # testing '_' in combination with caps, lowercase and numbers
  _ABCDEFabcdef0123456789:
    type: script
    run: "hostname"

  # testing '_' at end of word
  abcdefghijklmnopqrstuvwxyz_:
    type: script
    run: "hostname"

  # testing '.' in beginning of word
  .helloworld:
    type: script
    run: hostname

  # testing '.' in middle of word
  hello.world:
    type: script
    run: hostname

  # testing '.' at end of word
```

(continues on next page)

(continued from previous page)

```
  helloworld.:
    type: script
    run: hostname

File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/global.schema.json/invalid/missing-version.yml
--------------------------------------------------------------------------------
buildspecs:
  # Shell would be accepted to indicate a single line shell command (or similar)
  login_node_check:
    type: script
    run: "ping login 1"
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/global.schema.json/invalid/exceed_testname_length.yml
--------------------------------------------------------------------------------
# this test fails because it exceeds 32 character length for test name
version: "1.0"
buildspecs:
  this_test_exceeds_32_character_length:
    type: script
    run: hostname
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/global.schema.json/invalid/unique_maintainers.yml
--------------------------------------------------------------------------------
version: "1.0"
maintainers: [shahzebsiddiqui, shahzebsiddiqui]
buildspecs:
  hostname:
    type: script
    run: "hostname"
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/global.schema.json/invalid/maintainers_type_mismatch.yml
--------------------------------------------------------------------------------
version: "1.0"
# wrong type for maintainers key, expects a string
maintainers: 1
buildspecs:
  hostname:
    type: script
    run: "hostname"
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/global.schema.json/invalid/invalid_pattern.yml
--------------------------------------------------------------------------------
version: "1.0"
buildspecs:
  # invalid pattern for test. Must be matching regex "^[A-Za-z_.][A-Za-z0-9_]*$" when␣
↪declaring a dict
  (badname:
    type: script
    run: "ping login 1"
```

Script Schema

This is the script schema used for writing scripts (bash, csh, sh, zsh, tcsh, python) and this is used for validating test instance when `type: script` is specified. For more details on script schema see *Script Schema*.

Schema Content

```
$ buildtest schema -n script-v1.0.schema.json --json
{
  "$id": "script-v1.0.schema.json",
  "$schema": "http://json-schema.org/draft-07/schema#",
  "title": "script schema version 1.0",
  "description": "The script schema is of ``type: script`` in sub-schema which is used␣
↪for running shell scripts",
  "type": "object",
  "required": [
    "type",
    "run",
    "executor"
  ],
  "additionalProperties": false,
  "properties": {
    "type": {
      "type": "string",
      "pattern": "^script$",
      "description": "Select schema type to use when validating buildspec. This must be␣
↪of set to 'script'"
    },
    "description": {
      "$ref": "definitions.schema.json#/definitions/description"
    },
    "batch": {
      "$ref": "definitions.schema.json#/definitions/batch"
    },
    "sbatch": {
      "$ref": "definitions.schema.json#/definitions/sbatch"
    },
    "bsub": {
      "$ref": "definitions.schema.json#/definitions/bsub"
    },
    "cobalt": {
      "$ref": "definitions.schema.json#/definitions/cobalt"
    },
    "pbs": {
      "$ref": "definitions.schema.json#/definitions/pbs"
    },
    "BB": {
      "$ref": "definitions.schema.json#/definitions/BB"
    },
    "DW": {
      "$ref": "definitions.schema.json#/definitions/DW"
    },
```

(continues on next page)

(continued from previous page)

```
    "env": {
      "$ref": "definitions.schema.json#/definitions/env"
    },
    "vars": {
      "$ref": "definitions.schema.json#/definitions/env"
    },
    "executor": {
      "$ref": "definitions.schema.json#/definitions/executor"
    },
    "run_only": {
      "$ref": "definitions.schema.json#/definitions/run_only"
    },
    "shell": {
      "type": "string",
      "description": "Specify a shell launcher to use when running jobs. This sets the␣
↪shebang line in your test script. The ``shell`` key can be used with ``run`` section␣
↪to describe content of script and how its executed",
      "pattern": "^(/bin/bash|/bin/sh|/bin/csh|/bin/tcsh|/bin/
↪zsh|bash|sh|csh|tcsh|zsh|python).*"
    },
    "shebang": {
      "type": "string",
      "description": "Specify a custom shebang line. If not specified buildtest will␣
↪automatically add it in the test script."
    },
    "run": {
      "type": "string",
      "description": "A script to run using the default shell."
    },
    "status": {
      "$ref": "definitions.schema.json#/definitions/status"
    },
    "skip": {
      "$ref": "definitions.schema.json#/definitions/skip"
    },
    "tags": {
      "$ref": "definitions.schema.json#/definitions/tags"
    },
    "metrics": {
      "$ref": "definitions.schema.json#/definitions/metrics"
    },
    "executors": {
      "$ref": "definitions.schema.json#/definitions/executors"
    }
  }
}
```

Schema Examples

```
$ buildtest schema -n script-v1.0.schema.json --example
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/script-v1.0.schema.json/valid/examples.yml
--------------------------------------------------------------------------------
version: "1.0"
buildspecs:
  multiline_run:
    executor: generic.local.bash
    type: script
    description: multiline run command
    run: |
      echo "1"
      echo "2"

  single_command_run:
    executor: generic.local.bash
    type: script
    description: single command as a string for run command
    run: "hostname"

  declare_env:
    executor: generic.local.bash
    type: script
    description: declaring environment variables
    env:
      FOO: BAR
      X: 1
    run: |
      echo $FOO
      echo $X

  declare_vars:
    executor: generic.local.bash
    type: script
    description: declaring variables
    vars:
      First: Bob
      Last:  Bill
    run: |
      echo "First:" $First
      echo "Last:" $Last


  declare_shell_sh:
    executor: generic.local.sh
    type: script
    description: declare shell name to sh
    shell: sh
    run: hostname
```

(continues on next page)

(continued from previous page)

```
declare_shell_bash:
  executor: generic.local.bash
  type: script
  description: declare shell name to bash
  shell: bash
  run: hostname

declare_shell_python:
  executor: generic.local.python
  type: script
  description: declare shell name to python
  shell: python
  run: |
    print("Hello World")

declare_shell_bin_bash:
  executor: generic.local.bash
  type: script
  description: declare shell name to /bin/bash
  shell: "/bin/bash -e"
  run: hostname

declare_shell_name_bin_sh:
  executor: generic.local.sh
  type: script
  description: declare shell name to /bin/sh
  shell: "/bin/sh -e"
  run: hostname

declare_shell_opts:
  executor: generic.local.sh
  type: script
  description: declare shell name to sh
  shell: "sh -e"
  run: hostname

declare_shell_bin_zsh:
  executor: generic.local.zsh
  type: script
  description: declare shell zsh
  shell: "zsh"
  run: hostname

declare_shell_zsh:
  executor: generic.local.zsh
  type: script
  description: declare shell /bin/zsh
  shell: "zsh"
  run: hostname

declare_shell_bin_csh:
  executor: generic.local.csh
```

(continues on next page)

(continued from previous page)

```
  type: script
  description: declare shell /bin/csh
  shell: "/bin/csh"
  run: hostname

declare_shell_csh:
  executor: generic.local.csh
  type: script
  description: declare shell /bin/tcsh
  shell: "csh"
  run: hostname

declare_shell_bin_tcsh:
  executor: generic.local.csh
  type: script
  description: declare shell /bin/tcsh
  shell: "/bin/tcsh"
  run: hostname


declare_shell_tcsh:
  executor: generic.local.csh
  type: script
  description: declare shell tcsh
  shell: "tcsh"
  run: hostname

declare_shebang:
  executor: generic.local.bash
  type: script
  description: declare shell name to sh
  shebang: "#!/usr/bin/env bash"
  run: hostname

status_returncode_list:
  executor: generic.local.bash
  type: script
  description: The returncode can be a list of integers
  run: exit 0
  status:
    returncode: [0]

status_returncode_int:
  executor: generic.local.bash
  type: script
  description: The returncode can be an integer to match with single returncode
  run: exit 0
  status:
    returncode: 0

status_regex:
  executor: generic.local.bash
```

(continues on next page)

(continued from previous page)

```
    type: script
    description: This test pass with a regular expression status check
    run: hostname
    status:
      regex:
        stream: stdout
        exp: "^$"

  status_regex_returncode:
    executor: generic.local.bash
    type: script
    description: This test fails because returncode and regex specified
    run: hostname
    status:
      returncode: [0]
      regex:
        stream: stdout
        exp: "^hello"


  status_runtime_min_max:
    type: script
    executor: generic.local.sh
    description: "Run a sleep job for 2 seconds and test pass if its within 1.0-4.0sec"
    tags: ["tutorials"]
    run: sleep 2
    status:
      runtime:
        min: 1.0
        max: 4.0

  status_runtime_min:
    type: script
    executor: generic.local.sh
    description: "Run a sleep job for 2 seconds and test pass if exceeds mintime of 1.
↪0sec"
    tags: ["tutorials"]
    run: sleep 2
    status:
      runtime:
        min: 1.0

  status_runtime_max:
    type: script
    executor: generic.local.sh
    description: "Run a sleep job for 2 seconds and test pass if less than maxtime of 4.
↪0sec"
    tags: ["tutorials"]
    run: sleep 2
    status:
      runtime:
        max: 4.0
```

(continues on next page)

(continued from previous page)

```
sbatch_example:
  type: script
  executor: generic.local.bash
  description: This test runs hostname using sbatch directives
  sbatch:
    - "-t 10:00:00"
    - "-p normal"
    - "-N 1"
    - "-n 8"
  run: hostname

bsub_example:
  type: script
  executor: generic.local.bash
  description: This test runs hostname using bsub directives
  bsub:
    - "-W 00:30"
    - "-N 1"
  run: hostname

cobalt_example:
  type: script
  executor: generic.local.bash
  description: This test runs hostname using cobalt directives
  cobalt:
    - "-t 30"
    - "-n 1"
  run: hostname

skip_example:
  type: script
  executor: generic.local.bash
  description: this test is skip
  skip: true
  run: hostname

tag_str_example:
  type: script
  executor: generic.local.bash
  description: tags can be defined as string
  tags: network
  run: hostname

tag_list_example:
  type: script
  executor: generic.local.bash
  description: This is a tag example using list
  sbatch:
    - "-t 10:00:00"
    - "-p normal"
    - "-N 1"
```

(continues on next page)

(continued from previous page)

```
    - "-n 8"
  tags: ["slurm"]
  run: hostname

run_only_example:
  type: script
  executor: generic.local.bash
  description: run_only example that runs with user1 on Linux system (rhel, centos)␣
↪with LSF
  run_only:
    user: user1
    scheduler: lsf
    platform: Linux
    linux_distro:
      - rhel
      - centos
  run: |
    uname -av
    lsinfo

metrics_regex_example:
  type: script
  executor: generic.local.bash
  description: metrics regular expression example
  run: echo "HPCG result is VALID with a GFLOP/s rating of=63.6515"
  metrics:
    hpcg_rating:
      regex:
        exp: 'rating of=(\d+\.\d+)$'
        stream: stdout

metric_variable_assignment:
  executor: generic.local.sh
  type: script
  description: capture result metric based on variables and environment variable
  vars:
    GFLOPS: "63.6515"
  env:
    FOO: BAR
  run: |
    echo $GFLOPS
    echo $FOO
  tags: tutorials
  metrics:
    gflops:
      vars: "GFLOPS"
    foo:
      env: "FOO"

multi_executor_vars:
  type: script
  executor: 'generic.local.(sh|bash)'
```

(continues on next page)

(continued from previous page)

```
  description: single test multiple executor with variable declaration
  run: |
    echo $X
    echo $Y
  executors:
    generic.local.sh:
      vars:
        X: 1
        Y: 2
    generic.local.bash:
      vars:
        X: 10
        Y: 11

multi_executor_environment:
  type: script
  executor: 'generic.local.(sh|bash)'
  description: single test multiple executor with environment declaration
  run: echo $SHELL
  executors:
    generic.local.sh:
      env:
        SHELL: sh
    generic.local.bash:
      env:
        SHELL: bash

executors_sbatch_declaration:
  type: script
  executor: 'generic.local.(bash|sh)'
  description: Declaring sbatch by executors section
  tags: [tutorials]
  run: hostname
  sbatch: ["-N 4"]
  executors:
    generic.local.bash:
      sbatch: ["-n 4", "-N 1", "-t 30"]
    generic.local.sh:
      sbatch: ["-n 8", "-N 1", "-t 60"]

executors_bsub_declaration:
  type: script
  executor: 'generic.local.(bash|sh)'
  description: Declaring bsub  by executors section
  tags: [tutorials]
  run: hostname
  executors:
    generic.local.bash:
      bsub: ["-n 4", "-W 30"]
    generic.local.sh:
      bsub: ["-n 8", "-W 60"]
```

(continues on next page)

(continued from previous page)

```
  executors_pbs_declaration:
    type: script
    executor: 'generic.local.(bash|sh)'
    description: Declaring pbs by executors section
    tags: [tutorials]
    run: hostname
    executors:
      generic.local.bash:
        pbs: ["-l ncpus=4", "-l walltime=30"]
      generic.local.sh:
        pbs: ["-l ncpus=8", "-l walltime=60"]

  executors_status_declaration:
    type: script
    executor: 'generic.local.(bash|sh)'
    description: Declaring status by executors section
    tags: [tutorials]
    run: exit 0
    executors:
      generic.local.bash:
        status:
          returncode: 0
      generic.local.sh:
        status:
          returncode: [1, 2]

  executors_metrics_declaration:
    type: script
    executor: 'generic.local.(bash|sh)'
    description: Declaring metrics by executors section
    tags: [tutorials]
    run: echo "Hello World"
    executors:
      generic.local.bash:
        metrics:
          hello:
            regex:
              stream: stdout
              exp: "(Hello)"
      generic.local.sh:
        metrics:
          world:
            regex:
              stream: stdout
              exp: "(World)"
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/script-v1.0.schema.json/invalid/examples.yml
--------------------------------------------------------------------------------
version: "1.0"
buildspecs:
  invalid_test_name_&!@#$%:
    type: script
```

(continues on next page)

(continued from previous page)

```
  executor: generic.local.bash
  description: "invalid test name"

invalid_bash:
  type: script
  executor: generic.local.bash
  shell: "bash-missing-run"

missing_run_key:
  type: script
  executor: generic.local.bash
  description: invalid key name roon, missing run key
  roon: |
      systemctl is-active slurmd
      systemctl is-enabled slurmd | grep enabled

invalid_env_type:
  type: script
  executor: generic.local.bash
  description: env key should be a dictionary
  env:
    - FOO=BAR
  run: echo $FOO

invalid_vars_type:
  type: script
  executor: generic.local.bash
  description: var key should be a dictionary
  vars:
    - FOO=BAR
  run: echo $FOO


invalid_description:
  type: script
  executor: generic.local.bash
  description:
    - "Multi Line description"
    - "is not accepted"

invalid_regex_stream:
  type: script
  executor: generic.local.bash
  description: This test fails because of invalid regex stream
  run: hostname
  status:
    regex:
      stream: file
      exp: "world$"


regex_additionalProperties_test:
```

(continues on next page)

(continued from previous page)

```
  type: script
  executor: generic.local.bash
  description: Testing for additional properties in regex field
  run: hostname
  status:
    regex:
      stream: stdout
      exp: "world$"
      X: 1

missing_regex_exp:
  type: script
  executor: generic.local.bash
  description: This test fails because of missing key 'exp' in regex
  run: hostname
  status:
    regex:
      stream: stdout

invalid_returncode_type:
  type: script
  executor: generic.local.bash
  description: This test fails because of invalid return code type
  run: hostname
  status:
    returncode: ["1"]

empty_returncode_list:
  type: script
  executor: generic.local.bash
  description: An empty returncode list will cause an error
  run: hostname
  status:
    returncode: []

non_int_returncodes:
  type: script
  executor: generic.local.bash
  description: The returncode must be an int and not a number
  run: exit 1
  status:
    returncode:  1.01

non_int_returncodes_list:
  type: script
  executor: generic.local.bash
  description: The returncode must be a list of integers and no numbers
  run: exit 1
  status:
    returncode:  [1, 2.230]

invalid_shell_usr_bin_bash:
```

(continues on next page)

(continued from previous page)

```
  type: script
  executor: generic.local.bash
  description: invalid shell name '/usr/bin/bash'
  shell: /usr/bin/bash
  run: hostname

invalid_shell_type:
  type: script
  executor: generic.local.bash
  description: invalid shell type must be a string
  shell: ["/bin/bash"]
  run: hostname

invalid_type_shell_shebang:
  type: script
  executor: generic.local.bash
  description: invalid type for shell shebang, must be a string
  shebang: ["#!/bin/bash"]
  run: hostname

invalid_skip_value:
  type: script
  executor: generic.local.bash
  description: invalid value for skip, must be boolean
  skip: 1
  run: hostname

empty_tags:
  type: script
  executor: generic.local.bash
  description: tag list can't be empty, requires one item.
  tags: []
  run: hostname

non_unique_tags:
  type: script
  executor: local.bash
  description: tag names must be unique
  tags: ["network", "network"]
  run: hostname

invalid_tags_value:
  type: script
  executor: generic.local.bash
  description: invalid tag value must be all string items
  tags: ["network", 400 ]
  run: hostname

additionalProperties_test:
  type: script
  executor: generic.local.bash
  description: additional properties are not allowed so any invalid key/value pair␣
↪will result in error
```

(continues on next page)

(continued from previous page)

```
    FOO: BAR
    run: hostname

  additionalProperties_status:
    type: script
    executor: generic.local.bash
    description: test additional properties in status object. This is not allowed
    sbatch: [ "-n 2", "-q normal", "-t 10"]
    run: hostname
    status:
      slurm_job_state: "COMPLETED"
      FOO: BAR

  invalid_runtime_min:
    type: script
    executor: generic.local.sh
    description: "Invalid type for min property in runtime. Must be an integer or float␣
↪not a string"
    run: sleep 2
    status:
      runtime:
        min: "1"

  runtime_min_must_exceed_0:
    type: script
    executor: generic.local.sh
    description: "The runtime must exceed 0"
    run: sleep 2
    status:
      runtime:
        min: -1

  invalid_slurm_job_state:
    type: script
    executor: generic.local.sh
    description: invalid value for slurm_job_state, should raise error with enum values.
    sbatch:
      - "-n 2"
      - "-q normal"
      - "-t 10"
    run: hostname
    status:
      slurm_job_state: "FINISH"

  duplicate_linux_distro:
    type: script
    executor: generic.local.bash
    description: Duplicate items in linux_distro is not allowed
    run_only:
      linux_distro:
        - rhel
        - rhel
```

(continues on next page)

(continued from previous page)

```
    run: uname -av

  empty_list_linux_distro:
    type: script
    executor: generic.local.bash
    description: Empty List in linux_distro is not allowed. Requires atleast 1 item
    run_only:
      linux_distro: []
    run: uname -av

  additionalProperties_run_only:
    type: script
    executor: generic.local.bash
    description: additional Properties not allowed in run_only field. Invalid field␣
↪python
    run_only:
      user: root
      python: 3.5
    run: hostname

  invalid_metrics_additional_property:
    type: script
    executor: generic.local.bash
    description: Test for additional property for metrics property
    vars:
      FOO: BAR
    run: echo $FOO
    metrics:
      foo:
        variable: FOO

  invalid_metrics_type:
    type: script
    executor: generic.local.bash
    description: metrics property is an object, testing for type
    vars:
      FOO: BAR
    run: echo $FOO
    metrics: FOO

  executors_invalid_var_type:
    type: script
    executor: "generic.local.(bash|sh|zsh)"
    description: Invalid type field for 'vars'
    tags: [tutorials]
    run: echo $FOO
    executors:
      generic.local.bash:
        vars: ["FOO=BAR"]

  executors_additionalProperties:
    type: script
```

(continues on next page)

(continued from previous page)

```
    executor: "generic.local.(bash|sh|zsh)"
    description: Testing for additional properties in 'executors'
    tags: [tutorials]
    run: hostname
    sbatch: ["-N 4"]
    executors:
      generic.local.bash:
        sbatch: ["-n 4", "-N 1", "-t 30"]
        FOO: BAR
      generic.local.sh:
        sbatch: ["-n 8", "-N 1", "-t 60"]
      generic.local.zsh:
        sbatch: ["-n 16", "-N 2", "-t 120"]
```

Compiler Schema

This is the compiler schema used for validating buildspecs that define test using `type: compiler`. This schema is used for compiling a single source code. For more details see *Compiler Schema*

Schema Content

```
$ buildtest schema -n compiler-v1.0.schema.json --json
{
  "$id": "compiler-v1.0.schema.json",
  "$schema": "http://json-schema.org/draft-07/schema#",
  "title": "compiler schema version 1.0",
  "description": "The compiler schema is of ``type: compiler`` in sub-schema which is␣
↪used for compiling and running programs",
  "type": "object",
  "required": [
    "type",
    "source",
    "compilers",
    "executor"
  ],
  "definitions": {
    "cc": {
      "type": "string",
      "description": "Set C compiler wrapper"
    },
    "fc": {
      "type": "string",
      "description": "Set Fortran compiler wrapper"
    },
    "cxx": {
      "type": "string",
      "description": "Set C++ compiler wrapper"
    },
    "cflags": {
```

(continues on next page)

(continued from previous page)

```
      "type": "string",
      "description": "Set C compiler flags."
    },
    "fflags": {
      "type": "string",
      "description": "Set Fortran compiler flags."
    },
    "cxxflags": {
      "type": "string",
      "description": "Set C++ compiler flags."
    },
    "ldflags": {
      "type": "string",
      "description": "Set linker flags"
    },
    "cppflags": {
      "type": "string",
      "description": "Set C or C++ preprocessor flags"
    },
    "pre_build": {
      "type": "string",
      "description": "Run commands before building program"
    },
    "post_build": {
      "type": "string",
      "description": "Run commands after building program"
    },
    "pre_run": {
      "type": "string",
      "description": "Run commands before running program"
    },
    "post_run": {
      "type": "string",
      "description": "Run commands after running program"
    },
    "run": {
      "type": "string",
      "description": "Run command for launching compiled binary"
    },
    "default_compiler_all": {
      "type": "object",
      "description": "Specify compiler configuration for all compiler groups. Use the␣
↪``all`` property if configuration is shared across compiler groups. This property can␣
↪be overridden in compiler group or named compiler in ``config`` section.",
      "additionalProperties": false,
      "properties": {
        "sbatch": {
          "$ref": "definitions.schema.json#/definitions/sbatch"
        },
        "bsub": {
          "$ref": "definitions.schema.json#/definitions/bsub"
        },
```

(continues on next page)

(continued from previous page)

```
        "cobalt": {
          "$ref": "definitions.schema.json#/definitions/cobalt"
        },
        "pbs": {
          "$ref": "definitions.schema.json#/definitions/pbs"
        },
        "batch": {
          "$ref": "definitions.schema.json#/definitions/batch"
        },
        "BB": {
          "$ref": "definitions.schema.json#/definitions/BB"
        },
        "DW": {
          "$ref": "definitions.schema.json#/definitions/DW"
        },
        "env": {
          "$ref": "definitions.schema.json#/definitions/env"
        },
        "vars": {
          "$ref": "definitions.schema.json#/definitions/env"
        },
        "status": {
          "$ref": "definitions.schema.json#/definitions/status"
        },
        "pre_build": {
          "$ref": "#definitions/pre_build"
        },
        "post_build": {
          "$ref": "#definitions/post_build"
        },
        "pre_run": {
          "$ref": "#definitions/pre_run"
        },
        "post_run": {
          "$ref": "#definitions/post_run"
        },
        "run": {
          "$ref": "#definitions/run"
        }
      }
    },
    "default_compiler_config": {
      "type": "object",
      "description": "Specify compiler configuration for group of compilers. Use this␣
↪property if you want to define common configuration for all compilers of same group.␣
↪This property overrides ``all`` property. ",
      "properties": {
        "cc": {
          "$ref": "#definitions/cc"
        },
        "fc": {
          "$ref": "#definitions/fc"
```

(continues on next page)

(continued from previous page)

```
        },
        "cxx": {
          "$ref": "#definitions/cxx"
        },
        "cflags": {
          "$ref": "#definitions/cflags"
        },
        "fflags": {
          "$ref": "#definitions/fflags"
        },
        "cxxflags": {
          "$ref": "#definitions/cxxflags"
        },
        "ldflags": {
          "$ref": "#definitions/ldflags"
        },
        "cppflags": {
          "$ref": "#definitions/cppflags"
        },
        "sbatch": {
          "$ref": "definitions.schema.json#/definitions/sbatch"
        },
        "bsub": {
          "$ref": "definitions.schema.json#/definitions/bsub"
        },
        "cobalt": {
          "$ref": "definitions.schema.json#/definitions/cobalt"
        },
        "pbs": {
          "$ref": "definitions.schema.json#/definitions/pbs"
        },
        "batch": {
          "$ref": "definitions.schema.json#/definitions/batch"
        },
        "BB": {
          "$ref": "definitions.schema.json#/definitions/BB"
        },
        "DW": {
          "$ref": "definitions.schema.json#/definitions/DW"
        },
        "env": {
          "$ref": "definitions.schema.json#/definitions/env"
        },
        "vars": {
          "$ref": "definitions.schema.json#/definitions/env"
        },
        "status": {
          "$ref": "definitions.schema.json#/definitions/status"
        },
        "pre_build": {
          "$ref": "#definitions/pre_build"
        },
```

(continues on next page)

(continued from previous page)

```
        "post_build": {
          "$ref": "#definitions/post_build"
        },
        "pre_run": {
          "$ref": "#definitions/pre_run"
        },
        "post_run": {
          "$ref": "#definitions/post_run"
        },
        "run": {
          "$ref": "#definitions/run"
        }
      }
    },
    "compiler_declaration": {
      "type": "object",
      "description": "Specify compiler configuration at compiler level. The ``config``␣
↪section has highest precedence when searching compiler configuration. This overrides␣
↪fields found in compiler group and ``all`` property",
      "additionalProperties": false,
      "properties": {
        "cc": {
          "$ref": "#definitions/cc"
        },
        "fc": {
          "$ref": "#definitions/fc"
        },
        "cxx": {
          "$ref": "#definitions/cxx"
        },
        "cflags": {
          "$ref": "#definitions/cflags"
        },
        "fflags": {
          "$ref": "#definitions/fflags"
        },
        "cxxflags": {
          "$ref": "#definitions/cxxflags"
        },
        "ldflags": {
          "$ref": "#definitions/ldflags"
        },
        "cppflags": {
          "$ref": "#definitions/cppflags"
        },
        "sbatch": {
          "$ref": "definitions.schema.json#/definitions/sbatch"
        },
        "bsub": {
          "$ref": "definitions.schema.json#/definitions/bsub"
        },
        "cobalt": {
```

(continues on next page)

(continued from previous page)

```
          "$ref": "definitions.schema.json#/definitions/cobalt"
        },
        "pbs": {
          "$ref": "definitions.schema.json#/definitions/pbs"
        },
        "batch": {
          "$ref": "definitions.schema.json#/definitions/batch"
        },
        "BB": {
          "$ref": "definitions.schema.json#/definitions/BB"
        },
        "DW": {
          "$ref": "definitions.schema.json#/definitions/DW"
        },
        "env": {
          "$ref": "definitions.schema.json#/definitions/env"
        },
        "vars": {
          "$ref": "definitions.schema.json#/definitions/env"
        },
        "status": {
          "$ref": "definitions.schema.json#/definitions/status"
        },
        "pre_build": {
          "$ref": "#definitions/pre_build"
        },
        "post_build": {
          "$ref": "#definitions/post_build"
        },
        "pre_run": {
          "$ref": "#definitions/pre_run"
        },
        "post_run": {
          "$ref": "#definitions/post_run"
        },
        "run": {
          "$ref": "#definitions/run"
        },
        "module": {
          "type": "object",
          "additionalProperties": false,
          "properties": {
            "purge": {
              "type": "boolean",
              "description": "Run ``module purge`` if purge is set"
            },
            "load": {
              "$ref": "definitions.schema.json#/definitions/list_of_strings",
              "description": "Load one or more modules via ``module load``"
            },
            "restore": {
              "description": "Load a collection name via ``module restore``",
```

(continues on next page)

(continued from previous page)

```
              "type": "string"
            },
            "swap": {
              "description": "Swap modules using ``module swap``. The swap property␣
↪expects 2 unique modules.",
              "type": "array",
              "uniqueItems": true,
              "minItems": 2,
              "maxItems": 2,
              "items": {
                "type": "string"
              }
            }
          }
        }
      }
    }
  },
  "additionalProperties": false,
  "properties": {
    "type": {
      "type": "string",
      "pattern": "^compiler$",
      "description": "Select schema type to use when validating buildspec. This must be␣
↪of set to ``compiler``."
    },
    "description": {
      "$ref": "definitions.schema.json#/definitions/description"
    },
    "compilers": {
      "type": "object",
      "required": [
        "name"
      ],
      "additionalProperties": false,
      "properties": {
        "name": {
          "description": "Specify a list of regular expression to search compiler␣
↪instance from buildtest settings.",
          "$ref": "definitions.schema.json#/definitions/list_of_strings"
        },
        "exclude": {
          "description": "Specify a list of named compilers to exclude when building␣
↪test based on regular expression specified in ``name`` property. The ``exclude``␣
↪property has no effect if named compiler not found based on regular expression.",
          "$ref": "definitions.schema.json#/definitions/list_of_strings"
        },
        "default": {
          "type": "object",
          "additionalProperties": false,
          "properties": {
            "all": {
```

(continues on next page)

(continued from previous page)

```
              "$ref": "#definitions/default_compiler_all"
            },
            "gcc": {
              "$ref": "#definitions/default_compiler_config"
            },
            "intel": {
              "$ref": "#definitions/default_compiler_config"
            },
            "pgi": {
              "$ref": "#definitions/default_compiler_config"
            },
            "cray": {
              "$ref": "#definitions/default_compiler_config"
            },
            "clang": {
              "$ref": "#definitions/default_compiler_config"
            },
            "cuda": {
              "$ref": "#definitions/default_compiler_config"
            },
            "upcxx": {
              "$ref": "#definitions/default_compiler_config"
            }
          }
        },
        "config": {
          "type": "object",
          "description": "Specify compiler configuration based on named compilers.",
          "patternProperties": {
            "^.*$": {
              "$ref": "#definitions/compiler_declaration"
            }
          }
        }
      }
    },
    "source": {
      "type": "string",
      "description": "Specify a source file for compilation, the file can be relative␣
↪path to buildspec or an absolute path"
    },
    "executor": {
      "$ref": "definitions.schema.json#/definitions/executor"
    },
    "run_only": {
      "$ref": "definitions.schema.json#/definitions/run_only"
    },
    "skip": {
      "$ref": "definitions.schema.json#/definitions/skip"
    },
    "tags": {
      "$ref": "definitions.schema.json#/definitions/tags"
```

(continues on next page)

(continued from previous page)

```
    },
    "metrics": {
      "$ref": "definitions.schema.json#/definitions/metrics"
    }
  }
}
```

Schema Examples

```
$ buildtest schema -n compiler-v1.0.schema.json --example
File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/compiler-v1.0.schema.json/valid/examples.yml
--------------------------------------------------------------------------------
version: "1.0"
buildspecs:
  gnu_example:
    executor: local.bash
    type: compiler
    description: "gnu example with modules, and cflags example"
    source: src/hello.c
    compilers:
      name: [gcc]
      config:
        gcc@8.4.0:
          cflags: "-O3"

  intel_example:
    executor: local.bash
    type: compiler
    description: "intel example using cflags"
    source: src/hello.c
    compilers:
      name: [intel]
      config:
        intel@2018:
          cflags: "-O1"

  clang_example:
    executor: local.bash
    type: compiler
    description: "clang example using cflags"
    source: src/hello.c
    compilers:
      name: [clang]
      default:
        clang:
          cflags: "-O1"
      config:
        clang@11:
          cflags: "-O2"
```

(continues on next page)

(continued from previous page)

```
upcxx_example:
  executor: local.bash
  type: compiler
  description: "upcxx compiler declaration in default and config section "
  source: src/hello.c
  compilers:
    name: [upcxx]
    default:
      upcxx:
        cflags: "-g aries"
    config:
      upcxx@2020:
        cflags: "-O1 -g aries"

pgi_example:
  executor: local.bash
  type: compiler
  description: "pgi example using cxxflags, ldflags in default and config section"
  source: src/hello.cpp
  compilers:
    name: ["^(pgi|PrgEnv)"]
    default:
      pgi:
        cxxflags: "-O1"
        ldflags: "-lm"
    config:
      pgi@18.1:
        module:
          swap: [PrgEnv-gnu, PrgEnv-pgi]
          load: [pgi/18.1]
      pgi@18.2:
        module:
          swap: [PrgEnv-gnu, PrgEnv-pgi]
          load: [pgi/18.2]

cray_example:
  executor: local.bash
  type: compiler
  description: "cray example using fflags and cppflags"
  source: src/hello.f90
  compilers:
    name: ["PrgEnv-cray"]
    default:
      cray:
        fflags: "-O1"
    config:
      PrgEnv-cray@2.6.2:
        module:
          swap: [PrgEnv-intel, PrgEnv-cray/2.6.2]
```

(continues on next page)

(continued from previous page)

```
sbatch_example_all_compiler_groups:
  type: compiler
  description: sbatch example to for all compiler groups
  executor: local.bash
  source: src/hello.f90
  compilers:
    name: ["PrgEnv-cray"]
    default:
      cray:
        fflags: "-O1"
      all:
        sbatch: ["-t 10", "-n 2", "-C haswell" ]
    config:
      PrgEnv-cray@2.6.2:
        module:
          swap: [PrgEnv-intel, PrgEnv-cray/2.6.2]

bsub_all_compiler_groups:
  type: compiler
  description: bsub example for all compiler groups
  executor: local.bash
  source: "src/hello.cpp"
  compilers:
    name: [intel]
    default:
      all:
        bsub: ["-W 00:30", "-n 2"]
    config:
      intel@2019:
        cxxflags: "-O1"

cobalt_all_compiler_groups:
  type: compiler
  description: cobalt example for all compiler groups
  executor: local.bash
  source: "src/hello.cpp"
  compilers:
    name: [intel]
    default:
      all:
        cobalt: ["-t 30", "-n 1"]
    config:
      intel@2019:
        cxxflags: "-O1"

sbatch_compiler_group:
  type: compiler
  description: sbatch example in multiple compiler groups.
  executor: local.bash
  source: src/hello.f90
  compilers:
    name: ["^(gcc|intel)"]
```

(continues on next page)

(continued from previous page)

```
    default:
      gcc:
        fflags: "-O1"
        sbatch: ["-t 10", "-n 2", "-C haswell" ]
      intel:
        fflags: "-O2"
        sbatch: ["-t 10", "-n 2", "-C knl" ]
    config:
      gcc@8.1.0:
        sbatch: ["-t 60", "-n 2", "-C knl"]
        module:
          swap: [PrgEnv-intel, PrgEnv-gnu/6.1.0]


bsub_compiler_group:
  type: compiler
  description: bsub example in multiple compiler groups.
  executor: local.bash
  source: src/hello.f90
  compilers:
    name: ["^(gcc|intel)"]
    default:
      gcc:
        fflags: "-O1"
        bsub: ["-W 00:30", "-n 2" ]
      intel:
        fflags: "-O2"
        bsub: ["-W 00:30", "-n 4" ]
    config:
      gcc@8.1.0:
         bsub: ["-W 00:30", "-n 6" ]
         module:
           swap: [PrgEnv-intel, PrgEnv-gnu/6.1.0]

batch_example:
  type: compiler
  description: example using batch field
  executor: local.bash
  source: "src/hello.cpp"
  compilers:
    name: [intel]
    default:
      all:
        batch:
          "timelimit": "30"
          "nodecount": "2"
          "queue": "batch"
          "account": "biology"
    config:
      intel@2019:
        cxxflags: "-O1"
```

(continues on next page)

(continued from previous page)

```
env_example:
  type: compiler
  description: Setting environment variables
  executor: local.bash
  source: "src/hello.cpp"
  compilers:
    name: ["^(gcc)"]
    default:
      all:
        env:
          OMP_NUM_THREADS: 2
        run: $_EXEC 1 2 4
    config:
      gcc@10.2.0:
        cxxflags: "-fopenmp"

custom_env_by_compiler_group:
  type: compiler
  description: Setting environment variables in compiler groups
  executor: local.bash
  source: "src/hello.cpp"
  compilers:
    name: ["^(gcc|pgi)"]
    default:
      all:
        run: $_EXEC 1 2 4
      gcc:
        cxxflags: "-fopenmp"
        env:
          OMP_NUM_THREADS: 4
      pgi:
        cxxflags: "-mp"
        env:
          OMP_NUM_THREADS: 6
    config:
      gcc@10.2.0:
        env:
          OMP_NUM_THREADS: 6

      gcc@9.2.0:
        env:
          OMP_NUM_THREADS: 8

      pgi@9.2.0:
        env:
          OMP_NUM_THREADS: 10

vars_example:
  type: compiler
  description: Setting shell variables
  executor: local.bash
  source: "src/hello.cpp"
```

(continues on next page)

(continued from previous page)

```
  compilers:
    name: ["^(gcc)"]
    default:
      all:
        vars:
          OUTFILE: /tmp/file1.txt
        run: $_EXEC > $OUTFILE
    config:
      gcc@10.2.0:
        cxxflags: "-fopenmp"

pass_args_run:
  type: compiler
  description: Passing arguments to executable in run section
  executor: local.bash
  source: "src/hello.cpp"
  compilers:
    name: [intel]
    default:
      all:
        run: $_EXEC 1 2 4
    config:
      intel@2019:
        cxxflags: "-O1"

mpi_launcher_example:
  type: compiler
  description: mpi launcher example
  executor: local.bash
  source: "src/hello.cpp"
  compilers:
    name: [gcc]
    default:
      all:
        run: mpirun -np 2 $_EXEC
    config:
      gcc@7.3.0:
        cflags: "-O3"
        cxx: mpicxx

status_returncode_example:
  type: compiler
  description: Status returncode match example
  executor: local.bash
  source: "src/hello.cpp"
  compilers:
    name: [gnu]
    default:
      all:
        vars:
          OUTFILE: /tmp/file1.txt
        run: $_EXEC > $OUTFILE
```

(continues on next page)

(continued from previous page)

```
        status:
          returncode: 1
    config:
      gcc@10.2.0:
        cxxflags: "-fopenmp"

pre_post_build_run_sections:
  type: compiler
  description: Run commands pre and post build section
  executor: local.bash
  source: "src/hello.cpp"
  compilers:
    name: ["^(gcc)"]
    default:
      all:
        pre_build: echo "pre-build section for ALL compilers"
        post_build: echo "post-build section for ALL Compilers"
        pre_run: echo "pre-run section for ALL compilers"
        post_run: echo "post-run section for ALL Compilers"
      gcc:
        pre_build: echo "pre-build section for GCC compilers"
        post_build: echo "post-build section for GCC compilers"
        pre_run: echo "pre-run section for ALL compilers"
        post_run: echo "post-run section for ALL Compilers"
    config:
      gcc@7.3.0:
        pre_build: echo "pre-build section for gcc@7.3.0"
        post_build: echo "post-build section for gcc@7.3.0"
        pre_run: echo "pre-run section for ALL compilers"
        post_run: echo "post-run section for ALL Compilers"
        cflags: "-O3"
      gcc@8.2.0:
        pre_build: echo "gcc --version"
        cflags: "-O3"


multi_compilers:
  type: compiler
  description: Select one or more compilers to run test
  executor: local.bash
  source: "src/hello.cpp"
  compilers:
    name: ["^(gcc|intel|pgi|cray)"]
    exclude: [intel@18]
    default:
      gcc:
        cflags: "-fopenmp"
      intel:
        cflags: "-qopenmp"
      pgi:
        cflags: "-fopenmp"
      cray:
```

(continues on next page)

(continued from previous page)

```
          cflags: "-h omp"
      config:
        gcc@7.5.0:
          cflags: "-O3"
          module:
            load: [gcc/7.5.0]
        intel@17:
          module:
            load: [intel/2017]
        intel@18:
          module:
            load: [intel/2018]
        pgi/18.0:
          module:
            load: [pgi/18.0]
        craype/2.6.2:
          module:
            swap: [PrgEnv-intel, PrgEnv-cray]
            load: [craype/2.6.2]

  metrics_example:
    type: compiler
    description: Recording test metrics with compiler schema
    executor: local.bash
    source: "src/hello.cpp"
    compilers:
      name: [gnu]
      default:
        all:
          vars:
            OUTFILE: /tmp/file1.txt
          run: $_EXEC > $OUTFILE
          status:
            returncode: 1
      config:
        gcc@10.2.0:
          cxxflags: "-fopenmp"
    metrics:
      outfile:
        vars: "OUTFILE"

File: /home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/
↪buildtest/schemas/examples/compiler-v1.0.schema.json/invalid/examples.yml
--------------------------------------------------------------------------------
version: "1.0"
buildspecs:
  missing_type:
    executor: local.bash
    description: "type key is missing, this is a required field"
    source: "src/hello.c"
    compilers:
      name: [intel]
```

(continues on next page)

(continued from previous page)

```
missing_required_compilers:
  executor: local.bash
  type: compiler
  description: "missing required field compilers "
  source: "src/hello.c"

missing_required_source:
  executor: local.bash
  type: compiler
  description: "missing required field 'source' "
  compilers:
    name: [gcc]

invalid_type_value:
  executor: local.bash
  type: script
  description: "invalid value for type field must be 'compiler' "
  source: src/hello.c
  compilers:
    name: [gcc]

invalid_description_value:
  executor: local.bash
  type: compiler
  description: 1
  source: src/hello.c
  compilers:
    name: [gcc]

invalid_type_module:
  executor: local.bash
  type: compiler
  description: "type for 'module' key, expecting a property but received 'string' "
  source: src/hello.c
  compilers:
    name: [gcc]
    config:
      gcc/9.2.0:
        module: "module load gcc/9.2.0"

module_purge_invalid_type:
  executor: local.bash
  type: compiler
  description: "The purge property module is invalid. Expects bool got an int"
  source: src/hello.c
  compilers:
    name: [gcc]
    config:
      gcc/9.2.0:
        module:
          purge: 1
```

(continues on next page)

(continued from previous page)

```
module_swap_duplicate_check:
  executor: local.bash
  type: compiler
  description: "The swap property expects two unique items"
  source: src/hello.c
  compilers:
    name: [gcc]
    config:
      gcc/9.2.0:
        module:
          swap: [gcc/8.0, gcc/8.0]

module_swap_min_items:
  executor: local.bash
  type: compiler
  description: "The swap property expects a minimum of 2 items"
  source: src/hello.c
  compilers:
    name: [gcc]
    config:
      gcc/9.2.0:
        module:
          swap: [gcc/8.0]

module_swap_max_items:
  executor: local.bash
  type: compiler
  description: "The swap property expects a maximum of 2 items"
  source: src/hello.c
  compilers:
    name: [gcc]
    config:
      gcc/9.2.0:
        module:
          swap: [gcc/8.0, gcc/9.0, gcc/10.0]

module_load_duplicate_items:
  executor: local.bash
  type: compiler
  description: "The load property expects unique items"
  source: src/hello.c
  compilers:
    name: [gcc]
    config:
      gcc/9.2.0:
        module:
          load: [gcc/9.2.0, gcc/9.2.0]

module_load_min_items:
  executor: local.bash
  type: compiler
```

(continues on next page)

(continued from previous page)

```
  description: "The load property expects a minimum of 1 item"
  source: src/hello.c
  compilers:
    name: [gcc]
    config:
      gcc/9.2.0:
        module:
          load: []

additionalProperties_main:
  executor: local.bash
  type: compiler
  description: "test additionalProperties in main schema"
  foo: bar
  source: src/hello.c
  compilers:
    name: [gcc]

missing_required_compiler_name:
  executor: local.bash
  type: compiler
  description: "'name' field in compilers section is required field"
  source: src/hello.f90
  compilers:
  default:
    cray:
      fflags: "-O1"
  config:
    PrgEnv-cray@2.6.2:
      module:
        swap: [PrgEnv-intel, PrgEnv-cray/2.6.2]

uniqueItems_compiler_name:
  executor: local.bash
  type: compiler
  description: "Test unique items in 'name' field in compilers section"
  source: src/hello.f90
  compilers:
    name: ["^(PrgEnv-cray)", "^(PrgEnv-cray)"]
    config:
      PrgEnv-cray@2.6.2:
        fflags: "-O1"
        module:
          swap: [PrgEnv-intel, PrgEnv-cray/2.6.2]

additionalProperties_compiler:
  executor: local.bash
  type: compiler
  description: "Test additionalProperies in compiler section"
  source: src/hello.f90
  compilers:
    name: ["PrgEnv-cray"]
```

(continues on next page)

(continued from previous page)

```
    FOO: BAR
    default:
      all:
        env:
          X: 1
    config:
      PrgEnv-cray@2.6.2:
        fflags: "-O1"
        module:
          swap: [PrgEnv-intel, PrgEnv-cray/2.6.2]

additionalProperties_compiler_default_all:
  executor: local.bash
  type: compiler
  description: "Test additionalProperies in compiler default all section"
  source: src/hello.f90
  compilers:
    name: ["PrgEnv-cray"]
    default:
      all:
        XYZ: 123
    config:
      PrgEnv-cray@2.6.2:
        fflags: "-O1"
        module:
          swap: [PrgEnv-intel, PrgEnv-cray/2.6.2]

additionalProperties_compiler_config:
  executor: local.bash
  type: compiler
  description: "Test additionalProperies in compiler config section, FOO: BAR"
  source: src/hello.f90
  compilers:
    name: ["PrgEnv-cray"]
    config:
      PrgEnv-cray@2.6.2:
        FOO: BAR
        fflags: "-O1"
        module:
          swap: [PrgEnv-intel, PrgEnv-cray/2.6.2]
```

Spack Schema

This schema is used for writing tests with spack package manager using `type: spack` field. For more details see *Spack Schema*.

Schema Content

```
$ buildtest schema -n spack-v1.0.schema.json --json
{
  "$id": "spack-v1.0.schema.json",
  "$schema": "http://json-schema.org/draft-07/schema#",
  "title": "spack schema version 1.0",
  "description": "The spack schema is referenced using ``type: spack`` which is used for␣
↪generating tests using spack package manager",
  "type": "object",
  "required": [
    "type",
    "executor",
    "spack"
  ],
  "additionalProperties": false,
  "properties": {
    "type": {
      "type": "string",
      "pattern": "^spack$",
      "description": "Select schema type to use when validating buildspec. This must be␣
↪set to 'spack'"
    },
    "description": {
      "$ref": "definitions.schema.json#/definitions/description"
    },
    "executor": {
      "$ref": "definitions.schema.json#/definitions/executor"
    },
    "env": {
      "$ref": "definitions.schema.json#/definitions/env"
    },
    "vars": {
      "$ref": "definitions.schema.json#/definitions/env"
    },
    "sbatch": {
      "$ref": "definitions.schema.json#/definitions/sbatch"
    },
    "bsub": {
      "$ref": "definitions.schema.json#/definitions/bsub"
    },
    "cobalt": {
      "$ref": "definitions.schema.json#/definitions/cobalt"
    },
    "pbs": {
      "$ref": "definitions.schema.json#/definitions/pbs"
    },
```

(continues on next page)

(continued from previous page)

```
    "batch": {
      "$ref": "definitions.schema.json#/definitions/batch"
    },
    "BB": {
      "$ref": "definitions.schema.json#/definitions/BB"
    },
    "DW": {
      "$ref": "definitions.schema.json#/definitions/DW"
    },
    "skip": {
      "$ref": "definitions.schema.json#/definitions/skip"
    },
    "tags": {
      "$ref": "definitions.schema.json#/definitions/tags"
    },
    "status": {
      "$ref": "definitions.schema.json#/definitions/status"
    },
    "metrics": {
      "$ref": "definitions.schema.json#/definitions/metrics"
    },
    "executors": {
      "$ref": "definitions.schema.json#/definitions/executors"
    },
    "pre_cmds": {
      "type": "string",
      "description": "Shell commands run before spack"
    },
    "post_cmds": {
      "type": "string",
      "description": "Shell commands run after spack"
    },
    "spack": {
      "type": "object",
      "description": "Entry point to spack configuration",
      "required": [
        "root"
      ],
      "additionalProperties": false,
      "properties": {
        "root": {
          "type": "string"
        },
        "compiler_find": {
          "type": "boolean",
          "description": "Run ``spack compiler find`` if set to ``True``. This is run␣
↪right after sourcing spack startup script."
        },
        "mirror": {
          "$ref": "definitions.schema.json#/definitions/env",
          "description": "Add mirror by running ``spack mirror add``"
        },
```

(continues on next page)

(continued from previous page)

```
        "env": {
          "$ref": "#definitions/env",
          "description": "Manage spack environments via ``spack env`` command"
        },
        "install": {
          "$ref": "#definitions/install",
          "description": "Install spack packages by running ``spack install``. "
        },
        "verify_spack": {
          "type": "boolean",
          "description": "This boolean will determine if we need to check for file␣
↪existence where spack is cloned via ``root`` property and file **$SPACK_ROOT/share/
↪spack/setup-env.sh** exists. These checks can be disabled by setting this to ``False``␣
↪which can be useful if you dont want buildtest to raise exception during test␣
↪generation process and test is skipped.",
          "default": true
        },
        "test": {
          "$ref": "#definitions/test",
          "description": "Entry point to ``spack test``"
        }
      }
    }
  },
  "definitions": {
    "env": {
      "additionalProperties": false,
      "type": "object",
      "description": "Used for managing spack environment using ``spack env`` command. ",
      "properties": {
        "create": {
          "additionalProperties": false,
          "description": "Create a spack environment via ``spack env create``",
          "type": "object",
          "properties": {
            "remove_environment": {
              "type": "boolean",
              "description": "Remove existing spack environment before creating new␣
↪environment. If set to ``True`` we will run ``spack env rm -y <name>``.",
              "default": false
            },
            "name": {
              "type": "string",
              "description": "Name of spack environment to create"
            },
            "manifest": {
              "type": "string",
              "description": "Specify path to spack manifest file (``spack.yaml`` or␣
↪``spack.lock``) when creating environment"
            },
            "options": {
              "type": "string",
```

(continues on next page)

(continued from previous page)

```
              "description": "Pass options to ``spack env create`` command"
            },
            "dir": {
              "type": "string",
              "description": "Create a spack environment in a specific directory. This␣
↪will run ``spack env create -d <dir>``. Directory path does not have to exist prior to␣
↪execution however user must have appropriate ACL in-order to create directory."
            }
          }
        },
        "activate": {
          "additionalProperties": false,
          "type": "object",
          "description": "Activate a spack environment via ``spack env activate``",
          "properties": {
            "name": {
              "type": "string",
              "description": "Name of spack environment to activate. In order to␣
↪activate spack environment ``my-project`` you need to run ``spack env activate my-
↪project`` which is specified by ``name: my-project``."
            },
            "options": {
              "type": "string",
              "description": "Pass options to ``spack env activate`` command"
            },
            "dir": {
              "type": "string",
              "description": "Activate spack environment from directory."
            }
          }
        },
        "rm": {
          "additionalProperties": false,
          "description": "Remove an existing spack environment via ``spack env rm``.",
          "type": "object",
          "required": [
            "name"
          ],
          "properties": {
            "name": {
              "type": "string",
              "description": "Remove spack environment by name. This will run ``spack␣
↪env rm -y <name>``."
            }
          }
        },
        "mirror": {
          "$ref": "definitions.schema.json#/definitions/env",
          "description": "Add mirror in spack environment by running ``spack mirror add``
↪"
        },
        "specs": {
```

(continues on next page)

(continued from previous page)

```
          "$ref": "definitions.schema.json#/definitions/list_of_strings",
          "description": "Add specs to environment by running ``spack add <specs>``. The␣
↪``specs`` is a list of string which expect the argument to be name of spack package."
        },
        "concretize": {
          "type": "boolean",
          "description": "If ``concretize: true`` is set, we will concretize spack␣
↪environment by running ``spack concretize -f`` otherwise this line will be ignored."
        }
      }
    },
    "install": {
      "description": "Install spack packages using ``spack install`` command",
      "additionalProperties": false,
      "type": "object",
      "properties": {
        "options": {
          "type": "string",
          "description": "Pass options to ``spack install`` command"
        },
        "specs": {
          "$ref": "definitions.schema.json#/definitions/list_of_strings",
          "description": "List of specs to install using ``spack install`` command"
        }
      }
    },
    "test": {
      "type": "object",
      "additionalProperties": false,
      "required": [
        "run"
      ],
      "properties": {
        "remove_tests": {
          "type": "boolean",
          "description": "Remove all test suites in spack before running test via␣
↪``spack test run``. If set to ``True`` we will run ``spack test remove -y`` which will␣
↪remove all test suites."
        },
        "run": {
          "description": "Run tests using spack via ``spack test run`` command. This␣
↪command requires specs are installed in your spack instance prior to running tests.",
          "type": "object",
          "required": [
            "specs"
          ],
          "additionalProperties": false,
          "properties": {
            "option": {
              "type": "string",
              "description": "Pass options to ``spack test run``"
            },
```

(continues on next page)

(continued from previous page)

```
            "specs": {
              "$ref": "definitions.schema.json#/definitions/list_of_strings",
              "description": "List of specs to run tests by running ``spack test run
↪<specs>``."
            }
          }
        },
        "results": {
          "type": "object",
          "description": "View test results via ``spack test results`` after running␣
↪tests via ``spack test run``. Results can be viewed using suitename or installed specs␣
↪or both.",
          "additionalProperties": false,
          "anyOf": [
            {
              "required": [
                "specs"
              ]
            },
            {
              "required": [
                "suite"
              ]
            },
            {
              "required": [
                "specs",
                "suite"
              ]
            }
          ],
          "properties": {
            "option": {
              "type": "string",
              "description": "Pass options to ``spack test results``"
            },
            "suite": {
              "$ref": "definitions.schema.json#/definitions/list_of_strings",
              "description": "Report results by  suite name by running ``spack test␣
↪results <suite>``."
            },
            "specs": {
              "$ref": "definitions.schema.json#/definitions/list_of_strings",
              "description": "Report result by spec name by running ``spack test run --
↪<specs>``."
            }
          }
        }
      }
    }
  }
}
```

Schema Examples

```
$ buildtest schema -n spack-v1.0.schema.json --json
{
  "$id": "spack-v1.0.schema.json",
  "$schema": "http://json-schema.org/draft-07/schema#",
  "title": "spack schema version 1.0",
  "description": "The spack schema is referenced using ``type: spack`` which is used for␣
↪generating tests using spack package manager",
  "type": "object",
  "required": [
    "type",
    "executor",
    "spack"
  ],
  "additionalProperties": false,
  "properties": {
    "type": {
      "type": "string",
      "pattern": "^spack$",
      "description": "Select schema type to use when validating buildspec. This must be␣
↪set to 'spack'"
    },
    "description": {
      "$ref": "definitions.schema.json#/definitions/description"
    },
    "executor": {
      "$ref": "definitions.schema.json#/definitions/executor"
    },
    "env": {
      "$ref": "definitions.schema.json#/definitions/env"
    },
    "vars": {
      "$ref": "definitions.schema.json#/definitions/env"
    },
    "sbatch": {
      "$ref": "definitions.schema.json#/definitions/sbatch"
    },
    "bsub": {
      "$ref": "definitions.schema.json#/definitions/bsub"
    },
    "cobalt": {
      "$ref": "definitions.schema.json#/definitions/cobalt"
    },
    "pbs": {
      "$ref": "definitions.schema.json#/definitions/pbs"
    },
    "batch": {
      "$ref": "definitions.schema.json#/definitions/batch"
    },
    "BB": {
      "$ref": "definitions.schema.json#/definitions/BB"
```

(continues on next page)

(continued from previous page)

```
    },
    "DW": {
      "$ref": "definitions.schema.json#/definitions/DW"
    },
    "skip": {
      "$ref": "definitions.schema.json#/definitions/skip"
    },
    "tags": {
      "$ref": "definitions.schema.json#/definitions/tags"
    },
    "status": {
      "$ref": "definitions.schema.json#/definitions/status"
    },
    "metrics": {
      "$ref": "definitions.schema.json#/definitions/metrics"
    },
    "executors": {
      "$ref": "definitions.schema.json#/definitions/executors"
    },
    "pre_cmds": {
      "type": "string",
      "description": "Shell commands run before spack"
    },
    "post_cmds": {
      "type": "string",
      "description": "Shell commands run after spack"
    },
    "spack": {
      "type": "object",
      "description": "Entry point to spack configuration",
      "required": [
        "root"
      ],
      "additionalProperties": false,
      "properties": {
        "root": {
          "type": "string"
        },
        "compiler_find": {
          "type": "boolean",
          "description": "Run ``spack compiler find`` if set to ``True``. This is run␣
↪right after sourcing spack startup script."
        },
        "mirror": {
          "$ref": "definitions.schema.json#/definitions/env",
          "description": "Add mirror by running ``spack mirror add``"
        },
        "env": {
          "$ref": "#definitions/env",
          "description": "Manage spack environments via ``spack env`` command"
        },
        "install": {
```

(continues on next page)

(continued from previous page)

```
          "$ref": "#definitions/install",
          "description": "Install spack packages by running ``spack install``. "
        },
        "verify_spack": {
          "type": "boolean",
          "description": "This boolean will determine if we need to check for file␣
↪existence where spack is cloned via ``root`` property and file **$SPACK_ROOT/share/
↪spack/setup-env.sh** exists. These checks can be disabled by setting this to ``False``␣
↪which can be useful if you dont want buildtest to raise exception during test␣
↪generation process and test is skipped.",
          "default": true
        },
        "test": {
          "$ref": "#definitions/test",
          "description": "Entry point to ``spack test``"
        }
      }
    }
  },
  "definitions": {
    "env": {
      "additionalProperties": false,
      "type": "object",
      "description": "Used for managing spack environment using ``spack env`` command. ",
      "properties": {
        "create": {
          "additionalProperties": false,
          "description": "Create a spack environment via ``spack env create``",
          "type": "object",
          "properties": {
            "remove_environment": {
              "type": "boolean",
              "description": "Remove existing spack environment before creating new␣
↪environment. If set to ``True`` we will run ``spack env rm -y <name>``.",
              "default": false
            },
            "name": {
              "type": "string",
              "description": "Name of spack environment to create"
            },
            "manifest": {
              "type": "string",
              "description": "Specify path to spack manifest file (``spack.yaml`` or␣
↪``spack.lock``) when creating environment"
            },
            "options": {
              "type": "string",
              "description": "Pass options to ``spack env create`` command"
            },
            "dir": {
              "type": "string",
              "description": "Create a spack environment in a specific directory. This␣
↪will run ``spack env create -d <dir>``. Directory path does not have to exist prior to␣
↪execution however user must have appropriate ACL in-order to create directory."
```

(continued on the next page)

(continued from previous page)

```
            }
          }
        },
        "activate": {
          "additionalProperties": false,
          "type": "object",
          "description": "Activate a spack environment via ``spack env activate``",
          "properties": {
            "name": {
              "type": "string",
              "description": "Name of spack environment to activate. In order to␣
↪activate spack environment ``my-project`` you need to run ``spack env activate my-
↪project`` which is specified by ``name: my-project``."
            },
            "options": {
              "type": "string",
              "description": "Pass options to ``spack env activate`` command"
            },
            "dir": {
              "type": "string",
              "description": "Activate spack environment from directory."
            }
          }
        },
        "rm": {
          "additionalProperties": false,
          "description": "Remove an existing spack environment via ``spack env rm``.",
          "type": "object",
          "required": [
            "name"
          ],
          "properties": {
            "name": {
              "type": "string",
              "description": "Remove spack environment by name. This will run ``spack␣
↪env rm -y <name>``."
            }
          }
        },
        "mirror": {
          "$ref": "definitions.schema.json#/definitions/env",
          "description": "Add mirror in spack environment by running ``spack mirror add``
↪"
        },
        "specs": {
          "$ref": "definitions.schema.json#/definitions/list_of_strings",
          "description": "Add specs to environment by running ``spack add <specs>``. The␣
↪``specs`` is a list of string which expect the argument to be name of spack package."
        },
        "concretize": {
          "type": "boolean",
          "description": "If ``concretize: true`` is set, we will concretize spack␣
↪environment by running ``spack concretize -f`` otherwise this line will be ignored."
```

(continued on next page)

(continued from previous page)

```
        }
      }
    },
    "install": {
      "description": "Install spack packages using ``spack install`` command",
      "additionalProperties": false,
      "type": "object",
      "properties": {
        "options": {
          "type": "string",
          "description": "Pass options to ``spack install`` command"
        },
        "specs": {
          "$ref": "definitions.schema.json#/definitions/list_of_strings",
          "description": "List of specs to install using ``spack install`` command"
        }
      }
    },
    "test": {
      "type": "object",
      "additionalProperties": false,
      "required": [
        "run"
      ],
      "properties": {
        "remove_tests": {
          "type": "boolean",
          "description": "Remove all test suites in spack before running test via␣
↪``spack test run``. If set to ``True`` we will run ``spack test remove -y`` which will␣
↪remove all test suites."
        },
        "run": {
          "description": "Run tests using spack via ``spack test run`` command. This␣
↪command requires specs are installed in your spack instance prior to running tests.",
          "type": "object",
          "required": [
            "specs"
          ],
          "additionalProperties": false,
          "properties": {
            "option": {
              "type": "string",
              "description": "Pass options to ``spack test run``"
            },
            "specs": {
              "$ref": "definitions.schema.json#/definitions/list_of_strings",
              "description": "List of specs to run tests by running ``spack test run
↪<specs>``."
            }
          }
        },
        "results": {
```

(continues on next page)

(continued from previous page)

```
          "type": "object",
          "description": "View test results via ``spack test results`` after running␣
↪tests via ``spack test run``. Results can be viewed using suitename or installed specs␣
↪or both.",
          "additionalProperties": false,
          "anyOf": [
            {
              "required": [
                "specs"
              ]
            },
            {
              "required": [
                "suite"
              ]
            },
            {
              "required": [
                "specs",
                "suite"
              ]
            }
          ],
          "properties": {
            "option": {
              "type": "string",
              "description": "Pass options to ``spack test results``"
            },
            "suite": {
              "$ref": "definitions.schema.json#/definitions/list_of_strings",
              "description": "Report results by  suite name by running ``spack test␣
↪results <suite>``."
            },
            "specs": {
              "$ref": "definitions.schema.json#/definitions/list_of_strings",
              "description": "Report result by spec name by running ``spack test run --
↪<specs>``."
            }
          }
        }
      }
    }
  }
}
```

3.7 Build and Test Process

The *buildtest build* command is responsible for building and running tests. Every buildspec goes through a pipeline that discovers buildspecs, validates the buildspec and builds and runs the test. The buildspec must go through each stage of the pipeline, if it fails in one of the stage, the buildspec will be ignored.

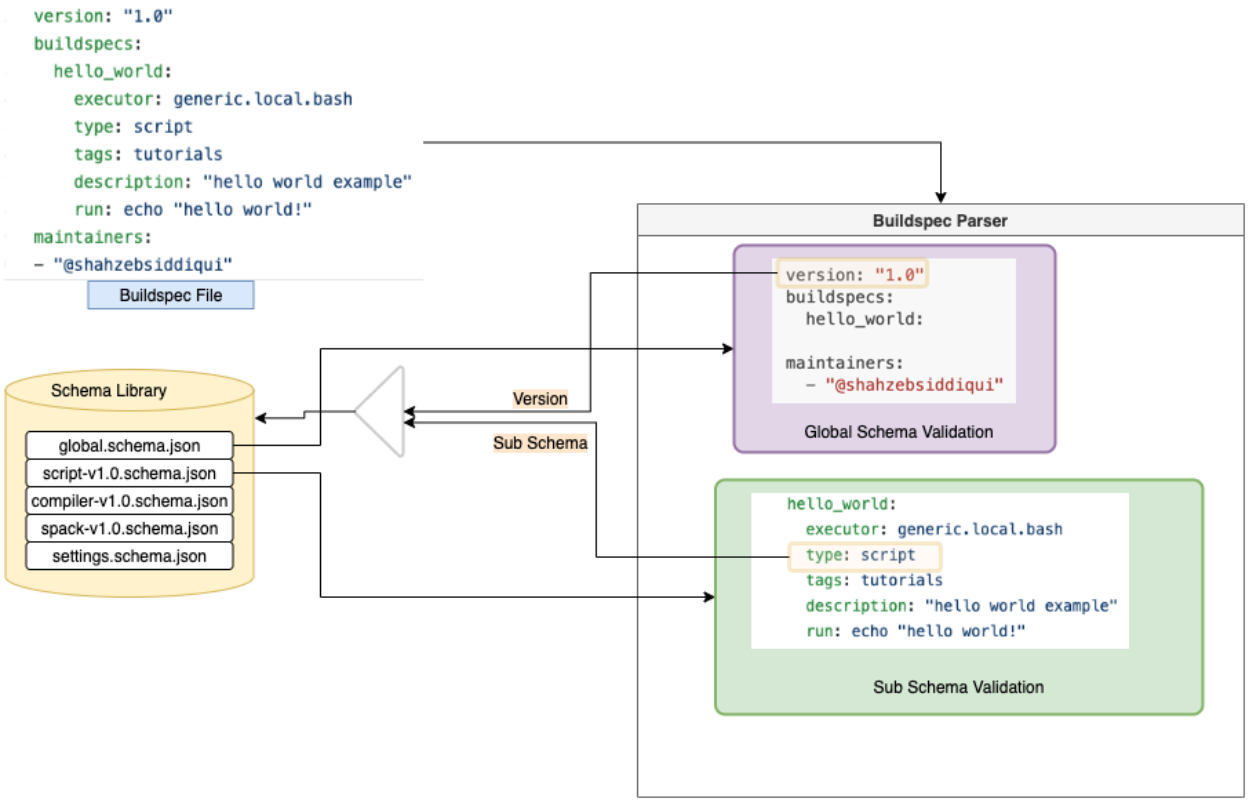
3.7.1 Discover Buildspecs

buildtest will discover buildspecs based on command line arguments since you can build by file, directory, executor, or tags. In **discover** stage, buildtest will detect buildspecs which is discussed in *Discover Buildspecs* .

For every discovered buildspecs, buildtest will validate the buildspecs in the **parse** stage which is performed using jsonschema.validate library. The parser will validate every buildspec with the global schema named global.schema.json and one of the sub-schemas, check *parsing buildspecs* section for more details.

3.7.2 Parse Buildspecs

A buildspec file may contain one or more test sections specified via `buildspec` field. Each test is validated by a sub-schema specified by `type` field. buildtest will validate the buildspec with global schema first followed by sub-schema by using the `version` field to look up the schema version for sub-schema. buildtest will look up the schema from its schema library and validate the test section `hello_world` with schema `script-v1.0.schema.json`.



Buildspecs will be ignored if it fails validation process for instance you may have an *Invalid Buildspecs*. Invalid buildspecs won't be sent to **build** stage since we can't reliably build a test-script.

3.7.3 Building Buildspecs

buildtest will send all valid buildspecs to **build** phase which is responsible for building a shell-script from the buildspec file. In this stage, we create a **Builder** object that is an instance of BuilderBase class that is a base class for building a buildspec. There is a sub-class for *BuilderBase* class such as ScriptBuilder and CompilerBuilder that implements how to build a test-script based on the sub-schema selection (`type: compiler`).

During build phase, there are additional checks on buildspecs to ensure we can generate a test-script. In the event of failure, buildtest will raise an exception and buildspec will be ignored. The ignored buildspecs are not sent to **run** stage

3.7.4 Running Buildspecs

In this stage, we run the test based on *executors* defined in configuration file. buildtest will select the executor defined by `executor` property in buildspec which is responsible for running the test. There is a BaseExecutor that is a base-class for all executors. We have sub-class for each executor type (Local, Slurm, Cobalt, PBS, Cobalt). In this stage, we run the test and get output, error, returncode and detect status of test (`PASS`, `FAIL`). If test is run via scheduler, we submit job to scheduler and poll jobID until it is finished.

Upon completion of test, we update the **Builder** object with the test results which is written to report file.

3.8 Using buildtest at HPC sites

We assume you have read the *Getting Started* and *Configuring buildtest* and now you want to use buildtest at your site. This document will highlight some points to consider before you start.

To get started, you should consider standing up an empty repository where you will host your tests. This can be GitHub, GitLab, bitbucket, etc…

3.8.1 Picking a version of buildtest

If you are going to use buildtest, you should consider if you want to use the bleeding edge (devel), stable release (master) or a tag release. Generally, we recommend you start off with stable release and then incrementally update your buildtest with new releases as they come out and check the CHANGELOG.rst for updates between version release.

Please make sure to read the appropriate version documentation based on the version of buildtest.

- Devel Docs: https://buildtest.readthedocs.io/en/devel/index.html
- Stable Docs: https://buildtest.readthedocs.io/en/latest/

3.8.2 Configuring buildtest for your site

Once you have picked a version of buildtest, you need to configure buildtest for your site, this requires you see *Configuring buildtest*. We recommend you see buildtest-cori configuration that provides how buildtest is configured at NERSC. Once you have defined your configuration file you should make sure your configuration is valid by running:

```
buildtest config validate
```

3.8.3 Writing Test

If you are going to write test, we assume you have read *Writing buildspecs* section which covers how to write buildspecs. You should consider reviewing the Schema Documentation: https://buildtesters.github.io/buildtest/ which goes in detail about each schema and buildspec attributes.

If you are writing tests, it's generally good practice to *define tags* in your test so you can group tests by a tagname and run them via `buildtest build --tags`. If you plan to use tags to run your tests, you should document tags and how they are meant to be used.

3.9 Conference and Publications

3.9.1 Talks

Conference	Date	Link
Facility Testing of E4S via E4S Testsuite, Spack Test, and buildtest	Sep 14, 2021	TBD
ECP Annual Meeting 2021	Apr 15, 2021	PDF, VIDEO
High Performance Computing & Simulation 2020 at HPBench	Mar 26, 2021	PDF
SEA Improving Scientific Software 2021	Mar 23, 2021	PDF, VIDEO
FOSDEM21	Feb 7, 2021	PDF
6th Easybuild User Meeting	Jan 29, 2021	PDF, VIDEO
FOSDEM20	Feb 2, 2020	PDF, VIDEO
5th Easybuild User Meeting	Jan 30, 2020	PDF, VIDEO
SC19 @ HUST workshop	Nov 18, 2019	PDF
HPCKP'18	June 22, 2018	PDF
HPCKP'17	June 15, 2017	PDF

3.9.2 Publications

- Siddiqui S. (2020) Buildtest: A Software Testing Framework with Module Operations for HPC Systems . In: Juckeland G., Chandrasekaran S. (eds) Tools and Techniques for High Performance Computing. HUST 2019, SE-HER 2019, WIHPC 2019. Communications in Computer and Information Science, vol 1190. Springer, Cham

3.9.3 Article

- https://www.hpcwire.com/2019/01/17/pfizer-hpc-engineer-aims-to-automate-software-stack-testing/

3.10 Contributing Guide

This guide is geared for developers and maintainers of buildtest who want to contribute back to buildtest project. There are many ways you can help contribute to buildtest that may include:

- Improve user documentation
- Increase test coverage of buildtest regression tests.
- Work on an existing issue
- Report a bug or new feature requests at https://github.com/buildtesters/buildtest/issues

3.10.1 Overview

buildtest codebase is written in Python 3, so if you are new to Python you will want to check out the python 3 tutorial: https://docs.python.org/3/tutorial/. This is a good starting point to understand python basics. If you are familiar with Python 2 you may want to review the Python 2-3 cheat sheet.

buildtest relies on YAML and JSON Schema, you should review Understanding JSON Schema article as it provides a thorough overview of JSON Schema. There are several resources to help you learn YAML for instance you can check out:

- https://www.tutorialspoint.com/yaml/index.htm
- https://learnxinyminutes.com/docs/yaml/

buildtest has a regression test that is run via pytest. You should be familiar with pytest and it's usage and documentation as it will help you write regression test. The regression test makes use of coverage to measure code coverage of buildtest source code. This is configured using .coveragerc file located in top of repo. The coverage data is pushed to codecov at https://codecov.io/gh/buildtesters/buildtest/.

buildtest has several CI checks written in GitHub workflows. These are found in .github/workflows directory of buildtest. You should familiarize yourself with github worflow syntax if you want to contribute back to github workflows.

Git is essential to code contribution so we recommend you get comfortable using *git* as it will be discussed in *code contributing guide*. We recommend you review one the following guides to help you learn *git*:

- https://guides.github.com/introduction/git-handbook/
- https://git-scm.com/docs/gittutorial
- https://guides.github.com/
- https://lab.github.com/

buildtest documentation is built on sphinx and hosted via readthedocs. Be sure to check out documentation on readthedocs to understand how it works. The buildtest project is hosted at https://readthedocs.org/projects/buildtest/ which hosts the public documentation at https://buildtest.readthedocs.io/. The documentation pages are written in reStructured Text (rST) which is Sphinx's markup language when hosting the docs.

3.10.2 Contributing Topics

Code Contribution Guide

This guide will walk through the code contribution guide, we expect you have a *github account* and experience using *git* and familiarity with GitHub interface.

GitHub Account

If you don't have a GitHub account please register your account.

Fork the repo

First, you'll need to fork the repo https://github.com/buildtesters/buildtest

You might need to setup your SSH keys in your git profile if you are using ssh option for cloning. For more details on setting up SSH keys in your profile, follow instruction found in https://help.github.com/articles/connecting-to-github-with-ssh/

SSH key will help you pull and push to repository without requesting for password for every commit. Once you have forked the repo, clone your local repo:

```
git clone git@github.com:YOUR\_GITHUB\_LOGIN/buildtest.git
```

Adding Upstream Remote

First you need to add the `upstream` repo, to do this you can issue the following:

```
git remote add upstream git@github.com/buildtesters/buildtest.git
```

The `upstream` tag is used to sync changes from upstream repo to keep your repo in sync before you contribute back.

Make sure you have set your user name and email set properly in git configuration. We don't want commits from unknown users. This can be done by setting the following:

```
git config user.name "First Last"
git config user.email "abc@example.com"
```

For more details see First Time Git Setup

Sync your branch from upstream

The `devel` from upstream will get Pull Requests from other contributors, in-order to sync your forked repo with upstream, run the commands below:

```
git checkout devel
git fetch upstream devel
git pull upstream devel
```

Once the changes are pulled locally you can sync devel branch with your fork as follows:

```
git checkout devel
git push origin devel
```

Repeat this same operation with `master` branch if you want to sync it with upstream repo

Contribution Workflow

If you want to contribute back, you should create a feature branch from *devel* and add your files, commit and push them to your fork. The workflow can be summarized as follows:

```
git checkout devel
git checkout -b featureX
git add <file1> <file2> ...
git commit -m "commit message"
git push origin featureX
```

Once the branch is created in your fork, you can create a Pull Request with the destination branch `devel` at https://github.com/buildtesters/buildtest and base branch which is your feature branch pushed at your fork.

Note: Do not push to `master` or `devel` branch on your fork or upstream.

Pull Request Review

Once you have submitted a Pull Request, please check the automated checks that are run for your PR to ensure checks are passed. Most common failures in CI checks are black and pyflakes issue, this can be done by *configuring black* and running *pyflakes*. Once all checks have passed, maintainer will review your PR and provide feedback so please be patient. Please coordinate with maintainer through PR or Slack.

Resolving PR Merge Conflicts

Often times, you may start a feature branch and your PR get's out of sync with `devel` branch which may lead to conflicts, this is a result of merging incoming PRs that may cause upstream *HEAD* to change over time which can cause merge conflicts. This may be confusing at first, but don't worry we are here to help. For more details about merge conflicts click here.

Syncing your feature branch with *devel* is out of scope for this documentation, however you can use the steps below as a *guide* when you run into this issue.

You may want to take the steps to first sync devel branch and then selectively rebase or merge `devel` into your feature branch.

First go to `devel` branch and fetch changes from upstream:

```
git checkout devel
git fetch upstream devel
```

Note you shouldn't be making any changes to your local `devel` branch, if `git fetch` was successful you can merge your `devel` with upstream as follows:

```
git merge upstream/devel
```

Next, navigate to your feature branch and sync feature changes with devel:

```
git checkout <feature-branch>
git merge devel
```

Note: Running above command will sync your feature branch with `devel` but you may have some file conflicts depending on files changed during PR. You will need to resolve them manually before pushing your changes

Instead of merge from `devel` you can rebase your commits interactively when syncing with `devel`. This can be done by running:

```
git rebase -i devel
```

Once you have synced your branch push your changes and check if file conflicts are resolved in your Pull Request:

```
git push origin <feature-branch>
```

General Tips

1. It's good practice to link PR to an issue during commit message. Such as stating `Fix #132` for fixing issue 132.

2. If you have an issue, ask your question in slack before reporting issue. If your issue is not resolved check any open issues for resolution before creating a new issue.

3. For new features or significant code refactor please notify maintainers and open an issue before working on task to keep everyone informed.

4. If you open an issue, please respond back during discussion, if there is no activity the issue will be closed.

5. Please refrain from opening duplicate issue, check if there is an existing issue addressing similar problem, instead you can participate in discussion in the issue or contact appropriate individuals directly in slack.

6. There should not be any branches other than `master` or `devel`. Feature branches should be pushed to your fork and not to origin.

Configuring Black Pre-Commit Hook

To configure pre-commit hook, make sure you install pre-commit via `pip install pre-commit`. The *pre-commit* utility should be available if you install extra dependencies from buildtest (`pip install -r docs/requirements.txt`).

You can configure `.pre-commit-config.yaml` with the version of python you are using. It is currently setup to run for python 3.7 version as follows:

```
language_version: python3.7
```

Alter this value based on python version you are using or refer to black version control integration.

To install the pre-commit hook run:

```
$ pre-commit install
pre-commit installed at .git/hooks/pre-commit
```

This will invoke hook `.git/hooks/pre-commit` prior to `git commit`. Shown below we attempt to commit which resulted in pre commit hook and caused black to format code.

```
$ git commit -m "test black commit with precommit"
black....................................................................Failed
- hook id: black
- files were modified by this hook

reformatted buildtest/config.py
All done!
1 file reformatted.
```

If you are interested in running black locally to see diff result from black without auto-formatting code, you can do the following:

```
$ black --check --diff .
--- tests/test_inspect.py       2020-02-25 18:58:58.360360 +0000
+++ tests/test_inspect.py       2020-02-25 18:59:07.336414 +0000
@@ -18,11 +18,11 @@
 def test_distro_short():
     assert "rhel" == distro_short("Red Hat Enterprise Linux Server")
     assert "centos" == distro_short("CentOS")
     assert "suse" == distro_short("SUSE Linux Enterprise Server")
-    x=0+1*3
+    x = 0 + 1 * 3
```

The changes will be shown with lines removed or added via - and +. For more details refer to black documentation.

isort

isort is a python utility that will sort python imports alphabetically. We use isort as part of the CI checks, there is a .isort.cfg that defines the isort configuration that is compatible with black utility. We have setup a pre-commit hook that can be used to automatically run isort as part of your `git commit` process. This is defined in pre-commit configuration file .pre-commit-config.yaml that can be installed by running `pre-commit install`. Once this is setup, you will see **isort** and **black** checks are run during the commit process.

```
$ git commit
isort....................................................................Passed
black....................................................................Passed
[sphinx_fix 85d9d42c] fix issue with rendering bullet points in sphinx. This is solved␣
↪by downgrading docutils to version 0.16.
 2 files changed, 5 insertions(+)
```

Please make sure you run `pip install -r docs/requirements.txt` to get the development dependencies that includes isort.

If you want to run isort, you can use the *-c* and *–diff* option to check and see diff between files. For instance in example below we see isort reports changes to `import` statement

```
$ isort -c --diff profile black  buildtest/main.py
ERROR: /Users/siddiq90/Documents/GitHubDesktop/buildtest/buildtest/main.py Imports are␣
↪incorrectly sorted and/or formatted.
--- /Users/siddiq90/Documents/GitHubDesktop/buildtest/buildtest/main.py:before      2021-
↪07-13 16:53:42.722718
+++ /Users/siddiq90/Documents/GitHubDesktop/buildtest/buildtest/main.py:after       2021-
↪07-13 16:54:12.135986
```

(continues on next page)

(continued from previous page)

```
@@ -1,8 +1,7 @@
 """Entry point for buildtest"""

+import os
 import webbrowser
-import os
-

 from buildtest.cli import get_parser
 from buildtest.cli.build import BuildTest
Broken 2 paths
```

If you want to apply the changes you can get rid of `-c` and `--diff` option and isort will apply the changes. Please see https://pycqa.github.io/isort/docs/configuration/black_compatibility.html and https://black.readthedocs.io/en/stable/guides/using_black_with_other_tools.html#isort for documentation regarding black and isort compatibility.

pyflakes

pyflakes is a program that checks for python source code for errors such as unused imports. We have configured an automated check to test your incoming PR using pyflakes. pyflakes should be available in your python environment if you installed buildtest extra dependencies in requirements.txt (`pip install -r docs/requirements.txt`).

You can run pyflakes against any file or directory the ones of importance is running pyflakes against buildtest source code and regression test. You can do that by running:

```
pyflakes buildtest tests
```

GitHub Integrations

buildtest has several CI checks that are run when you create a Pull Request, it is your responsibility to review the CI checks and make sure all checks are passing. Each pull request will show the CI checks, you can see the github actions that are also typically linked as part of the pull request.

Coverage

We use coverage to measure code coverage of buildtest when running regression test. We use CodeCov to display coverage reports through web interface. The coverage configuration is managed by .coveragerc file found in the root of the repo.

Whenever you add new feature to buildtest, please add regression test with test coverage to help maintainers review new feature request. For more details on running coverage tests see *Running test via coverage*.

CodeCov

Codecov report coverage details in web-browser. CodeCov can perform pull request comments after coverage report is uploaded to Codecov which is useful for reviewer and assignee to see status of coverage report during PR review process. The codecov file .codecov.yml is used for configuration codecov. For more details on codecov yaml file see https://docs.codecov.io/docs/codecov-yaml.

Gitlab CI checks

buildtest has automated CI checks on gitlab servers: https://software.nersc.gov and https://code.ornl.gov. The gitlab pipelines are stored in .gitlab directory found in root of repository.

The mirror.yml github workflow is responsible for mirroring and trigger CI check and return result back to github PR. Currently, we are using github action stenongithub/gitlab-mirror-and-ci-action to perform pull mirroring and triggering CI job.

The gitlab server https://software.nersc.gov is hosted at NERSC. The following steps were taken to setup pipeline

1. Create a Personal Access token with **read_api**, **read_repository**, **write_repository** scope at https://software.nersc.gov/-/profile/personal_access_tokens
2. Define a secret **CORI_GITLAB_PASSWORD** at https://github.com/buildtesters/buildtest/settings/secrets/actions with token value generated in step 1
3. Import buildtest project from github at https://software.nersc.gov/siddiq90/buildtest
4. Add variable **SECRET_CODECOV_TOKEN** in https://software.nersc.gov/siddiq90/buildtest/-/settings/ci_cd that contains codecov token found at https://app.codecov.io/gh/buildtesters/buildtest/settings
5. Change gitlab CI configuration file to .gitlab/cori.yml under **Settings > CI/CD > General pipelines**. For more details see https://docs.gitlab.com/ee/ci/pipelines/settings.html#custom-cicd-configuration-path

The gitlab server https://code.ornl.gov is hosted at OLCF which has access to systems like Summit and Ascent. We performed similar steps at as shown above with slight modification

1. Create a Personal access token with same scope at https://code.ornl.gov/-/profile/personal_access_tokens
2. Define a secret **OLCF_GITLAB_PASSWORD** at https://github.com/buildtesters/buildtest/settings/secrets/actions
3. Import buildtest project at https://code.ornl.gov/ecpcitest/buildtest. Currently, all projects in `ecpcitest` project group has access to gitlab runners.
4. Add variable **SECRET_CODECOV_TOKEN** in https://code.ornl.gov/ecpcitest/buildtest/-/settings/ci_cd that contains codecov token found at https://app.codecov.io/gh/buildtesters/buildtest/settings
5. Change gitlab CI configuration file to .gitlab/olcf.yml

Currently, the gitlab pipelines are triggered manually which requires a user to have access to the gitlab project to run the pipeline. The pipelines can be run manually at https://software.nersc.gov/siddiq90/buildtest/-/pipelines and https://code.ornl.gov/ecpcitest/buildtest/-/pipelines

The github workflow mirror.yml defines gitlab configuration for each mirror. Any changes to mirror path must be addressed in this workflow to ensure pull mirroring is done properly.

GitHub Bots

buildtest has a few bots to do various operations that are described below.

- Stale - stale bot is used to close outdated issues. This is configured in `.github/stale.yml`. If there is no activity on a issue after certain time period, **probot-stale** will mark the issue and project maintainers can close it manually. For more details on Stale refer to the documentation
- CodeCov - The codecov bot will report codecov report from the issued pull request once coverage report is complete. The configuration for codecov is defined in `.codecov.yml` found in root of repo.
- Pull Request Size - is a bot that labels Pull Request by number of **changed** lines of code.

Building Documentation

The buildtest documentation is written in reStructuredText using sphinx. You should be familiar with rst if you want to contribute to user documentation.

ReadTheDocs

buildtest documentation is hosted by ReadTheDocs at https://readthedocs.org which is a documentation platform for building and hosting your docs.

buildtest project can be found at https://readthedocs.org/projects/buildtest/ which will show the recent builds and project setting. If you are interested in becoming a maintainer, please contact **Shahzeb Siddiqui** (`shahzebmsiddiqui@gmail.com`) to grant access to this project.

Setup

buildtest documentation is located in top-level docs directory. If you want to build the documentation you will need to make sure your python environment has all the packages defined in `docs/requirements.txt`. If your environment is already setup as described in *Installing buildtest* then you can skip this step.

To install your python packages, you can run the following:

```
pip install -r docs/requirements.txt
```

Building docs locally

To build your documentation simply run the following:

```
cd docs
make clean
make html
```

It is best practice to run `make clean` to ensure sphinx will remove old html content from previous builds, but it is ok to skip this step if you are making minor changes.

Running `make html` will build the sphinx project and generate all the html files in `docs/_build/html`. Once this process is complete you may want to view the documentation. If you have `firefox` in your system you can simply run the following:

```
make view
```

This will open a `firefox` session to the root of your documentation that was recently generated. Make sure you have X11 forwarding in order for firefox to work properly. Refer to the `Makefile` to see all of the make tags or run `make` or `make help` for additional help.

Automate Documentation Examples

buildtest has a script in top-level folder `script/docgen.py` to automate documentation examples. This script can be run as follows:

```
python script/docgen.py
```

This assumes your buildtest environment is setup, the script will write documentation test examples in `docs/docgen`. Consider running this script when **adding**, **modifying**, or **removing** documentation examples. Once the test are complete, you will want to add the tests, commit and push as follows:

```
git add docs/docgen
git commit -m <MESSAGE>
git push
```

Regression Tests

buildtest has a suite of regression tests to verify the state of buildtest. These tests are located in the top-level directory tests. buildtest is using pytest for running the regression tests.

Getting Started

In order to write regression tests, you should have `pytest` and `coverage` installed in your python environment. You can do this by installing all dependencies found in requirements file:

```
pip install -r docs/requirements.txt
```

Writing Regression Tests

If you want to write a new regression test, you should be familiar with coverage report that is pushed to codecov. The coverage report will give a detailed line-line coverage of source code HIT/MISS when running the regression test. Increasing coverage report would be great way to write a new regression test.

The tests directory is structured in a way that each source file has a corresponding test file that starts with `test_`. For instance, if you want to write a test for `buildtest/utils/command.py`, there will be a corresponding test under `tests/utils/test_command.py`.

If you adding a new directory, make sure the name corresponds to one found under `buildtest` directory and add a `__init__.py` in the new directory. This is required by pytest for test discovery. All test methods must start with **test_** in order for pytest to run your regression test.

Shown below is a simple test that always passes

```
def test_regression_example1():
    assert True
```

For more details on writing tests with pytest see Getting-Started.

Running Regression Test

The recommended way to run regression test is via:

```
$ python $BUILDTEST_ROOT/scripts/regtest.py
```

This script is a wrapper to *pytest* and *coverage*. We have a pytest.ini found in top-level folder that defines pytest configuration. If you want to run tests natively via *pytest* without using the script you can just run `pytest` and it will run with options defined in *pytest.ini* file.

If you want to run all schema tests you can use the `schema` marker as follows:

```
pytest -v -m schema
```

To see a list of pytest markers see pytest.ini or run:

```
pytest --markers
```

For a complete list of options refer to pytest documentation or run `pytest --help`.

Running test via coverage

There is a coverage configuration file .coveragerc located in root of buildtest that is read by **coverage** utility. The regtest.py script will collect coverage details upon completion of regression test which is equivalent to running *coverage run -m pytest* but we make some additional checks when running the script. Upon completion of tests you can run `coverage report` to show coverage results of your regression test run locally. Shown below is an example output:

```
$ coverage report
Name                                             Stmts   Miss Branch BrPart      Cover
-------------------------------------------------------------------------------------
buildtest/__init__.py                                3      3      0      0     0.00%
buildtest/defaults.py                               17     17      0      0     0.00%
buildtest/executors/slurm.py                       110     93     28      0    12.32%
buildtest/executors/cobalt.py                      110     93     22      0    12.88%
buildtest/executors/pbs.py                          96     81     14      0    13.64%
buildtest/executors/lsf.py                         103     85     16      0    15.13%
buildtest/utils/timer.py                            15      9      4      0    31.58%
buildtest/menu/__init__.py                          29     16     10      0    33.33%
buildtest/executors/setup.py                       108     60     60      8    35.71%
buildtest/menu/compilers.py                        107     60     50      3    38.22%
buildtest/config.py                                158     72     76     10    47.86%
buildtest/system.py                                155     70     38     11    50.78%
buildtest/docs.py                                    5      2      0      0    60.00%
buildtest/log.py                                    19      7      0      0    63.16%
buildtest/buildsystem/base.py                      185     45     50      8    67.23%
buildtest/menu/build.py                            421    117    208     22    70.59%
buildtest/buildsystem/batch.py                      75     17     44      7    71.43%
buildtest/buildsystem/compilerbuilder.py           193     36     52     10    77.14%
buildtest/buildsystem/builders.py                  107     24     60      8    77.25%
buildtest/utils/tools.py                            19      2     12      2    80.65%
```

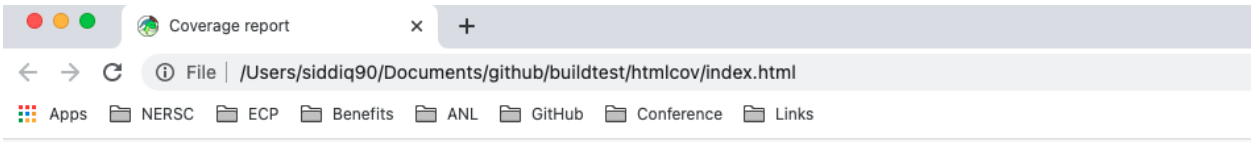
(continues on next page)

(continued from previous page)

```
buildtest/exceptions.py                          7      2      4      0    81.82%
buildtest/menu/buildspec.py                    356     46    188     22    83.82%
buildtest/executors/local.py                    49      3     10      4    88.14%
buildtest/buildsystem/scriptbuilder.py          41      3     10      3    88.24%
buildtest/utils/file.py                         68     11     30      0    88.78%
buildtest/menu/report.py                       193     16    114     14    89.58%
buildtest/executors/base.py                     61      4     18      2    89.87%
buildtest/utils/command.py                      68      3     20      5    90.91%
buildtest/menu/config.py                        73      4     12      1    94.12%
buildtest/buildsystem/parser.py                 51      2     18      2    94.20%
buildtest/menu/schema.py                        26      0     16      2    95.24%
buildtest/menu/inspect.py                       63      2     46      3    95.41%
buildtest/schemas/defaults.py                   32      0      0      0   100.00%
buildtest/schemas/utils.py                      26      0      8      0   100.00%
buildtest/utils/shell.py                        30      0      8      0   100.00%
-------------------------------------------------------------------------------
TOTAL                                         3179   1005   1246    147    66.19%
```

4 empty files skipped.

If you want to view the coverage details locally in a browser you can run: `coverage html` which will write the results to directory **htmlcov**. You can open the file `open htmlcov/index.html` and it will show you a summary of coverage results that you would see from codecov.



Coverage report: 66.19%

Module ↑	statements	missing	excluded	branches	partial	coverage
buildtest/__init__.py	3	3	0	0	0	0.00%
buildtest/buildsystem/base.py	185	45	4	50	8	67.23%
buildtest/buildsystem/batch.py	75	17	0	44	7	71.43%
buildtest/buildsystem/builders.py	107	24	0	60	8	77.25%
buildtest/buildsystem/compilerbuilder.py	193	36	0	52	10	77.14%
buildtest/buildsystem/parser.py	51	2	4	18	2	94.20%
buildtest/buildsystem/scriptbuilder.py	41	3	0	10	3	88.24%
buildtest/config.py	158	72	0	76	10	47.86%
buildtest/defaults.py	17	17	0	0	0	0.00%
buildtest/docs.py	5	2	0	0	0	60.00%
buildtest/exceptions.py	7	2	2	4	0	81.82%
buildtest/executors/base.py	61	4	4	18	2	89.87%
buildtest/executors/cobalt.py	110	93	0	22	0	12.88%
buildtest/executors/local.py	49	3	0	10	4	88.14%
buildtest/executors/lsf.py	103	85	0	16	0	15.13%
buildtest/executors/pbs.py	96	81	0	14	0	13.64%
buildtest/executors/setup.py	108	60	4	60	8	35.71%
buildtest/executors/slurm.py	110	93	0	28	0	12.32%
buildtest/log.py	19	7	0	0	0	63.16%
buildtest/menu/__init__.py	29	16	113	10	0	33.33%
buildtest/menu/build.py	421	117	0	208	22	70.59%
buildtest/menu/buildspec.py	356	46	0	188	22	83.82%
buildtest/menu/compilers.py	107	60	8	50	3	38.22%
buildtest/menu/config.py	73	4	0	12	1	94.12%
buildtest/menu/inspect.py	63	2	0	46	3	95.41%
buildtest/menu/report.py	193	16	0	114	14	89.58%
buildtest/menu/schema.py	26	0	0	16	2	95.24%
buildtest/schemas/defaults.py	32	0	0	0	0	100.00%
buildtest/schemas/utils.py	26	0	0	8	0	100.00%
buildtest/system.py	155	70	0	38	11	50.78%
buildtest/utils/command.py	68	3	0	20	5	90.91%
buildtest/utils/file.py	68	11	0	30	0	88.78%
buildtest/utils/shell.py	30	0	4	8	0	100.00%
buildtest/utils/timer.py	15	9	0	4	0	31.58%
buildtest/utils/tools.py	19	2	2	12	2	80.65%
Total	**3179**	**1005**	**145**	**1246**	**147**	**66.19%**

For more details on coverage please refer to coverage documentation.

Tox

buildtest provides a tox.ini configuration to allow user to test regression test in isolated virtual environment. To get started install tox:

```
pip install tox
```

Refer to tox documentation for more details. To run tox for all envrionment you can run:

```
tox
```

If your system has one python instance let's say python 3.7 you can test for python 3.7 environment by running `tox -e py37`.

Contributing to Schemas

Schema Docs

Schema Documentation are hosted on branch gh-pages which is hosted via GitHub Pages at https://buildtesters.github.io/buildtest/.

There is an automated workflow jsonschema2md which publishes schemas, documentation and examples. If you want to edit top-level page README.md please send a pull-request to *gh-pages* branch.

Adding a new schema

If you want to add a new schema to buildtest you need to do the following:

1. Add schema file in buildtest/schemas and schema file must end in **.schema.json**. If it's a sub-schema it must in format `<name>-<version>.schema.json`. For example a schema name `script-v2.0.schema.json` will be sub-schema script and version 2.0.
2. Their should be a folder that corresponds to name of schema in examples directory.
3. There should be a list of invalid and valid examples for schema.
4. There should be regression testfile in schema_tests to test the schema.

Be sure to update properties and take account for:

- a property being required or not
- Make use of *additionalProperties: false* when defining properties so that additional keys in properties are not passed in.
- requirements for the values provided (types, lengths, etc.)
- If you need help, see *Resources* or reach out to someone in Slack.

Running Schema Tests

The schema tests are found in folder `tests/schema_tests` which has regression test for each schema. The purpose for schema test is to ensure Buildspecs are written according to specification outlined in schemas. Furthermore, we have edge cases to test invalid Buildspec recipes to ensure schemas are working as expected.

To run all schema test you can run via marker:

```
pytest -v -m schema
```

JSON Definitions

We store all JSON definitions in defintions.schema.json which are fields need to be reused in other schemas. A JSON definition is defined under `defintions` field, in this example we define a definition anchor **list_of_strings** that declares an array of string:

```
{
  "definitions": {
    "list_of_strings": {
      "type": "array",
      "uniqueItems": true,
      "minItems": 1,
      "items": {"type": "string"}
    },
  }
}
```

A definition anchor can be referenced using **$ref** keyword. In example below we declare a definitions **string_or_list** that uses `$ref` that points to anchor `list_of_strings`:

```
"string_or_list": {
  "oneOf": [
    {"type": "string"},
    {"$ref": "#/definitions/list_of_strings"}
  ]
},
```

For example the `tags` field is defined in **definitions.schema.json** that references definition `string_or_list`:

```
"tags": {
  "description": "Classify tests using a tag name, this can be used for categorizing␣
↪test and building tests using ``--tags`` option",
  "$ref": "#/definitions/string_or_list"
},
```

The tags field is used in other schemas like **compiler-v1.0.schema.json** and **script-v1.0.schema.json**. In this example we declare **tags** field and reference tags anchor from definitions.schema.json:

```
"tags": {
  "$ref": "definitions.schema.json#/definitions/tags"
}
```

It's worth noting each schema must have a **$id** in order for JSON to resolve references (`$ref`). For example the definitions schema has the following id:

```
"$id": "definitions.schema.json"
```

It's recommended each schema has a **$schema**, **$title**, **description** field for each schema. Currently, we support JSON Schema Draft7 so our schema field must be set to the following:

```
"$schema": "http://json-schema.org/draft-07/schema#",
```

Resources

The following sites (along with the files here) can be useful to help with your development of a schema.

- json-schema.org
- json schema readthedocs

If you have issues with writing json schema please join the JSON-SCHEMA Slack Channel

Maintainer Guide

This is a guide for buildtest maintainers

Incoming Pull Request

These are just a few points to consider when dealing with incoming pull requests

1. Any incoming Pull Request should be assigned to one or more maintainers for review.
2. Upon approval, the PR should be **Squash and Merge**. If it's important to preserve a few commits during PR then **Rebase and Merge** is acceptable.
3. The final commit PR commit, either Squash Commit or Rebase should have meaningful comments and if possible link to the github issue.
4. Maintainers can request user to put meaningful commit if author has not provided a meaningful message (i.e `git commit --amend`)
5. Maintainers are requested that committer name and email is from a valid Github account. If not please request the committer to fix the author name and email.
6. All incoming PRs should be pushed to `devel` branch, if you see any PR sent to any other branch please inform code owner to fix it

Release Process

Every buildtest release will be tagged with a version number using format **X.Y.Z**. Every release will have a git tags such as `v1.2.3` to correspond to release **1.2.3**. Git tags should be pushed to upstream by **release manager** only. The process for pushing git tags can be described in the following article: Git Basics - Tagging

We will create annotated tags as follows:

```
git tag -a v1.2.3 -m "buildtest version 1.2.3"
```

Once tag is created you can view the tag details by running either:

```
git tag
git show v1.2.3
```

We have created the tag locally, next we must push the tag to the upstream repo by doing the following:

```
git push origin v.1.2.3
```

Every release must have a release note that is maintained in file CHANGELOG.rst

Under buildtest releases a new release can be created that corresponds to the git tag. In the release summary, just direct with a message stating **refer to CHANGELOG.rst for more details**

Once the release is published, make sure to open a pull request from `devel` –> `master` and **Rebase and Merge** to master branch. If there are conflicts during merge for any reason, then simply remove `master` and create a master branch from devel.

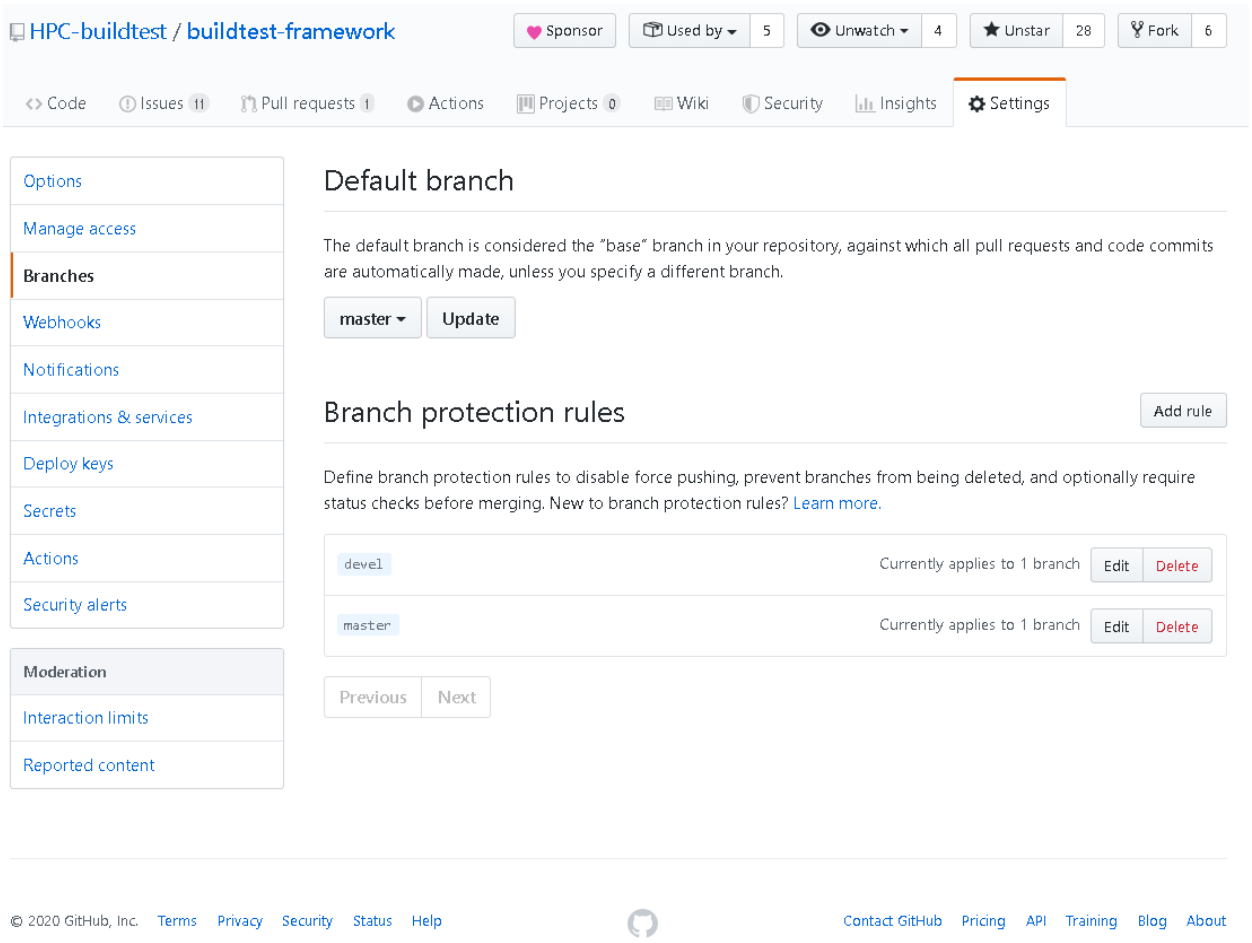
Default Branch

The default branch should be `devel` which should be protected branch.

Branch Settings

All maintainers are encouraged to view branch settings for `devel` and `master`. If something is not correct please consult with the maintainers.

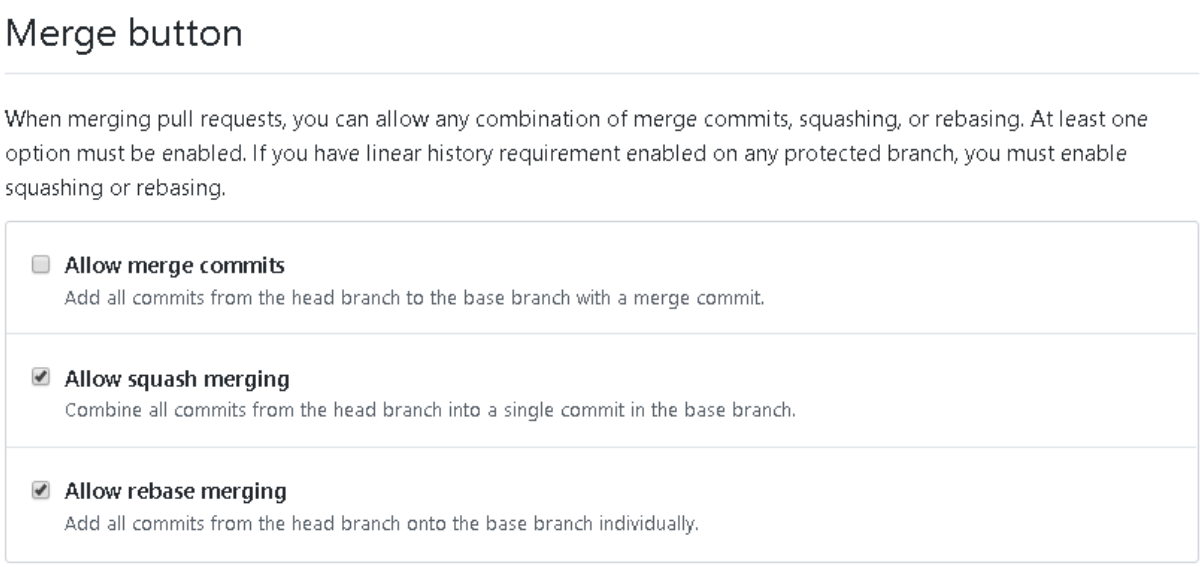
The master and devel branches should be protected branches and master should be enabled as default branch. Shown below is the expected configuration.



Merge Settings

We have disabled `Merge Commits` for the Merge button in Pull Request. This was done because we wanted a linear history as a requirement for `devel` branch. This avoids having a maintainer accidently merge a PR with `Merge Commit` which adds an extra commit.

Shown below is the recommended configuration.



If you notice a deviation, please consult with the maintainers.

Google Analytics

The buildtest site is tracked via Google Analytics, if you are interested in get access contact **Shahzeb Siddiqui (@shahzebsiddiqui)**

Read The Docs Access

buildtest project for readthedocs can be found at https://readthedocs.org/projects/buildtest/. If you need to administer project configuration, please contact **Shahzeb Siddiqui @shahzebsiddiqui** to gain access.

Slack Admin Access

If you need admin access to Slack Channel please contact **Shahzeb Siddiqui @shahzebsiddiqui**. The slack admin link is https://hpcbuildtest.slack.com/admin

New Maintainers Checklist

Onboarding Email

This guide is to help onboard new maintainers into the buildtest project. To get started send an invitation email as follows:

```
We are pleased to invite you to the buildtest project and become a
buildtesters (a.k.a buildtest maintainer). We understand your time is
valuable; therefore we request a minimal effort of 2-3hrs per week towards buildtest.

As a buildtesters, you will be working on the following:
```

(continues on next page)

(continued from previous page)

```
  * Monitor and triage issues
  * Assist user in slack channel (#general)
  * Update documentation
  * Review or triage Pull Request
  * Issue new pull request
  * Troubleshoot build errors in regression test or CI checks

As a buildtesters you may be granted elevated privilege to the following
services: GitHub, ReadTheDocs, Slack, and Google Analytics. As a
buildtesters, you agree to be accessible on Slack as our primary communication
channel.

If you agree to these terms, you will be assigned to work with another buildtest
maintainer in your first two weeks. Once you are confident in your duties, we
will let you work independently at your own pace, should you need help please
contact one of the buildtesters.

Please review the contributing guide: https://buildtest.readthedocs.io/en/devel/
↪contributing.html
if you are unsure about your responsibilities as a buildtesters.

If you agree to these terms and conditions, please reply "I CONFIRM".

Thanks,
buildtest
```

Onboarding Checklist

- Please make sure the maintainer has a GitHub account if not please create an account at https://github.com/join.
- Ensure user has setup two-factor authentication (2FA) with GitHub.
- Invite member to buildtesters organization.
- Add member to buildtest repository with **Role: Maintain**.
- Invite member to join slack channel and preferably install Slack on your workstation and phone. Please follow instructions to download slack for Windows, Mac, or Android. Slack is available on Apple Store and Google Play Store.
- Once member is added to Slack, ensure member has the appropriate account type. Generally you will want member to be a **Workspace Admin** for more details see Slack Roles & Permissions.
- Ensure member has an account at ReadTheDocs if not please request member to create an account at https://readthedocs.org/accounts/signup/. Once member has an account please add member to buildtest readthedocs project at https://readthedocs.org/dashboard/buildtest/users/. This will ensure user has ability to access readthedocs platform when troubleshooting build errors related to documentation.

3.11 API Reference

This page contains auto-generated API reference documentation[1].

3.11.1 buildtest

Subpackages

buildtest.buildsystem

Submodules

buildtest.buildsystem.base

BuilderBase class is an abstract class that defines common functions for any types of builders. Each type schema (script, compiler) is implemented as separate Builder.

ScriptBuilder class implements 'type: script' CompilerBuilder class implements 'type: compiler'

Module Contents

Classes

BuilderBase	The BuilderBase is an abstract class that implements common functions for

class buildtest.buildsystem.base.**BuilderBase**(*name*, *recipe*, *buildspec*, *executor*, *buildexecutor*, *testdir*)

Bases: abc.ABC

The BuilderBase is an abstract class that implements common functions for any kind of builder.

__repr__(*self*)

Return repr(self).

__str__(*self*)

Return str(self).

_build_setup(*self*)

This method is the setup operation to get ready to build test which includes getting unique build id, setting up metadata object to store test details such as where test will be located and directory of test. This section cannot be reached without a valid, loaded recipe.

_check_regex(*self*)

This method conducts a regular expression check using `re.search` with regular expression defined in Buildspec. User must specify an output stream (stdout, stderr) to select when performing regex. In buildtest, this would read the .out or .err file based on stream and run the regular expression to see if there is a match. This method will return a boolean True indicates there is a match otherwise False if `regex` object not defined or `re.search` doesn't find a match.

Parameters **builder** (*BuilderBase (subclass)*) – instance of BuilderBase class

[1] Created with sphinx-autoapi

Returns A boolean return True/False based on if re.search is successful or not

Return type bool

_check_runtime(*self*)
This method will return a boolean (True/False) based on runtime specified in buildspec and check with test runtime. User can specify both *min* and *max*, or just specify *min* or *max*.

_default_test_variables(*self*)
Return a list of lines inserted in testscript that define buildtest specific variables that can be referenced when writing tests. The buildtest variables all start with BUILDTEST_*

_emit_command(*self*)
This method will return a shell command used to invoke the script that is used for tests that use local executors

_generate_unique_id(*self*)
Generate a unique build id using `uuid.uuid4()`.

_get_burst_buffer(*self*, *burstbuffer*)
Get Burst Buffer directives (#BB) lines specified by BB property

Parameters **burstbuffer** (*dict, required*) – Burst Buffer configuration specified by BB property

Returns list of burst buffer directives

Return type list

_get_data_warp(*self*, *datawarp*)
Get Cray Data Warp directives (#DW) lines specified by DW property.

Parameters **datawarp** (*dict, required*) – Data Warp configuration specified by DW property

Returns list of data warp directives

Return type list

_get_environment(*self*, *env*)
Retrieve a list of environment variables defined in buildspec and return them as list with the shell equivalent command

Returns list of environment variable lines to add to test script.

Return type list

_get_variables(*self*, *variables*)
Retrieve a list of variables defined in buildspec and return them as list with the shell equivalent command.

Returns list of variables variable lines to add to test script.

Return type list

_returncode_check(*self*)
Check status check of `returncode` field if specified in status property.

_set_execute_perm(*self*, *fname*)
Set permission to 755 for a given file. The filepath must be an absolute path to file

_set_metadata_values(*self*)
This method sets self.metadata that contains metadata for each builder object.

_write_build_script(*self*)
This method will write the build script used for running the test

_write_test(*self*)
This method is responsible for invoking `generate_script` that formulates content of testscript which is implemented in each subclass. Next we write content to file and apply 755 permission on script so it has executable permission.

add_metrics(*self*)
This method will update the metrics field stored in `self.metadata['metrics']`. The `metrics` property can be defined in the buildspdec to assign value to a metrics name based on regular expression, environment or variable assignment.

build(*self*)
This method is responsible for invoking setup, creating test directory and writing test. This method is called from an instance object of this class that does `builder.build()`.

check_test_state(*self*)
This method is responsible for detecting state of test (PASS/FAIL) based on returncode or regular expression.

complete(*self*)
This method is invoked to indicate that builder job is complete after polling job.

copy_stage_files(*self*)
Copy output and error file into test root directory since stage directory will be removed.

endtime(*self*)
This method is called upon termination of job, we get current time using `datetime.datetime.now()` and calculate runtime of job

error(*self*)
Return error content

abstract generate_script(*self*)
Build the testscript content implemented in each subclass

get_cobalt_directives(*self*)
Get #COBALT lines based on `cobalt` property

get_job_directives(*self*)
This method returns a list of lines containing the scheduler directives

get_lsf_directives(*self*)
Get #BSUB lines based on `bsub` property

get_pbs_directives(*self*)
Get #PBS lines based on `pbs` property

get_runtime(*self*)

get_slurm_directives(*self*)
Get #SBATCH lines based on `sbatch` property

get_test_extension(*self*)
Return the test extension, which depends on the shell used. Based on the value of `shell` key we return the shell extension.

shell: bash –> sh (default)

Returns returns test extension based on shell type

Return type str

incomplete(*self*)
This method indicates that builder job is not complete after polling job either job was cancelled by scheduler or job failed to run.

output(*self*)
Return output content

post_run_steps(*self*)

run(*self*)
Run the test and record the starttime and start timer. We also return the instance object of type BuildTest-Command which is used by Executors for processing output and error

run_command(*self*)
Command used to run the build script. buildtest will change into the stage directory (self.stage_dir) before running the test.

runtime(*self*)
Calculate runtime of job by calculating delta between endtime and starttime. The unit of measure is seconds.

sched_init(*self*)
This method will resolve scheduler fields: 'sbatch', 'pbs', 'bsub', 'cobalt'

start(*self*)
Keep internal time for start of test. We start timer by calling Timer class

starttime(*self*)
This method will record the starttime when job starts execution by using `datetime.datetime.now()`

stop(*self*)
Stop timer of test and calculate duration.

buildtest.buildsystem.batch

Module Contents

Classes

BatchScript
CobaltBatchScript
LSFBatchScript
PBSBatchScript
SlurmBatchScript

class buildtest.buildsystem.batch.**BatchScript**

get_headers(*self*)

class buildtest.buildsystem.batch.**CobaltBatchScript**(*batch=None*, *cobalt=None*)
Bases: *BatchScript*

batch_translation

build_header(*self*)

class buildtest.buildsystem.batch.**LSFBatchScript**(*batch=None*, *bsub=None*)
Bases: *BatchScript*

batch_translation

build_header(*self*)
Generate BSUB directive that will be part of the script

class buildtest.buildsystem.batch.**PBSBatchScript**(*batch=None*, *pbs=None*)
Bases: *BatchScript*

batch_translation

build_header(*self*)

class buildtest.buildsystem.batch.**SlurmBatchScript**(*batch=None*, *sbatch=None*)
Bases: *BatchScript*

batch_translation

build_header(*self*)
Generate SBATCH directive that will be part of the script

buildtest.buildsystem.builders

This file implements the Builder class that is responsible for getting builders from a buildspec file. The Builder class is invoked once buildspec file has parsed validation via BuildspecParser.

Module Contents

Classes

Builder

class buildtest.buildsystem.builders.**Builder**(*bp*, *buildexecutor*, *filters*, *testdir*, *configuration*, *buildtest_system=None*, *rebuild=1*)

_build_compilers(*self*, *name*, *recipe*)
This method will perform regular expression with 'name' field in compilers section and retrieve one or more compiler that were defined in buildtest configuration. If any compilers were retrieved we return one or more builder objects that call CompilerBuilder

Parameters

- **bp** (BuildspecParser) – an instance of BuilderspecParser class
- **recipe** (*dict*) – loaded test recipe

_generate_builders(*self*, *recipe*, *name*, *compiler_name=None*)
This method is responsible for generating builders by applying regular expression specified by *executor* field in buildspec with list of executors. If their is a match we generate a builder.

Parameters

- **name** (*str*) – Name of test in buildspec file
- **recipe** (*object*) – Loaded test recipe from a test section.
- **compiler_name** (*str, optional*) – Name of compiler

Returns A list of builder objects

_skip_tests_by_tags(*self*, *recipe*, *name*)

This method determines if test should be skipped based on tag names specified in filter field that is specified on command line via `buildtest build --filter tags=<TAGNAME>`

Parameters

- **recipe** (*dict*) – loaded buildspec recipe as dictionary
- **name** (*str*) – An instance of test from buildspec file

Returns Returns a boolean True/False which determines if test is skipped.

Return type bool

_skip_tests_by_type(*self*, *recipe*, *name*)

This method determines if test should be skipped based on type field specified in filter field that is specified on command line via `buildtest build --filter type=<SCHEMATYPE>`

Parameters

- **recipe** (*dict*) – loaded buildspec recipe as dictionary
- **name** (*str*) – An instance of test from buildspec file

Returns Returns a boolean True/False which determines if test is skipped.

Return type bool

_skip_tests_run_only(*self*, *recipe*, *name*)

This method will skip tests based on `run_only` field from buildspec. Checks are performed based on conditionals and if any conditional is not met we skip test.

Parameters

- **recipe** (*dict, required*) – loaded buildspec recipe as dictionary
- **name** (*str, required*) – name of test from buildspec file

Returns Returns a boolean to see if test is skipped based on `run_only` property

Return type bool

get_builders(*self*)

get_test_names(*self*)

Return the list of test names for the loaded Buildspec recipe. This can be retrieved by returning a list of keys under 'buildspecs' property

Returns A list of test names in buildspec file

Return type list

buildtest.buildsystem.compilerbuilder

Module Contents

Classes

CompilerBuilder	The BuilderBase is an abstract class that implements common functions for

class buildtest.buildsystem.compilerbuilder.**CompilerBuilder**(*name*, *recipe*, *buildspec*, *buildexecutor*, *executor*, *configuration*, *compiler=None*, *testdir=None*)

Bases: *buildtest.buildsystem.base.BuilderBase*

The BuilderBase is an abstract class that implements common functions for any kind of builder.

cc

cflags

cppflags

cxx

cxxflags

fc

fflags

lang_ext_table

ldflags

type = compiler

_compile_cmd(*self*)

This method generates the compilation line and returns the output as a list. The compilation line depends on the the language detected that is stored in variable `self.lang`.

_detect_lang(*self*, *sourcefile*)

This method will return the Programming Language based by looking up file extension of source file.

_get_modules(*self*, *modules*)

Return a list of module command as a list of instructions based on `module` property.

param modules 'module' property specified in buildspec used for loading/swapping modules

type modules object

_process_compiler_config(*self*)

This method is responsible for setting cc, fc, cxx class variables based on compiler selection. The order of precedence is `config`, `default`, then buildtest setting. Compiler settings in 'config' takes highest precedence, this overrides any configuration in 'default'. Finally we resort to compiler configuration in buildtest setting if none defined. This method is responsible for setting cc, fc, cxx, cflags, cxxflags, fflags, ldflags, and cppflags.

_resolve_source(*self*)
This method resolves full path to source file, it checks for absolute path first before checking relative path that is relative to Buildspec recipe.

_run_cmd(*self*)
This method builds the run command which refers to how to run the generated binary after compilation.

generate_script(*self*)
This method is responsible for generating test script for compiler schema. The method `generate_script` is implemented in each subclass because implementation on test generation differs across schema types.

This method will add the lines into list which comprise content of test. The method will return a list containing lines of test script.

get_cc(*self*)

get_cflags(*self*)

get_cppfilags(*self*)

get_cxx(*self*)

get_cxxflags(*self*)

get_fc(*self*)

get_fflags(*self*)

get_ldflags(*self*)

get_path(*self*)
This method returns the full path for C, C++, Fortran compilers

set_cc(*self*, *cc*)

set_cflags(*self*, *cflags*)

set_cppflags(*self*, *cppflags*)

set_cxx(*self*, *cxx*)

set_cxxflags(*self*, *cxxflags*)

set_fc(*self*, *fc*)

set_fflags(*self*, *fflags*)

set_ldflags(*self*, *ldflags*)

setup(*self*)
The setup method is responsible for process compiler section, getting modules pre_build, post_build, pre_run, post_run section and generate compilation and run command. This method invokes other methods and set values in class variables. This method is called by self.generate_script method.

buildtest.buildsystem.parser

BuildspecParser is intended to read in a Buildspec file with one or more test blocks, and then generate builders based on the type of each. The BuilderBase is the base class for all builders that expose functions to run builds.

Module Contents

Classes

BuildspecParser	A BuildspecParser is a base class for loading and validating a Buildspec file.

class buildtest.buildsystem.parser.**BuildspecParser**(*buildspec*, *buildexecutor*)

A BuildspecParser is a base class for loading and validating a Buildspec file. The type (e.g., script) and version are derived from reading in the file, and then matching to a Buildspec schema.

The schemas are located in buildtest/schemas, we load the schema dictionary and validate each buildspec with global schema and a sub-schema based on the `type` field. If the schema fails validation check, then we stop immediately.

__repr__(*self*)

Return repr(self).

__str__(*self*)

Return str(self).

_check_executor(*self*, *test*)

This method checks if `executor` property is not None and executor value is found in list of available executors.

Parameters **test** (*str, required*) – name of test in `buildspecs` property in buildspec file

_check_schema_type(*self*, *test*)

Check `type` field is a valid sub-schema and verify `type` + `version` will resolve to a schema file.

_validate(*self*)

This method will validate the entire buildspec file with global schema and each test section with a sub-schema. The global validation ensures that the overall structure of the file is sound for further parsing. We load in the global.schema.json for this purpose.

A buildspec is composed of one or more tests, each section is validated with a sub-schema. The `type` field is used for sub-schema lookup from schema library. Finally we validate loaded recipe with sub-schema.

buildtest.buildsystem.scriptbuilder

Module Contents

Classes

ScriptBuilder	The BuilderBase is an abstract class that implements common functions for

class buildtest.buildsystem.scriptbuilder.**ScriptBuilder**(*name*, *recipe*, *buildspec*, *executor*, *buildexecutor*, *testdir*)

Bases: *buildtest.buildsystem.base.BuilderBase*

The BuilderBase is an abstract class that implements common functions for any kind of builder.

type = script

generate_script(*self*)

This method builds the testscript content based on the builder type. For ScriptBuilder we need to add the shebang, environment variables and the run section. If shell is python we write a python script and return immediately. The variables, environment section are not applicable for python scripts

Returns return content of test script

Return type list

write_python_script(*self*)

This method is used for writing python script when `shell: python` is set. The content from `run` section is added into a python script. The file is written to run directory and we simply invoke python script by running `python script.py`

buildtest.buildsystem.spack

This method defines the Spack buildsystem for the spack package manager (https://spack.readthedocs.io/en/latest/) by generating scripts that will do various spack operation. The SpackBuilder class will generate a test script using the schema definition 'spack-v1.0.schema.json' that defines how buildspecs are written.

Module Contents

Classes

SpackBuilder	The BuilderBase is an abstract class that implements common functions for

class buildtest.buildsystem.spack.**SpackBuilder**(*name*, *recipe*, *buildspec*, *buildexecutor*, *executor*, *testdir=None*)

Bases: *buildtest.buildsystem.base.BuilderBase*

The BuilderBase is an abstract class that implements common functions for any kind of builder.

type = spack

_resolve_spack_root(*self*, *path*, *verify_spack=True*)

Given a path find the startup spack setup script to source.

_spack_environment(*self*, *spack_env*)

This method is responsible for creating a spack environment, activate an existing spack environment, create a spack environment from a directory and a manifest file (spack.yaml, spack.lock)

generate_script(*self*)

Method responsible for generating the content of test script for spack buildsystem

buildtest.cli

buildtest cli: include functions to build, get test configurations, and interact with a global configuration for buildtest.

Submodules

buildtest.cli.build

This module contains all the methods related to "buildtest build" which is used for building test scripts from a Buildspec

Module Contents

Classes

BuildTest	This class is an interface to building tests via "buildtest build" command.

Functions

discover_buildspecs(buildspecs=None, exclude_buildspecs=None, executors=None, tags=None)	This method discovers all buildspecs based on –buildspecs, –tags, –executor
discover_buildspecs_by_executor(executors)	This method discovers buildspecs by executor name, using `buildtest build --executor`
discover_buildspecs_by_tags(tagnames)	This method discovers buildspecs by tags, using `--tags` option
discover_by_buildspecs(buildspec)	Given a buildspec file specified by the user with `buildtest build --buildspec`,
print_discovered_buildspecs(buildspec_dict)	This method will print the discovered buildspecs in the table format
print_filters()	
update_report(valid_builders, report_file=BUILD_REPORT)	This method will update BUILD_REPORT after every test run performed

Attributes

logger

class buildtest.cli.build.**BuildTest**(*configuration=None*, *buildspecs=None*, *exclude_buildspecs=None*, *tags=None*, *executors=None*, *testdir=None*, *stage=None*, *filter_buildspecs=None*, *rebuild=None*, *buildtest_system=None*, *report_file=None*, *max_pend_time=None*, *poll_interval=None*, *keep_stage_dir=None*, *helpfilter=None*)

This class is an interface to building tests via "buildtest build" command.

_print_build_phase(*self*, *invalid_builders*, *table*)

_print_jobs_after_poll(*self*, *valid_builders*)
Print table of all tests after polling

_print_test_summary(*self*)
Print a summary of total pass and fail test with percentage breakdown.

_update_build_history(*self*)
Write a build history file that is stored in **$BUILDTEST_ROOT/var/.history** directory summarizing output of build. The history file is a json file named *build.json* which contains a copy of the build log for troubleshooting. buildtest will create a sub-directory that is incremented such as 0, 1, 2 in **$BUILDTEST_ROOT/var/.history** which is used to differentiate builds.

_validate_filters(*self*)

build(*self*)
This method is responsible for discovering buildspecs based on input argument. Then we parse the buildspecs and retrieve builder objects for each test. Each builder object will invoke *build* which will build the test script, and then we run the test and update report.

build_phase(*self*)
This method will build all tests by invoking class method `build` for each builder that generates testscript in the test directory.

parse_buildspecs(*self*)
Parse all buildspecs by passing buildspec file to `BuildspecParser` class. If buildspec fails validation we skip the buildspec and print all skipped buildspecs. If buildspec passes validation we get all builders by invoking `Builder` class that is responsible for creating builder objects for each test.

Returns A list of builder objects which are instances of `BuilderBase` class

Return type list

poll_jobs(*self*, *poll_queue*, *valid_builders*)
This method will poll jobs by processing all jobs in `poll_queue`. If job is cancelled by scheduler, we remove this from valid_builders list. This method will return a list of valid_builders after polling. If there are no valid_builders after polling, the method will return None

Parameters

- **poll_queue** (*list, required*) – a list of jobs that need to be polled. The jobs will poll using poll method from executor
- **valid_builders** (*list, required*) – list of valid builders

resolve_testdirectory(*self*, *cli_testdir=None*)
This method resolves which test directory to select. For example, one can specify test directory via command line `buildtest build --testdir <path>` or path in configuration file. The default is $HOME/.buildtest/var/tests

Parameters **cli_testdir** (*str*) – test directory from command line `buildtest build --testdir`

Returns Path to test directory to use

Return type str

run_phase(*self*)
This method will run all builders with the appropriate executor. The executor argument is an instance of `BuildExecutor` that is responsible for orchestrating builder execution to the appropriate executor class. The executor contains a list of executors picked up from buildtest configuration. For tests running locally, we get the test metadata and count PASS/FAIL test state which is printed at end in Test Summary. For

tests that need to run via scheduler, the first stage of run will dispatch job, and state will be *N/A*. We first dispatch all jobs and later poll jobs until they are complete. The poll section is skipped if all tests are run locally. In poll section we regenerate table with all valid_builders and updated test state and returncode and recalculate total pass/fail tests. Finally we return a list of valid_builders which are tests that ran through one of the executors. Any test that failed to run or be dispatched will be skipped during run stage and not added in *valid_builders*. The *valid_builders* contains the test meta-data that is used for updating test report in next stage.

Returns A list of valid builders

Return type list

buildtest.cli.build.**discover_buildspecs**(*buildspecs=None*, *exclude_buildspecs=None*, *executors=None*, *tags=None*)

This method discovers all buildspecs based on –buildspecs, –tags, –executor and excluding buildspecs (–exclude).

Parameters

- **buildspecs** (*list*) – List of input buildspecs passed by argument *buildtest build –buildspec*
- **exclude_buildspecs** (*list*) – List of excluded buildspecs by argument *buildtest build –exclude*
- **tags** (*list*) – List of input tags for discovering buildspecs by argument *buildtest build –tags*
- **executors** (*list*) – List of input executors for discovering buildspecs by argument *buildtest build –executor*

buildtest.cli.build.**discover_buildspecs_by_executor**(*executors*)

This method discovers buildspecs by executor name, using `buildtest build --executor` command. This method will read BUILDSPEC_CACHE_FILE and search for `executor` key in buildspec recipe and match with input executor name. The return is a list of matching buildspec with executor name to process.

Parameters **executors** (*list*) – List of input executor name from command line argument `buildtest build --executor <name>`

Returns a list of buildspec files that match tag name

Return type list

buildtest.cli.build.**discover_buildspecs_by_tags**(*tagnames*)

This method discovers buildspecs by tags, using `--tags` option from `buildtest build` command. This method will read BUILDSPEC_CACHE_FILE and search for `tags` key in buildspec recipe and match with input tag. Since `tags` field is a list, we check if input tag is in `list` and if so we add the entire buildspec into a list. The return is a list of buildspec files to process.

Parameters **input_tag** (*list*) – List of input tags from command line argument `buildtest build --tags <tags>`

Returns a list of buildspec files that match tag name

Return type list

buildtest.cli.build.**discover_by_buildspecs**(*buildspec*)

Given a buildspec file specified by the user with `buildtest build --buildspec`, discover one or more files and return a list for buildtest to process. This method is called once per argument of `--buildspec` or `--exclude` option. If its a directory path we recursively find all buildspecs with option. If its a directory path we recursively find all buildspecs with .yml extension. If filepath doesn't exist or file extension is not .yml we return None and capture error in log.

file path buildtest build –buildspec tutorials/hello.sh.yml

directory path buildtest build –buildspec tutorials

Parameters **buildspec** (*str*) – Input argument from `buildtest build --buildspec`

Returns A list of discovered buildspec with resolved path, if its invalid we return None

Return type list or None

`buildtest.cli.build.`**logger**

`buildtest.cli.build.`**print_discovered_buildspecs**(*buildspec_dict*)
This method will print the discovered buildspecs in the table format

`buildtest.cli.build.`**print_filters**()

`buildtest.cli.build.`**update_report**(*valid_builders*, *report_file=BUILD_REPORT*)
This method will update BUILD_REPORT after every test run performed by `buildtest build`. If BUILD_REPORT is not created, we will create file and update json file by extracting contents from builder.metadata

Parameters

- **valid_builders** (*instance of BuilderBase (subclass)*) – builder object that were successful during build and able to execute test
- **report_file** (*str*) – specify location to report file

buildtest.cli.buildspec

Module Contents

Classes

BuildspecCache	

Functions

buildspec_find(args, configuration)	Entry point for `buildtest buildspec find` command
buildspec_validate(configuration, buildspecs=None, excluded_buildspecs=None, tags=None, executors=None)	Entry point for `buildtest buildspec validate`. This method is responsible for discovering buildspec
show_buildspecs(name, configuration)	This is the entry point for `buildtest buildspec show` command which will print content of
summarize_buildspec_cache(configuration)	

Attributes

logger

class buildtest.cli.buildspec.**BuildspecCache**(*configuration*, *rebuild=False*, *filterfields=None*, *formatfields=None*, *roots=None*, *header=None*, *terse=None*)

default_format_fields = ['name', 'type', 'executor', 'tags', 'description']

filter_fields = ['type', 'executor', 'tags', 'buildspec']

format_fields

table

_check_filter_fields(*self*)
This method checks filter fields are valid. The filter fields are specified as ``buildtest buildspec find –filter <KEY1>=<VAL1>,<KEY2>=<VAL2>,...

_check_format_fields(*self*)
This method will check if all format fields are valid. Format fields are passed as comma separated fields: `--format field1,field2,field3,...`

_discover_buildspecs(*self*)
This method retrieves buildspecs based on `self.paths` which is a list of directory paths to search. If `--root` is specified we process each argument and recursively find all .yml files

_filter_buildspecs(*self*, *executor*, *tags*, *schema_type*)
This method will return a boolean True/False that determines if buildspec test entry is skipped as part of filter process. The filter are done based on executor, tags, type field. `True` indicates test needs to be skipped.

Parameters

- **executor** (*str, required*) – 'executor; field from buildspec recipe
- **tags** (*str or list, required*) – 'tags' field from buildspec recipe
- **schema_type** (*str, required*) – 'type' field from buildspec recipe

Returns boolean to determine if we need to skip buildspec

Return type bool

_validate_buildspecs(*self*, *buildspecs*)
Given a list of buildspec files, validate each buildspec using BuildspecParser and return a list of valid buildspecs. Any invalid buildspecs are added to separate list

_write_buildspec_cache(*self*)
This method is responsible for writing buildspec cache to file

build(*self*)
This method will build buildspec cache file. If user requests to rebuild cache we remove the file and recreate cache. If cache file exists, we simply load from cache

build_cache(*self*)
This method will rebuild the buildspec cache file by recursively searching all .yml files specified by input argument `paths` which is a list of directory roots. The buildspecs are validated and cache file is updated"

Returns Rebuild cache file

executor_breakdown(*self*)
This method will return a dictionary with breakdown of executors by test names.

find_buildspecs(*self*)
This method will find buildspecs based on cache content. We skip any tests based on executor filter, tag filter or type filter and build a table of tests that will be printed using `print_buildspecs` method.

get_cache(*self*)
Returns cache file as loaded dictionary

get_invalid_buildspecs(*self*)
Return a list of invalid buildspecs

get_maintainers(*self*)
Return a list of maintainers.

get_names(*self*)
Return a list of test names found in buildspec cache. We only return test names for valid buildspecs

get_paths(*self*)
Return a list of search paths

get_unique_executors(*self*)
Return a list of unique executors.

get_unique_tags(*self*)
Return a list of unique tags.

get_valid_buildspecs(*self*)
Return a list of valid buildspecs

load_paths(*self*)
Add all paths to search for buildspecs. We must read configuration file and check property `buildspec_roots` for list of directories to search. We check all directories exist, if any fail we don't add them to path. In addition, we add the default buildspec path where we find tutorials and general tests.

lookup_buildspec_by_name(*self*, *name*)
Given an input test name, return corresponding buildspec file found in the cache. :param name: Name of test to query in buildspec cache :type name: str, required

print_buildspecfiles(*self*, *terse=None*, *header=None*)
This method implements `buildtest buildspec find --buildspec` which reports all buildspec files in cache.

Parameters **terse** (*bool*) – This argument controls output of `buildtest buildspec find --buildspec` which is a boolean. If its `True` we print output in raw format otherwise we print in table format

print_buildspecs(*self*, *terse=None*, *header=None*)
Print buildspec table

print_by_executors(*self*, *terse=None*, *header=None*)
This method prints executors by tests and implements `buildtest buildspec find --group-by-executor` command

Parameters **terse** (*bool*) – Print output in machine readable format

print_by_tags(*self*, *terse=None*, *header=None*)
This method prints tags by tests and implements `buildtest buildspec find --group-by-tags` command

Parameters **terse** (*bool*) – Print output in machine readable format

print_executors(*self*, *terse=None*, *header=None*)
This method implements `buildtest buildspec find --executors` which reports all executors from cache.

Parameters **terse** (*bool*) – This argument controls output of `buildtest buildspec find --executor` which is a boolean. If its `True` we print output in raw format otherwise we print in table format

static print_filter_fields()
This method prints filter fields available for buildspec cache. This method implements command `buildtest buildspec find --helpfilter`

static print_format_fields()
This method prints format fields available for buildspec cache. This method implements command `buildtest buildspec find --helpformat`

print_invalid_buildspecs(*self*, *error=None*)
Print invalid buildspecs from cache file. This method implements command `buildtest buildspec find invalids` :param error: controls whether error message for each buildspec is printed. If set to *False*, the error messages will be omitted :type error: bool, optional

print_maintainer(*self*, *terse=None*, *header=None*)
This method prints maintainers from buildspec cache file which implements `buildtest buildspec find --maintainers` command.

Parameters **terse** (*bool*) – This argument controls output of `buildtest buildspec find --maintainers` which is a boolean. If its `True` we print output in raw format otherwise we print in table format

print_maintainers_by_buildspecs(*self*, *terse=None*, *header=None*)
This method prints maintainers breakdown by buildspecs. This method implements `buildtest buildspec find --maintainers-by-buildspecs`

Parameters **terse** (*bool*) – Print output in machine readable format

print_paths(*self*)
This method print buildspec paths, this implements command `buildtest buildspec find --paths`

print_tags(*self*, *terse=None*, *header=None*)
This method implements `buildtest buildspec find --tags` which reports a list of unique tags from all buildspecs in cache file.

Parameters **terse** (*bool*) – This argument controls output of `buildtest buildspec find --tags` which is a boolean. If its `True` we print output in raw format otherwise we print in table format

tag_breakdown(*self*)
This method will return a breakdown of tags by test names.

test_breakdown_by_buildspec(*self*)
This method will return a dictionary with breakdown of buildspecs by test names.

buildtest.cli.buildspec.**buildspec_find**(*args*, *configuration*)
Entry point for `buildtest buildspec find` command

buildtest.cli.buildspec.**buildspec_validate**(*configuration*, *buildspecs=None*, *excluded_buildspecs=None*, *tags=None*, *executors=None*)
Entry point for `buildtest buildspec validate`. This method is responsible for discovering buildspec with same options used for building buildspecs that includes `--buildspec`, `--exclude`, `--tag`, and `--executor`. Upon discovery we pass each buildspec to `BuildspecParser` class to validate buildspec and report any errors during validation which is raised as exceptions.

Parameters

- **configuration** (*instance of SiteConfiguration*) – An instance of SiteConfiguration class which is the loaded buildtest configuration used for validating the buildspecs.
- **buildspecs** (*List, optional*) – List of paths to buildspec file which can be a file or directory
- **excluded_buildspecs** (*List, optional*) –
- **tags** – List of tag names to search for buildspec
- **executors** (*List, optional*) – List of executor names to search for buildspecs

buildtest.cli.buildspec.**logger**

buildtest.cli.buildspec.**show_buildspecs**(*name*, *configuration*)
This is the entry point for `buildtest buildspec show` command which will print content of buildspec based on name of test

buildtest.cli.buildspec.**summarize_buildspec_cache**(*configuration*)

buildtest.cli.cdash

Module Contents

Functions

cdash_cmd(args, default_configuration=None, open_browser=True)	This method is entry point for `buildtest cdash` command which implements uploading
upload_test_cdash(build_name, configuration, site=None, report_file=None)	This method is responsible for reading report file and pushing results to CDASH

buildtest.cli.cdash.**cdash_cmd**(*args*, *default_configuration=None*, *open_browser=True*)
This method is entry point for `buildtest cdash` command which implements uploading results to CDASH server and command line interface to open CDASH project.

Parameters

- **args** (*ArgumentParser*) – Instance of ArgumentParser that contains arguments for `buildtest cdash` command
- **default_configuration** (SiteConfiguration, *optional*) – The loaded default configuration which is an instance of SiteConfiguration
- **open_browser** (*optional*) – boolean to control if we open page in web browser using webbrowser.open. This is enabled by default, but can be turned off especially when running regression test where we don't want to see the page

buildtest.cli.cdash.**upload_test_cdash**(*build_name*, *configuration*, *site=None*, *report_file=None*)
This method is responsible for reading report file and pushing results to CDASH server. User can specify cdash settings in configuration file or pass them in command line. The command `buildtest cdash upload` will upload results to CDASH.

Parameters

- **build_name** – build name that shows up in CDASH

- **configuration** (SiteConfiguration) – Instance of SiteConfiguration class that contains the configuration file
- **site** (*str, optional*) – site name that shows up in CDASH
- **report** (*str, optional*) – Path to report file when uploading results. This is specified via `buildtest cdash upload -r` command

Returns

buildtest.cli.compilers

Module Contents

Classes

BuildtestCompilers

Functions

compiler_cmd(args, configuration)	
compiler_find(args, configuration)	This method implements `buildtest config compilers find` which detects

class buildtest.cli.compilers.**BuildtestCompilers**(*configuration*, *settings_file=None*, *debug=False*)

compiler_table

_update_compiler_section(*self*)

This method will update the compiler section by adding new compilers if found

Returns Updated compiler section for buildtest configuration

Return type dict

_validate_modules(*self*, *module_dict*)

This method will validate modules by running `module load` test for all discovered modules specified in parameter `discovered_modules`. This method returns a list of modules that were valid, if all tests pass we return the same list. A module test pass if we get a returncode 0.

find_compilers(*self*)

This method returns compiler modules discovered depending on your module system. If you have Lmod system we use spider utility to detect modules, this is leveraging Lmodule API. If you have environment-modules we parse output of `module av -t`.

Returns return a list of compiler modules detected based on module key name.

Return type dict

list(*self*)

Return all compilers defined in buildtest configuration

print_compilers(*self*)
This method implements `buildtest config compilers` which prints all compilers from buildtest configuration

print_json(*self*)
Prints compiler section in JSON, this implements `buildtest config compilers --json`

print_yaml(*self*)
Prints compiler section in YAML, this implements `buildtest config compilers --yaml`

buildtest.cli.compilers.**compiler_cmd**(*args*, *configuration*)

buildtest.cli.compilers.**compiler_find**(*args*, *configuration*)
This method implements `buildtest config compilers find` which detects new compilers based on module names defined in configuration. If system has Lmod we use Lmodule API to detect the compilers. For environment-modules we search for all modules in current `$MODULEPATH`.

buildtest.cli.config

Module Contents

Functions

config_cmd(args, configuration)	
validate_config(configuration)	This method implements `buildtest config validate` which attempts to
view_configuration(configuration)	View buildtest configuration file. This implements `buildtest config view`
view_executors(configuration, buildexecutor, json_format=False, yaml_format=False)	Display executors from buildtest configuration. This implements `buildtest config executors` command.
view_summary(configuration, buildtestsystem=None)	This method implements `buildtest config summary` option. In this method
view_system(configuration)	This method implements command `buildtest config systems` which displays

buildtest.cli.config.**config_cmd**(*args*, *configuration*)

buildtest.cli.config.**validate_config**(*configuration*)
This method implements `buildtest config validate` which attempts to validate buildtest settings with schema. If it's not validate an exception is raised which could be ValidationError or ConfigurationError.

buildtest.cli.config.**view_configuration**(*configuration*)
View buildtest configuration file. This implements `buildtest config view`

buildtest.cli.config.**view_executors**(*configuration*, *buildexecutor*, *json_format=False*, *yaml_format=False*)
Display executors from buildtest configuration. This implements `buildtest config executors` command. If no option is specified we display output in JSON format

buildtest.cli.config.**view_summary**(*configuration*, *buildtestsystem=None*)
This method implements `buildtest config summary` option. In this method we will display a summary of System Details, Buildtest settings, Schemas, Repository details, Buildspecs files and test names.

Parse buildtestsystem instance of class BuildTestSystem, optional

buildtest.cli.config.**view_system**(*configuration*)
This method implements command `buildtest config systems` which displays system details from configuration file in table format.

buildtest.cli.edit

Module Contents

Functions

edit_buildspec(buildspec, configuration)	Open buildspec in editor and validate buildspec with parser

buildtest.cli.edit.**edit_buildspec**(*buildspec*, *configuration*)
Open buildspec in editor and validate buildspec with parser

buildtest.cli.help

Module Contents

Functions

buildtest_help(command)	Entry point for `buildtest help` which display a summary of how to use buildtest commands
print_build_help()	This method will print help message for command `buildtest help build`
print_buildspec_help()	This method will print help message for command `buildtest help buildspec`
print_cdash_help()	This method will print help message for command `buildtest help cdash`
print_config_help()	This method will print help message for command `buildtest help config`
print_edit_help()	This method will print help message for command `buildtest help edit`
print_history_help()	This method will print help message for command `buildtest help history`
print_inspect_help()	This method will print help message for command `buildtest help inspect`
print_report_help()	This method will print help message for command `buildtest help report`
print_schema_help()	This method will print help message for command `buildtest help schema`

buildtest.cli.help.**buildtest_help**(*command*)
Entry point for `buildtest help` which display a summary of how to use buildtest commands

buildtest.cli.help.**print_build_help**()
This method will print help message for command `buildtest help build`

buildtest.cli.help.**print_buildspec_help**()
This method will print help message for command `buildtest help buildspec`

buildtest.cli.help.**print_cdash_help**()
This method will print help message for command `buildtest help cdash`

buildtest.cli.help.**print_config_help**()
This method will print help message for command `buildtest help config`

buildtest.cli.help.**print_edit_help**()
This method will print help message for command `buildtest help edit`

buildtest.cli.help.**print_history_help**()
This method will print help message for command `buildtest help history`

buildtest.cli.help.**print_inspect_help**()
This method will print help message for command `buildtest help inspect`

buildtest.cli.help.**print_report_help**()
This method will print help message for command `buildtest help report`

buildtest.cli.help.**print_schema_help**()
This method will print help message for command `buildtest help schema`

buildtest.cli.history

Module Contents

Functions

build_history(args)	This is the entry point for command `buildtest build history` command which reports
list_builds(header=None, terse=None)	This method is entry point for `buildtest history list` which prints all previous builds
query_builds(build_id, log_option)	This method is called when user runs *buildtest history query* which will
sorted_alphanumeric(data)	This method is used for alpha numeric sorting of files.

Attributes

logger

buildtest.cli.history.**build_history**(*args*)
This is the entry point for command `buildtest build history` command which reports

buildtest.cli.history.**list_builds**(*header=None*, *terse=None*)
This method is entry point for `buildtest history list` which prints all previous builds stored in **BUILD_HISTORY_DIR**. Each directory has a `build.json` file that stores content of each build that was run by `buildtest build`.

Parameters

- **header** (*bool, optional*) – Control whether header columns are displayed with terse for-

mat

- **terse** (*bool, optional*) – Print output in terse format

buildtest.cli.history.**logger**

buildtest.cli.history.**query_builds**(*build_id*, *log_option*)
This method is called when user runs *buildtest history query* which will report the build.json and logfile.

Parameters

- **build_id** (*int, required*) – Input argument *buildtest history query <id>*
- **log_option** (*bool, required*) – Input argument *buildtest history query <id> –log*

buildtest.cli.history.**sorted_alphanumeric**(*data*)
This method is used for alpha numeric sorting of files.

buildtest.cli.inspect

This module implements methods for buildtest inspect command that can be used to retrieve test record from report file in JSON format.

Module Contents

Functions

inspect_buildspec(report, input_buildspecs, all_records)	This method implements command `buildtest inspect buildspec`
inspect_by_id(report, args)	This method implements `buildtest inspect id` command
inspect_by_name(report, names, all_records)	Implements command `buildtest inspect name` which will print all test records
inspect_cmd(args)	Entry point for `buildtest inspect` command
inspect_list(report, terse=None, header=None)	Implements method `buildtest inspect list`
inspect_query(report, args)	Entry point for `buildtest inspect query` command.

buildtest.cli.inspect.**inspect_buildspec**(*report*, *input_buildspecs*, *all_records*)
This method implements command `buildtest inspect buildspec`

buildtest.cli.inspect.**inspect_by_id**(*report*, *args*)
This method implements `buildtest inspect id` command

buildtest.cli.inspect.**inspect_by_name**(*report*, *names*, *all_records*)
Implements command `buildtest inspect name` which will print all test records by given name in JSON format.

buildtest.cli.inspect.**inspect_cmd**(*args*)
Entry point for `buildtest inspect` command

buildtest.cli.inspect.**inspect_list**(*report*, *terse=None*, *header=None*)
Implements method `buildtest inspect list`

buildtest.cli.inspect.**inspect_query**(*report*, *args*)
Entry point for `buildtest inspect query` command.

buildtest.cli.report

Module Contents

Classes

Report	

Functions

is_int(val)	
report_cmd(args)	
report_summary(report)	Implements `buildtest report summary`

Attributes

logger	

class buildtest.cli.report.**Report**(*report_file=None*, *filter_args=None*, *format_args=None*, *latest=None*, *oldest=None*)

display_table

filter_fields = ['buildspec', 'name', 'executor', 'state', 'tags', 'returncode']

format_fields = ['buildspec', 'command', 'compiler', 'endtime', 'errfile', 'executor', 'full_id', 'hostname',...

_check_filter_fields(*self*)
This method will validate filter fields `buildtest report --filter` by checking if field is valid filter field. If one specifies an invalid filter field, we will raise an exception

_check_format_fields(*self*)
Check all format arguments (–format) are valid, the arguments are specified in format (–format key1=val1,key2=val2). We make sure each key is valid format field.

_filter_by_executor(*self*, *test*)

_filter_by_names(*self*, *name*)
Filter test by name of test. This method will return True if record should be processed, otherwise returns False

Parameters **name** (*str*) – Name of test

_filter_by_returncode(*self*, *test*)

_filter_by_state(*self*, *test*)

_filter_by_tags(*self*, *test*)
This method will return a boolean (True/False) to check if test should be skipped from report. Given an input test, we check if test has 'tags' property in buildspec and if tagnames specified by `--filter tags` are found in the test. If there is a match we return `False`. A `True` indicates the test will be filtered out.

Parameters `test` (*dict*) – test record

Returns Return True if test is filtered out, otherwise return False

Return type bool

breakdown_by_test_names(*self*)
Returns a dictionary with number of test runs by testname

filter_buildspecs_from_report(*self*)
This method filters the report table input filter `--filter buildspec`. If entry found in buildspec cache we add to list

get(*self*)
Return raw content of report file

get_buildspecs(*self*)

get_ids(*self*)
Return a dict in the format ``` {

<test-id>:

{ 'name': <name test> 'buildspec': <buildspec>

}

...

get_names(*self*)
Return a list of test names from report file

get_testids(*self*)
Return a list of test ids from the report file

load(*self*)
This method is responsible for loading report file. If file not found or report is empty dictionary we raise an error. The report file is loaded using `json.loads` and return value is a dictionary containing entire report of all tests.

print_filter_fields(*self*)
Implements command `buildtest report --helpfilter`

print_format_fields(*self*)
Implements command `buildtest report --helpformat`

print_report(*self*, *terse=None*, *noheader=None*)

process_report(*self*)

reportfile(*self*)
Return full path to report file

buildtest.cli.report.**is_int**(*val*)

buildtest.cli.report.**logger**

buildtest.cli.report.**report_cmd**(*args*)

buildtest.cli.report.**report_summary**(*report*)
Implements `buildtest report summary`

buildtest.cli.schema

Module Contents

Functions

schema_cmd(args)	This method implements command `buildtest schema` which shows a list

buildtest.cli.schema.**schema_cmd**(*args*)

This method implements command `buildtest schema` which shows a list of schemas, their json content and list of schema examples. The input `args` is an instance of argparse class that contains user selection via command line. This method can do the following

`buildtest schema` - Show all schema names `buildtest schema --name <NAME> -j ``. View json content of a specified schema ``buildtest schema --name <NAME> -e`. Show schema examples Parameters:

Parameters **args** (*<class 'argparse.Namespace'>*) – instance of argparse class

Result output of json schema on console

Package Contents

Functions

build_menu(subparsers)	This method implements command line menu for `buildtest build` command.
buildspec_menu(subparsers)	This method implements `buildtest buildspec` command
cdash_menu(subparsers)	This method builds arguments for `buildtest cdash` command.
config_menu(subparsers)	This method adds argparse argument for `buildtest config`
edit_menu(subparsers)	
get_parser()	
handle_kv_string(val)	This method is used as type field in –filter argument in `buildtest buildspec find`.
history_menu(subparsers)	This method builds the command line menu for `buildtest history` command
inspect_menu(subparsers)	This method builds argument for `buildtest inspect` command
positive_number(value)	Checks if input value is positive value and within range of 1-50. This method
report_menu(subparsers)	This method implements the `buildtest report` command options
schema_menu(subparsers)	This method builds menu for `buildtest schema`

continues on next page

Table 29 – continued from previous page

single_kv_string(val)	This method is used for filter field in `buildtest build --filter`.

Attributes

BUILDTEST_COPYRIGHT
BUILDTEST_VERSION
BUILD_REPORT
schema_table

buildtest.cli.**BUILDTEST_COPYRIGHT = Copyright (c) 2021, The Regents of the University of California, through Lawrence Berkeley...**

buildtest.cli.**BUILDTEST_VERSION = 0.10.2**

buildtest.cli.**BUILD_REPORT**

buildtest.cli.**build_menu**(*subparsers*)
This method implements command line menu for `buildtest build` command.

buildtest.cli.**buildspec_menu**(*subparsers*)
This method implements `buildtest buildspec` command

buildtest.cli.**cdash_menu**(*subparsers*)
This method builds arguments for `buildtest cdash` command.

buildtest.cli.**config_menu**(*subparsers*)
This method adds argparse argument for `buildtest config`

buildtest.cli.**edit_menu**(*subparsers*)

buildtest.cli.**get_parser**()

buildtest.cli.**handle_kv_string**(*val*)
This method is used as type field in –filter argument in `buildtest buildspec find`. This method returns a dict of key,value pair where input is in format key1=val1,key2=val2,key3=val3

Parameters

- **val** (*bool*) – input value
- **multiple_keys** – multiple_keys is a boolean to determine if key/value pair accepts multiple key/value arguments

Returns dictionary of key/value pairs

Return type dict

buildtest.cli.**history_menu**(*subparsers*)
This method builds the command line menu for `buildtest history` command

buildtest.cli.**inspect_menu**(*subparsers*)
This method builds argument for `buildtest inspect` command

buildtest.cli.**positive_number**(*value*)
Checks if input value is positive value and within range of 1-50. This method is used for –rebuild option

buildtest.cli.**report_menu**(*subparsers*)
This method implements the `buildtest report` command options

buildtest.cli.**schema_menu**(*subparsers*)
This method builds menu for `buildtest schema`

buildtest.cli.**schema_table**

buildtest.cli.**single_kv_string**(*val*)
This method is used for filter field in `buildtest build --filter`. This method returns a dict of key/value pair where input must be a single key/value pair

Parameters **val** (*str*) – input value

Returns dictionary of key/value pairs

Return type dict

buildtest.executors

Submodules

buildtest.executors.base

BuildExecutor: manager for test executors

Module Contents

Classes

BaseExecutor	The BaseExecutor is an abstract base class for all executors.

class buildtest.executors.base.**BaseExecutor**(*name*, *settings*, *site_configs*)
The BaseExecutor is an abstract base class for all executors.

type = base

__repr__(*self*)
Return repr(self).

__str__(*self*)
Return str(self).

load(*self*)
Load a particular configuration based on the name. This method should set defaults for the executor, and will vary based on the class.

run(*self*)
The run step basically runs the build. This is run after setup so we are sure that the builder is defined. This is also where we set the result to return.

buildtest.executors.cobalt

This method implements CobaltExecutor class which is defines how cobalt executor submit job to Cobalt scheduler.

Module Contents

Classes

CobaltExecutor	The CobaltExecutor class is responsible for submitting jobs to Cobalt Scheduler.
CobaltJob	The `CobaltJob` class performs operation on cobalt job upon job submission such

Attributes

logger

class buildtest.executors.cobalt.**CobaltExecutor**(*name*, *settings*, *site_configs*, *max_pend_time=None*)

Bases: *buildtest.executors.base.BaseExecutor*

The CobaltExecutor class is responsible for submitting jobs to Cobalt Scheduler. The class implements the following methods:

- **load**: load Cobalt executors from configuration file
- **dispatch**: submit Cobalt job to scheduler
- **poll**: poll Cobalt job via qstat and retrieve job state
- **gather**: gather job record including output, error, exit code

type = cobalt

dispatch(*self*, *builder*)

This method is responsible for dispatching job to Cobalt Scheduler by invoking `builder.run()` which runs the build script. If job is submitted to scheduler, we get the JobID and pass this to `CobaltJob` class. At job submission, cobalt will report the output and error file which can be retrieved using **qstat**. We retrieve the cobalt job record using `builder.job.gather()`.

Parameters **builder** (*BuilderBase, required*) – builder object

gather(*self*, *builder*)

This method is responsible for moving output and error file in the run directory. We need to read `<JOBID>.cobaltlog` file which contains output of exit code by performing a regular expression `(exit code of. )(\d+)(\;)`. The cobalt log file will contain a line: **task completed normally with an exit code of 0; initiating job cleanup and removal**

Parameters **builder** (*BuilderBase, required*) – builder object

launcher_command(*self*)

load(*self*)

Load the a Cobalt executor configuration from buildtest settings.

poll(*self*, *builder*)
This method is responsible for polling Cobalt job by invoking the builder method `builder.job.poll()`. We check the job state and existence of output file. If file exists or job is complete, we gather the results and return from function. If job is pending we check if job time exceeds `max_pend_time` time limit and cancel job.

Parameters **builder** (`BuilderBase`, *required*) – builder object

class buildtest.executors.cobalt.**CobaltJob**(*jobID*)
Bases: *buildtest.executors.job.Job*

The `CobaltJob` class performs operation on cobalt job upon job submission such as polling job, gather job record, cancel job. We also retrieve job state and determine if job is pending, running, complete, suspended.

cancel(*self*)
Cancel job by running `qdel <jobid>`. This method is called if job timer exceeds `max_pend_time` if job is pending.

cobalt_log(*self*)
Return job cobalt.log file

error_file(*self*)
Return job error file

exitcode(*self*)
Return job exit code

gather(*self*)

Gather Job state by running qstat -lf <jobid> which retrieves all fields. The output is in text format which is parsed into key/value pair and stored in a dictionary. This method will return a dict containing the job record

```
$ qstat -lf 347106
   JobID: 347106
       JobName           : hold_job
       User              : shahzebsiddiqui
       WallTime          : 00:10:00
       QueuedTime        : 00:13:14
       RunTime           : N/A
       TimeRemaining     : N/A
```

`

is_cancelled(*self*)
Return `True` if job is cancelled otherwise returns `False`. Job state is `cancelled` which is set by class `cancel` method

is_complete(*self*)
Return `True` if job is complete otherwise returns `False`. Cobalt job state for completed job job is marked as `exiting`

is_pending(*self*)
Return `True` if job is pending otherwise returns `False`. When cobalt recieves job it is in `starting` followed by `queued` state. We check if job is in either state.

is_running(*self*)
Return `True` if job is running otherwise returns `False`. Cobalt job state for running job is is marked as `running`

is_suspended(*self*)
Return `True` if job is suspended otherwise returns `False`. Cobalt job state for suspended is marked as `user_hold`

output_file(*self*)
Return job output file

poll(*self*)
Poll job by running `qstat -l --header State <jobid>` which retrieves job state.

buildtest.executors.cobalt.**logger**

buildtest.executors.job

Module Contents

Classes

Job	This is a base class for holding job level data and common methods for used

class buildtest.executors.job.**Job**(*jobID*)
This is a base class for holding job level data and common methods for used for batch job submission.

abstract cancel(*self*)
Cancel job

get(*self*)
Return Job ID

abstract is_pending(*self*)
Check if job is in pending state

abstract is_running(*self*)
Check if job is in running state

abstract is_suspended(*self*)
Check if job is in suspended state

abstract poll(*self*)
Poll job and update job state.

state(*self*)

buildtest.executors.local

This module implements the LocalExecutor class responsible for submitting jobs to localhost. This class is called in class BuildExecutor when initializing the executors.

Module Contents

Classes

LocalExecutor	The LocalExecutor class is responsible for running tests locally for

class buildtest.executors.local.**LocalExecutor**(*name*, *settings*, *site_configs*)

Bases: *buildtest.executors.base.BaseExecutor*

The LocalExecutor class is responsible for running tests locally for bash, sh and python shell. The LocalExecutor runs the tests and gathers the output and error results and writes to file. This class implements `load`, `check` and `run` method.

type = local

check(*self*)

Check if shell binary is available

load(*self*)

Load a particular configuration based on the name. This method should set defaults for the executor, and will vary based on the class.

run(*self*, *builder*)

This method is responsible for running test for LocalExecutor which runs test locally. We keep track of metadata in `builder.metadata` that keeps track of run result. The output and error file are written to filesystem.

Parameters **builder** (BuilderBase, *required*) – builder object

buildtest.executors.lsf

This module implements the LSFExecutor class responsible for submitting jobs to LSF Scheduler. This class is called in class BuildExecutor when initializing the executors.

Module Contents

Classes

LSFExecutor	The LSFExecutor class is responsible for submitting jobs to LSF Scheduler.
LSFJob	This is a base class for holding job level data and common methods for used

Attributes

logger

class buildtest.executors.lsf.**LSFExecutor**(*name*, *settings*, *site_configs*, *max_pend_time=None*)
Bases: *buildtest.executors.base.BaseExecutor*

The LSFExecutor class is responsible for submitting jobs to LSF Scheduler. The LSFExecutor performs the following steps

- **load**: load lsf configuration from buildtest configuration file
- **dispatch**: dispatch job to scheduler and acquire job ID
- **poll**: wait for LSF jobs to finish
- **gather**: Once job is complete, gather job data

type = lsf

dispatch(*self*, *builder*)
This method is responsible for dispatching job to scheduler and extracting job ID by applying a `re.search` against output at onset of job submission. If job id is not retrieved due to job failure or unable to match regular expression we mark job incomplete by invoking `builder.incomplete()` method and return from method.

If we have a valid job ID we invoke `LSFJob` class given the job id to poll job and store this into `builder.job` attribute.

Parameters **builder** (*BuilderBase, required*) – builder object

gather(*self*, *builder*)
Gather Job detail after completion of job by invoking the builder method `builder.job.gather()`. We retrieve exit code, output file, error file and update builder metadata.

Parameters **builder** (*BuilderBase, required*) – builder object

launcher_command(*self*)
This command returns the launcher command and any options specified in configuration file. This is useful when generating the build script in the BuilderBase class

load(*self*)
Load the a LSF executor configuration from buildtest settings.

poll(*self*, *builder*)
Given a builder object we poll the job by invoking builder method `builder.job.poll()` return state of job. If job is suspended or pending we stop timer and check if timer exceeds max_pend_time value which could be defined in configuration file or passed via command line `--max-pend-time`

Parameters **builder** (*BuilderBase, required*) – builder object

class buildtest.executors.lsf.**LSFJob**(*jobID*)
Bases: *buildtest.executors.job.Job*

This is a base class for holding job level data and common methods for used for batch job submission.

cancel(*self*)
Cancel LSF Job by running `bkill <jobid>`. This is called if job has exceeded *max_pend_time* limit during poll stage.

error_file(*self*)
Return job error file

exitcode(*self*)
Return job exit code

gather(*self*)
Gather Job record at onset of job completion by running `bjobs -o '<format1> <format2>' <jobid> -json`. The format fields extracted from job are the following:

- "job_name"
- "stat"
- "user"
- "user_group"
- "queue"
- "proj_name"
- "pids"
- "exit_code"
- "from_host"
- "exec_host"
- "submit_time"
- "start_time"
- "finish_time"
- "nthreads"
- "exec_home"
- "exec_cwd"
- "output_file"
- "error_file"

Shown below is the output format and we retrieve the job records defined in **RECORDS** property

```
$ bjobs -o 'job_name stat user user_group queue proj_name pids exit_code from_
↪host exec_host submit_time start_time finish_time nthreads exec_home exec_cwd␣
↪output_file error_file' 58652 -json
{
  "COMMAND":"bjobs",
  "JOBS":1,
  "RECORDS":[
    {
      "JOB_NAME":"hold_job",
      "STAT":"PSUSP",
      "USER":"shahzebsiddiqui",
      "USER_GROUP":"GEN014ECPCI",
      "QUEUE":"batch",
      "PROJ_NAME":"GEN014ECPCI",
      "PIDS":"",
      "EXIT_CODE":"",
```

(continues on next page)

(continued from previous page)

```
      "FROM_HOST":"login1",
      "EXEC_HOST":"",
      "SUBMIT_TIME":"May 28 12:45",
      "START_TIME":"",
      "FINISH_TIME":"",
      "NTHREADS":"",
      "EXEC_HOME":"",
      "EXEC_CWD":"",
      "OUTPUT_FILE":"hold_job.out",
      "ERROR_FILE":"hold_job.err"
    }
  ]
}
```

is_complete(*self*)
Check if Job is complete which is in `DONE` state. Return `True` if there is a match otherwise return `False`

is_failed(*self*)
Check if Job failed. We return `True` if job is in `EXIT` state otherwise return `False`

is_pending(*self*)
Check if Job is pending which is reported by LSF as `PEND`. Return `True` if there is a match otherwise returns `False`

is_running(*self*)
Check if Job is running which is reported by LSF as `RUN`. Return `True` if there is a match otherwise returns `False`

is_suspended(*self*)
Check if Job is in suspended state which could be in any of the following states: [`PSUSP`, `USUSP`, `SSUSP`]. We return `True` if job is in one of the states otherwise return `False`

output_file(*self*)
Return job output file

poll(*self*)
Given a job id we poll the LSF Job by retrieving its job state, output file, error file and exit code. We run the following commands to retrieve following states

- Job State: `bjobs -noheader -o 'stat' <JOBID>`
- Output File: `bjobs -noheader -o 'output_file' <JOBID>'`
- Error File: `bjobs -noheader -o 'error_file' <JOBID>'`
- Exit Code File: `bjobs -noheader -o 'EXIT_CODE' <JOBID>'`

buildtest.executors.lsf.**logger**

buildtest.executors.pbs

This module implements PBSExecutor class that defines how executors submit job to PBS Scheduler

Module Contents

Classes

PBSExecutor	The PBSExecutor class is responsible for submitting jobs to PBS Scheduler.
PBSJob	See https://www.altair.com/pdfs/pbsworks/PBSReferenceGuide2021.1.pdf section 8.1 for Job State Codes

Attributes

logger

class buildtest.executors.pbs.**PBSExecutor**(*name*, *settings*, *site_configs*, *max_pend_time=None*)

Bases: *buildtest.executors.base.BaseExecutor*

The PBSExecutor class is responsible for submitting jobs to PBS Scheduler. The class implements the following methods:

load: load PBS executors from configuration file dispatch: submit PBS job to scheduler poll: poll PBS job via qstat and retrieve job state gather: gather job result cancel: cancel job if it exceeds max pending time

poll_cmd = qstat

type = pbs

dispatch(*self*, *builder*)

This method is responsible for dispatching PBS job, get JobID and start record metadata in builder object. If job failed to submit we check returncode and exit with failure. After we submit job, we start timer and record when job was submitted and poll job once to get job details and store them in builder object.

Parameters **builder** (*BuilderBase, required*) – builder object

gather(*self*, *builder*)

This method is responsible for getting output of job using *qstat -x -f -F json <jobID>* and storing the result in builder object. We retrieve specific fields such as exit status, start time, end time, runtime and store them in builder object. We read output and error file and store the content in builder object.

Parameters **builder** (*BuilderBase, required*) – builder object

launcher_command(*self*)

load(*self*)

Load the a Cobalt executor configuration from buildtest settings.

poll(*self*, *builder*)

This method is responsible for polling Cobalt job, we check the job state and existence of output file. If file exists or job is in 'exiting' stage we set job to 'done' stage and gather results. If job is in 'pending' stage

we check if job exceeds 'max_pend_time' time limit by checking with builder timer attribute using `start` and `stop` method. If job exceeds the time limit job is cancelled.

Parameters **builder** (BuilderBase, *required*) – builder object

class buildtest.executors.pbs.**PBSJob**(*jobID*)
Bases: *buildtest.executors.job.Job*

See https://www.altair.com/pdfs/pbsworks/PBSReferenceGuide2021.1.pdf section 8.1 for Job State Codes

cancel(*self*)
Cancel job

error_file(*self*)

exitcode(*self*)

fail(*self*)

gather(*self*)

is_complete(*self*)

is_pending(*self*)
Check if job is in pending state

is_running(*self*)
Check if job is in running state

is_suspended(*self*)
Check if job is in suspended state

output_file(*self*)

poll(*self*)
Poll job and update job state.

success(*self*)
This method determines if job was completed successfully. According to https://www.altair.com/pdfs/pbsworks/PBSAdminGuide2021.1.pdf section 14.9 Job Exit Status Codes we have the following:

Exit Code: X < 0 - Job could not be executed Exit Code: 0 <= X < 128 - Exit value of Shell or top-level process Exit Code: X >= 128 - Job was killed by signal

Exit Code 0 is a success

buildtest.executors.pbs.**logger**

buildtest.executors.setup

This module is responsible for setup of executors defined in buildtest configuration. The BuildExecutor class initializes the executors and chooses the executor class (LocalExecutor, LSFExecutor, SlurmExecutor, CobaltExecutor) to call depending on executor name.

Module Contents

Classes

BuildExecutor	A BuildExecutor is responsible for initialing executors from buildtest configuration

Attributes

logger

class buildtest.executors.setup.**BuildExecutor**(*site_config*, *max_pend_time=None*)

A BuildExecutor is responsible for initialing executors from buildtest configuration file which provides a list of executors. This class keeps track of all executors and provides the following methods:

setup: This method will write executor's `before_script.sh` that is sourced in each test upon calling executor. **run**: Responsible for invoking executor's **run** method based on builder object which is of type BuilderBase. **poll**: This is responsible for invoking `poll` method for corresponding executor from the builder object by checking job state

__repr__(*self*)

Return repr(self).

__str__(*self*)

Return str(self).

_choose_executor(*self*, *builder*)

Choose executor is called at the onset of a run and poll stage. Given a builder object we retrieve the executor property `builder.executor` of the builder and check if there is an executor object and of type *BaseExecutor*.

Parameters **builder** (*BuilderBase (subclass), required.*) – the builder with the loaded Buildspec.

get(*self*, *name*)

Given the name of an executor return the executor object which is of subclass of *BaseExecutor*

is_cobalt(*self*, *executor_type*)

is_local(*self*, *executor_type*)

is_lsf(*self*, *executor_type*)

is_pbs(*self*, *executor_type*)

is_slurm(*self*, *executor_type*)

list_executors(*self*)

poll(*self*, *builders*)

The poll stage is called after the *run* stage for builders that require job submission through a batch executor. Given a set of builders object which are instance of BuilderBase, we select the executor object and invoke the *poll* method for the executor.

1. If job is pending, running, suspended we poll job

2. If job is complete we gather job results and mark job complete
3. Otherwise we mark job incomplete and it will be ignored by buildtest in reporting

Poll all jobs for batch executors (LSF, Slurm, Cobalt, PBS). For slurm we poll until job is in `PENDING` or `RUNNING` state. If Slurm job is in `FAILED` or `COMPLETED` state we assume job is finished and we gather results. If its in any other state we ignore job and return out of method.

For LSF jobs we poll job if it's in `PEND` or `RUN` state, if its in `DONE` state we gather results, otherwise we assume job is incomplete and return with `ignore_job` set to `True`. This informs buildtest to ignore job when showing report.

For Cobalt jobs, we poll if its in `starting`, `queued`, or `running` state. For Cobalt jobs we cannot query job after its complete since JobID is no longer present in queuing system. Therefore, for when job is complete which is `done` or `exiting` state, we mark job is complete.

For PBS jobs we poll job if its in queued or running stage which corresponds to `Q` and `R` in job stage. If job is finished (`F`) we gather results. If job is in `H` stage we automatically cancel job otherwise we ignore job and mark job complete.

Parameters **builder** (*list , required*) – a list of builder objects for polling. Each element is an instance of BuilderBase (subclass)

Returns Return a list of builders

Return type list

run(*self*, *builder*)

This method implements the executor run implementation. Given a builder object we first detect the correct executor object to use and invoke its `run` method. The executor object is a sub-class of BaseExecutor (i.e LocalExecutor, SlurmExecutor, LSFExecutor,...).

Parameters **builder** (BuilderBase *(subclass), required.*) – the builder with the loaded test configuration.

setup(*self*)

This method creates directory `var/executors/<executor-name>` for every executor defined in buildtest configuration and write scripts before_script.sh if the field `before_script` is specified in executor section. This method is called after executors are initialized in the class **__init__** method.

buildtest.executors.setup.**logger**

buildtest.executors.slurm

This module implements the SlurmExecutor class responsible for submitting jobs to Slurm Scheduler. This class is called in class BuildExecutor when initializing the executors.

Module Contents

Classes

SlurmExecutor	The SlurmExecutor class is responsible for submitting jobs to Slurm Scheduler.
SlurmJob	This is a base class for holding job level data and common methods for used

Attributes

logger

class buildtest.executors.slurm.**SlurmExecutor**(*name*, *settings*, *site_configs*, *max_pend_time=None*)
Bases: *buildtest.executors.base.BaseExecutor*

The SlurmExecutor class is responsible for submitting jobs to Slurm Scheduler. The SlurmExecutor performs the following steps:

- **load**: load slurm configuration from buildtest configuration file
- **dispatch**: dispatch job to scheduler and acquire job ID
- **poll**: wait for Slurm jobs to finish, if job is pending and exceeds *max_pend_time* then cancel job
- **gather**: Once job is complete, gather job data

type = slurm

dispatch(*self*, *builder*)
This method is responsible for dispatching job to slurm scheduler and extracting job id. If job id is valid we pass the job to *SlurmJob* class and store object in `builder.job`.

Parameters **builder** (*BuilderBase, required*) – builder object

gather(*self*, *builder*)
Gather Slurm job data after job completion. In this step we call `builder.job.gather()`, and update builder metadata such as returncode, output and error file.

Parameters **builder** (*BuilderBase (subclass), required*) – instance of BuilderBase

launcher_command(*self*)
Return sbatch launcher command with options used to submit job

load(*self*)
Load the a slurm executor configuration from buildtest settings.

poll(*self*, *builder*)
This method is called during poll stage where we invoke `builder.job.poll()` to get updated job state. If job is pending or suspended we stop timer and check if job needs to be cancelled if time exceeds *max_pend_time* value.

Parameters **builder** (*BuilderBase, required*) – builder object

class buildtest.executors.slurm.**SlurmJob**(*jobID*, *cluster=None*)
Bases: *buildtest.executors.job.Job*

This is a base class for holding job level data and common methods for used for batch job submission.

cancel(*self*)
Cancel job by running `scancel <jobid>`. If job is specified to a slurm cluster we cancel job using `scancel <jobid> --clusters=<cluster>`. This method is called if job exceeds *max_pend_time*.

complete(*self*)
This method is used for gathering job result we assume job is complete if it's in any of the following state: `COMPLETED`, `FAILED`, `OUT_OF_MEMORY`, `TIMEOUT`

exitcode(*self*)
Return job exit code

gather(*self*)

Gather job record which is called after job completion. We use *sacct* to gather job record and return the job record as a dictionary. The command we run is `sacct -j <jobid> -X -n -P -o <field1>,<field2>,...,<fieldN>`. We retrieve the following format fields from job record:

- "Account"
- "AllocNodes"
- "AllocTRES"
- "ConsumedEnergyRaw"
- "CPUTimeRaw"
- "Elapsed"
- "End"
- "ExitCode"
- "JobID"
- "JobName"
- "NCPUS"
- "NNodes"
- "QOS"
- "ReqGRES"
- "ReqMem"
- "ReqNodes"
- "ReqTRES"
- "Start"
- "State"
- "Submit"
- "UID"
- "User"
- "WorkDir"

The output of sacct is parseable using the pipe symbol (|) and stored into a dict

```
$ sacct -j 42909266 -X -n -P -o Account,AllocNodes,AllocTRES,ConsumedEnergyRaw,
↪CPUTimeRaw,Elapsed,End,ExitCode,JobID,JobName,NCPUS,NNodes,QOS,ReqGRES,ReqMem,
↪ReqNodes,ReqTRES,Start,State,Submit,UID,User,WorkDir --clusters=cori
nstaff|1|billing=272,cpu=272,energy=262,mem=87G,node=1|262|2176|00:00:08|2021-
↪05-27T18:47:49|0:0|42909266|slurm_metadata|272|1|debug_knl|PER_
↪NODE:craynetwork:1|87Gn|1|billing=1,cpu=1,node=1|2021-05-
↪27T18:47:41|COMPLETED|2021-05-27T18:44:07|92503|siddiq90|/global/u1/s/
↪siddiq90/.buildtest/tests/cori.slurm.knl_debug/metadata/slurm_metadata/0/stage
```

is_cancelled(*self*)

If job is cancelled return `True` otherwise return `False`. Slurm will report `CANCELLED` for job state.

is_complete(*self*)

If job is complete return `True` otherwise return `False`. Slurm will report `COMPLETED` for job state.

is_failed(*self*)
If job failed return `True` otherwise return `False`. Slurm will report `FAILED` for job state.

is_out_of_memory(*self*)
If job is out of memory return `True` otherwise return `False`. Slurm will report `OUT_OF_MEMORY` for job state.

is_pending(*self*)
If job is pending return `True` otherwise return `False`. Slurm Job state for pending is `PENDING`.

is_running(*self*)
If job is running return `True` otherwise return `False`. Slurm will report `RUNNING` for job state.

is_suspended(*self*)
If job is suspended return `True` otherwise return `False`. Slurm will report `SUSPENDED` for job state.

is_timeout(*self*)
If job timed out return `True` otherwise return `False`. Slurm will report `TIMEOUT` for job state.

poll(*self*)
Poll job to extract job state and exit code. We also retrieve job work directory. We run the following commands to retrieve the following properties.

- Job State: `sacct -j <jobid> -o State -n -X -P`
- ExitCode and Workdir: `sacct -j <jobid> -X -n -P -o ExitCode,Workdir`

state(*self*)
Return job state

workdir(*self*)
Return job work directory

`buildtest.executors.slurm.`**logger**

buildtest.schemas

Submodules

buildtest.schemas.defaults

Module Contents

Functions

custom_validator(recipe, schema)	This is a custom validator for validating JSON documents. We implement a

Attributes

here
resolver
schema_store
schema_table

buildtest.schemas.defaults.**custom_validator**(*recipe*, *schema*)

This is a custom validator for validating JSON documents. We implement a custom resolver for finding json schemas locally by implementing a schema store. The input arguments `recipe` and `schema` is your input JSON recipe and schema content for validating the recipe. This method uses Draft7Validator for validating schemas.

Parameters

- **recipe** (*dict*) – Input recipe as JSON document
- **schema** (*dict*) – Input JSON Schema content to validate JSON document

buildtest.schemas.defaults.**here**

buildtest.schemas.defaults.**resolver**

buildtest.schemas.defaults.**schema_store**

buildtest.schemas.defaults.**schema_table**

buildtest.schemas.utils

Utility and helper functions for schemas.

Module Contents

Functions

load_recipe(path)	Load a yaml recipe file. The file must be in .yml extension
load_schema(path)	Load a json schema file, the file extension must be '.schema.json'

Attributes

here	

buildtest.schemas.utils.**here**

buildtest.schemas.utils.**load_recipe**(*path*)
Load a yaml recipe file. The file must be in .yml extension for buildtest to load.

Parameters **path** (*str*) – the path to the recipe file.

buildtest.schemas.utils.**load_schema**(*path*)
Load a json schema file, the file extension must be '.schema.json'

Parameters **path** (*str*) – the path to the schema file.

buildtest.utils

Submodules

buildtest.utils.command

Module Contents

Classes

BuildTestCommand	Class method to invoke shell commands and retrieve output and error.
Capturing	capture output from stdout and stderr into capture object.

class buildtest.utils.command.**BuildTestCommand**(*cmd=None*)
Class method to invoke shell commands and retrieve output and error. This class is inspired and derived from utils functions in https://github.com/vsoch/scif

decode(*self*, *line*)
Given a line of output (error or regular) decode using the system default, if appropriate

execute(*self*)
Execute a system command and return output and error. :param cmd: shell command to execute :type cmd: str, required :return: Output and Error from shell command :rtype: two str objects

get_command(*self*)
Returns the executed command :rtype: str

get_error(*self*)
Returns the error from shell command :rtype: str

get_output(*self*)
Returns the output from shell command :rtype: str

returncode(*self*)
Returns the return code from shell command :rtype: int

set_command(*self*, *cmd*)
parse is called when a new command is provided to ensure we have a list. We don't check that the executable is on the path, as the initialization might not occur in the runtime environment.

class buildtest.utils.command.**Capturing**
capture output from stdout and stderr into capture object. This is based off of github.com/vsoch/gridtest but modified to write files. The stderr and stdout are set to temporary files at the init of the capture, and then they are closed when we exit. This means expected usage looks like:

with Capturing() as capture: process = subprocess.Popen(...)

And then the output and error are retrieved from reading the files: and exposed as properties to the client:

capture.out capture.err

And cleanup means deleting these files, if they exist.

__enter__(*self*)

__exit__(*self*, **args*)

cleanup(*self*)

property err(*self*)
Return error stream. Returns empty string if empty or doesn't exist. Returns (str) : error stream written to file

property out(*self*)
Return output stream. Returns empty string if empty or doesn't exist. Returns (str) : output stream written to file

set_stderr(*self*)

set_stdout(*self*)

buildtest.utils.file

This module provides some generic file and directory level operation that include the following: 1. Check if path is a File or Directory via is_file(), is_dir() 2. Create a directory via create_dir() 3. Walk a directory tree based on single extension using walk_tree() 4. Resolve path including shell and user expansion along with getting realpath to file using resolve_path() 5. Read and write a file via read_file(), write_file()

Module Contents

Functions

create_dir(dirname)	Create a directory if it doesn't exist. If directory contains variable
is_dir(dirname)	This method will check if a directory exist. If directory found we return
is_file(fname)	This method will check if file exist, if so returns True otherwise returns False
load_json(fname)	Given a filename, resolves full path to file and loads json file. This method will
read_file(filepath)	This method is used to read a file specified by argument `filepath`.

continues on next page

Table 49 – continued from previous page

remove_file(fpath)	This method is responsible for removing a file. The input path is an absolute path
resolve_path(path, exist=True)	This method will resolve a file path to account for shell expansion and resolve paths in
walk_tree(root_dir, ext=None)	This method will traverse a directory tree and return list of files
write_file(filepath, content)	This method is used to write an input `content` to a file specified by

buildtest.utils.file.**create_dir**(*dirname*)

Create a directory if it doesn't exist. If directory contains variable expansion ($HOME), user expansion (~) we resolve this before creating directory. If there is an error creating directory we raise an exception

Parameters **dirname** (*str, required*) – directory path to create

Returns creates the directory or print an exception message upon failure

Return type Catches exception of type OSError

buildtest.utils.file.**is_dir**(*dirname*)

This method will check if a directory exist. If directory found we return True otherwise False.

Parameters **dir** (*str, required*) – directory path

Returns returns a boolean True/False depending on if input is a valid directory.

Return type bool

buildtest.utils.file.**is_file**(*fname*)

This method will check if file exist, if so returns True otherwise returns False

Parameters **file** (*str, required*) – file path

Returns returns a boolean True/False depending on if input is a valid file.

Return type bool

buildtest.utils.file.**load_json**(*fname*)

Given a filename, resolves full path to file and loads json file. This method will catch exception json.JSONDecodeError and raise an exception with useful message. If there is no error we return content of json file

buildtest.utils.file.**read_file**(*filepath*)

This method is used to read a file specified by argument `filepath`. If filepath is not a string we raise an error. We also run `resolve_path` to get realpath to file and account for shell or user expansion. The return from `resolve_path` will be a valid file or `None` so we check if input is an invalid file. Finally we read the file and return the content of the file as a string.

Parameters **filepath** (*str, required*) – file name to read

Raises BuildTestError: If filepath is not a string BuildTestError: If filepath is not valid file

Returns return content of file as a string

Return type str

buildtest.utils.file.**remove_file**(*fpath*)

This method is responsible for removing a file. The input path is an absolute path to file. We check for exceptions first, and return immediately before removing file.

Parameters **fpath** (*str, required*) – full path to file

buildtest.utils.file.**resolve_path**(*path*, *exist=True*)

This method will resolve a file path to account for shell expansion and resolve paths in when a symlink is provided in the file. This method assumes file already exists.

param path file path to resolve

type path str, required

param exist expects a boolean to determine if filepath should be returned or None. By default, *exist* is *True*

and file is checked using *os.path.exist* to return full path.

```
>>> a = resolve_path("$HOME/.bashrc")
>>> assert a
>>> b = resolve_path("$HOME/.bashrc1", exist=False)
>>> assert b
>>> c = resolve_path("$HOME/.bashrc1", exist=True)
>>> assert not c
```

file is checked``os.path.exists`` after getting realpath using `os.path.realpath()`. resolve :return: return realpath to file if found otherwise return None :rtype: str or None

buildtest.utils.file.**walk_tree**(*root_dir*, *ext=None*)

This method will traverse a directory tree and return list of files based on extension type. This method invokes is_dir() to check if directory exists before traversal.

Parameters:

Parameters

- **root_dir** (*str, required*) – directory path to traverse
- **ext** (*str, optional*) – file extensions to search in traversal

Returns returns a list of file paths

Return type list

buildtest.utils.file.**write_file**(*filepath*, *content*)

This method is used to write an input `content` to a file specified by `filepath`. Both `filepath` and `content` must be a `str`. An error is raised if `filepath` is not a string or a directory. If ``content`` is not a str, we return `None` since we can't process the content for writing. Finally, we write the content to file and return. A successful write will return nothing otherwise an exception will occur during the write process.

Parameters

- **filepath** (*str, required*) – file name to write
- **content** (*str, required*) – content to write to file

Raises BuildTestError: System error if filepath is not string BuildTestError: System error if filepath is a directory

Returns Return nothing if write is successful. A system error if `filepath` is not str or directory. If argument `content` is not str we return `None`

buildtest.utils.shell

Module Contents

Classes

Shell

class buildtest.utils.shell.**Shell**(*shell='bash'*)

valid_shells = ['bash', 'sh', 'zsh', 'csh', 'tcsh', '/bin/bash', '/bin/csh', '/bin/sh', '/bin/tcsh',...

__repr__(*self*)
Return repr(self).

__str__(*self*)
Return str(self).

get(*self*)
Return shell attributes as a dictionary

property opts(*self*)
retrieve the shell opts that are set on init, and updated with setter

property path(*self*)
This method returns the full path to shell program using `shutil.which()` If shell program is not found we raise an exception. The shebang is is updated assuming path is valid which is just adding character '#!' in front of path. The return is full path to shell program. This method automatically updates the shell path when there is a change in attribute self.name

```
>>> shell = Shell("bash")
>>> shell.path
'/usr/bin/bash'
>>> shell.name="sh"
>>> shell.path
'/usr/bin/sh'
```

buildtest.utils.timer

Module Contents

Classes

Timer

class buildtest.utils.timer.**Timer**

start(*self*)
Start a new timer

stop(*self*)
Stop the timer, and report the elapsed time

exception buildtest.utils.timer.**TimerError**
Bases: Exception

A custom exception used to report errors in use of Timer class

buildtest.utils.tools

Module Contents

Classes

Hasher	dict() -> new empty dictionary

Functions

deep_get(dictionary, *keys)

class buildtest.utils.tools.**Hasher**
Bases: dict

dict() -> new empty dictionary dict(mapping) -> new dictionary initialized from a mapping object's

(key, value) pairs

dict(iterable) -> new dictionary initialized as if via: d = {} for k, v in iterable:

d[k] = v

dict(kwargs) -> new dictionary initialized with the name=value pairs** in the keyword argument list. For example: dict(one=1, two=2)

__missing__(*self*, *key*)

__str__(*self*)
Return str(self).

get(*self*, *path*, *sep='.'*, *default=None*)
D.get(k[,d]) -> D[k] if k in D, else d. d defaults to None.

buildtest.utils.tools.**deep_get**(*dictionary*, **keys*)

Submodules

buildtest.config

Module Contents

Classes

SiteConfiguration	This class is an interface to buildtest configuration

Attributes

logger

class buildtest.config.**SiteConfiguration**(*settings_file=None*)

This class is an interface to buildtest configuration

_executor_check(*self*)

_validate_cobalt_executors(*self*)

Validate cobalt queue property by running `qstat -Ql <queue>. If its a non-zero exit code then queue doesn't exist otherwise it is a valid queue.

_validate_lsf_executors(*self*)

This method validates all LSF executors. We check if queue is available and in `Open:Active` state.

_validate_pbs_executors(*self*)

Validate pbs queue property by running by checking if queue is found and queue is 'enabled' and 'started' which are two properties found in pbs queue configuration that can be retrieved using `qstat -Q -f -F json`. The output is in the following format

```
$ qstat -Q -f -F json
 {
     "timestamp":1615924938,
     "pbs_version":"19.0.0",
     "pbs_server":"pbs",
     "Queue":{
         "workq":{
             "queue_type":"Execution",
             "total_jobs":0,
             "state_count":"Transit:0 Queued:0 Held:0 Waiting:0 Running:0␣
↪Exiting:0 Begun:0 ",
             "resources_assigned":{
                 "mem":"0kb",
                 "ncpus":0,
                 "nodect":0
             },
             "hasnodes":"True",
             "enabled":"True",
             "started":"True"
```

(continues on next page)

(continued from previous page)

```
        }
    }
}
```

_validate_slurm_executors(*self*)
This method will validate slurm executors, we check if partition, qos, and cluster fields are valid values by retrieving details from slurm configuration. These checks are performed on fields `partition`, `qos` or `cluster` if specified in executor section.

detect_system(*self*)
This method gets current system by setting `self.target` by matching `hostnames` entry in each system list with actual system. We retrieve target hostname and determine which system configuration to use. If no system is found we raise an error.

property file(*self*)

load(*self*)
Loads configuration file

name(*self*)
Return name of matched system from configuration file

resolve(*self*)
This method will resolve path to configuration file. The order of precedence is as follows:

1. command line argument - Must be valid path
2. User Configuration: $HOME/.buildtest/config.yml
3. Default Configuration: $BUILDTEST_ROOT/buildtest/settings/config.yml

validate(*self*, *validate_executors=True*)
This method validates the site configuration with schema

buildtest.config.**logger**

buildtest.defaults

Buildtest defaults, including environment variables and paths, are defined or derived here.

Module Contents

buildtest.defaults.**BUILDSPEC_CACHE_FILE**

buildtest.defaults.**BUILDSPEC_DEFAULT_PATH**

buildtest.defaults.**BUILDTEST_BUILDSPEC_DIR**

buildtest.defaults.**BUILDTEST_DEFAULT_TESTDIR**

buildtest.defaults.**BUILDTEST_EXECUTOR_DIR**

buildtest.defaults.**BUILDTEST_REPORT_SUMMARY**

buildtest.defaults.**BUILDTEST_ROOT**

buildtest.defaults.**BUILDTEST_USER_HOME**

buildtest.defaults.**BUILD_HISTORY_DIR**

buildtest.defaults.**BUILD_REPORT**

buildtest.defaults.**DEFAULT_SETTINGS_FILE**

buildtest.defaults.**DEFAULT_SETTINGS_SCHEMA**

buildtest.defaults.**SCHEMA_ROOT**

buildtest.defaults.**USER_SETTINGS_FILE**

buildtest.defaults.**VAR_DIR**

buildtest.defaults.**supported_schemas**

buildtest.defaults.**supported_type_schemas = ['script-v1.0.schema.json', 'compiler-v1.0.schema.json']**

buildtest.defaults.**userhome**

buildtest.exceptions

Module Contents

exception buildtest.exceptions.**BuildTestError**(*msg*, **args*)
Bases: Exception

Class responsible for error handling in buildtest. This is a sub-class of Exception class.

__str__(*self*)
Return str(self).

exception buildtest.exceptions.**BuildspecError**(*buildspec*, *msg*)
Bases: Exception

raise exception if there is an issue with Buildspec in parsing or building test

__str__(*self*)
Return str(self).

exception buildtest.exceptions.**ConfigurationError**(*config*, *settings_file*, *msg*)
Bases: Exception

This will raise an error related with buildtest configuration file

__str__(*self*)
Return str(self).

exception buildtest.exceptions.**ExecutorError**
Bases: Exception

This class raises an error with Executor class and its operation

buildtest.log

Methods related to buildtest logging

Module Contents

Functions

init_logfile(logfile=FILE_LOG, debug=None)	Initialize a log file intended for a builder. This requires

Attributes

FILE_LOG
LOG_FORMATTER
LOG_NAME

buildtest.log.**FILE_LOG**

buildtest.log.**LOG_FORMATTER = %(asctime)s [%(filename)s:%(lineno)s - %(funcName)5s()] - [%(levelname)s] %(message)s**

buildtest.log.**LOG_NAME = buildtest**

buildtest.log.**init_logfile**(*logfile=FILE_LOG*, *debug=None*)
Initialize a log file intended for a builder. This requires passing the filename intended for the log (from the builder) and returns the logger. :param logfile: logfile name :type logfile: str

buildtest.main

Entry point for buildtest

Module Contents

Functions

main()	Entry point to buildtest.

buildtest.main.**main**()
Entry point to buildtest.

buildtest.system

This module detects System changes defined in class BuildTestSystem.

Module Contents

Classes

BuildTestSystem	BuildTestSystem is a class that detects system configuration
Cobalt	The Cobalt class checks for Cobalt binaries and gets a list of Cobalt queues
LSF	The LSF class checks for LSF binaries and returns a list of LSF queues
PBS	The PBS class checks for Cobalt binaries and gets a list of Cobalt queues
Scheduler	This is a base Scheduler class used for implementing common methods for
Slurm	The Slurm class implements common functions to query Slurm cluster

Attributes

system

class buildtest.system.**BuildTestSystem**

BuildTestSystem is a class that detects system configuration

system

check(*self*)

Based on the module "distro" get system details like linux distro, processor, hostname, etc...

check_scheduler(*self*)

Check existence of batch scheduler and if so determine which scheduler it is. Currently we support Slurm, LSF, and Cobalt we invoke each class and see if its valid state. The checks determine if scheduler binaries exist in $PATH.

detect_module_tool(*self*)

Check if module tool exists, we check for Lmod or environment-modules by checking if environment variable `LMOD_VERSION`, `MODULE_VERSION` or `MODULES_CMD` exist. We check this with input specification in buildtest configuration. If user specifies lmod as the module tool but detected environment-modules, buildtest should pick this up and report this as part of configuration check

get(*self*)

class buildtest.system.**Cobalt**

Bases: *Scheduler*

The Cobalt class checks for Cobalt binaries and gets a list of Cobalt queues

binaries = ['qsub', 'qstat', 'qdel', 'nodelist', 'showres', 'partlist']

_get_queues(*self*)
Get all Cobalt queues by running `qstat -Ql` and parsing output

class buildtest.system.**LSF**
Bases: *Scheduler*

The LSF class checks for LSF binaries and returns a list of LSF queues

binaries = ['bsub', 'bqueues', 'bkill', 'bjobs']

_get_queues(*self*)
Return json dictionary of available LSF Queues and their queue states. The command we run is the following: `bqueues -o 'queue_name status' -json` which returns a JSON record of all queue details.

```
$ bqueues -o 'queue_name status' -json
    {
      "COMMAND":"bqueues",
      "QUEUES":2,
      "RECORDS":[
        {
          "QUEUE_NAME":"batch",
          "STATUS":"Open:Active"
        },
        {
          "QUEUE_NAME":"test",
          "STATUS":"Open:Active"
        }
      ]
    }
```

class buildtest.system.**PBS**
Bases: *Scheduler*

The PBS class checks for Cobalt binaries and gets a list of Cobalt queues

binaries = ['qsub', 'qstat', 'qdel', 'qstart', 'qhold', 'qmgr']

_get_queues(*self*)
Get queue configuration using `qstat -Q -f -F json` and retrieve a list of queues.

class buildtest.system.**Scheduler**
This is a base Scheduler class used for implementing common methods for detecting Scheduler details. The subclass implement specific queries that are scheduler specific. The `Slurm`, `LSF`, `PBS` and `Cobalt` class inherit from Base Class `Scheduler`.

logger

check(*self*)
Check if binaries exist binary exist in $PATH

class buildtest.system.**Slurm**
Bases: *Scheduler*

The Slurm class implements common functions to query Slurm cluster including partitions, qos, cluster. We check existence of slurm binaries in $PATH and return if slurm cluster is in valid state.

binaries = ['sbatch', 'sacct', 'sacctmgr', 'sinfo', 'scancel']

_get_clusters(*self*)
Get list of slurm clusters by running `sacctmgr list cluster -P -n format=Cluster`. The output is a list of slurm clusters something as follows

```
$ sacctmgr list cluster -P -n format=Cluster
cori
escori
```

_get_partitions(*self*)

Get list of all partitions slurm partitions using `sinfo -a -h -O partitionname`. The output is a list of queue names

```
$ sinfo -a -h -O partitionname
system
system_shared
debug_hsw
debug_knl
jupyter
```

_get_qos(*self*)

Retrieve a list of all slurm qos by running `sacctmgr list qos -P -n format=Name`. The output is a list of qos. Shown below is an example output

```
$ sacctmgr list qos -P -n  format=Name
normal
premium
low
serialize
scavenger
```

buildtest.system.**system**

Package Contents

buildtest.**BUILDTEST_COPYRIGHT = Copyright (c) 2021, The Regents of the University of California, through Lawrence Berkeley...**

buildtest.**BUILDTEST_VERSION = 0.10.2**

buildtest.**__version__**

3.12 Buildtest Command Reference

buildtest is a HPC testing framework for building and running tests.

```
usage: buildtest [options] [COMMANDS]
```

3.12.1 Named Arguments

-V, --version	show program's version number and exit
-c, --config	Specify Path to Configuration File
-d, --debug	Print debug messages to screen Default: False
--color	Possible choices: on, off Enable or disable color Default: "on"

3.12.2 COMMANDS

Possible choices: build, buildspec, config, report, inspect, history, edit, schema, cdash, docs, schemadocs, help

3.12.3 Sub-commands:

build

Build and Run test

```
buildtest build [-h] [-b BUILDSPEC] [-x EXCLUDE] [-e EXECUTOR] [-t TAGS]
                [-f FILTER] [--helpfilter] [-k]
                [--max-pend-time MAX_PEND_TIME]
                [--poll-interval POLL_INTERVAL] [--rebuild REBUILD]
                [-r REPORT] [-s {parse,build}] [--testdir TESTDIR]
```

discover

select buildspecs

-b, --buildspec	Specify a buildspec (file or directory) to build. A buildspec must end in '.yml' extension.
-x, --exclude	Exclude one or more buildspecs (file or directory) from processing. A buildspec must end in '.yml' extension.
-e, --executor	Discover buildspecs by executor name found in buildspec cache
-t, --tags	Discover buildspecs by tags found in buildspec cache

filter

Filter tests

-f, --filter Filter buildspec based on tags, type, or maintainers. Usage: –filter key1=val1,key2=val2

--helpfilter Show available filter fields used with –filter option

Default: False

extra

All extra options

-k, --keep-stage-dir Keep stage directory after job completion.

Default: False

--max-pend-time Specify Maximum Pending Time (sec) for job before cancelling job. This only applies for batch job submission.

--poll-interval Specify Poll Interval (sec) for polling batch jobs

--rebuild Rebuild test X number of times. Must be a positive number between [1-50]

-r, --report Specify a report file where tests will be written.

-s, --stage Possible choices: parse, build

control behavior of buildtest build

--testdir Specify a custom test directory where to write tests. This overrides configuration file and default location.

buildspec

Buildspec Interface

```
buildtest buildspec [-h]  ...
```

subcommands

Find buildspec from cache file

Possible choices: find, summary, show, validate

Sub-commands:

find

Query information from buildspecs cache

```
buildtest buildspec find [-h] [-b] [-e] [--group-by-tags]
                         [--group-by-executor] [-m] [-mb] [-p] [-t]
                         [--filter FILTER] [--format FORMAT] [--helpfilter]
                         [--helpformat] [-n] [--terse] [-r] [--root ROOT]
                         ...
```

Positional Arguments

Possible choices: invalid

Named Arguments

-r, --rebuild Rebuild buildspec cache and find all buildspecs again

Default: False

--root Specify root buildspecs (directory) path to load buildspecs into buildspec cache.

filter and format

filter and format options

--filter Filter buildspec cache with filter fields in format –filter key1=val1,key2=val2

--format Format buildspec cache with format fields in format –format field1,field2,…

--helpfilter Show Filter fields for –filter option for filtering buildspec cache output

Default: False

--helpformat Show Format fields for –format option for formatting buildspec cache output

Default: False

terse

terse options

-n, --no-header Print output without header in terse output

Default: False

--terse Print output in machine readable format

Default: False

query

query options to retrieve from buildspec cache

-b, --buildspec Get all buildspec files from cache

Default: False

-e, --executors get all unique executors from buildspecs

Default: False

--group-by-tags Group tests by tag name

Default: False

--group-by-executor Group tests by executor name

Default: False

-m, --maintainers Get all maintainers for all buildspecs

Default: False

-mb, --maintainers-by-buildspecs Show maintainers breakdown by buildspecs

Default: False

-p, --paths print all root buildspec paths

Default: False

-t, --tags List all available tags

Default: False

Sub-commands:

invalid

Show invalid buildspecs

```
buildtest buildspec find invalid [-h] [-e]
```

Named Arguments

-e, --error Show error messages

Default: False

summary

Print summary of buildspec cache

```
buildtest buildspec summary [-h]
```

show

Show content of buildspec file

```
buildtest buildspec show [-h] name
```

Positional Arguments

name Show content of buildspec based on test name

validate

Validate buildspecs with JSON Schema

```
buildtest buildspec validate [-h] [-b BUILDSPEC] [-x EXCLUDE] [-e EXECUTOR]
                             [-t TAG]
```

Named Arguments

-b, --buildspec Specify path to buildspec (file, or directory) to validate

-x, --exclude Specify path to buildspec to exclude (file or directory) during validation

-e, --executor Specify buildspecs by executor name to validate

-t, --tag Specify buildspecs by tag name to validate

config

Query buildtest configuration

```
buildtest config [-h]  ...
```

subcommands

Query information from buildtest configuration file

Possible choices: compilers, executors, summary, systems, validate, view

Sub-commands:

compilers

Search compilers

```
buildtest config compilers [-h] [-j] [-y]  ...
```

Named Arguments

-j, --json	List compiler details in JSON format Default: False
-y, --yaml	List compiler details in YAML format Default: False

subcommands

Find new compilers and add them to detected compiler section

Possible choices: find

Sub-commands:

find

Find compilers

```
buildtest config compilers find [-h] [-d]
```

Named Arguments

-d, --debug	Display Debugging output when finding compilers Default: False

executors

Query executors from buildtest configuration

```
buildtest config executors [-h] [-j] [-y]
```

Named Arguments

-j, --json	View executor in JSON format Default: False
-y, --yaml	View executors in YAML format Default: False

summary

Provide summary of buildtest settings.

```
buildtest config summary [-h]
```

systems

List all available systems

```
buildtest config systems [-h]
```

validate

Validate buildtest settings file with schema.

```
buildtest config validate [-h]
```

view

View Buildtest Configuration File

```
buildtest config view [-h]
```

report

Query test report

```
buildtest report [-h] [--filter FILTER] [--format FORMAT] [--helpfilter]
                 [--helpformat] [--latest] [--oldest] [-n] [-r REPORT] [-t]
                 ...
```

Named Arguments

--filter	Filter report by filter fields. The filter fields must be a key=value pair and multiple fields can be comma separated in the following format: –filter key1=val1,key2=val2 . For list of filter fields run: –helpfilter.
--format	format field for printing purposes. For more details see –helpformat for list of available fields. Fields must be separated by comma (usage: –format <field1>,<field2>,...)
--helpfilter	List available filter fields to be used with –filter option Default: False
--helpformat	List of available format fields Default: False
--latest	Retrieve latest record of particular test Default: False
--oldest	Retrieve oldest record of particular test Default: False
-n, --no-header	Don't print headers column used with terse option (–terse). Default: False
-r, --report	Specify a report file to read Default: "/home/docs/checkouts/readthedocs.org/user_builds/buildtest/checkouts/v0.10.2/var/report.json"
-t, --terse	Print output in machine readable format Default: False

subcommands

Fetch test results from report file and print them in table format

Possible choices: clear, list, summary

Sub-commands:

clear

delete report file

```
buildtest report clear [-h]
```

list

List all report files

```
buildtest report list [-h]
```

summary

Summarize test report

```
buildtest report summary [-h]
```

inspect

Inspect a test based on NAME or ID

```
buildtest inspect [-h] [-r REPORT]  ...
```

Named Arguments

-r, --report Specify a report file to load when inspecting test

subcommands

Inspect Test result based on Test ID or Test Name

Possible choices: buildspec, id, name, query, list

Sub-commands:

buildspec

Inspect a test based on buildspec

```
buildtest inspect buildspec [-h] [-a] [buildspec [buildspec ...]]
```

Positional Arguments

buildspec List of buildspecs to query

Named Arguments

-a, --all Fetch all records for a given test

Default: False

id

Specify a Test ID

```
buildtest inspect id [-h] [id [id ...]]
```

Positional Arguments

id Test ID

name

Specify name of test

```
buildtest inspect name [-h] [-a] [name [name ...]]
```

Positional Arguments

name Name of test

Named Arguments

-a, --all Fetch all test records for a given test name

Default: False

query

Query fields from record

```
buildtest inspect query [-h] [-b] [-d {first,last,all}] [-e] [-o] [-t]
                        [name [name ...]]
```

Positional Arguments

name	Name of test

Named Arguments

-b, --buildscript	Print build script
	Default: False
-d, --display	Possible choices: first, last, all
	Determine how records are fetched, by default it will report the last record of the test.
	Default: "last"
-e, --error	Print error file
	Default: False
-o, --output	Print output file
	Default: False
-t, --testpath	Print content of testpath
	Default: False

list

List all test ids

```
buildtest inspect list [-h] [-n] [-t]
```

Named Arguments

-n, --no-header	Print output without header in terse format (–terse)
	Default: False
-t, --terse	Print output in terse format
	Default: False

history

Query build history

```
buildtest history [-h]  ...
```

subcommands

Query build history file

Possible choices: list, query

Sub-commands:

list

List a summary of all builds

```
buildtest history list [-h] [-n] [-t]
```

Named Arguments

-n, --no-header Do not print header columns in terse output (–terse)

Default: False

-t, --terse Print output in machine readable format

Default: False

query

Query information for a particular build

```
buildtest history query [-h] [-l] id
```

Positional Arguments

id Select a build ID

Named Arguments

-l, --log Display logfile for corresponding build id

Default: False

edit

Edit a buildspec and validate with schema file

```
buildtest edit [-h] buildspec
```

Positional Arguments

buildspec Open buildspec in editor and validate upon closing file

schema

List schema contents and examples

```
buildtest schema [-h] [-e] [-j] [-n Schema Name]
```

Named Arguments

-e, --example Show schema examples

Default: False

-j, --json Display json schema file

Default: False

-n, --name Possible choices: global.schema.json, definitions.schema.json, settings.schema.json, compiler-v1.0.schema.json, spack-v1.0.schema.json, script-v1.0.schema.json

show schema by name (e.g., script)

cdash

Upload test to CDASH server

```
buildtest cdash [-h]  ...
```

subcommands

buildtest CDASH integeration

Possible choices: view, upload

Sub-commands:

view

Open CDASH project in webbrowser

```
buildtest cdash view [-h] [--url URL]
```

Named Arguments

--url Specify a url to CDASH project

upload

Upload Test to CDASH server

```
buildtest cdash upload [-h] [-r REPORT] [--site SITE] buildname
```

Positional Arguments

buildname Specify Build Name reported in CDASH

Named Arguments

-r, --report Path to report file to upload test results

--site Specify site name reported in CDASH

docs

Open buildtest docs in browser

```
buildtest docs [-h]
```

schemadocs

Open buildtest schema docs in browser

```
buildtest schemadocs [-h]
```

help

buildtest command guide

```
buildtest help [-h]
               {build,buildspec,cdash,config,edit,history,inspect,report,schema}
```

Positional Arguments

command Possible choices: build, buildspec, cdash, config, edit, history, inspect, report, schema

Show help message for command

GitHub: https://github.com/buildtesters/buildtest Documentation: https://buildtest.readthedocs.io/en/latest/index.html Schema Documentation: https://buildtesters.github.io/buildtest/ Slack: http://hpcbuildtest.slack.com/

Please report issues at https://github.com/buildtesters/buildtest/issues

CHAPTER

FOUR

LICENSE

buildtest is released under the MIT license

CHAPTER

FIVE

INDICES AND TABLES

- genindex
- modindex
- search

PYTHON MODULE INDEX

b

INDEX

Symbols

A

B

C

D

E

F

G

H

I

J

L

M

N

O

P

Q

R

S

T

U

V

W