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# **decisionengine modules**

***Release 1.7.0***

**Fermi Research Alliance, LLC.**

**Oct 15, 2021**



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The decisionengine\_modules package contains provider specific implementations of base classes provided by the decision engine framework.



## RELEASE NOTES

### 1.1 Release 1.7.0

This release features:

- Adopt new produces-consumes decorators introduced in the Framework
- Added structured logging. Improved python logging and adoption of structured logs format that will increase the semantic content of the messages and ease the export of information for dashboards and Elastic Search.
- Migrated to setuptools package development library. This build system is the standard vanilla python build system provided with the python distribution. Build configurations have been updated and rpm packaging remains the primary distribution method.
- The billing\_calculator is now hosted in HEPCloud's GitHub organization

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**Note:** The RPM package was renamed from decisionengine-standard-library to decisionengine\_modules. rpm/yum updates from the old RPM will work correctly.

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**Note:** The “channel\_name” key in the Source Proxy config dictionaries needs to be changed to “source\_channel”. “channel\_name” is now being used to describe the name of the channel itself, not the name of the channel the Source Proxy is getting information from.

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#### 1.1.1 Issues fixed in this release

- 354 : Interior log messages from decision engine modules subroutines are missing;
- 348 : Name convention on bill\_calculator\_hep vs. billing\_calculator\_hep
- 333 : DE modules entrypoint script always pick DE default branch, this becomes an issue when testing DE modules branches enhancement
- 325 : Follow up for 323 unit test inside correction map logic
- 323 : Need to be able to add the conversion map to the factory\_entries source onmachine\_patch operations

## 1.1.2 Full list of commits since version 1.6.0

4d2c9fe: Updated documentation for 1.7.0 release

7451799: Updated release notes for 1.7.0 RC4 (1.6.99.post8)

34d2d74: Added module logger for functions in glide\_frontend\_element.py outside the class

41e1060: fixes to tests

ab0c739: Update release\_notes\_1.7.rst

cc94791: Updated release notes for 1.7.0 RC3 (1.6.99.post7)

076371a: changes needed for structured logging

77a79ad: Use latest version of bill calc

385266c: Fix requiements to match our usage

56e2d9e: Add config for lgtn

31d9d77: Rename bill\_calculator\_hep imports

2cd29c4: Updated release notes for 1.7.0 RC2 (1.6.99.post6)

f8c4c73: standardizing logging

160e3b8: Added a note to the release notes about the RPM name change

456003b: Release notes ready for v1.7.0

f8eef94: changes for structured logging

8a8c3dc: Set more firm version requirements for setup.py

3b44f36: Allow use of custom DEframework branch to test DE modules pick DEframework branch from DE modules branch

d454093: Legacy boto isn't used internally any longer

e87e1fb: Don't package tests at top level

76f3ae1: Fix GlideinWMS RPM requirement

5f9534f: Move packaging to develop

267995b: Implementing PEP8 issues

2a4d266: Adding new test for correction map

1c60be8: Update Jenkins file to cope with setuptools

a674626: Migrate to setuptools

7efbe56: Preparing 1.7, ready for 1.6.99.post2

5c3f8b3: Add in Jenkinsfile pipeline configuration a timeout at stage level

bd83afa: bill-calculator-hep now on official pypi

518ffdc: Fix coding error.

68d6441: Fix typos encountered during integration testing.

5435707: Check for configuration error.

4f7fc04: Accomodate breaking changes introduced by the framework.

a27f92a: Added 1.6.2 release notes, from branch 1.6



c7351ca: Merge pull request #329 from jcpunk/billing\_calc  
82c7b33: Add billing-calculator into CI environment  
6658c62: Merge pull request #327 from knoepfel/produces-consumes-configuration  
5a1ab2b: Address Marco's comments.  
0e2a005: Upgrade to new produces/consumes/supports\_config interface  
e8fd175: Python cleanups  
5edf1f5: Remove unneeded files  
4a30632: Merge pull request #324 from hyunwoo18/t323  
1f80c4a: Correction map implemented too  
9ce3b1c: Fix import (#321)  
5449e00: fix typo  
7c0752f: bump trrunk version

## 1.2 Release 1.6.2

Patch level (bug fix) release.

Correction map for GlideinWMS Factory Entries added. (#323, PR#324) Fixed imports and a typo.

### 1.2.1 Full list of commits since version 1.6.1

4f6e313: Correction map implemented too  
bdf4324: releasing 1.6.2-0.1.rc1  
53c7d6c: getting ready to release 1.6.2  
9a9f99d: Fix import (#321)  
d502bf1: fix typo

## 1.3 Release 1.6.0

In this release:

- Adapt to decisionengine framework migration to setuptools.
- Drop cmake step before running unit tests.
- Enhanced logging.
- Bug fixes.

### 1.3.1 Issues fixed in this release

275 : (b639a74)

### 1.3.2 Full list of commits since version 1.5.0

f93831c : enhanced logging and error handling in util directory (#320)  
798972f : replaced method\_whitelist with allowed\_methods (as former os deprecated) (#319)  
b8af4b3 : Update Jenkins pipeline configuration (#318)  
b639a74 : Handle KeyError exception (#317)  
4c9e25e : Add about.py for useful names (#310)  
48e725f : update unittest document  
36b799e : Configure DE Modules to use DE Framework with setuptools (#316)  
45fc425 : Move to raw flake8 test action (#315)  
478b0a5 : Update gh-actions to best practices (#311)  
6285f49 : Drop obsolete github action (#309)  
911fef7 : Do a limited pin on dependencies (#308)  
ab096a8 : Sync-up .gitignore (#304)  
cd7e668 : Move to raw github actions (and codecov.io) (#298)  
4a997d4 : Remove building of C++ Logic Engine from unit tests

## 1.4 Release 1.5.0

In this release:

- New AWS bill calculator
- Bug fixes

### 1.4.1 Issues fixed in this release

- 271 : Change configuration so the bill-calculator-hep-mapsacosta library doesn't write stuff to stdout (5410c46)
- 283 : Change DEAccountConstants.py to allow more variables through (7a65032)
- 293 : Unit test tests/test\_job\_q.py is failing (f5006fb)
- 263 : Python3 encodes hex strings differently, resulting in malformed htcondor classads (c16f0)
- 289 : Travis CI fails after decisionengine transitioned to pybind11 (2bec1da)
- 281 : New exception in NERSC newt get\_usage (398dc42)

## 1.4.2 Full list of commits since version 1.4.2

5410c46 : new bill calculator package (#303)

7a65032 : Resolving issue 283 (#301)

1a2c3e4 : Fix syntax errors and pylint bits (#300)

976c4a4 : Minor linting of actions (#297)

c43f311 : Drop redundant action, pep8speaks is already doing this (#296)

10691e4 : Add support to use custom docker layer as base of the docker image (#295)

f5006fb : fix for unit test test\_job\_q issue 293 (#294)

0b588ef : Update workflow per changes at github (#292)

7841d19 : Updated Jenkins configuration documentation (#291)

c08ffce : edited release notes

c16f0ac : Another fix to malformed strings (#288)

2bec1da : Fix #289 where TravisCI is missing changes from <https://github.com/HEPCloud/decisionengine/commit/ea7ade57ca825afb0afbfa5ebd49820b16786d8b> (#290)

8647bb2 : Update to current python test matrix (#287)

234a78e : update release notes

398dc42 : decisionengine\_modules/NERSC/util: Added more 5xx codes to retry (#285)

d2df861 : force docker pull when building the docker container to make sure to use an updated base layer (#280)

9a78d22 : added 1.4.0 release notes

5d3b7ec : Updating Dockerfile for unittest (#279)

e16531e : Provide default for util function. (#278)

02f1738 : set RPM version number to 1.5.0rc and drop py3 suffix (#277)

664b9fe : Add timeout support for unit test on Jenkins for DE modules repo (#274)

e392a3c : Added initial unit test for glide\_frontend\_element.py (#269)

2f0069f : Updated DE modules Jenkins documentation

## 1.5 Release 1.4.2

In this release:

- Bug fixes to 1.4.1 release

### 1.5.1 Issues fixed in this release

- [282](#) : Decision Engine classad encoding problems make multiple exceptions in the factory ([c16f0ac](#))

### 1.5.2 Full list of commits since version 1.4.1

[c16f0ac](#) : Another fix to malformed strings (#288)

## 1.6 Release 1.4.1

In this release:

- Bug fixes to 1.4.0 release

### 1.6.1 Issues fixed in this release

- [281](#) : New exception in NERSC newt get\_usage ([4d1301e](#))

### 1.6.2 Full list of commits since version 1.4.0

[4d1301e](#) : decisionengine\_modules/NERSC/util: Added more 5xx codes to retry (#285)

## 1.7 Release 1.4.0

In this release:

- Works with python3 glideinWMS package
- Uses new AWS bill calculator
- Improved Jenkins CI pipeline

### 1.7.1 Issues fixes in this release

- [59](#) : Replace AWS Billing and GCE Billing modules with revamped bill Calculator code ([71f25ea](#))
- [246](#) : Modify NERSCAllocation main() so that it can be run standalone ([11ce772](#))
- [263](#) : Python3 encodes hex strings differently, resulting in malformed htcondor classads ([13a24e4](#))
- [255](#) : Add option to config of condor/sources/job\_q.py and slots.py ([6f65af4](#))

## 1.7.2 Full list of commits since version 1.3.0

42f62d3 : remove py3 from package name  
6e56c4d : bump version number  
6433dba : Add support to test any branch in Jenkins for DE modules repo (#276)  
60db1b3 : Accommodate breaking changes to framework's configuration system. (#273)  
13a24e4 : Fix263 (#272)  
a866e47 : Correct 'file\_cache is unavailable when using oauth2client >= 4.0.0' (#267)  
2c82064 : Fix requirements.txt for #266 (#268)  
6f65af4 : A more generic solution for the issue 255 (#265)  
df08cb4 : Speed up tests. (#264)  
057e578 : Update Jenkins pipeline to properly test closing PR (#262)  
a28f272 : Adding Jenkins pipeline documentation (#261)  
71f25ea : T59 (#258)  
90b6580 : Updating Jenkins pipeline configuration (#260)  
b4bd759 : dealing with 2 columnsindividually (#257)  
11ce772 : decisionengine\_modules/NERSC: Can run NerscAllocationInfo.py without (#256)  
4a70465 : doc: add release notes

## 1.8 Release 1.3.0

In this release:

- Introduced Jsonnet based configuration system
- Improved error handling

### 1.8.1 Full list of commits since version 1.2.0

e8c8e24 : Update to split a tuple key into two separate keys, this allows python config file to be JSON compliant config file (#254)  
fbb5d28 : add jsonnet dependency in build/scripts/utlis.sh for unit tests (#252)  
95a0a32 : decisionengine\_modules/glideinwms: Added retry to factory queries (#250)  
77f894a : Aws (#249)  
3be5be1 : Set theme jekyll-theme-slate  
a73e7f8 : Doc (#247)  
f8aa96d : Adding editor config file, see <https://editorconfig.org/> (#248)  
1ab1720 : Issue no. 237 (#245)  
5edc8f9 : Issue 227 (#243)  
e6047f2 : GCE channel goes OFFLINE on a timeout (#242)

63e3627 : Aws billing (#241)  
c3626b9 : 1.1.3/fix (#239)  
ae7c5a6 : Jenkins pipeline improvements (#236)  
310befd : T198 (#235)  
a65886d : Fix import as reported in : <https://github.com/HEPCloud/decisionengin...> (#232)  
93711cc : Run coveralls even if tests fail (#229)  
03d763a : Jenkins pipeline improvements (#230)  
f48d30f : Fix/223 (#228)  
c8aa262 : github ticket 199 (#222)  
0323bda : Address : [https://github.com/HEPCloud/decisionengine\\_modules/issues/224](https://github.com/HEPCloud/decisionengine_modules/issues/224) (#226)  
62e4df6 : Add support to run CI on Jenkins (#221)  
5ab1541 : bump master version to 1.2.0 (for now) (#219)  
bc19c65 : decisionengine\_modules/NERSC: Added retry loop for NERSC API Calls (#220)  
41a50de : Sync up pep8speaks and run\_pylint.sh with decisionengine settings (#218)  
db4634f : silence pylint error (#217)  
1b95141 : Fix whitespace around operator error  
746ea38 : ignore W503  
8a8b5f4 : remove unused variable  
a6668bf : fix PEP8 warnings  
13773ee : address pep8 warnings  
6bea4ca : silence pylint error  
f589895 : Pass sort=True parameter to fix future warning (#215)  
a1d0507 : fixing pep8 warning  
a10bd17 : debugging one import error  
ec501ad : make coveralls.io links work  
deab1a7 : T201 (#204)  
69f2645 : Add coveragerc  
6d8a5f5 : decisionengine\_modules/NERSC: Make Nersc API call backward-compatible with old config (#196)  
a7e0af9 : Only run Github Actions for python3.6 (#24)

## 1.9 Release 1.2.0

In this release:

- Switched to python3
- NERSC newt interface adapted to changed NERSC RESTful API
- Improved unit tests
- Added Jenkins CI pipeline

### 1.9.1 Patches:

30d928b : clone version 1.2.0 of decisionengine

ae7c5a6 : Jenkins pipeline improvements (#236)

310befd : T198 (#235)

a65886d : Fix import as reported in : <https://github.com/HEPCloud/decisionengin...> (#232)

93711cc : Run coveralls even if tests fail (#229)

03d763a : Jenkins pipeline improvements (#230)

f48d30f : Fix/223 (#228)

c8aa262 : github ticket 199 (#222)

0323bda : Address : [https://github.com/HEPCloud/decisionengine\\_modules/issues/224](https://github.com/HEPCloud/decisionengine_modules/issues/224) (#226)

62e4df6 : Add support to run CI on Jenkins (#221)

5ab1541 : bump master version to 1.2.0 (for now) (#219)

bc19c65 : decisionengine\_modules/NERSC: Added retry loop for NERSC API Calls (#220)

41a50de : Sync up pep8speaks and run\_pylint.sh with decisionengine settings (#218)

db4634f : silence pylint error (#217)

1b95141 : Fix whitespace around operator error

746ea38 : ignore W503

8a8b5f4 : remove unused variable

a6668bf : fix PEP8 warnings

13773ee : address pep8 warnings

6bea4ca : silence pylint error

f589895 : Pass sort=True parameter to fix future warning (#215)

a1d0507 : fixing pep8 warning

a10bd17 : debugging one import error

ec501ad : make coveralls.io links work

deab1a7 : T201 (#204)

69f2645 : Add coveragerc

6d8a5f5 : decisionengine\_modules/NERSC: Make Nersc API call backward-compatible with old config (#196)

a7e0af9 : Only run Github Actions for python3.6 (#24)

## 1.10 Release 1.1.0

In this release:

- Fixed. [https://github.com/HEPCloud/decisionengine\\_modules/issues/62](https://github.com/HEPCloud/decisionengine_modules/issues/62). “Update Nersc Allocation Info source for new NERSC API “
- significant code cleanup and pep8 compliance
- unit test work
- CI (GitHub actions and Travis) is introduced

### 1.10.1 Patches:

6455c93 : 1.1 (#203)

375bec5 : clone specific branch of decisionengine (#202)

36c66a8 : set version to 1.1.0

40f31bb : Use sparse checkout for first checkout to get ./github/actions (#23)

b2933d7 : Remove unpackaged files (#22)

fee64ea : remove python shebang, fix logging-too-many-args, fix unsubscriptable-object (#21)

fbf4eb6 : Fixes pep8 warnings. (#20)

9f26659 : Hyunwoo2to3 (#19)

6870b0b : travis-ci: install boto3, htcondor and execute test in one directory above decisionengine\_modules (#18)

22ed8b9 : Fixup condor-classad (#17)

c9edb09 : Add unit test github action. Run as non-root uid. Install python packages in virtualenv. (#14)

b41257d : Setup pep8speaks (#16)

b3bbe28 : Transitioned NERSC API to new IRIS API for accounting data. (#15)

267ec14 : Setup travis (#13)

4151a9a : unittest: Fix GCEResourceLimits so that it does not depend on configuration (#12)

5a44018 : Update decisionengine\_modules rpmbuild and pylint actions. (#9)

c562696 : Update entrypoint.sh (#8)

6d953f2 : rpm spec: remove unwated directory (#7)

474c39c : unittest: make htcondor\_query test pass (#6)

f0ff5a9 : unittest improvements (#5)

e928059 : AWS: fix all but one unit tests

182b582 : fix unit tests, light formatting

bb4a9e4 : Cache venv directory instead.

d805129 : Test pip cache



b64e85d : Add Github Actions



## DEVELOPER DOCUMENTATION

The developer documentation is in the [GitHub Wiki](#)



## JENKINS CI PIPELINE

### 3.1 Decisionengine modules CI with Jenkins pipeline

Jenkins dashboard with Decisionengine modules CI results is available [here](#).

A CI build is triggered any time a PR is created/closed or a commit is made to an existing PR. There are also *nightly CI builds* to test a list of predefined branches.

The Jenkins pipeline runs *pep8*, *pylint* and *unit\_tests* test suites alongside the *rpmbuild* stage. The Jenkins dashboard looks like this:

**Pipeline decisionengine\_modules\_pipeline**  
DE modules pipeline

**Last Successful Artifacts**

Artifact	Size	View
pep8.mail.results	1.31 KB	<a href="#">view</a>
pep8.pep8.merge258.log	0 B	<a href="#">view</a>
pep8.pylint.merge258.log	0 B	<a href="#">view</a>
pep8.results.merge258.log	44 B	<a href="#">view</a>
pylint.mail.results	1.31 KB	<a href="#">view</a>
pylint.pep8.merge258.log	0 B	<a href="#">view</a>
pylint.pylint.merge258.log	0 B	<a href="#">view</a>
pylint.results.merge258.log	44 B	<a href="#">view</a>
pytest.log	10.78 KB	<a href="#">view</a>
rpmbuild.tar	210.00 KB	<a href="#">view</a>

**Recent Changes**

**Build History**

Build	Time	Status
189#PR#258	Sep 2, 2020 4:14 PM	Success
188#PR#258	Sep 2, 2020 3:31 PM	Success
187#PR#258	Sep 2, 2020 3:05 PM	Success
186#master	Sep 2, 2020 2:31 AM	Success
185#PR#260	Sep 1, 2020 1:38 PM	Success
184	Sep 1, 2020 2:31 AM	Success
183	Aug 31, 2020 2:31 AM	Success
182	Aug 30, 2020 2:31 AM	Success
181	Aug 29, 2020 2:31 AM	Success
180	Aug 28, 2020 2:31 AM	Success
179	Aug 27, 2020 3:54 PM	Success
178	Aug 27, 2020 3:54 PM	Success
177	Aug 27, 2020 3:39 PM	Success
176	Aug 27, 2020 3:39 PM	Success


**Stage View**

Stage	Declarative: Checkout SCM	DE modules tests	pep8	pylint	unit_tests	rpmbuild
Average stage times: (Average full run time: ~25min)	903ms	66ms	4min 28s	22min 26s	10min 36s	3min 16s
189#PR#258	1s	72ms	14min 10s	34min 22s	22min 31s	14min 52s
188#PR#258	539ms	112ms	4min 53s	24min 50s	11min 13s	6min 3s
187#PR#258	850ms	79ms	3min 35s	24min 7s	10min 50s	1min 19s
186#master	1s	58ms	3min 27s	21min 55s	9min 3s	22s
185#PR#260	777ms	54ms	7s	25s	5s	4s
184	494ms	36ms	2min 49s	22min 16s	8min 53s	21s
183	618ms	78ms	3min 36s	23min 3s	9min 2s	28s


On the bottom left side there is the list of recent CI builds that are named after the PR or the branch tested.

On the bottom right side the dashboard shows for each CI build detailed status for each test suite.

Hovering the mouse over the *status box* for each CI build stage, a tool-tip with a button to access log details shows up.

Next to the build number the symbol  gives access to a menu with the list of artifacts stored for that build. Those artifacts include logs and the tarball with RPMs.

From the panel on the left side it is possible to access the PR on GitHub by clicking on the PR icon that looks like this  #258.

On occasion it could be useful to trigger a manual CI build to test a branch on the official DE GitHub repository or on the user fork. For this purpose, on the top left panel the user can click on the  **Build with Parameters** button, and this panel shows up

# Pipeline decisionengine\_modules\_pipeline

This build requires parameters:

DOCKER_IMAGE	<input type="text" value="vitodb/decision-engine-modules-ci:jenkins"/> Docker image name to use. Default is: vitodb/decision-engine-modules-ci:jenkins
DE_MOD_REPO	<input type="text" value="https://github.com/HEPCloud/decisionengine_modules"/> Decisionengine modules repo. Default is: https://github.com/HEPCloud/decisionengine_modules/
BRANCH	<input type="text" value="master"/> Branch to test. Default is: master
PYTEST_TIMEOUT	<input type="text" value="300"/> Timeout in seconds for unit_tests (it applies to individual unit test) Default is: 300

Build

the user can modify these parameters to customize what code to test with the CI build.

The *DE\_MOD\_REPO* parameter can point to the user fork or to the main repository.

The *BRANCH* parameter can point to the desired branch to test.

The *PYTEST\_TIMEOUT* parameter is the timeout in seconds for *unit\_tests*.

When ready, by clicking on the *Build* button, the CI build will start.

The [pipeline configuration](#) is part of the decisionengine\_modules repo.

## 3.1.1 Nightly CI build configuration

The nightly CI build for Decisionengine framework uses this [Jenkins project](#) that triggers a CI build using the Jenkins pipeline described above to test a list of predefined branches.

The screenshot shows the Jenkins web interface for a project named 'decisionengine\_ci'. The top navigation bar includes 'Jenkins', 'CI', and 'decisionengine\_ci'. The left sidebar contains a list of actions: 'Back to Dashboard', 'Status' (selected), 'Changes', 'Workspace', 'Build Now', 'Configure', 'Delete Multi-configuration project', 'Rebuild Last', 'Job Config History', 'Rename', and 'Set Next Build Number'. The main content area displays the project name 'Project decisionengine\_ci' with a description 'Decision Engine CI running inside dedicated docker container'. Below this are sections for 'Configurations' (showing 'BRANCH=master' and 'BRANCH=1.4'), 'Subprojects' (listing 'decisionengine\_modules\_pipeline' and 'decisionengine\_pipeline' as non-blocking), and 'Permalinks' (listing the last build, stable build, successful build, and completed build, all for build #295, 7 hours and 6 minutes ago). At the bottom, the 'Build History' section shows a table of recent builds.

Build Number	Timestamp
#295	Nov 19, 2020 2:23 AM
#294	Nov 18, 2020 2:23 AM
#293	Nov 17, 2020 2:23 AM

Branches to test are defined using the project matrix as shown in the picture below. Each branch in the list (here *master* and *1.4*) spawns an independent CI build.



The screenshot shows the Jenkins Configuration Matrix configuration page. The 'Configuration Matrix' tab is selected. Under the 'User-defined Axis' section, the 'Name' field is set to 'BRANCH' and the 'Values' field is set to 'master 1.4'. There is a red 'X' icon in the top right corner of the axis configuration area and a blue question mark icon next to the values field.

In the *Build* section of the configuration it is set the list of Jenkins subprojects to be triggered, in this case we have *decisionengine\_pipeline* and *decisionengine\_modules\_pipeline*.

The *Parameters* text box is used to override parameters of each Jenkins subproject with a custom value.

In total this Jenkins project triggers 4 CI builds, i.e. 2 branches X 2 Jenkins subprojects.

The screenshot shows the Jenkins Build configuration page. The 'Build' tab is selected. Under the 'Trigger/call builds on other projects' section, the 'Projects to build' field is set to 'decisionengine\_pipeline,decisionengine\_modules\_pipeline'. The 'Block until the triggered projects finish their builds' checkbox is unchecked. Under the 'Predefined parameters' section, the 'Parameters' field is set to 'BRANCH=\${BRANCH}'. There are red 'X' icons in the top right corner of the 'Trigger/call builds on other projects' and 'Predefined parameters' sections, and blue question mark icons next to the 'Projects to build' and 'Parameters' fields.

Finally the *Build Triggers* section is used to setup the schedule for the periodic build, in this case it is scheduled to run at about 2 AM.

Jenkins will choose the actual time depending on the actual load on the system.

General

Advanced Project Options

Source Code Management

Build Triggers

Configuration Matrix

Build Environment

Build

Post-build Actions

### Build Triggers

☐ Trigger builds remotely (e.g., from scripts)

☐ Build after other projects are built

☒ Build periodically

Schedule

H 2 \* \* \*

Would last have run at Wednesday, November 4, 2020 2:23:53 AM CST;  
would next run at Thursday, November 5, 2020 2:23:53 AM CST.

## SOURCE CODE

### 4.1 Welcome to decisionengine\_modules's documentation!

#### 4.1.1 setup module

### 4.2 Indices and tables

- [genindex](#)
- [modindex](#)
- [search](#)



## INDICES AND TABLES

- `genindex`
- `modindex`
- `search`