decisionengine

Release 1.1.1

Fermi Research Alliance, LLC.

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The Decision Engine is a critical component of the HEP Cloud Facility. It provides the functionality of resource scheduling for disparate resource providers, including those which may have a cost or a restricted allocation of cycles

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CHAPTER

ONE

RELEASE NOTES

1.1 Release 1.1.0

In this release:

- Fixed. https://github.com/HEPCloud/decisionengine_modules/issues/108 "Supply Postgres script to delete fields in main database before a certain date"
- significant code cleanup and pep8 compliance
- · unit test work
- CI (GitHub actions and Travis) is introduced

commits

f894b1d: Skip unittest (#77)

632e64b: Add ipython

f681a79: Make python 2.7 tests run on 1.1 branch

d6a32c0: implementation of data reaper (#75)

2ad8614: Use sparse checkout for first checkout to get .github/actions (#65)

812f032: Cat output of pytest log Exit pylint entrypoint with the line count of pep8 and pylint logs Deal with (detach

from ...) Only tar up (S)RPMS dirs for rpm build.

6b05ec7: Fix errors reported by run_pylint (#62)

d9f5b66 : Setup pep8speaks

c3b8ac2: Run github actions as non-root uid. Install packages in virtualenv and remove system rpms.

ae01f9e: Support Python 3 for Boost Python

579761c: Support Python 3 for Boost Python

044b979: Remove unnecessary using declarations.

00f6d00 : Add extra header dependency due to Boost Python ommission.

24e0795 : Apply clang-format

17c17f9: Remove JSON dependency.

faa0b22: Massive cleanup.

07b555f: Updates to Github Actions to allow building with python3.6

fef6c11: Fix errors when running pylint.sh multiple times

```
da6f077: Autopep8 -i fixes
39fe5b3: TaskManager: fix calling log_exception with correct number of arguments and minor format changes to
reduce PEP8 warnings
17396da: logicengine: get rid of compuler warnings
01dc3d1: Only track what we need
b609d73 : Configure coveralls (and some minor cleanup)
bd9ed5e: Many C++ cleanups
2a61876: Add Badges
c864f27: Do not call pytest fixtures directly.
307db5f: white space fix
882b58f: fix unit tests
1da687c: Replace Boost facilities with C++ STL ones.
5a6e6b1: Run tests on push
8404245 : Add missing Boost regex library dependency.
ceb5fe7: Apply clang-format to files that were missed earlier.
3de9940 : Apply clang-format to C++ code.
8a8f560: Cache venv directory instead
ad017ce: Build private boost for testing
928c64a: Test pip cache
358939a: Adjust CMakeLists.txt files to use correct Python versions
9f0ddb3: Add pylint github action.
5e6ce4a: Remove more unused C++ files.
63717fe: Setup travis to use new cmake var
74fab2a: Use cmake argumement -DPYVER=3.6 to build python3 library https://fermicloud140.fnal.gov/reviews/r/
843f30c: Minor cleanups per travis-lint
a538cac: Remove unused C++ files.
4c9d125: Update repo where action is taken from
87fb2d9: Update rpms installed in docker image. Update entrypoint.sh to use cmake3.
199ee87: Find python3 libraries using cmake3 from epel rpm Also need to install python3-devel
4c79d2c: Remove unnused GNUmakefiles.
94342ee: Add unit test as a Github Action
1a0e102: more advanced travis.yml
0be413f: Add helper file for pip
7794327: Make recursive import happy
7005c78 : Add simple target
```

de8b0fa: python3 compliance: replace string.join() where appropriate, handle UserDict

2662e6c: note required packages

3b87119 : Add missing header includes.

3e79b84: Remove defunct code and its tests

b1dbe1a: Ensure attribs are defined at init

c4ad78a: Correct logger arguments do avoid duplicate string parse

a8dcc67: Remove unused imports (per pylint)

d3502b5: Remove obsolete CVS directories.

d744111: add six module to the list of required modules

0a9b1e8: Fix class declaration

b83157e: Handle metaclasses

549f33b: Add config for Travis CI

ee71044: Drop trailing white space

3f82af6: Python3 forward compatible syntax

28bf291 : Add safe (for python 2.7) python3 compatible syntax

1d1d76f : prepare for python3

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CHAPTER

TWO

DEVELOPER DOCUMENTATION

First command cd is just to make sure that you end up in a directory that will contain two subdirectory decisionengine and decisionengine_modules. Of course this can be done in any directory, not necessarily home directory.

2.1 Decisionengine framework

2.1.1 Prerequisites:

```
yum install -y https://dl.fedoraproject.org/pub/epel/epel-release-latest-7.noarch.rpm
yum install -y https://download.postgresql.org/pub/repos/yum/reporpms/EL-7-x86_64/
-pgdg-redhat-repo-latest.noarch.rpm
yum install -y python3 python3-pip cmake3 boost-devel python36-devel boost-python36-
-devel postgresql11 postgresql11-server
pip3 install pandas DBUtils psycopg2-binary tabulate mock pytest
```

2.1.2 Build & test

```
cd
git clone https://github.com/HEPCloud/decisionengine
export PYTHONPATH='pwd'
mkdir decisionengine/framework/logicengine/cxx/build
cd decisionengine/framework/logicengine/cxx/build
cmake3 .. -DPYVER=3.6
make -j <number> # say number of CPUs on your box
cd ../../
ln -s cxx/build/ErrorHandler/RE.so
ln -s cxx/build/ErrorHandler/libLogicEngine.so
export LD_LIBRARY_PATH=`pwd`
cd ../../
#pytest -v --tb=native
python3 -m pytest
   ======= test session starts...
→=========
platform linux -- Python 3.6.8, pytest-5.3.5, py-1.8.1, pluggy-0.13.1
rootdir: /root/junjk/decisionengine
collected 26 items
```

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2.2 Decisionengine_modules

2.2.1 Prerequisites:

In Addition to above installed packages

```
yum install condor
pip3 install htcondor boto boto3 google_auth google-api-python-client gcs-oauth2-boto-
plugin
```

2.2.2 Test

```
cd
git clone https://github.com/HEPCloud/decisionengine_modules
python3 -m pytest decisionengine_modules
```

Current status:

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```
decisionengine_modules/AWS/tests/test_AWSSpotPriceWithSourceProxy.py ..
→ [ 9%]
decisionengine_modules/AWS/tests/test_AWS_figure_of_merit_publisher.py ..
decisionengine_modules/AWS/tests/test_AWS_price_performance_publisher.py ...
decisionengine_modules/AWS/tests/test_FigureOfMerit.py ...

→ [ 17%]

decisionengine_modules/tests/test_AwsBurnRate.py ..

→ [ 20%]

decisionengine_modules/tests/test_GCEBillingInfo.py ..
decisionengine_modules/tests/test_GCEFigureOfMerit_publisher.py ..

→ [ 24%]

decisionengine_modules/tests/test_GCEInstancePerformanceInfo.py ..

→ [ 27%]

decisionengine_modules/tests/test_GCEPricePerformance_publisher.py ..

→ [ 29%]

decisionengine_modules/tests/test_GCEResourceLimits.py ..
→ [ 31%]
decisionengine_modules/tests/test_GceBurnRate.py ...

→ [ 34%]

{\tt decisionengine\_modules/tests/test\_GceFigureOfMerit.py} \ \dots
→ [ 36%]
decisionengine_modules/tests/test_GceOccupancy.py ...
decisionengine_modules/tests/test_NerscAllocationInfo.py ..
decisionengine_modules/tests/test_NerscFigureOfMerit.py ..
decisionengine_modules/tests/test_NerscFigureOfMerit_publisher.py ..

→ [ 45%]

decisionengine_modules/tests/test_NerscInstancePerformance.py ..

→ [ 48%]

decisionengine_modules/tests/test_NerscJobInfo.py ...

→ [ 50%]

decisionengine_modules/tests/test_factory_client.py ....
decisionengine_modules/tests/test_factory_entries.py ....

→ [ 60%]

decisionengine_modules/tests/test_factory_global.py ....

→ [ 64%]

decisionengine_modules/tests/test_fomorderplugin.py ....

→ [ 69%]

decisionengine_modules/tests/test_grid_figure_of_merit.py .

→ 「 70%]

decisionengine_modules/tests/test_htcondor_query.py ....

→ [ 75%]

decisionengine_modules/tests/test_job_clustering.py .....
→ [ 81%]
decisionengine_modules/tests/test_job_clustering_publisher.py ..
decisionengine_modules/tests/test_job_q.py ...
→ [ 87%]
decisionengine_modules/tests/test_slots.py ..
decisionengine_modules/tests/glideinwms/publishers/test_decisionenginemonitor.py ...
                                                                          (continues on next page)

→ [ 92%]
```

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CHAPTER

THREE

SOURCE CODE

3.1 Welcome to decisionengine's documentation!

3.1.1 decisionengine package

Subpackages

decisionengine.framework package

Subpackages

decisionengine.framework.configmanager package

Submodules

decisionengine.framework.configmanager.ConfigManager module

```
class decisionengine.framework.configmanager.ConfigManager.Bases: object
    check_keys (channel_conf_dict)
        check that channel config has mandatory keys :type data: dict
    static create (module_name, class_name, parameters)
    get_channels()
    get_global_config()
    get_produces (channel_config)
    is_updated()
    load()
    reload()
    validate_channel (channel)
        Validate channels :type channel: dict
```

Module contents

decisionengine.framework.dataspace package

Subpackages

decisionengine.framework.dataspace.datasources package

Subpackages

decisionengine.framework.dataspace.datasources.tests package

Submodules

decisionengine.framework.dataspace.datasources.tests.test postgresql module

```
decisionengine.framework.dataspace.datasources.tests.test_postgresql.data()
decisionengine.framework.dataspace.datasources.tests.test_postgresgl.dataproduct()
decisionengine.framework.dataspace.datasources.tests.test_postgresql.datasource(postgresql,
decisionengine.framework.dataspace.datasources.tests.test_postgresql.header(data)
decisionengine.framework.dataspace.datasources.tests.test_postgresql.metadata(data)
decisionengine.framework.dataspace.datasources.tests.test_postgresql.taskmanager()
decisionengine.framework.dataspace.datasources.tests.test_postgresql.test_create_tables(dataspace.datasources.tests.test_postgresql.test_create_tables)
decisionengine.framework.dataspace.datasources.tests.test_postgresql.test_generate_insert_
decisionengine.framework.dataspace.datasources.tests.test_postgresql.test_get_last_generat
decisionengine.framework.dataspace.datasources.tests.test_postgresql.test_get_taskmanager(
decisionengine.framework.dataspace.datasources.tests.test_postgresql.test_insert(datasource,
                                                                                       dat-
                                                                                       aprod-
                                                                                       uct.
                                                                                       header,
                                                                                       meta-
                                                                                       data)
decisionengine.framework.dataspace.datasources.tests.test_postgresql.test_store_taskmanage
```

Module contents

Submodules

decisionengine.framework.dataspace.datasources.postgresql module

```
class decisionengine.framework.dataspace.datasources.postgresql.Postgresql (config_dict)
     Bases: decisionengine.framework.dataspace.datasource.DataSource
     Implementation of postgresql data source
     _Postgresql__query (query_string, values=None, cursor_factory=None)
     _abc_cache = <_weakrefset.WeakSet object>
     _abc_negative_cache = <_weakrefset.WeakSet object>
     _abc_negative_cache_version = 185
     _abc_registry = <_weakrefset.WeakSet object>
     _delete (sql_query, values=None)
     _insert(table_name_or_sql_query, record=None)
     _insert_returning_result(table_name_or_sql_query, record=None)
     _remove (sql_query, values=None)
     _select (query_string, values=None, cursor_factory=None)
     _select_dictresult (sql_query, values=None)
     _select_getresult (sql_query, values=None)
     _select_tuple (sql_query, values)
     _update (query_string, values=None)
     _update_returning_result (query_string, values=None)
     close()
         Close all connections to the database
     connect()
         Create a pool of database connections
     create tables()
         Create database tables
     delete_data_older_than (days)
         Delete data older that days interval :type days: int :arg days: remove data older than days interval
     duplicate_datablock (taskmanager_id, generation_id, new_generation_id)
         For the given taskmanager_id, make a copy of the datablock with given generation_id, set the generation_id
         for the datablock copy
             Parameters
                 • taskmanager_id (string) - taskmanager_id for generation to be retrieved
                 • generation_id (int) - generation_id of the data
                 • new generation id (int) - generation id of the new datablock created
     get connection()
```

get datablock (taskmanager id, generation id)

Return the entire datablock from the dataproduct table for the given taskmanager_id, generation_id

Parameters

- taskmanager_id (string) taskmanager_id for generation to be retrieved
- **generation_id** (int) generation_id of the data

get_dataproduct (taskmanager_id, generation_id, key)

Return the data from the dataproduct table for the given taskmanager id, generation id, key

Parameters

- taskmanager_id (string) taskmanager_id for generation to be retrieved
- generation_id (int) generation_id of the data
- key (string) key for the value

get_header (taskmanager_id, generation_id, key)

Return the header from the header table for the given taskmanager_id, generation_id, key

Parameters

- taskmanager_id (string) taskmanager_id for generation to be retrieved
- generation_id (int) generation_id of the data
- key (string) key for the value

get_last_generation_id (taskmanager_name, taskmanager_id=None)

Return last generation id for current task manager or taskmanager w/ task_manager_id.

Parameters

- name (string) task manager name
- taskmanager_id (string) task manager id

get_metadata (taskmanager_id, generation_id, key)

Return the metadata from the metadata table for the given taskmanager_id, generation_id, key

Parameters

- taskmanager_id (string) taskmanager_id for generation to be retrieved
- generation_id (int) generation_id of the data
- key (string) key for the value

get schema(table=None)

Given the table name return it's schema

Parameters table (string) - Name of the table

get_taskmanager_id=None)

Retrieve TaskManager:type taskmanager_name: string:arg taskmanager_name: name of taskmanager to retrieve:type taskmanager_id: string:arg taskmanager_id: id of taskmanager to retrieve

insert (taskmanager_id, generation_id, key, value, header, metadata)

Insert data into respective tables for the given taskmanager_id, generation_id, key

Parameters

- taskmanager_id (string) taskmanager_id for generation to be retrieved
- generation_id (int) generation_id of the data

- key (string) key for the value
- value (object) Value can be an object or dict
- header (Header) Header for the value
- header Metadata for the value

store taskmanager (name, taskmanager id)

Store TaskManager:type taskmanager_name: string:arg taskmanager_name: name of taskmanager to retrieve:type taskmanager id: string:arg taskmanager id: id of taskmanager to retrieve

```
tables = {'dataproduct': ['taskmanager_id TEXT', 'generation_id INT', 'key TEXT', 'va
```

update (taskmanager_id, generation_id, key, value, header, metadata)

Update the data in respective tables for the given taskmanager_id, generation_id, key

Parameters

- taskmanager_id (string) taskmanager_id for generation to be retrieved
- generation_id (int) generation_id of the data
- **key** (string) key for the value
- value (object) Value can be an object or dict
- header (Header) Header for the value
- header Metadata for the value

 ${\tt decisionengine.framework.dataspace.datasources.postgresql.{\tt generate_insert_query}~({\it table_name}, \\ {\it keys})}$

Generate insert query given table name and list of fields

Parameters

- table_name (str) Name of the table to insert into
- keys List of column names

Kevs list

Return type str - insert query

Module contents

Submodules

decisionengine.framework.dataspace.datablock module

Insert a new product into database with header and metadata

```
setitem (key, value, header, metadata=None)
```

put a product in the database with header and metadata

```
_update (key, value, header, metadata)
```

Update an existing product in the database with header and metadata

duplicate()

Duplicate the datablock and return this new DataBlock. The intent is that at the point the duplication occurs there is only information from the sources in the DataBlock. This also increments the generation_id of this DataBlock.

TODO: Also update the header and the metadata information TODO: Make this threadsafe

```
Return type DataBlock
```

get (key, default=None)

Return the value associated with the key in the database

```
Return type dict
```

get_header(key)

Return the Header associated with the key in the database

```
Return type Header
```

get_metadata(key)

Return the metadata associated with the key in the database

```
Return type Metadata
```

get_taskmanager (taskmanager_name, taskmanager_id=None)

Retrieve TaskManager :type taskmanager_name: string :arg taskmanager_name: name of taskmanager to retrieve :type taskmanager_id: string :arg taskmanager_id: id of taskmanager to retrieve :rtype: :obj: dict

The dictionary returned looks like: {'datestamp': datetime.datetime(2017, 12, 20, 17, 37, 17, 503210,

```
tzinfo=psycopg2.tz.FixedOffsetTimezone(offset=-360, name=None)),
```

```
'sequence_id': 135L, 'name': 'AWS_Calculations', 'taskmanager_id': '77B16EB5-C79E-45B0-B1B1-37E846692E1D'}
```

is_expired(key=None)

Check if the dataproduct for a given key or any key is expired

keys()

mark_expired (expiration_time)

Set the expiration_time for the current generation of the dataproduct and mark it as expired if expiration_time <= current time

```
put (key, value, header, metadata=None)
```

Put data into the DataBlock

store_taskmanager (taskmanager_name, taskmanager_id)

Persist TaskManager, returns sequence number :type taskmanager_name: string :type taskmanager_id: :obj: string :rtype: int

```
exception decisionengine.framework.dataspace.datablock.ExpiredDataError
    Bases: Exception
    Errors due to invalid Metadata
class decisionengine.framework.dataspace.datablock.Header(taskmanager_id,
                                                                ate time=None, expira-
                                                                tion time=None, sched-
                                                                uled create time=None,
                                                                creator='module'.
                                                                schema_id=None)
    Bases: collections.UserDict
    _abc_cache = <_weakrefset.WeakSet object>
    _abc_negative_cache = <_weakrefset.WeakSet object>
    _abc_negative_cache_version = 185
    _abc_registry = <_weakrefset.WeakSet object>
    default data lifetime = 1800
    is valid()
        Check if the Header has minimum required information
    required_keys = {'create_time', 'creator', 'expiration_time', 'scheduled_create_time',
exception decisionengine.framework.dataspace.datablock.InvalidHeaderError
    Bases: Exception
    Errors due to invalid Metadata
exception decisionengine.framework.dataspace.datablock.InvalidMetadataError
    Bases: Exception
    Errors due to invalid Metadata
exception decisionengine.framework.dataspace.datablock.KeyNotFoundError
    Bases: Exception
    Errors due to invalid Metadata
class decisionengine.framework.dataspace.datablock.Metadata(taskmanager_id,
                                                                  state='NEW', gener-
                                                                  ation id=None, gen-
                                                                  eration time=None,
                                                                  missed_update_count=0)
    Bases: collections.UserDict
    _abc_cache = <_weakrefset.WeakSet object>
    _abc_negative_cache = <_weakrefset.WeakSet object>
    _abc_negative_cache_version = 185
    _abc_registry = <_weakrefset.WeakSet object>
    required_keys = {'generation_id', 'generation_time', 'missed_update_count', 'state', '
    set state(state)
        Set the state for the Metadata
    valid_states = {'END_CYCLE', 'METADATA_UPDATE', 'NEW', 'START_BACKUP'}
```

```
decisionengine.framework.dataspace.datablock.compress(obj)
     Compress python object :param obj: python object :return: compressed object
decisionengine.framework.dataspace.datablock.decompress(zbytes)
     Decompress zipped byte stream, convert to string. :param zbytes: byte stream :return: uncompressed string
decisionengine.framework.dataspace.datablock.zdumps(obj)
     Pickle and compress :param obj: a python object :return: compressed string
decisionengine.framework.dataspace.datablock.zloads(zbytes)
     Decompress and unpickle If input is not compressed attempts to just unpickle it
         Parameters zbytes - compressed bytes
         Returns returns python object
decisionengine.framework.dataspace.datasource module
class decisionengine.framework.dataspace.datasource.DataSource(config)
     Bases: object
     _abc_cache = <_weakrefset.WeakSet object>
     _abc_negative_cache = <_weakrefset.WeakSet object>
     abc negative cache version = 185
     _abc_registry = <_weakrefset.WeakSet object>
     abstract close()
         Close all connections to the database
     abstract connect()
         Create a pool of database connections
     abstract create_tables()
         Create database tables
     dataproduct_table = 'dataproduct'
         Name of the dataproduct table
     abstract delete data older than (days)
         Delete data older that interval :type days: long :arg days: remove data older than interval
     abstract duplicate_datablock (taskmanager_id, generation_id, new_generation_id)
         For the given taskmanager_id, make a copy of the datablock with given generation_id, set the generation_id
         for the datablock copy
             Parameters
                 • taskmanager_id (string) - taskmanager_id for generation to be retrieved
                 • generation_id (int) - generation_id of the data
                 • new_generation_id (int) - generation_id of the new datablock created
     abstract get_datablock (taskmanager_id, generation_id)
         Return the entire datablock from the dataproduct table for the given taskmanager_id, generation_id
             Parameters
                 • taskmanager_id (string) - taskmanager_id for generation to be retrieved
```

• generation_id (int) - generation_id of the data

abstract get dataproduct (taskmanager id, generation id, key)

Return the data from the dataproduct table for the given taskmanager_id, generation_id, key

Parameters

- taskmanager_id (string) taskmanager_id for generation to be retrieved
- **generation_id** (int) generation_id of the data
- **key** (string) key for the value

abstract get_header(taskmanager_id, generation_id, key)

Return the header from the header table for the given taskmanager_id, generation_id, key

Parameters

- taskmanager_id (string) taskmanager_id for generation to be retrieved
- generation_id (int) generation_id of the data
- **key** (string) key for the value

abstract get_last_generation_id(name, taskmanager_id=None)

Return last generation id for current task manager or taskmanager w/ task_manager_id.

Parameters

- name (string) task manager name
- taskmanager_id (string) task manager id

abstract get_metadata(taskmanager_id, generation_id, key)

Return the metadata from the metadata table for the given taskmanager_id, generation_id, key

Parameters

- taskmanager_id (string) taskmanager_id for generation to be retrieved
- $generation_id(int) generation_id of the data$
- **key** (string) key for the value

abstract get_schema(table=None)

Given the table name return it's schema

Parameters table (string) - Name of the table

abstract get_taskmanager(taskmanager_name, taskmanager_id)

Retrieve TaskManager :type taskmanager_name: string :arg taskmanager_name: name of taskmanager to retrieve :type taskmanager_id: string :arg taskmanager_id: id of taskmanager to retrieve

header_table = 'header'

Name of the header table

abstract insert (taskmanager_id, generation_id, key, value, header, metadata)

Insert data into respective tables for the given taskmanager_id, generation_id, key

Parameters

- taskmanager_id (string) taskmanager_id for generation to be retrieved
- generation_id (int) generation_id of the data
- key (string) key for the value
- value (object) Value can be an object or dict
- header (Header) Header for the value

• header - Metadata for the value

```
metadata table = 'metadata'
```

Name of the metadata table

```
abstract store_taskmanager(taskmanager_name, taskmanager_id)
```

Store TaskManager:type taskmanager_name: string:arg taskmanager_name: name of taskmanager to retrieve:type taskmanager id: string:arg taskmanager id: id of taskmanager to retrieve

taskmanager table = 'taskmanager'

Name of the taskmanager table

abstract update (taskmanager_id, generation_id, key, value, header, metadata)

Update the data in respective tables for the given taskmanager_id, generation_id, key

Parameters

- taskmanager_id (string) taskmanager_id for generation to be retrieved
- generation_id (int) generation_id of the data
- **key** (string) key for the value
- value (object) Value can be an object or dict
- header (Header) Header for the value
- header Metadata for the value

decisionengine.framework.dataspace.dataspace module

```
class decisionengine.framework.dataspace.dataspace.DataSourceLoader
     Bases: object
     ds = None
     static create_datasource (module_name, class_name, config)
class decisionengine.framework.dataspace.dataspace.DataSpace(config)
     Bases: object
     DataSpace class is collection of datablocks and provides interface to the database used to store the actual data
     tables created = False
         Description of tables and their columns
     close()
     delete (taskmanager id, all generations=False)
     duplicate_datablock (taskmanager_id, generation_id, new_generation_id)
     get_dataproduct (taskmanager_id, generation_id, key)
     get_header (taskmanager_id, generation_id, key)
     get_last_generation_id (taskmanager_name, taskmanager_id=None)
     get_metadata (taskmanager_id, generation_id, key)
     get_taskmanager (taskmanager_name, taskmanager_id=None)
     insert (taskmanager_id, generation_id, key, value, header, metadata)
     mark_demented (taskmanager_id, keys, generation_id=None)
```

```
mark_expired (taskmanager_id, generation_id, key, expiry_time)
    store_taskmanager (name, id)
    update (taskmanager_id, generation_id, key, value, header, metadata)
exception decisionengine.framework.dataspace.dataspace.DataSpaceConfigurationError
    Bases: Exception
    Errors related to database access
exception decisionengine.framework.dataspace.dataspace.DataSpaceConnectionError
    Bases: Exception
    Errors related to database access
exception decisionengine.framework.dataspace.dataspace.DataSpaceError
    Bases: Exception
    Errors related to database access
exception decisionengine.framework.dataspace.dataspace.DataSpaceExistsError
    Bases: Exception
    Errors related to database access
class decisionengine.framework.dataspace.dataspace.Reaper(config)
    Bases: object
    Reaper provides functionality of periodic deletion of data older than retention interval in days
    reaper loop (delay)
    _set_state(value)
    get_retention_interval()
    get_state()
    reap()
    set_retention_interval(interval)
    start (delay=0)
         Start thread with an optional delay to start the thread in X seconds
    stop()
class decisionengine.framework.dataspace.dataspace.Singleton
    Bases: type
    Singleton pattern using Metaclass http://stackoverflow.com/questions/6760685/creating-a-singleton-in-python
    instances = {}
class decisionengine.framework.dataspace.dataspace.State
    Bases: enum. Enum
    An enumeration.
    ERROR = 7
    IDLE = 1
    RUNNING = 3
    SLEEPING = 4
    STARTING = 2
```

```
STOPPED = 6
STOPPING = 5
```

Module contents

decisionengine.framework.engine package

Submodules

decisionengine.framework.engine.DecisionEngine module

Main loop for Decision Engine. The following environment variable points to decision engine configuration file: DECISION_ENGINE_CONFIG_FILE if this environment variable is not defined the DE-Config.py file from the ``../tests/etc/` directory will be used.

XML-RPC calls are forwarded to a registered function that matches

XML-RPC calls are forwarded to a registered function that matches the called XML-RPC method name. If no such function exists then the call is forwarded to the registered instance, if available.

If the registered instance has a _dispatch method then that method will be called with the name of the XML-RPC method and its parameters as a tuple e.g. instance._dispatch('add',(2,3))

If the registered instance does not have a _dispatch method then the instance will be searched to find a matching method and, if found, will be called.

Methods beginning with an '_' are considered private and will not be called.

```
rpc_show_config(channel=None)
    rpc_start_channel (channel)
    rpc_start_channels()
    rpc_status()
    rpc_stop()
    rpc_stop_channel (channel)
    rpc_stop_channels()
    start_channel (channel)
    start_channels()
    stop_channel (channel)
    stop_channels()
class decisionengine.framework.engine.DecisionEngine.RequestHandler(request,
                                                                            client address,
                                                                            server)
    Bases: xmlrpc.server.SimpleXMLRPCRequestHandler
    rpc_paths = ('/RPC2',)
class decisionengine.framework.engine.DecisionEngine.RpcServer(server_address,
                                                                      questHandler-
    Bases: socketserver. Threading MixIn, xmlrpc.server. Simple XMLRPCServer
class decisionengine.framework.engine.DecisionEngine.Worker(task_manager, con-
                                                                   fig)
    Bases: multiprocessing.context.Process
    run()
        Method to be run in sub-process; can be overridden in sub-class
decisionengine.framework.engine.de client module
Module contents
decisionengine.framework.modules package
Submodules
decisionengine.framework.modules.LogicEngine module
class decisionengine.framework.modules.LogicEngine.LogicEngine (set_of_parameters)
    Bases: decisionengine.framework.modules.Module.Module
    evaluate (data_block)
```

decisionengine.framework.modules.Module module

```
class decisionengine.framework.modules.Module.Module(set_of_parameters)
    Bases: object
    get_data_bock()
    get_paramaters()
    set_data_bock(data_block)

decisionengine.framework.modules.Publisher module

class decisionengine.framework.modules.Publisher.Publisher(set of parameters)
```

```
Bases: decisionengine.framework.modules.Module.Module

consumes (name_list)

publish (data_block=None)
```

decisionengine.framework.modules.Source module

```
class decisionengine.framework.modules.Source.Source(set_of_parameters)
    Bases: decisionengine.framework.modules.Module.Module
    acquire()
    produces(name_schema_id_list)
```

decisionengine.framework.modules.SourceProxy module

Fill in data from another channel data block

Source Proxy Channel configuration using source proxy must have in parameters 'channel_name', defining foreign channel name and 'Dataproducts', defining foreign (and optionally local) data keys. See consumes() doc. Example of source proxy configuration:

```
"AWSJobLimits": { "module": "modules.source_proxy", "name": "SourceProxy", "parameters": {"channel_name": "channel_aws_config_data",

"Dataproducts":[("aws_instance_limits", "Job_Limits")], "retries": 3,

"retry_timeout": 20,

},

"schedule": 360,
},

_get_data(data_block, key)

acquire()

Overrides Source class method

consumes()
```

```
Assumes that self.datakeys has the following structure: is a list of tuples or singletons:
             (data_product_name, data_product_name_translation), .... ] or [ data_product_name, ....
     must_have = ('channel_name', 'Dataproducts')
     produces()
         Assumes that self.datakeys has the following structure or
decisionengine.framework.modules.SourceProxy.main()
     Call this a a test unit or use as CLI of this module
decisionengine.framework.modules.SourceProxy.module_config_info()
     print this module configuration information
decisionengine.framework.modules.SourceProxy.module_config_template()
     print a template for this module configuration data
decisionengine.framework.modules.Transform module
class decisionengine.framework.modules.Transform.Transform(set of parameters)
     Bases: decisionengine.framework.modules.Module.Module
     consumes (name_list)
     produces (name schema id list)
     transform()
decisionengine.framework.modules.de logger module
Looger to use in all modules
decisionengine.framework.modules.de_logger.get_logger()
     get default logger - "decision_engine" :rtype: logging.Logger - rotating file logger
decisionengine.framework.modules.de_logger.set_logging(log_file_name='/tmp/decision_engine_logs/decision_
                                                                   max file size=200000000,
                                                                   max_backup_count=6)
         Parameters
               • log_file_name (str) - log file name
               • max_file_size (int) - maximal size of log file. If reached save and start new log.
               • max_backup_count (int) - start rotaion after this number is reached
         Return type logging. Logger - rotating file logger
decisionengine.framework.modules.de_logger.set_stream_logging(logger_name=")
     This is for debugging. Set stream logging for logger.
         Parameters logger_name (str) - logger name
         Return type logging.Logger
```

Module contents

decisionengine.framework.taskmanager package

Submodules

decisionengine.framework.taskmanager.TaskManager module

```
Task Manager
class decisionengine.framework.taskmanager.TaskManager.Channel(channel_dict)
     Bases: object
     Decision Channel. Instantiates workers according to channel configuration
class decisionengine.framework.taskmanager.TaskManager.TaskManager(name,
                                                                                     task_manager_id,
                                                                                     genera-
                                                                                     tion_id,
                                                                                     chan-
                                                                                     nel_dict,
                                                                                     global_config)
     Bases: object
     Task Manager
     data_block_put (data, header, data_block)
          Put data into data block
             Parameters
                 • data (dict) - key, value pairs
                 • header (Header) - data header
                 • data_block (DataBlock) - data block
     decision_cycle()
         Decision cycle to be run periodically (by trigger)
     do_backup()
         Duplicate current data block and return its copy
             Return type DataBlock
     get_state()
     offline_task_manager(current_data_block)
          offline and stop task manager
     run()
          Task Manager main loop
     run_logic_engine (data_block=None)
          Run Logic Engine.
             Parameters data_block (DataBlock) - data block
     run_publishers (actions, facts, data_block=None)
          Run Publishers in main process.
```

Parameters data_block (DataBlock) - data block

```
run source (src)
          Get the data from source and put it into the data block
             Parameters src(Worker) – source Worker
     run_transform(transform, data_block)
          Run a transform
              Parameters
                 • transform (Worker) - source Worker
                 • data_block (DataBlock) - data block
     run_transforms (data_block=None)
          Run transforms. So far in main process.
             Parameters data_block (DataBlock) - data block
     set_state(state)
     start_sources(data_block=None)
          Start sources, each in a separate thread
             Parameters data_block (DataBlock) - data block
     stop_task_manager()
          signal task manager to stop
     wait for all(events done)
          Wait for all sources or transforms to finish
             Parameters events_done (list) - list of events to wait for
     wait_for_any (events_done)
          Wait for any sources to finish
             Parameters events_done (list) - list of events to wait for
class decisionengine.framework.taskmanager.TaskManager.Worker(conf_dict)
     Bases: object
     Provides interface to loadable modules an events to sycronise execution
     DEFAULT SCHEDULE = 300
decisionengine.framework.taskmanager.TaskManager.log_exception(logger,
                                                                                header_message)
Module contents
decisionengine.framework.util package
Submodules
decisionengine.framework.util.tsort module
See:
https://en.wikipedia.org/wiki/Topological_sorting
```

Kahn's topological sorting algorithm

L Empty list that will contain the sorted elements S Set of all nodes with no incoming edge while S is non-empty do remove a node n from S add n to tail of L for each node m with an edge e from n to m do

remove edge e from the graph if m has no other incoming edges then

insert m into S

if graph has edges then return error (graph has at least one cycle)

else return L (a topologically sorted order)

```
decisionengine.framework.util.tsort.tsort(graph)
```

Function implementing Kahn's topological sorting algorithm returns two lists: sorted list and cyclic lost (if graph is acyclic second list is always None)

Return type list

Module contents

Module contents

Module contents

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- genindex
- modindex
- search

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