Airflow Documentation

Release 1.10.2

Apache Airflow

Jan 23, 2019

Contents

Airflow is a platform to programmatically author, schedule and monitor workflows.

Use airflow to author workflows as directed acyclic graphs (DAGs) of tasks. The airflow scheduler executes your tasks on an array of workers while following the specified dependencies. Rich command line utilities make performing complex surgeries on DAGs a snap. The rich user interface makes it easy to visualize pipelines running in production, monitor progress, and troubleshoot issues when needed.

When workflows are defined as code, they become more maintainable, versionable, testable, and collaborative.

CHAPTER 1

Principles

- **Dynamic**: Airflow pipelines are configuration as code (Python), allowing for dynamic pipeline generation. This allows for writing code that instantiates pipelines dynamically.
- **Extensible**: Easily define your own operators, executors and extend the library so that it fits the level of abstraction that suits your environment.
- **Elegant**: Airflow pipelines are lean and explicit. Parameterizing your scripts is built into the core of Airflow using the powerful **Jinja** templating engine.
- **Scalable**: Airflow has a modular architecture and uses a message queue to orchestrate an arbitrary number of workers. Airflow is ready to scale to infinity.

CHAPTER 2

Beyond the Horizon

Airflow **is not** a data streaming solution. Tasks do not move data from one to the other (though tasks can exchange metadata!). Airflow is not in the Spark Streaming or Storm space, it is more comparable to Oozie or Azkaban.

Workflows are expected to be mostly static or slowly changing. You can think of the structure of the tasks in your workflow as slightly more dynamic than a database structure would be. Airflow workflows are expected to look similar from a run to the next, this allows for clarity around unit of work and continuity.

CHAPTER 3

Content

3.1 Project

3.1.1 History

Airflow was started in October 2014 by Maxime Beauchemin at Airbnb. It was open source from the very first commit and officially brought under the Airbnb Github and announced in June 2015.

The project joined the Apache Software Foundation's incubation program in March 2016.

3.1.2 Committers

- @mistercrunch (Maxime "Max" Beauchemin)
- @r39132 (Siddharth "Sid" Anand)
- @criccomini (Chris Riccomini)
- @bolkedebruin (Bolke de Bruin)
- @artwr (Arthur Wiedmer)
- @jlowin (Jeremiah Lowin)
- @aoen (Dan Davydov)
- @msumit (Sumit Maheshwari)
- @alexvanboxel (Alex Van Boxel)
- @saguziel (Alex Guziel)
- @joygao (Joy Gao)
- @fokko (Fokko Driesprong)
- @ash (Ash Berlin-Taylor)

- @kaxilnaik (Kaxil Naik)
- @feng-tao (Tao Feng)
- @hiteshs (Hitesh Shah)
- @jghoman (Jakob Homan)

For the full list of contributors, take a look at Airflow's Github Contributor page:

3.1.3 Resources & links

- Airflow's official documentation
- Mailing list (send emails to `dev-subscribe@airflow.apache.org` and/or `commits-subscribe@airflow.apache.org` to subscribe to each)
- Issues on Apache's Jira
- Gitter (chat) Channel
- More resources and links to Airflow related content on the Wiki

3.1.4 Roadmap

Please refer to the Roadmap on the wiki

3.2 License

```
                                 Apache License
                           Version 2.0, January 2004
                        http://www.apache.org/licenses/

TERMS AND CONDITIONS FOR USE, REPRODUCTION, AND DISTRIBUTION

1. Definitions.

   "License" shall mean the terms and conditions for use, reproduction,
   and distribution as defined by Sections 1 through 9 of this document.

   "Licensor" shall mean the copyright owner or entity authorized by
   the copyright owner that is granting the License.

   "Legal Entity" shall mean the union of the acting entity and all
   other entities that control, are controlled by, or are under common
   control with that entity. For the purposes of this definition,
   "control" means (i) the power, direct or indirect, to cause the
   direction or management of such entity, whether by contract or
   otherwise, or (ii) ownership of fifty percent (50%) or more of the
```

(continues on next page)

(continued from previous page)

```
   outstanding shares, or (iii) beneficial ownership of such entity.

   "You" (or "Your") shall mean an individual or Legal Entity
   exercising permissions granted by this License.

   "Source" form shall mean the preferred form for making modifications,
   including but not limited to software source code, documentation
   source, and configuration files.

   "Object" form shall mean any form resulting from mechanical
   transformation or translation of a Source form, including but
   not limited to compiled object code, generated documentation,
   and conversions to other media types.

   "Work" shall mean the work of authorship, whether in Source or
   Object form, made available under the License, as indicated by a
   copyright notice that is included in or attached to the work
   (an example is provided in the Appendix below).

   "Derivative Works" shall mean any work, whether in Source or Object
   form, that is based on (or derived from) the Work and for which the
   editorial revisions, annotations, elaborations, or other modifications
   represent, as a whole, an original work of authorship. For the purposes
   of this License, Derivative Works shall not include works that remain
   separable from, or merely link (or bind by name) to the interfaces of,
   the Work and Derivative Works thereof.

   "Contribution" shall mean any work of authorship, including
   the original version of the Work and any modifications or additions
   to that Work or Derivative Works thereof, that is intentionally
   submitted to Licensor for inclusion in the Work by the copyright owner
   or by an individual or Legal Entity authorized to submit on behalf of
   the copyright owner. For the purposes of this definition, "submitted"
   means any form of electronic, verbal, or written communication sent
   to the Licensor or its representatives, including but not limited to
   communication on electronic mailing lists, source code control systems,
   and issue tracking systems that are managed by, or on behalf of, the
   Licensor for the purpose of discussing and improving the Work, but
   excluding communication that is conspicuously marked or otherwise
   designated in writing by the copyright owner as "Not a Contribution."

   "Contributor" shall mean Licensor and any individual or Legal Entity
   on behalf of whom a Contribution has been received by Licensor and
   subsequently incorporated within the Work.

2. Grant of Copyright License. Subject to the terms and conditions of
   this License, each Contributor hereby grants to You a perpetual,
   worldwide, non-exclusive, no-charge, royalty-free, irrevocable
   copyright license to reproduce, prepare Derivative Works of,
   publicly display, publicly perform, sublicense, and distribute the
   Work and such Derivative Works in Source or Object form.

3. Grant of Patent License. Subject to the terms and conditions of
   this License, each Contributor hereby grants to You a perpetual,
   worldwide, non-exclusive, no-charge, royalty-free, irrevocable
   (except as stated in this section) patent license to make, have made,
   use, offer to sell, sell, import, and otherwise transfer the Work,
```

(continues on next page)

(continued from previous page)

```
   where such license applies only to those patent claims licensable
   by such Contributor that are necessarily infringed by their
   Contribution(s) alone or by combination of their Contribution(s)
   with the Work to which such Contribution(s) was submitted. If You
   institute patent litigation against any entity (including a
   cross-claim or counterclaim in a lawsuit) alleging that the Work
   or a Contribution incorporated within the Work constitutes direct
   or contributory patent infringement, then any patent licenses
   granted to You under this License for that Work shall terminate
   as of the date such litigation is filed.

4. Redistribution. You may reproduce and distribute copies of the
   Work or Derivative Works thereof in any medium, with or without
   modifications, and in Source or Object form, provided that You
   meet the following conditions:

   (a) You must give any other recipients of the Work or
       Derivative Works a copy of this License; and

   (b) You must cause any modified files to carry prominent notices
       stating that You changed the files; and

   (c) You must retain, in the Source form of any Derivative Works
       that You distribute, all copyright, patent, trademark, and
       attribution notices from the Source form of the Work,
       excluding those notices that do not pertain to any part of
       the Derivative Works; and

   (d) If the Work includes a "NOTICE" text file as part of its
       distribution, then any Derivative Works that You distribute must
       include a readable copy of the attribution notices contained
       within such NOTICE file, excluding those notices that do not
       pertain to any part of the Derivative Works, in at least one
       of the following places: within a NOTICE text file distributed
       as part of the Derivative Works; within the Source form or
       documentation, if provided along with the Derivative Works; or,
       within a display generated by the Derivative Works, if and
       wherever such third-party notices normally appear. The contents
       of the NOTICE file are for informational purposes only and
       do not modify the License. You may add Your own attribution
       notices within Derivative Works that You distribute, alongside
       or as an addendum to the NOTICE text from the Work, provided
       that such additional attribution notices cannot be construed
       as modifying the License.

   You may add Your own copyright statement to Your modifications and
   may provide additional or different license terms and conditions
   for use, reproduction, or distribution of Your modifications, or
   for any such Derivative Works as a whole, provided Your use,
   reproduction, and distribution of the Work otherwise complies with
   the conditions stated in this License.

5. Submission of Contributions. Unless You explicitly state otherwise,
   any Contribution intentionally submitted for inclusion in the Work
   by You to the Licensor shall be under the terms and conditions of
   this License, without any additional terms or conditions.
   Notwithstanding the above, nothing herein shall supersede or modify
```

(continues on next page)

(continued from previous page)

```
   the terms of any separate license agreement you may have executed
   with Licensor regarding such Contributions.

6. Trademarks. This License does not grant permission to use the trade
   names, trademarks, service marks, or product names of the Licensor,
   except as required for reasonable and customary use in describing the
   origin of the Work and reproducing the content of the NOTICE file.

7. Disclaimer of Warranty. Unless required by applicable law or
   agreed to in writing, Licensor provides the Work (and each
   Contributor provides its Contributions) on an "AS IS" BASIS,
   WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
   implied, including, without limitation, any warranties or conditions
   of TITLE, NON-INFRINGEMENT, MERCHANTABILITY, or FITNESS FOR A
   PARTICULAR PURPOSE. You are solely responsible for determining the
   appropriateness of using or redistributing the Work and assume any
   risks associated with Your exercise of permissions under this License.

8. Limitation of Liability. In no event and under no legal theory,
   whether in tort (including negligence), contract, or otherwise,
   unless required by applicable law (such as deliberate and grossly
   negligent acts) or agreed to in writing, shall any Contributor be
   liable to You for damages, including any direct, indirect, special,
   incidental, or consequential damages of any character arising as a
   result of this License or out of the use or inability to use the
   Work (including but not limited to damages for loss of goodwill,
   work stoppage, computer failure or malfunction, or any and all
   other commercial damages or losses), even if such Contributor
   has been advised of the possibility of such damages.

9. Accepting Warranty or Additional Liability. While redistributing
   the Work or Derivative Works thereof, You may choose to offer,
   and charge a fee for, acceptance of support, warranty, indemnity,
   or other liability obligations and/or rights consistent with this
   License. However, in accepting such obligations, You may act only
   on Your own behalf and on Your sole responsibility, not on behalf
   of any other Contributor, and only if You agree to indemnify,
   defend, and hold each Contributor harmless for any liability
   incurred by, or claims asserted against, such Contributor by reason
   of your accepting any such warranty or additional liability.
```

3.3 Quick Start

The installation is quick and straightforward.

```
# airflow needs a home, ~/airflow is the default,
# but you can lay foundation somewhere else if you prefer
# (optional)
export AIRFLOW_HOME=~/airflow

# install from pypi using pip
pip install apache-airflow

# initialize the database
```

(continues on next page)

(continued from previous page)

```
airflow initdb

# start the web server, default port is 8080
airflow webserver -p 8080

# start the scheduler
airflow scheduler

# visit localhost:8080 in the browser and enable the example dag in the home page
```

Upon running these commands, Airflow will create the `$AIRFLOW_HOME` folder and lay an "airflow.cfg" file with defaults that get you going fast. You can inspect the file either in `$AIRFLOW_HOME/airflow.cfg`, or through the UI in the `Admin->Configuration` menu. The PID file for the webserver will be stored in `$AIRFLOW_HOME/airflow-webserver.pid` or in `/run/airflow/webserver.pid` if started by systemd.

Out of the box, Airflow uses a sqlite database, which you should outgrow fairly quickly since no parallelization is possible using this database backend. It works in conjunction with the `SequentialExecutor` which will only run task instances sequentially. While this is very limiting, it allows you to get up and running quickly and take a tour of the UI and the command line utilities.

Here are a few commands that will trigger a few task instances. You should be able to see the status of the jobs change in the `example1` DAG as you run the commands below.

```
# run your first task instance
airflow run example_bash_operator runme_0 2015-01-01
# run a backfill over 2 days
airflow backfill example_bash_operator -s 2015-01-01 -e 2015-01-02
```

3.3.1 What's Next?

From this point, you can head to the *Tutorial* section for further examples or the *How-to Guides* section if you're ready to get your hands dirty.

3.4 Installation

3.4.1 Getting Airflow

The easiest way to install the latest stable version of Airflow is with `pip`:

```
pip install apache-airflow
```

You can also install Airflow with support for extra features like `s3` or `postgres`:

```
pip install apache-airflow[postgres,s3]
```

Note: GPL dependency

One of the dependencies of Apache Airflow by default pulls in a GPL library ('unidecode'). In case this is a concern you can force a non GPL library by issuing `export SLUGIFY_USES_TEXT_UNIDECODE=yes` and then proceed with the normal installation. Please note that this needs to be specified at every upgrade. Also note that if *unidecode* is already present on the system the dependency will still be used.

3.4.2 Extra Packages

The `apache-airflow` PyPI basic package only installs what's needed to get started. Subpackages can be installed depending on what will be useful in your environment. For instance, if you don't need connectivity with Postgres, you won't have to go through the trouble of installing the `postgres-devel` yum package, or whatever equivalent applies on the distribution you are using.

Behind the scenes, Airflow does conditional imports of operators that require these extra dependencies.

Here's the list of the subpackages and what they enable:

subpackage	install command	enables
all	`pip install apache-airflow[all]`	All Airflow features known to man
all_dbs	`pip install apache-airflow[all_dbs]`	All databases integrations
async	`pip install apache-airflow[async]`	Async worker classes for Gunicorn
celery	`pip install apache-airflow[celery]`	CeleryExecutor
cloudant	`pip install apache-airflow[cloudant]`	Cloudant hook
crypto	`pip install apache-airflow[crypto]`	Encrypt connection passwords in metadata
devel	`pip install apache-airflow[devel]`	Minimum dev tools requirements
devel_hadoop	`pip install apache-airflow[devel_hadoop]`	Airflow + dependencies on the Hadoop sta
druid	`pip install apache-airflow[druid]`	Druid related operators & hooks
gcp_api	`pip install apache-airflow[gcp_api]`	Google Cloud Platform hooks and operato
github_enterprise	`pip install apache-airflow[github_enterprise]`	Github Enterprise auth backend
google_auth	`pip install apache-airflow[google_auth]`	Google auth backend
hdfs	`pip install apache-airflow[hdfs]`	HDFS hooks and operators
hive	`pip install apache-airflow[hive]`	All Hive related operators
jdbc	`pip install apache-airflow[jdbc]`	JDBC hooks and operators
kerberos	`pip install apache-airflow[kerberos]`	Kerberos integration for Kerberized Hadoo
kubernetes	`pip install apache-airflow[kubernetes]`	Kubernetes Executor and operator
ldap	`pip install apache-airflow[ldap]`	LDAP authentication for users
mssql	`pip install apache-airflow[mssql]`	Microsoft SQL Server operators and hook,
mysql	`pip install apache-airflow[mysql]`	MySQL operators and hook, support as an
password	`pip install apache-airflow[password]`	Password authentication for users
postgres	`pip install apache-airflow[postgres]`	PostgreSQL operators and hook, support a
qds	`pip install apache-airflow[qds]`	Enable QDS (Qubole Data Service) suppor
rabbitmq	`pip install apache-airflow[rabbitmq]`	RabbitMQ support as a Celery backend
redis	`pip install apache-airflow[redis]`	Redis hooks and sensors
s3	`pip install apache-airflow[s3]`	`S3KeySensor`, `S3PrefixSensor`
samba	`pip install apache-airflow[samba]`	`Hive2SambaOperator`
slack	`pip install apache-airflow[slack]`	`SlackAPIPostOperator`
ssh	`pip install apache-airflow[ssh]`	SSH hooks and Operator
vertica	`pip install apache-airflow[vertica]`	Vertica hook support as an Airflow backen

3.4.3 Initiating Airflow Database

Airflow requires a database to be initiated before you can run tasks. If you're just experimenting and learning Airflow, you can stick with the default SQLite option. If you don't want to use SQLite, then take a look at *Initializing a Database Backend* to setup a different database.

After configuration, you'll need to initialize the database before you can run tasks:

```
airflow initdb
```

3.5 Tutorial

This tutorial walks you through some of the fundamental Airflow concepts, objects, and their usage while writing your first pipeline.

3.5.1 Example Pipeline definition

Here is an example of a basic pipeline definition. Do not worry if this looks complicated, a line by line explanation follows below.

```
"""
Code that goes along with the Airflow tutorial located at:
https://github.com/apache/airflow/blob/master/airflow/example_dags/tutorial.py
"""
from airflow import DAG
from airflow.operators.bash_operator import BashOperator
from datetime import datetime, timedelta


default_args = {
    'owner': 'airflow',
    'depends_on_past': False,
    'start_date': datetime(2015, 6, 1),
    'email': ['airflow@example.com'],
    'email_on_failure': False,
    'email_on_retry': False,
    'retries': 1,
    'retry_delay': timedelta(minutes=5),
    # 'queue': 'bash_queue',
    # 'pool': 'backfill',
    # 'priority_weight': 10,
    # 'end_date': datetime(2016, 1, 1),
}

dag = DAG('tutorial', default_args=default_args, schedule_interval=timedelta(days=1))

# t1, t2 and t3 are examples of tasks created by instantiating operators
t1 = BashOperator(
    task_id='print_date',
    bash_command='date',
    dag=dag)

t2 = BashOperator(
    task_id='sleep',
    bash_command='sleep 5',
    retries=3,
    dag=dag)

templated_command = """
    {% for i in range(5) %}
        echo "{{ ds }}"
        echo "{{ macros.ds_add(ds, 7)}}"
        echo "{{ params.my_param }}"
    {% endfor %}
"""
```

(continues on next page)

(continued from previous page)

```
t3 = BashOperator(
    task_id='templated',
    bash_command=templated_command,
    params={'my_param': 'Parameter I passed in'},
    dag=dag)

t2.set_upstream(t1)
t3.set_upstream(t1)
```

3.5.2 It's a DAG definition file

One thing to wrap your head around (it may not be very intuitive for everyone at first) is that this Airflow Python script is really just a configuration file specifying the DAG's structure as code. The actual tasks defined here will run in a different context from the context of this script. Different tasks run on different workers at different points in time, which means that this script cannot be used to cross communicate between tasks. Note that for this purpose we have a more advanced feature called `XCom`.

People sometimes think of the DAG definition file as a place where they can do some actual data processing - that is not the case at all! The script's purpose is to define a DAG object. It needs to evaluate quickly (seconds, not minutes) since the scheduler will execute it periodically to reflect the changes if any.

3.5.3 Importing Modules

An Airflow pipeline is just a Python script that happens to define an Airflow DAG object. Let's start by importing the libraries we will need.

```
# The DAG object; we'll need this to instantiate a DAG
from airflow import DAG

# Operators; we need this to operate!
from airflow.operators.bash_operator import BashOperator
```

3.5.4 Default Arguments

We're about to create a DAG and some tasks, and we have the choice to explicitly pass a set of arguments to each task's constructor (which would become redundant), or (better!) we can define a dictionary of default parameters that we can use when creating tasks.

```
from datetime import datetime, timedelta

default_args = {
    'owner': 'airflow',
    'depends_on_past': False,
    'start_date': datetime(2015, 6, 1),
    'email': ['airflow@example.com'],
    'email_on_failure': False,
    'email_on_retry': False,
    'retries': 1,
    'retry_delay': timedelta(minutes=5),
    # 'queue': 'bash_queue',
    # 'pool': 'backfill',
```

(continues on next page)

(continued from previous page)

```
    # 'priority_weight': 10,
    # 'end_date': datetime(2016, 1, 1),
}
```

For more information about the BaseOperator's parameters and what they do, refer to the `airflow.models.BaseOperator` documentation.

Also, note that you could easily define different sets of arguments that would serve different purposes. An example of that would be to have different settings between a production and development environment.

3.5.5 Instantiate a DAG

We'll need a DAG object to nest our tasks into. Here we pass a string that defines the `dag_id`, which serves as a unique identifier for your DAG. We also pass the default argument dictionary that we just defined and define a `schedule_interval` of 1 day for the DAG.

```
dag = DAG(
    'tutorial', default_args=default_args, schedule_interval=timedelta(days=1))
```

3.5.6 Tasks

Tasks are generated when instantiating operator objects. An object instantiated from an operator is called a constructor. The first argument `task_id` acts as a unique identifier for the task.

```
t1 = BashOperator(
    task_id='print_date',
    bash_command='date',
    dag=dag)

t2 = BashOperator(
    task_id='sleep',
    bash_command='sleep 5',
    retries=3,
    dag=dag)
```

Notice how we pass a mix of operator specific arguments (`bash_command`) and an argument common to all operators (`retries`) inherited from BaseOperator to the operator's constructor. This is simpler than passing every argument for every constructor call. Also, notice that in the second task we override the `retries` parameter with `3`.

The precedence rules for a task are as follows:

1. Explicitly passed arguments
2. Values that exist in the `default_args` dictionary
3. The operator's default value, if one exists

A task must include or inherit the arguments `task_id` and `owner`, otherwise Airflow will raise an exception.

3.5.7 Templating with Jinja

Airflow leverages the power of Jinja Templating and provides the pipeline author with a set of built-in parameters and macros. Airflow also provides hooks for the pipeline author to define their own parameters, macros and templates.

This tutorial barely scratches the surface of what you can do with templating in Airflow, but the goal of this section is to let you know this feature exists, get you familiar with double curly brackets, and point to the most common template variable: `{{ ds }}` (today's "date stamp").

```
templated_command = """
    {% for i in range(5) %}
        echo "{{ ds }}"
        echo "{{ macros.ds_add(ds, 7) }}"
        echo "{{ params.my_param }}"
    {% endfor %}
"""

t3 = BashOperator(
    task_id='templated',
    bash_command=templated_command,
    params={'my_param': 'Parameter I passed in'},
    dag=dag)
```

Notice that the `templated_command` contains code logic in `{% %}` blocks, references parameters like `{{ ds }}`, calls a function as in `{{ macros.ds_add(ds, 7)}}`, and references a user-defined parameter in `{{ params.my_param }}`.

The `params` hook in `BaseOperator` allows you to pass a dictionary of parameters and/or objects to your templates. Please take the time to understand how the parameter `my_param` makes it through to the template.

Files can also be passed to the `bash_command` argument, like `bash_command='templated_command.sh'`, where the file location is relative to the directory containing the pipeline file (`tutorial.py` in this case). This may be desirable for many reasons, like separating your script's logic and pipeline code, allowing for proper code highlighting in files composed in different languages, and general flexibility in structuring pipelines. It is also possible to define your `template_searchpath` as pointing to any folder locations in the DAG constructor call.

Using that same DAG constructor call, it is possible to define `user_defined_macros` which allow you to specify your own variables. For example, passing `dict(foo='bar')` to this argument allows you to use `{{ foo }}` in your templates. Moreover, specifying `user_defined_filters` allow you to register you own filters. For example, passing `dict(hello=lambda name: 'Hello %s' % name)` to this argument allows you to use `{{ 'world' | hello }}` in your templates. For more information regarding custom filters have a look at the Jinja Documentation

For more information on the variables and macros that can be referenced in templates, make sure to read through the *Macros* section

3.5.8 Setting up Dependencies

We have tasks *t1*, *t2* and *t3* that do not depend on each other. Here's a few ways you can define dependencies between them:

```
t1.set_downstream(t2)

# This means that t2 will depend on t1
# running successfully to run.
# It is equivalent to:
t2.set_upstream(t1)

# The bit shift operator can also be
# used to chain operations:
t1 >> t2
```

(continues on next page)

(continued from previous page)

```
# And the upstream dependency with the
# bit shift operator:
t2 << t1

# Chaining multiple dependencies becomes
# concise with the bit shift operator:
t1 >> t2 >> t3

# A list of tasks can also be set as
# dependencies. These operations
# all have the same effect:
t1.set_downstream([t2, t3])
t1 >> [t2, t3]
[t2, t3] << t1
```

Note that when executing your script, Airflow will raise exceptions when it finds cycles in your DAG or when a dependency is referenced more than once.

3.5.9 Recap

Alright, so we have a pretty basic DAG. At this point your code should look something like this:

```
"""
Code that goes along with the Airflow tutorial located at:
https://github.com/apache/airflow/blob/master/airflow/example_dags/tutorial.py
"""
from airflow import DAG
from airflow.operators.bash_operator import BashOperator
from datetime import datetime, timedelta


default_args = {
    'owner': 'airflow',
    'depends_on_past': False,
    'start_date': datetime(2015, 6, 1),
    'email': ['airflow@example.com'],
    'email_on_failure': False,
    'email_on_retry': False,
    'retries': 1,
    'retry_delay': timedelta(minutes=5),
    # 'queue': 'bash_queue',
    # 'pool': 'backfill',
    # 'priority_weight': 10,
    # 'end_date': datetime(2016, 1, 1),
}

dag = DAG(
    'tutorial', default_args=default_args, schedule_interval=timedelta(days=1))

# t1, t2 and t3 are examples of tasks created by instantiating operators
t1 = BashOperator(
    task_id='print_date',
    bash_command='date',
    dag=dag)
```

(continues on next page)

(continued from previous page)

```
t2 = BashOperator(
    task_id='sleep',
    bash_command='sleep 5',
    retries=3,
    dag=dag)

templated_command = """
    {% for i in range(5) %}
        echo "{{ ds }}"
        echo "{{ macros.ds_add(ds, 7)}}"
        echo "{{ params.my_param }}"
    {% endfor %}
"""

t3 = BashOperator(
    task_id='templated',
    bash_command=templated_command,
    params={'my_param': 'Parameter I passed in'},
    dag=dag)

t2.set_upstream(t1)
t3.set_upstream(t1)
```

3.5.10 Testing

3.5.10.1 Running the Script

Time to run some tests. First let's make sure that the pipeline parses. Let's assume we're saving the code from the previous step in `tutorial.py` in the DAGs folder referenced in your `airflow.cfg`. The default location for your DAGs is `~/airflow/dags`.

```
python ~/airflow/dags/tutorial.py
```

If the script does not raise an exception it means that you haven't done anything horribly wrong, and that your Airflow environment is somewhat sound.

3.5.10.2 Command Line Metadata Validation

Let's run a few commands to validate this script further.

```
# print the list of active DAGs
airflow list_dags

# prints the list of tasks the "tutorial" dag_id
airflow list_tasks tutorial

# prints the hierarchy of tasks in the tutorial DAG
airflow list_tasks tutorial --tree
```

3.5.10.3 Testing

Let's test by running the actual task instances on a specific date. The date specified in this context is an `execution_date`, which simulates the scheduler running your task or dag at a specific date + time:

```
# command layout: command subcommand dag_id task_id date

# testing print_date
airflow test tutorial print_date 2015-06-01

# testing sleep
airflow test tutorial sleep 2015-06-01
```

Now remember what we did with templating earlier? See how this template gets rendered and executed by running this command:

```
# testing templated
airflow test tutorial templated 2015-06-01
```

This should result in displaying a verbose log of events and ultimately running your bash command and printing the result.

Note that the `airflow test` command runs task instances locally, outputs their log to stdout (on screen), doesn't bother with dependencies, and doesn't communicate state (running, success, failed, ...) to the database. It simply allows testing a single task instance.

3.5.10.4 Backfill

Everything looks like it's running fine so let's run a backfill. `backfill` will respect your dependencies, emit logs into files and talk to the database to record status. If you do have a webserver up, you'll be able to track the progress. `airflow webserver` will start a web server if you are interested in tracking the progress visually as your backfill progresses.

Note that if you use `depends_on_past=True`, individual task instances will depend on the success of the preceding task instance, except for the start_date specified itself, for which this dependency is disregarded.

The date range in this context is a `start_date` and optionally an `end_date`, which are used to populate the run schedule with task instances from this dag.

```
# optional, start a web server in debug mode in the background
# airflow webserver --debug &

# start your backfill on a date range
airflow backfill tutorial -s 2015-06-01 -e 2015-06-07
```

3.5.11 What's Next?

That's it, you've written, tested and backfilled your very first Airflow pipeline. Merging your code into a code repository that has a master scheduler running against it should get it to get triggered and run every day.

Here's a few things you might want to do next:

- Take an in-depth tour of the UI - click all the things!
- Keep reading the docs! Especially the sections on:
  - Command line interface
  - Operators
  - Macros
- Write your first pipeline!

3.6 How-to Guides

Setting up the sandbox in the *Quick Start* section was easy; building a production-grade environment requires a bit more work!

These how-to guides will step you through common tasks in using and configuring an Airflow environment.

3.6.1 Setting Configuration Options

The first time you run Airflow, it will create a file called `airflow.cfg` in your `$AIRFLOW_HOME` directory (`~/airflow` by default). This file contains Airflow's configuration and you can edit it to change any of the settings. You can also set options with environment variables by using this format: `$AIRFLOW__{SECTION}__{KEY}` (note the double underscores).

For example, the metadata database connection string can either be set in `airflow.cfg` like this:

```
[core]
sql_alchemy_conn = my_conn_string
```

or by creating a corresponding environment variable:

```
AIRFLOW__CORE__SQL_ALCHEMY_CONN=my_conn_string
```

You can also derive the connection string at run time by appending `_cmd` to the key like this:

```
[core]
sql_alchemy_conn_cmd = bash_command_to_run
```

The following config options support this `_cmd` version:

- `sql_alchemy_conn` in `[core]` section
- `fernet_key` in `[core]` section
- `broker_url` in `[celery]` section
- `result_backend` in `[celery]` section
- `password` in `[atlas]` section
- `smtp_password` in `[smtp]` section
- `bind_password` in `[ldap]` section
- `git_password` in `[kubernetes]` section

The idea behind this is to not store passwords on boxes in plain text files.

The order of precedence for all config options is as follows -

1. environment variable
2. configuration in airflow.cfg
3. command in airflow.cfg
4. Airflow's built in defaults

3.6.2 Initializing a Database Backend

If you want to take a real test drive of Airflow, you should consider setting up a real database backend and switching to the LocalExecutor.

As Airflow was built to interact with its metadata using the great SqlAlchemy library, you should be able to use any database backend supported as a SqlAlchemy backend. We recommend using **MySQL** or **Postgres**.

Note: We rely on more strict ANSI SQL settings for MySQL in order to have sane defaults. Make sure to have specified *explicit_defaults_for_timestamp=1* in your my.cnf under *[mysqld]*

Note: If you decide to use **Postgres**, we recommend using the `psycopg2` driver and specifying it in your SqlAlchemy connection string. Also note that since SqlAlchemy does not expose a way to target a specific schema in the Postgres connection URI, you may want to set a default schema for your role with a command similar to `ALTER ROLE username SET search_path = airflow, foobar;`

Once you've setup your database to host Airflow, you'll need to alter the SqlAlchemy connection string located in your configuration file `$AIRFLOW_HOME/airflow.cfg`. You should then also change the "executor" setting to use "LocalExecutor", an executor that can parallelize task instances locally.

```
# initialize the database
airflow initdb
```

3.6.3 Using Operators

An operator represents a single, ideally idempotent, task. Operators determine what actually executes when your DAG runs.

See the *Operators Concepts* documentation and the *Operators API Reference* for more information.

3.6.3.1 BashOperator

Use the `BashOperator` to execute commands in a Bash shell.

```
run_this = BashOperator(
    task_id='run_after_loop',
    bash_command='echo 1',
    dag=dag,
)
```

Templating

You can use *Jinja templates* to parameterize the `bash_command` argument.

```
also_run_this = BashOperator(
    task_id='also_run_this',
    bash_command='echo "run_id={{ run_id }} | dag_run={{ dag_run }}"',
    dag=dag,
)
```

Troubleshooting

Jinja template not found

Add a space after the script name when directly calling a Bash script with the `bash_command` argument. This is because Airflow tries to apply a Jinja template to it, which will fail.

```
t2 = BashOperator(
    task_id='bash_example',

    # This fails with `Jinja template not found` error
    # bash_command="/home/batcher/test.sh",

    # This works (has a space after)
    bash_command="/home/batcher/test.sh ",
    dag=dag)
```

3.6.3.2 PythonOperator

Use the *`PythonOperator`* to execute Python callables.

```
def print_context(ds, **kwargs):
    pprint(kwargs)
    print(ds)
    return 'Whatever you return gets printed in the logs'


run_this = PythonOperator(
    task_id='print_the_context',
    provide_context=True,
    python_callable=print_context,
    dag=dag,
)
```

Passing in arguments

Use the op_args and op_kwargs arguments to pass additional arguments to the Python callable.

```
def my_sleeping_function(random_base):
    """This is a function that will run within the DAG execution"""
    time.sleep(random_base)


# Generate 5 sleeping tasks, sleeping from 0.0 to 0.4 seconds respectively
for i in range(5):
    task = PythonOperator(
        task_id='sleep_for_' + str(i),
        python_callable=my_sleeping_function,
        op_kwargs={'random_base': float(i) / 10},
        dag=dag,
    )

    run_this >> task
```

Templating

When you set the provide_context argument to True, Airflow passes in an additional set of keyword arguments: one for each of the *Jinja template variables* and a templates_dict argument.

The templates_dict argument is templated, so each value in the dictionary is evaluated as a *Jinja template*.

3.6.3.3 Google Cloud Storage Operators

GoogleCloudStorageToBigQueryOperator

Use the *GoogleCloudStorageToBigQueryOperator* to execute a BigQuery load job.

3.6.3.4 Google Compute Engine Operators

GceInstanceStartOperator

Use the *GceInstanceStartOperator* to start an existing Google Compute Engine instance.

Arguments

The following examples of OS environment variables used to pass arguments to the operator:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
GCE_ZONE = os.environ.get('GCE_ZONE', 'europe-west1-b')
GCE_INSTANCE = os.environ.get('GCE_INSTANCE', 'testinstance')
```

Using the operator

The code to create the operator:

```
gce_instance_start = GceInstanceStartOperator(
    project_id=GCP_PROJECT_ID,
    zone=GCE_ZONE,
    resource_id=GCE_INSTANCE,
    task_id='gcp_compute_start_task'
)
```

You can also create the operator without project id - project id will be retrieved from the GCP connection id used:

```
gce_instance_start2 = GceInstanceStartOperator(
    zone=GCE_ZONE,
    resource_id=GCE_INSTANCE,
    task_id='gcp_compute_start_task2'
)
```

Templating

```
template_fields = ('project_id', 'zone', 'resource_id', 'gcp_conn_id', 'api_version')
```

More information

See Google Compute Engine API documentation.

GceInstanceStopOperator

Use the operator to stop Google Compute Engine instance.

For parameter definition, take a look at *GceInstanceStopOperator*

Arguments

The following examples of OS environment variables used to pass arguments to the operator:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
GCE_ZONE = os.environ.get('GCE_ZONE', 'europe-west1-b')
GCE_INSTANCE = os.environ.get('GCE_INSTANCE', 'testinstance')
```

Using the operator

The code to create the operator:

```
gce_instance_stop = GceInstanceStopOperator(
    project_id=GCP_PROJECT_ID,
    zone=GCE_ZONE,
    resource_id=GCE_INSTANCE,
    task_id='gcp_compute_stop_task'
)
```

You can also create the operator without project id - project id will be retrieved from the GCP connection used:

```
gce_instance_stop2 = GceInstanceStopOperator(
    zone=GCE_ZONE,
    resource_id=GCE_INSTANCE,
    task_id='gcp_compute_stop_task2'
)
```

Templating

```
template_fields = ('project_id', 'zone', 'resource_id', 'gcp_conn_id', 'api_version')
```

More information

See Google Compute Engine API documentation.

GceSetMachineTypeOperator

Use the operator to change machine type of a Google Compute Engine instance.

For parameter definition, take a look at `GceSetMachineTypeOperator`.

Arguments

The following examples of OS environment variables used to pass arguments to the operator:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
GCE_ZONE = os.environ.get('GCE_ZONE', 'europe-west1-b')
GCE_INSTANCE = os.environ.get('GCE_INSTANCE', 'testinstance')
```

```
GCE_SHORT_MACHINE_TYPE_NAME = os.environ.get('GCE_SHORT_MACHINE_TYPE_NAME', 'n1-
↪standard-1')
SET_MACHINE_TYPE_BODY = {
    'machineType': 'zones/{}/machineTypes/{}'.format(GCE_ZONE, GCE_SHORT_MACHINE_TYPE_
↪NAME)
}
```

Using the operator

The code to create the operator:

```
gce_set_machine_type = GceSetMachineTypeOperator(
    project_id=GCP_PROJECT_ID,
    zone=GCE_ZONE,
    resource_id=GCE_INSTANCE,
    body=SET_MACHINE_TYPE_BODY,
    task_id='gcp_compute_set_machine_type'
)
```

You can also create the operator without project id - project id will be retrieved from the GCP connection used:

```
gce_set_machine_type2 = GceSetMachineTypeOperator(
    zone=GCE_ZONE,
    resource_id=GCE_INSTANCE,
    body=SET_MACHINE_TYPE_BODY,
    task_id='gcp_compute_set_machine_type2'
)
```

Templating

```
template_fields = ('project_id', 'zone', 'resource_id', 'gcp_conn_id', 'api_version')
```

More information

See Google Compute Engine API documentation.

GceInstanceTemplateCopyOperator

Use the operator to copy an existing Google Compute Engine instance template applying a patch to it.

For parameter definition, take a look at *GceInstanceTemplateCopyOperator*.

Arguments

The following examples of OS environment variables used to pass arguments to the operator:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
GCE_ZONE = os.environ.get('GCE_ZONE', 'europe-west1-b')
```

```
GCE_TEMPLATE_NAME = os.environ.get('GCE_TEMPLATE_NAME', 'instance-template-test')
GCE_NEW_TEMPLATE_NAME = os.environ.get('GCE_NEW_TEMPLATE_NAME',
                                       'instance-template-test-new')
GCE_NEW_DESCRIPTION = os.environ.get('GCE_NEW_DESCRIPTION', 'Test new description')
GCE_INSTANCE_TEMPLATE_BODY_UPDATE = {
    "name": GCE_NEW_TEMPLATE_NAME,
    "description": GCE_NEW_DESCRIPTION,
    "properties": {
        "machineType": "n1-standard-2"
    }
}
```

Using the operator

The code to create the operator:

```
gce_instance_template_copy = GceInstanceTemplateCopyOperator(
    project_id=GCP_PROJECT_ID,
    resource_id=GCE_TEMPLATE_NAME,
    body_patch=GCE_INSTANCE_TEMPLATE_BODY_UPDATE,
```

(continues on next page)

(continued from previous page)

```
    task_id='gcp_compute_igm_copy_template_task'
)
```

You can also create the operator without project id - project id will be retrieved from the GCP connection used:

```
gce_instance_template_copy2 = GceInstanceTemplateCopyOperator(
    resource_id=GCE_TEMPLATE_NAME,
    body_patch=GCE_INSTANCE_TEMPLATE_BODY_UPDATE,
    task_id='gcp_compute_igm_copy_template_task_2'
)
```

Templating

```
template_fields = ('project_id', 'resource_id', 'request_id',
                   'gcp_conn_id', 'api_version')
```

More information

See Google Compute Engine API documentation.

GceInstanceGroupManagerUpdateTemplateOperator

Use the operator to update template in Google Compute Engine Instance Group Manager.

For parameter definition, take a look at *GceInstanceGroupManagerUpdateTemplateOperator*.

Arguments

The following examples of OS environment variables used to pass arguments to the operator:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
GCE_ZONE = os.environ.get('GCE_ZONE', 'europe-west1-b')
```

```
GCE_INSTANCE_GROUP_MANAGER_NAME = os.environ.get('GCE_INSTANCE_GROUP_MANAGER_NAME',
                                                 'instance-group-test')

SOURCE_TEMPLATE_URL = os.environ.get(
    'SOURCE_TEMPLATE_URL',
    "https://www.googleapis.com/compute/beta/projects/" + GCP_PROJECT_ID +
    "/global/instanceTemplates/instance-template-test")

DESTINATION_TEMPLATE_URL = os.environ.get(
    'DESTINATION_TEMPLATE_URL',
    "https://www.googleapis.com/compute/beta/projects/" + GCP_PROJECT_ID +
    "/global/instanceTemplates/" + GCE_NEW_TEMPLATE_NAME)

UPDATE_POLICY = {
    "type": "OPPORTUNISTIC",
    "minimalAction": "RESTART",
```

(continues on next page)

(continued from previous page)

```
    "maxSurge": {
        "fixed": 1
    },
    "minReadySec": 1800
}
```

Using the operator

The code to create the operator:

```
gce_instance_group_manager_update_template = \
    GceInstanceGroupManagerUpdateTemplateOperator(
        project_id=GCP_PROJECT_ID,
        resource_id=GCE_INSTANCE_GROUP_MANAGER_NAME,
        zone=GCE_ZONE,
        source_template=SOURCE_TEMPLATE_URL,
        destination_template=DESTINATION_TEMPLATE_URL,
        update_policy=UPDATE_POLICY,
        task_id='gcp_compute_igm_group_manager_update_template'
    )
```

You can also create the operator without project id - project id will be retrieved from the GCP connection used:

```
gce_instance_group_manager_update_template2 = \
    GceInstanceGroupManagerUpdateTemplateOperator(
        resource_id=GCE_INSTANCE_GROUP_MANAGER_NAME,
        zone=GCE_ZONE,
        source_template=SOURCE_TEMPLATE_URL,
        destination_template=DESTINATION_TEMPLATE_URL,
        task_id='gcp_compute_igm_group_manager_update_template_2'
    )
```

Templating

```
template_fields = ('project_id', 'resource_id', 'zone', 'request_id',
                   'source_template', 'destination_template',
                   'gcp_conn_id', 'api_version')
```

Troubleshooting

You might find that your GceInstanceGroupManagerUpdateTemplateOperator fails with missing permissions. To execute the operation, the service account requires the permissions that theService Account User role provides (assigned via Google Cloud IAM).

More information

See Google Compute Engine API documentation.

3.6.3.5 Google Cloud Bigtable Operators

All examples below rely on the following variables, which can be passed via environment variables.

```
GCP_PROJECT_ID = getenv('GCP_PROJECT_ID', 'example-project')
CBT_INSTANCE_ID = getenv('CBT_INSTANCE_ID', 'some-instance-id')
CBT_INSTANCE_DISPLAY_NAME = getenv('CBT_INSTANCE_DISPLAY_NAME', 'Human-readable name')
CBT_INSTANCE_TYPE = getenv('CBT_INSTANCE_TYPE', '2')
CBT_INSTANCE_LABELS = getenv('CBT_INSTANCE_LABELS', '{}')
CBT_CLUSTER_ID = getenv('CBT_CLUSTER_ID', 'some-cluster-id')
CBT_CLUSTER_ZONE = getenv('CBT_CLUSTER_ZONE', 'europe-west1-b')
CBT_CLUSTER_NODES = getenv('CBT_CLUSTER_NODES', '3')
CBT_CLUSTER_NODES_UPDATED = getenv('CBT_CLUSTER_NODES_UPDATED', '5')
CBT_CLUSTER_STORAGE_TYPE = getenv('CBT_CLUSTER_STORAGE_TYPE', '2')
CBT_TABLE_ID = getenv('CBT_TABLE_ID', 'some-table-id')
CBT_POKE_INTERVAL = getenv('CBT_POKE_INTERVAL', '60')
```

BigtableInstanceCreateOperator

Use the `BigtableInstanceCreateOperator` to create a Google Cloud Bigtable instance.

If the Cloud Bigtable instance with the given ID exists, the operator does not compare its configuration and immediately succeeds. No changes are made to the existing instance.

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
create_instance_task = BigtableInstanceCreateOperator(
    project_id=GCP_PROJECT_ID,
    instance_id=CBT_INSTANCE_ID,
    main_cluster_id=CBT_CLUSTER_ID,
    main_cluster_zone=CBT_CLUSTER_ZONE,
    instance_display_name=CBT_INSTANCE_DISPLAY_NAME,
    instance_type=int(CBT_INSTANCE_TYPE),
    instance_labels=json.loads(CBT_INSTANCE_LABELS),
    cluster_nodes=int(CBT_CLUSTER_NODES),
    cluster_storage_type=int(CBT_CLUSTER_STORAGE_TYPE),
    task_id='create_instance_task',
)
create_instance_task2 = BigtableInstanceCreateOperator(
    instance_id=CBT_INSTANCE_ID,
    main_cluster_id=CBT_CLUSTER_ID,
    main_cluster_zone=CBT_CLUSTER_ZONE,
    instance_display_name=CBT_INSTANCE_DISPLAY_NAME,
    instance_type=int(CBT_INSTANCE_TYPE),
    instance_labels=json.loads(CBT_INSTANCE_LABELS),
    cluster_nodes=int(CBT_CLUSTER_NODES),
    cluster_storage_type=int(CBT_CLUSTER_STORAGE_TYPE),
    task_id='create_instance_task2',
)
create_instance_task >> create_instance_task2
```

BigtableInstanceDeleteOperator

Use the `BigtableInstanceDeleteOperator` to delete a Google Cloud Bigtable instance.

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
delete_instance_task = BigtableInstanceDeleteOperator(
    project_id=GCP_PROJECT_ID,
    instance_id=CBT_INSTANCE_ID,
    task_id='delete_instance_task',
)
delete_instance_task2 = BigtableInstanceDeleteOperator(
    instance_id=CBT_INSTANCE_ID,
    task_id='delete_instance_task2',
)
```

BigtableClusterUpdateOperator

Use the `BigtableClusterUpdateOperator` to modify number of nodes in a Cloud Bigtable cluster.

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
cluster_update_task = BigtableClusterUpdateOperator(
    project_id=GCP_PROJECT_ID,
    instance_id=CBT_INSTANCE_ID,
    cluster_id=CBT_CLUSTER_ID,
    nodes=int(CBT_CLUSTER_NODES_UPDATED),
    task_id='update_cluster_task',
)
cluster_update_task2 = BigtableClusterUpdateOperator(
    instance_id=CBT_INSTANCE_ID,
    cluster_id=CBT_CLUSTER_ID,
    nodes=int(CBT_CLUSTER_NODES_UPDATED),
    task_id='update_cluster_task2',
)
cluster_update_task >> cluster_update_task2
```

BigtableTableCreateOperator

Creates a table in a Cloud Bigtable instance.

If the table with given ID exists in the Cloud Bigtable instance, the operator compares the Column Families. If the Column Families are identical operator succeeds. Otherwise, the operator fails with the appropriate error message.

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
create_table_task = BigtableTableCreateOperator(
    project_id=GCP_PROJECT_ID,
    instance_id=CBT_INSTANCE_ID,
    table_id=CBT_TABLE_ID,
    task_id='create_table',
)
create_table_task2 = BigtableTableCreateOperator(
    instance_id=CBT_INSTANCE_ID,
    table_id=CBT_TABLE_ID,
    task_id='create_table_task2',
)
create_table_task >> create_table_task2
```

Advanced

When creating a table, you can specify the optional `initial_split_keys` and `column_familes`. Please refer to the Python Client for Google Cloud Bigtable documentation for Table and for Column Families.

BigtableTableDeleteOperator

Use the `BigtableTableDeleteOperator` to delete a table in Google Cloud Bigtable.

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
delete_table_task = BigtableTableDeleteOperator(
    project_id=GCP_PROJECT_ID,
    instance_id=CBT_INSTANCE_ID,
    table_id=CBT_TABLE_ID,
    task_id='delete_table_task',
)
delete_table_task2 = BigtableTableDeleteOperator(
    instance_id=CBT_INSTANCE_ID,
    table_id=CBT_TABLE_ID,
    task_id='delete_table_task2',
)
```

BigtableTableWaitForReplicationSensor

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

Use the `BigtableTableWaitForReplicationSensor` to wait for the table to replicate fully.

The same arguments apply to this sensor as the *BigtableTableCreateOperator*.

Note: If the table or the Cloud Bigtable instance does not exist, this sensor waits for the table until timeout hits and does not raise any exception.

Using the operator

```
wait_for_table_replication_task = BigtableTableWaitForReplicationSensor(
    project_id=GCP_PROJECT_ID,
    instance_id=CBT_INSTANCE_ID,
    table_id=CBT_TABLE_ID,
    poke_interval=int(CBT_POKE_INTERVAL),
    timeout=180,
    task_id='wait_for_table_replication_task',
)
wait_for_table_replication_task2 = BigtableTableWaitForReplicationSensor(
    instance_id=CBT_INSTANCE_ID,
    table_id=CBT_TABLE_ID,
    poke_interval=int(CBT_POKE_INTERVAL),
    timeout=180,
    task_id='wait_for_table_replication_task2',
)
```

3.6.3.6 Google Cloud Functions Operators

GcfFunctionDeleteOperator

Use the operator to delete a function from Google Cloud Functions.

For parameter definition, take a look at *GcfFunctionDeleteOperator*.

Arguments

The following examples of OS environment variables show how you can build function name to use in the operator:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
GCP_LOCATION = os.environ.get('GCP_LOCATION', 'europe-west1')
GCF_SHORT_FUNCTION_NAME = os.environ.get('GCF_SHORT_FUNCTION_NAME', 'hello').\
    replace("-", "_")  # make sure there are no dashes in function name (!)
FUNCTION_NAME = 'projects/{}/locations/{}/functions/{}'.format(GCP_PROJECT_ID,
                                                               GCP_LOCATION,
                                                               GCF_SHORT_FUNCTION_
↪NAME)
```

Using the operator

```
delete_task = GcfFunctionDeleteOperator(
    task_id="gcf_delete_task",
    name=FUNCTION_NAME
)
```

Templating

```
template_fields = ('name', 'gcp_conn_id', 'api_version')
```

More information

See Google Cloud Functions API documentation.

GcfFunctionDeployOperator

Use the operator to deploy a function to Google Cloud Functions. If a function with this name already exists, it will be updated.

For parameter definition, take a look at *GcfFunctionDeployOperator*.

Arguments

In the example DAG the following environment variables are used to parameterize the operator's definition:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
GCP_LOCATION = os.environ.get('GCP_LOCATION', 'europe-west1')
GCF_SHORT_FUNCTION_NAME = os.environ.get('GCF_SHORT_FUNCTION_NAME', 'hello').\
    replace("-", "_")  # make sure there are no dashes in function name (!)
FUNCTION_NAME = 'projects/{}/locations/{}/functions/{}'.format(GCP_PROJECT_ID,
                                                               GCP_LOCATION,
                                                               GCF_SHORT_FUNCTION_
↪NAME)
```

```
GCF_SOURCE_ARCHIVE_URL = os.environ.get('GCF_SOURCE_ARCHIVE_URL', '')
GCF_SOURCE_UPLOAD_URL = os.environ.get('GCF_SOURCE_UPLOAD_URL', '')
GCF_SOURCE_REPOSITORY = os.environ.get(
    'GCF_SOURCE_REPOSITORY',
    'https://source.developers.google.com/'
    'projects/{}/repos/hello-world/moveable-aliases/master'.format(GCP_PROJECT_ID))
GCF_ZIP_PATH = os.environ.get('GCF_ZIP_PATH', '')
GCF_ENTRYPOINT = os.environ.get('GCF_ENTRYPOINT', 'helloWorld')
GCF_RUNTIME = 'nodejs6'
GCP_VALIDATE_BODY = os.environ.get('GCP_VALIDATE_BODY', True)
```

Some of those variables are used to create the request's body:

```
body = {
    "name": FUNCTION_NAME,
    "entryPoint": GCF_ENTRYPOINT,
    "runtime": GCF_RUNTIME,
    "httpsTrigger": {}
}
```

When a DAG is created, the default_args dictionary can be used to pass arguments common with other tasks:

```
default_args = {
    'start_date': dates.days_ago(1)
}
```

Note that the neither the body nor the default args are complete in the above examples. Depending on the variables set, there might be different variants on how to pass source code related fields. Currently, you can pass either `sourceArchiveUrl`, `sourceRepository` or `sourceUploadUrl` as described in the Cloud Functions API specification.

Additionally, `default_args` or direct operator args might contain `zip_path` parameter to run the extra step of uploading the source code before deploying it. In this case, you also need to provide an empty `sourceUploadUrl` parameter in the body.

Using the operator

Depending on the combination of parameters, the Function's source code can be obtained from different sources:

```
if GCF_SOURCE_ARCHIVE_URL:
    body['sourceArchiveUrl'] = GCF_SOURCE_ARCHIVE_URL
elif GCF_SOURCE_REPOSITORY:
    body['sourceRepository'] = {
        'url': GCF_SOURCE_REPOSITORY
    }
elif GCF_ZIP_PATH:
    body['sourceUploadUrl'] = ''
    default_args['zip_path'] = GCF_ZIP_PATH
elif GCF_SOURCE_UPLOAD_URL:
    body['sourceUploadUrl'] = GCF_SOURCE_UPLOAD_URL
else:
    raise Exception("Please provide one of the source_code parameters")
```

The code to create the operator:

```
deploy_task = GcfFunctionDeployOperator(
    task_id="gcf_deploy_task",
    project_id=GCP_PROJECT_ID,
    location=GCP_LOCATION,
    body=body,
    validate_body=GCP_VALIDATE_BODY
)
```

You can also create the operator without project id - project id will be retrieved from the GCP connection used:

```
deploy2_task = GcfFunctionDeployOperator(
    task_id="gcf_deploy2_task",
    location=GCP_LOCATION,
    body=body,
    validate_body=GCP_VALIDATE_BODY
)
```

Templating

```
template_fields = ('project_id', 'location', 'gcp_conn_id', 'api_version')
```

Troubleshooting

If during the deploy you see an error similar to:

"HttpError 403: Missing necessary permission iam.serviceAccounts.actAs for on resource project-name@appspot.gserviceaccount.com. Please grant the roles/iam.serviceAccountUser role."

it means that your service account does not have the correct Cloud IAM permissions.

1. Assign your Service Account the Cloud Functions Developer role.
2. Grant the user the Cloud IAM Service Account User role on the Cloud Functions runtime service account.

The typical way of assigning Cloud IAM permissions with *gcloud* is shown below. Just replace PROJECT_ID with ID of your Google Cloud Platform project and SERVICE_ACCOUNT_EMAIL with the email ID of your service account.

```
gcloud iam service-accounts add-iam-policy-binding \
  PROJECT_ID@appspot.gserviceaccount.com \
  --member="serviceAccount:[SERVICE_ACCOUNT_EMAIL]" \
  --role="roles/iam.serviceAccountUser"
```

You can also do that via the GCP Web console.

See Adding the IAM service agent user role to the runtime service for details.

If the source code for your function is in Google Source Repository, make sure that your service account has the Source Repository Viewer role so that the source code can be downloaded if necessary.

More information

See Google Cloud Functions API documentation.

3.6.3.7 Google Cloud Spanner Operators

CloudSpannerInstanceDatabaseDeleteOperator

Deletes a database from the specified Cloud Spanner instance. If the database does not exist, no action is taken, and the operator succeeds.

For parameter definition, take a look at `CloudSpannerInstanceDatabaseDeleteOperator`.

Arguments

Some arguments in the example DAG are taken from environment variables.

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
GCP_SPANNER_INSTANCE_ID = os.environ.get('GCP_SPANNER_INSTANCE_ID', 'testinstance')
GCP_SPANNER_DATABASE_ID = os.environ.get('GCP_SPANNER_DATABASE_ID', 'testdatabase')
GCP_SPANNER_CONFIG_NAME = os.environ.get('GCP_SPANNER_CONFIG_NAME',
                                         'projects/example-project/instanceConfigs/
↪eur3')
GCP_SPANNER_NODE_COUNT = os.environ.get('GCP_SPANNER_NODE_COUNT', '1')
GCP_SPANNER_DISPLAY_NAME = os.environ.get('GCP_SPANNER_DISPLAY_NAME', 'Test Instance')
# OPERATION_ID should be unique per operation
OPERATION_ID = 'unique_operation_id'
```

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
spanner_database_delete_task = CloudSpannerInstanceDatabaseDeleteOperator(
    project_id=GCP_PROJECT_ID,
    instance_id=GCP_SPANNER_INSTANCE_ID,
    database_id=GCP_SPANNER_DATABASE_ID,
    task_id='spanner_database_delete_task'
)
spanner_database_delete_task2 = CloudSpannerInstanceDatabaseDeleteOperator(
    instance_id=GCP_SPANNER_INSTANCE_ID,
    database_id=GCP_SPANNER_DATABASE_ID,
    task_id='spanner_database_delete_task2'
)
```

Templating

```
template_fields = ('project_id', 'instance_id', 'gcp_conn_id')
```

More information

See Google Cloud Spanner API documentation for database drop call.

CloudSpannerInstanceDatabaseDeployOperator

Creates a new Cloud Spanner database in the specified instance, or if the desired database exists, assumes success with no changes applied to database configuration. No structure of the database is verified - it's enough if the database exists with the same name.

For parameter definition, take a look at `CloudSpannerInstanceDatabaseDeployOperator`.

Arguments

Some arguments in the example DAG are taken from environment variables.

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
GCP_SPANNER_INSTANCE_ID = os.environ.get('GCP_SPANNER_INSTANCE_ID', 'testinstance')
GCP_SPANNER_DATABASE_ID = os.environ.get('GCP_SPANNER_DATABASE_ID', 'testdatabase')
GCP_SPANNER_CONFIG_NAME = os.environ.get('GCP_SPANNER_CONFIG_NAME',
                                         'projects/example-project/instanceConfigs/
↪eur3')
GCP_SPANNER_NODE_COUNT = os.environ.get('GCP_SPANNER_NODE_COUNT', '1')
GCP_SPANNER_DISPLAY_NAME = os.environ.get('GCP_SPANNER_DISPLAY_NAME', 'Test Instance')
# OPERATION_ID should be unique per operation
OPERATION_ID = 'unique_operation_id'
```

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
spanner_database_deploy_task = CloudSpannerInstanceDatabaseDeployOperator(
    project_id=GCP_PROJECT_ID,
    instance_id=GCP_SPANNER_INSTANCE_ID,
    database_id=GCP_SPANNER_DATABASE_ID,
    ddl_statements=[
        "CREATE TABLE my_table1 (id INT64, name STRING(MAX)) PRIMARY KEY (id)",
        "CREATE TABLE my_table2 (id INT64, name STRING(MAX)) PRIMARY KEY (id)",
    ],
    task_id='spanner_database_deploy_task'
)
spanner_database_deploy_task2 = CloudSpannerInstanceDatabaseDeployOperator(
    instance_id=GCP_SPANNER_INSTANCE_ID,
    database_id=GCP_SPANNER_DATABASE_ID,
    ddl_statements=[
        "CREATE TABLE my_table1 (id INT64, name STRING(MAX)) PRIMARY KEY (id)",
        "CREATE TABLE my_table2 (id INT64, name STRING(MAX)) PRIMARY KEY (id)",
    ],
    task_id='spanner_database_deploy_task2'
)
```

Templating

```
template_fields = ('project_id', 'instance_id', 'database_id', 'ddl_statements',
                   'gcp_conn_id')
template_ext = ('.sql', )
```

More information

See Google Cloud Spanner API documentation for database create

CloudSpannerInstanceDatabaseUpdateOperator

Runs a DDL query in a Cloud Spanner database and allows you to modify the structure of an existing database.

You can optionally specify an operation_id parameter which simplifies determining whether the statements were executed in case the update_database call is replayed (idempotency check). The operation_id should be unique within the database, and must be a valid identifier: *[a-z][a-z0-9_]**. More information can be found in the documentation of updateDdl API

For parameter definition take a look at `CloudSpannerInstanceDatabaseUpdateOperator`.

Arguments

Some arguments in the example DAG are taken from environment variables.

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
GCP_SPANNER_INSTANCE_ID = os.environ.get('GCP_SPANNER_INSTANCE_ID', 'testinstance')
GCP_SPANNER_DATABASE_ID = os.environ.get('GCP_SPANNER_DATABASE_ID', 'testdatabase')
GCP_SPANNER_CONFIG_NAME = os.environ.get('GCP_SPANNER_CONFIG_NAME',
                                         'projects/example-project/instanceConfigs/
↪eur3')
GCP_SPANNER_NODE_COUNT = os.environ.get('GCP_SPANNER_NODE_COUNT', '1')
GCP_SPANNER_DISPLAY_NAME = os.environ.get('GCP_SPANNER_DISPLAY_NAME', 'Test Instance')
# OPERATION_ID should be unique per operation
OPERATION_ID = 'unique_operation_id'
```

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
spanner_database_update_task = CloudSpannerInstanceDatabaseUpdateOperator(
    project_id=GCP_PROJECT_ID,
    instance_id=GCP_SPANNER_INSTANCE_ID,
    database_id=GCP_SPANNER_DATABASE_ID,
    ddl_statements=[
        "CREATE TABLE my_table3 (id INT64, name STRING(MAX)) PRIMARY KEY (id)",
    ],
    task_id='spanner_database_update_task'
)
```

```
spanner_database_update_idempotent1_task = CloudSpannerInstanceDatabaseUpdateOperator(
    project_id=GCP_PROJECT_ID,
    instance_id=GCP_SPANNER_INSTANCE_ID,
    database_id=GCP_SPANNER_DATABASE_ID,
    operation_id=OPERATION_ID,
    ddl_statements=[
        "CREATE TABLE my_table_unique (id INT64, name STRING(MAX)) PRIMARY KEY (id)",
    ],
    task_id='spanner_database_update_idempotent1_task'
)
spanner_database_update_idempotent2_task = CloudSpannerInstanceDatabaseUpdateOperator(
    instance_id=GCP_SPANNER_INSTANCE_ID,
    database_id=GCP_SPANNER_DATABASE_ID,
    operation_id=OPERATION_ID,
    ddl_statements=[
        "CREATE TABLE my_table_unique (id INT64, name STRING(MAX)) PRIMARY KEY (id)",
    ],
    task_id='spanner_database_update_idempotent2_task'
)
```

Templating

```
template_fields = ('project_id', 'instance_id', 'database_id', 'ddl_statements',
                   'gcp_conn_id')
template_ext = ('.sql', )
```

More information

See Google Cloud Spanner API documentation for database update_ddl.

CloudSpannerInstanceDatabaseQueryOperator

Executes an arbitrary DML query (INSERT, UPDATE, DELETE).

For parameter definition take a look at `CloudSpannerInstanceDatabaseQueryOperator`.

Arguments

Some arguments in the example DAG are taken from environment variables.

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
GCP_SPANNER_INSTANCE_ID = os.environ.get('GCP_SPANNER_INSTANCE_ID', 'testinstance')
GCP_SPANNER_DATABASE_ID = os.environ.get('GCP_SPANNER_DATABASE_ID', 'testdatabase')
GCP_SPANNER_CONFIG_NAME = os.environ.get('GCP_SPANNER_CONFIG_NAME',
                                         'projects/example-project/instanceConfigs/
↪eur3')
GCP_SPANNER_NODE_COUNT = os.environ.get('GCP_SPANNER_NODE_COUNT', '1')
GCP_SPANNER_DISPLAY_NAME = os.environ.get('GCP_SPANNER_DISPLAY_NAME', 'Test Instance')
# OPERATION_ID should be unique per operation
OPERATION_ID = 'unique_operation_id'
```

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
spanner_instance_query_task = CloudSpannerInstanceDatabaseQueryOperator(
    project_id=GCP_PROJECT_ID,
    instance_id=GCP_SPANNER_INSTANCE_ID,
    database_id=GCP_SPANNER_DATABASE_ID,
    query=["DELETE FROM my_table2 WHERE true"],
    task_id='spanner_instance_query_task'
)
spanner_instance_query_task2 = CloudSpannerInstanceDatabaseQueryOperator(
    instance_id=GCP_SPANNER_INSTANCE_ID,
    database_id=GCP_SPANNER_DATABASE_ID,
    query=["DELETE FROM my_table2 WHERE true"],
    task_id='spanner_instance_query_task2'
)
```

Templating

```
template_fields = ('project_id', 'instance_id', 'database_id', 'query', 'gcp_conn_id')
template_ext = ('.sql',)
```

More information

See Google Cloud Spanner API documentation for the DML syntax.

CloudSpannerInstanceDeleteOperator

Deletes a Cloud Spanner instance. If an instance does not exist, no action is taken, and the operator succeeds.

For parameter definition take a look at `CloudSpannerInstanceDeleteOperator`.

Arguments

Some arguments in the example DAG are taken from environment variables:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
GCP_SPANNER_INSTANCE_ID = os.environ.get('GCP_SPANNER_INSTANCE_ID', 'testinstance')
GCP_SPANNER_DATABASE_ID = os.environ.get('GCP_SPANNER_DATABASE_ID', 'testdatabase')
GCP_SPANNER_CONFIG_NAME = os.environ.get('GCP_SPANNER_CONFIG_NAME',
                                         'projects/example-project/instanceConfigs/
↪eur3')
GCP_SPANNER_NODE_COUNT = os.environ.get('GCP_SPANNER_NODE_COUNT', '1')
GCP_SPANNER_DISPLAY_NAME = os.environ.get('GCP_SPANNER_DISPLAY_NAME', 'Test Instance')
# OPERATION_ID should be unique per operation
OPERATION_ID = 'unique_operation_id'
```

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
spanner_instance_delete_task = CloudSpannerInstanceDeleteOperator(
    project_id=GCP_PROJECT_ID,
    instance_id=GCP_SPANNER_INSTANCE_ID,
    task_id='spanner_instance_delete_task'
)
spanner_instance_delete_task2 = CloudSpannerInstanceDeleteOperator(
    instance_id=GCP_SPANNER_INSTANCE_ID,
    task_id='spanner_instance_delete_task2'
)
```

Templating

```
template_fields = ('project_id', 'instance_id', 'gcp_conn_id')
```

More information

See Google Cloud Spanner API documentation for instance delete.

3.6.3.8 Google Cloud Sql Operators

CloudSqlInstanceDatabaseCreateOperator

Creates a new database inside a Cloud SQL instance.

For parameter definition, take a look at `CloudSqlInstanceDatabaseCreateOperator`.

Arguments

Some arguments in the example DAG are taken from environment variables:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
INSTANCE_NAME = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME', 'test-mysql')
INSTANCE_NAME2 = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME2', 'test-mysql2')
DB_NAME = os.environ.get('GCSQL_MYSQL_DATABASE_NAME', 'testdb')
```

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
sql_db_create_task = CloudSqlInstanceDatabaseCreateOperator(
    project_id=GCP_PROJECT_ID,
    body=db_create_body,
    instance=INSTANCE_NAME,
    task_id='sql_db_create_task'
)
sql_db_create_task2 = CloudSqlInstanceDatabaseCreateOperator(
    body=db_create_body,
    instance=INSTANCE_NAME,
    task_id='sql_db_create_task2'
)
```

Example request body:

```
db_create_body = {
    "instance": INSTANCE_NAME,
    "name": DB_NAME,
    "project": GCP_PROJECT_ID
}
```

Templating

```
template_fields = ('project_id', 'instance', 'gcp_conn_id', 'api_version')
```

More information

See Google Cloud SQL API documentation for database insert.

CloudSqlInstanceDatabaseDeleteOperator

Deletes a database from a Cloud SQL instance.

For parameter definition, take a look at `CloudSqlInstanceDatabaseDeleteOperator`.

Arguments

Some arguments in the example DAG are taken from environment variables:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
INSTANCE_NAME = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME', 'test-mysql')
INSTANCE_NAME2 = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME2', 'test-mysql2')
DB_NAME = os.environ.get('GCSQL_MYSQL_DATABASE_NAME', 'testdb')
```

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
sql_db_delete_task = CloudSqlInstanceDatabaseDeleteOperator(
    project_id=GCP_PROJECT_ID,
    instance=INSTANCE_NAME,
    database=DB_NAME,
    task_id='sql_db_delete_task'
)
sql_db_delete_task2 = CloudSqlInstanceDatabaseDeleteOperator(
    instance=INSTANCE_NAME,
    database=DB_NAME,
    task_id='sql_db_delete_task2'
)
```

Templating

```
template_fields = ('project_id', 'instance', 'database', 'gcp_conn_id',
                   'api_version')
```

More information

See Google Cloud SQL API documentation for database delete.

CloudSqlInstanceDatabasePatchOperator

Updates a resource containing information about a database inside a Cloud SQL instance using patch semantics. See: https://cloud.google.com/sql/docs/mysql/admin-api/how-tos/performance#patch

For parameter definition, take a look at `CloudSqlInstanceDatabasePatchOperator`.

Arguments

Some arguments in the example DAG are taken from environment variables:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
INSTANCE_NAME = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME', 'test-mysql')
INSTANCE_NAME2 = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME2', 'test-mysql2')
DB_NAME = os.environ.get('GCSQL_MYSQL_DATABASE_NAME', 'testdb')
```

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
sql_db_patch_task = CloudSqlInstanceDatabasePatchOperator(
    project_id=GCP_PROJECT_ID,
    body=db_patch_body,
    instance=INSTANCE_NAME,
    database=DB_NAME,
    task_id='sql_db_patch_task'
)
sql_db_patch_task2 = CloudSqlInstanceDatabasePatchOperator(
    body=db_patch_body,
    instance=INSTANCE_NAME,
    database=DB_NAME,
    task_id='sql_db_patch_task2'
)
```

Example request body:

```
db_patch_body = {
    "charset": "utf16",
    "collation": "utf16_general_ci"
}
```

Templating

```
template_fields = ('project_id', 'instance', 'database', 'gcp_conn_id',
                   'api_version')
```

More information

See Google Cloud SQL API documentation for database patch.

CloudSqlInstanceDeleteOperator

Deletes a Cloud SQL instance in Google Cloud Platform.

For parameter definition, take a look at `CloudSqlInstanceDeleteOperator`.

Arguments

Some arguments in the example DAG are taken from OS environment variables:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
INSTANCE_NAME = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME', 'test-mysql')
INSTANCE_NAME2 = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME2', 'test-mysql2')
DB_NAME = os.environ.get('GCSQL_MYSQL_DATABASE_NAME', 'testdb')
```

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
sql_instance_delete_task = CloudSqlInstanceDeleteOperator(
    project_id=GCP_PROJECT_ID,
    instance=INSTANCE_NAME,
    task_id='sql_instance_delete_task'
)
sql_instance_delete_task2 = CloudSqlInstanceDeleteOperator(
    instance=INSTANCE_NAME2,
    task_id='sql_instance_delete_task2'
)
```

Templating

```
template_fields = ('project_id', 'instance', 'gcp_conn_id', 'api_version')
```

More information

See Google Cloud SQL API documentation for delete.

CloudSqlInstanceExportOperator

Exports data from a Cloud SQL instance to a Cloud Storage bucket as a SQL dump or CSV file.

Note: This operator is idempotent. If executed multiple times with the same export file URI, the export file in GCS will simply be overridden.

For parameter definition take a look at `CloudSqlInstanceExportOperator`.

Arguments

Some arguments in the example DAG are taken from Airflow variables:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
INSTANCE_NAME = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME', 'test-mysql')
INSTANCE_NAME2 = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME2', 'test-mysql2')
DB_NAME = os.environ.get('GCSQL_MYSQL_DATABASE_NAME', 'testdb')
```

```
EXPORT_URI = os.environ.get('GCSQL_MYSQL_EXPORT_URI', 'gs://bucketName/fileName')
IMPORT_URI = os.environ.get('GCSQL_MYSQL_IMPORT_URI', 'gs://bucketName/fileName')
```

Example body defining the export operation:

```
export_body = {
    "exportContext": {
        "fileType": "sql",
        "uri": EXPORT_URI,
        "sqlExportOptions": {
            "schemaOnly": False
        }
    }
}
```

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
sql_export_task = CloudSqlInstanceExportOperator(
    project_id=GCP_PROJECT_ID,
    body=export_body,
    instance=INSTANCE_NAME,
    task_id='sql_export_task'
)
sql_export_task2 = CloudSqlInstanceExportOperator(
    body=export_body,
    instance=INSTANCE_NAME,
    task_id='sql_export_task2'
)
```

Templating

```
template_fields = ('project_id', 'instance', 'gcp_conn_id', 'api_version')
```

More information

See Google Cloud SQL API documentation for export.

Troubleshooting

If you receive an “Unauthorized” error in GCP, make sure that the service account of the Cloud SQL instance is authorized to write to the selected GCS bucket.

It is not the service account configured in Airflow that communicates with GCS, but rather the service account of the particular Cloud SQL instance.

To grant the service account with the appropriate WRITE permissions for the GCS bucket you can use the *GoogleCloudStorageBucketCreateAclEntryOperator*, as shown in the example:

```
sql_gcp_add_bucket_permission_task = GoogleCloudStorageBucketCreateAclEntryOperator(
    entity="user-{{ task_instance.xcom_pull("
           "'sql_instance_create_task', key='service_account_email') "
           "}}",
    role="WRITER",
    bucket=export_url_split[1],  # netloc (bucket)
    task_id='sql_gcp_add_bucket_permission_task'
)
```

CloudSqlInstanceImportOperator

Imports data into a Cloud SQL instance from a SQL dump or CSV file in Cloud Storage.

CSV import:

This operator is NOT idempotent for a CSV import. If the same file is imported multiple times, the imported data will be duplicated in the database. Moreover, if there are any unique constraints the duplicate import may result in an error.

SQL import:

This operator is idempotent for a SQL import if it was also exported by Cloud SQL. The exported SQL contains 'DROP TABLE IF EXISTS' statements for all tables to be imported.

If the import file was generated in a different way, idempotence is not guaranteed. It has to be ensured on the SQL file level.

For parameter definition take a look at `CloudSqlInstanceImportOperator`.

Arguments

Some arguments in the example DAG are taken from Airflow variables:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
INSTANCE_NAME = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME', 'test-mysql')
INSTANCE_NAME2 = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME2', 'test-mysql2')
DB_NAME = os.environ.get('GCSQL_MYSQL_DATABASE_NAME', 'testdb')
```

```
EXPORT_URI = os.environ.get('GCSQL_MYSQL_EXPORT_URI', 'gs://bucketName/fileName')
IMPORT_URI = os.environ.get('GCSQL_MYSQL_IMPORT_URI', 'gs://bucketName/fileName')
```

Example body defining the import operation:

```
import_body = {
    "importContext": {
        "fileType": "sql",
        "uri": IMPORT_URI
    }
}
```

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
sql_import_task = CloudSqlInstanceImportOperator(
    project_id=GCP_PROJECT_ID,
    body=import_body,
    instance=INSTANCE_NAME2,
    task_id='sql_import_task'
)
sql_import_task2 = CloudSqlInstanceImportOperator(
    body=import_body,
    instance=INSTANCE_NAME2,
    task_id='sql_import_task2'
)
```

Templating

```
template_fields = ('project_id', 'instance', 'gcp_conn_id', 'api_version')
```

More information

See Google Cloud SQL API documentation for import.

Troubleshooting

If you receive an "Unauthorized" error in GCP, make sure that the service account of the Cloud SQL instance is authorized to read from the selected GCS object.

It is not the service account configured in Airflow that communicates with GCS, but rather the service account of the particular Cloud SQL instance.

To grant the service account with the appropriate READ permissions for the GCS object you can use the *GoogleCloudStorageObjectCreateAclEntryOperator*, as shown in the example:

```
sql_gcp_add_object_permission_task = GoogleCloudStorageObjectCreateAclEntryOperator(
    entity="user-{{ task_instance.xcom_pull("
           "'sql_instance_create_task2', key='service_account_email')"
           " }}",
    role="READER",
    bucket=import_url_split[1],  # netloc (bucket)
    object_name=import_url_split[2][1:],  # path (strip first '/')
    task_id='sql_gcp_add_object_permission_task',
)
prev_task = next_dep(sql_gcp_add_object_permission_task, prev_task)

# For import to work we also need to add the Cloud SQL instance's Service Account
# write access to the whole bucket!.
sql_gcp_add_bucket_permission_2_task = GoogleCloudStorageBucketCreateAclEntryOperator(
    entity="user-{{ task_instance.xcom_pull("
           "'sql_instance_create_task2', key='service_account_email') "
```

(continues on next page)

(continued from previous page)

```
            "}}",
    role="WRITER",
    bucket=import_url_split[1],  # netloc
    task_id='sql_gcp_add_bucket_permission_2_task',
)
```

CloudSqlInstanceCreateOperator

Creates a new Cloud SQL instance in Google Cloud Platform.

For parameter definition, take a look at `CloudSqlInstanceCreateOperator`.

If an instance with the same name exists, no action will be taken and the operator will succeed.

Arguments

Some arguments in the example DAG are taken from OS environment variables:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
INSTANCE_NAME = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME', 'test-mysql')
INSTANCE_NAME2 = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME2', 'test-mysql2')
DB_NAME = os.environ.get('GCSQL_MYSQL_DATABASE_NAME', 'testdb')
```

Example body defining the instance:

```
body = {
    "name": INSTANCE_NAME,
    "settings": {
        "tier": "db-n1-standard-1",
        "backupConfiguration": {
            "binaryLogEnabled": True,
            "enabled": True,
            "startTime": "05:00"
        },
        "activationPolicy": "ALWAYS",
        "dataDiskSizeGb": 30,
        "dataDiskType": "PD_SSD",
        "databaseFlags": [],
        "ipConfiguration": {
            "ipv4Enabled": True,
            "requireSsl": True,
        },
        "locationPreference": {
            "zone": "europe-west4-a"
        },
        "maintenanceWindow": {
            "hour": 5,
            "day": 7,
            "updateTrack": "canary"
        },
        "pricingPlan": "PER_USE",
        "replicationType": "ASYNCHRONOUS",
        "storageAutoResize": False,
        "storageAutoResizeLimit": 0,
```

(continues on next page)

(continued from previous page)

```
        "userLabels": {
            "my-key": "my-value"
        }
    },
    "databaseVersion": "MYSQL_5_7",
    "region": "europe-west4",
}
```

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
sql_instance_create_task = CloudSqlInstanceCreateOperator(
    project_id=GCP_PROJECT_ID,
    body=body,
    instance=INSTANCE_NAME,
    task_id='sql_instance_create_task'
)
```

Templating

```
template_fields = ('project_id', 'instance', 'gcp_conn_id', 'api_version')
```

More information

See Google Cloud SQL API documentation for insert.

CloudSqlInstancePatchOperator

Updates settings of a Cloud SQL instance in Google Cloud Platform (partial update).

For parameter definition, take a look at `CloudSqlInstancePatchOperator`.

This is a partial update, so only values for the settings specified in the body will be set / updated. The rest of the existing instance's configuration will remain unchanged.

Arguments

Some arguments in the example DAG are taken from OS environment variables:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
INSTANCE_NAME = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME', 'test-mysql')
INSTANCE_NAME2 = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME2', 'test-mysql2')
DB_NAME = os.environ.get('GCSQL_MYSQL_DATABASE_NAME', 'testdb')
```

Example body defining the instance:

```
patch_body = {
    "name": INSTANCE_NAME,
    "settings": {
        "dataDiskSizeGb": 35,
        "maintenanceWindow": {
            "hour": 3,
            "day": 6,
            "updateTrack": "canary"
        },
        "userLabels": {
            "my-key-patch": "my-value-patch"
        }
    }
}
```

Using the operator

You can create the operator with or without project id. If project id is missing it will be retrieved from the GCP connection used. Both variants are shown:

```
sql_instance_patch_task = CloudSqlInstancePatchOperator(
    project_id=GCP_PROJECT_ID,
    body=patch_body,
    instance=INSTANCE_NAME,
    task_id='sql_instance_patch_task'
)

sql_instance_patch_task2 = CloudSqlInstancePatchOperator(
    body=patch_body,
    instance=INSTANCE_NAME,
    task_id='sql_instance_patch_task2'
)
```

Templating

```
template_fields = ('project_id', 'instance', 'gcp_conn_id', 'api_version')
```

More information

See Google Cloud SQL API documentation for patch.

CloudSqlQueryOperator

Performs DDL or DML SQL queries in Google Cloud SQL instance. The DQL (retrieving data from Google Cloud SQL) is not supported. You might run the SELECT queries, but the results of those queries are discarded.

You can specify various connectivity methods to connect to running instance, starting from public IP plain connection through public IP with SSL or both TCP and socket connection via Cloud SQL Proxy. The proxy is downloaded and started/stopped dynamically as needed by the operator.

There is a *gcpcloudsql://* connection type that you should use to define what kind of connectivity you want the operator to use. The connection is a "meta" type of connection. It is not used to make an actual connectivity on its own, but it determines whether Cloud SQL Proxy should be started by *CloudSqlDatabaseHook* and what kind of database connection (Postgres or MySQL) should be created dynamically to connect to Cloud SQL via public IP address or via the proxy. The 'CloudSqlDatabaseHook' uses `CloudSqlProxyRunner` to manage Cloud SQL Proxy lifecycle (each task has its own Cloud SQL Proxy)

When you build connection, you should use connection parameters as described in `CloudSqlDatabaseHook`. You can see examples of connections below for all the possible types of connectivity. Such connection can be reused between different tasks (instances of *CloudSqlQueryOperator*). Each task will get their own proxy started if needed with their own TCP or UNIX socket.

For parameter definition, take a look at `CloudSqlQueryOperator`.

Since query operator can run arbitrary query, it cannot be guaranteed to be idempotent. SQL query designer should design the queries to be idempotent. For example, both Postgres and MySQL support CREATE TABLE IF NOT EXISTS statements that can be used to create tables in an idempotent way.

Arguments

If you define connection via *AIRFLOW_CONN_** URL defined in an environment variable, make sure the URL components in the URL are URL-encoded. See examples below for details.

Note that in case of SSL connections you need to have a mechanism to make the certificate/key files available in predefined locations for all the workers on which the operator can run. This can be provided for example by mounting NFS-like volumes in the same path for all the workers.

Some arguments in the example DAG are taken from the OS environment variables:

```
GCP_PROJECT_ID = os.environ.get('GCP_PROJECT_ID', 'example-project')
GCP_REGION = os.environ.get('GCP_REGION', 'europe-west-1b')

GCSQL_POSTGRES_INSTANCE_NAME_QUERY = os.environ.get(
    'GCSQL_POSTGRES_INSTANCE_NAME_QUERY',
    'testpostgres')
GCSQL_POSTGRES_DATABASE_NAME = os.environ.get('GCSQL_POSTGRES_DATABASE_NAME',
                                              'postgresdb')
GCSQL_POSTGRES_USER = os.environ.get('GCSQL_POSTGRES_USER', 'postgres_user')
GCSQL_POSTGRES_PASSWORD = os.environ.get('GCSQL_POSTGRES_PASSWORD', 'password')
GCSQL_POSTGRES_PUBLIC_IP = os.environ.get('GCSQL_POSTGRES_PUBLIC_IP', '0.0.0.0')
GCSQL_POSTGRES_PUBLIC_PORT = os.environ.get('GCSQL_POSTGRES_PUBLIC_PORT', 5432)
GCSQL_POSTGRES_CLIENT_CERT_FILE = os.environ.get('GCSQL_POSTGRES_CLIENT_CERT_FILE',
                                                 ".key/postgres-client-cert.pem")
GCSQL_POSTGRES_CLIENT_KEY_FILE = os.environ.get('GCSQL_POSTGRES_CLIENT_KEY_FILE',
                                                ".key/postgres-client-key.pem")
GCSQL_POSTGRES_SERVER_CA_FILE = os.environ.get('GCSQL_POSTGRES_SERVER_CA_FILE',
                                               ".key/postgres-server-ca.pem")

GCSQL_MYSQL_INSTANCE_NAME_QUERY = os.environ.get('GCSQL_MYSQL_INSTANCE_NAME_QUERY',
                                                 'testmysql')
GCSQL_MYSQL_DATABASE_NAME = os.environ.get('GCSQL_MYSQL_DATABASE_NAME', 'mysqldb')
GCSQL_MYSQL_USER = os.environ.get('GCSQL_MYSQL_USER', 'mysql_user')
GCSQL_MYSQL_PASSWORD = os.environ.get('GCSQL_MYSQL_PASSWORD', 'password')
GCSQL_MYSQL_PUBLIC_IP = os.environ.get('GCSQL_MYSQL_PUBLIC_IP', '0.0.0.0')
GCSQL_MYSQL_PUBLIC_PORT = os.environ.get('GCSQL_MYSQL_PUBLIC_PORT', 3306)
GCSQL_MYSQL_CLIENT_CERT_FILE = os.environ.get('GCSQL_MYSQL_CLIENT_CERT_FILE',
```

(continues on next page)

(continued from previous page)

```
                                              ".key/mysql-client-cert.pem")
GCSQL_MYSQL_CLIENT_KEY_FILE = os.environ.get('GCSQL_MYSQL_CLIENT_KEY_FILE',
                                             ".key/mysql-client-key.pem")
GCSQL_MYSQL_SERVER_CA_FILE = os.environ.get('GCSQL_MYSQL_SERVER_CA_FILE',
                                            ".key/mysql-server-ca.pem")

SQL = [
    'CREATE TABLE IF NOT EXISTS TABLE_TEST (I INTEGER)',
    'CREATE TABLE IF NOT EXISTS TABLE_TEST (I INTEGER)',  # shows warnings logged
    'INSERT INTO TABLE_TEST VALUES (0)',
    'CREATE TABLE IF NOT EXISTS TABLE_TEST2 (I INTEGER)',
    'DROP TABLE TABLE_TEST',
    'DROP TABLE TABLE_TEST2',
]
```

Example connection definitions for all connectivity cases. Note that all the components of the connection URI should be URL-encoded:

```

HOME_DIR = expanduser("~")


def get_absolute_path(path):
    if path.startswith("/"):
        return path
    else:
        return os.path.join(HOME_DIR, path)


postgres_kwargs = dict(
    user=quote_plus(GCSQL_POSTGRES_USER),
    password=quote_plus(GCSQL_POSTGRES_PASSWORD),
    public_port=GCSQL_POSTGRES_PUBLIC_PORT,
    public_ip=quote_plus(GCSQL_POSTGRES_PUBLIC_IP),
    project_id=quote_plus(GCP_PROJECT_ID),
    location=quote_plus(GCP_REGION),
    instance=quote_plus(GCSQL_POSTGRES_INSTANCE_NAME_QUERY),
    database=quote_plus(GCSQL_POSTGRES_DATABASE_NAME),
    client_cert_file=quote_plus(get_absolute_path(GCSQL_POSTGRES_CLIENT_CERT_FILE)),
    client_key_file=quote_plus(get_absolute_path(GCSQL_POSTGRES_CLIENT_KEY_FILE)),
    server_ca_file=quote_plus(get_absolute_path(GCSQL_POSTGRES_SERVER_CA_FILE))
)

# The connections below are created using one of the standard approaches - via␣
↪environment
# variables named AIRFLOW_CONN_* . The connections can also be created in the database
# of AIRFLOW (using command line or UI).

# Postgres: connect via proxy over TCP
os.environ['AIRFLOW_CONN_PROXY_POSTGRES_TCP'] = \
    "gcpcloudsql://{user}:{password}@{public_ip}:{public_port}/{database}?" \
    "database_type=postgres&" \
    "project_id={project_id}&" \
    "location={location}&" \
    "instance={instance}&" \
```

(continues on next page)

(continued from previous page)

```
    "use_proxy=True&" \
    "sql_proxy_use_tcp=True".format(**postgres_kwargs)

# Postgres: connect via proxy over UNIX socket (specific proxy version)
os.environ['AIRFLOW_CONN_PROXY_POSTGRES_SOCKET'] = \
    "gcpcloudsql://{user}:{password}@{public_ip}:{public_port}/{database}?" \
    "database_type=postgres&" \
    "project_id={project_id}&" \
    "location={location}&" \
    "instance={instance}&" \
    "use_proxy=True&" \
    "sql_proxy_version=v1.13&" \
    "sql_proxy_use_tcp=False".format(**postgres_kwargs)

# Postgres: connect directly via TCP (non-SSL)
os.environ['AIRFLOW_CONN_PUBLIC_POSTGRES_TCP'] = \
    "gcpcloudsql://{user}:{password}@{public_ip}:{public_port}/{database}?" \
    "database_type=postgres&" \
    "project_id={project_id}&" \
    "location={location}&" \
    "instance={instance}&" \
    "use_proxy=False&" \
    "use_ssl=False".format(**postgres_kwargs)

# Postgres: connect directly via TCP (SSL)
os.environ['AIRFLOW_CONN_PUBLIC_POSTGRES_TCP_SSL'] = \
    "gcpcloudsql://{user}:{password}@{public_ip}:{public_port}/{database}?" \
    "database_type=postgres&" \
    "project_id={project_id}&" \
    "location={location}&" \
    "instance={instance}&" \
    "use_proxy=False&" \
    "use_ssl=True&" \
    "sslcert={client_cert_file}&" \
    "sslkey={client_key_file}&" \
    "sslrootcert={server_ca_file}"\
    .format(**postgres_kwargs)

mysql_kwargs = dict(
    user=quote_plus(GCSQL_MYSQL_USER),
    password=quote_plus(GCSQL_MYSQL_PASSWORD),
    public_port=GCSQL_MYSQL_PUBLIC_PORT,
    public_ip=quote_plus(GCSQL_MYSQL_PUBLIC_IP),
    project_id=quote_plus(GCP_PROJECT_ID),
    location=quote_plus(GCP_REGION),
    instance=quote_plus(GCSQL_MYSQL_INSTANCE_NAME_QUERY),
    database=quote_plus(GCSQL_MYSQL_DATABASE_NAME),
    client_cert_file=quote_plus(get_absolute_path(GCSQL_MYSQL_CLIENT_CERT_FILE)),
    client_key_file=quote_plus(get_absolute_path(GCSQL_MYSQL_CLIENT_KEY_FILE)),
    server_ca_file=quote_plus(get_absolute_path(GCSQL_MYSQL_SERVER_CA_FILE))
)

# MySQL: connect via proxy over TCP (specific proxy version)
os.environ['AIRFLOW_CONN_PROXY_MYSQL_TCP'] = \
    "gcpcloudsql://{user}:{password}@{public_ip}:{public_port}/{database}?" \
    "database_type=mysql&" \
    "project_id={project_id}&" \
```

(continues on next page)

(continued from previous page)

```
    "location={location}&" \
    "instance={instance}&" \
    "use_proxy=True&" \
    "sql_proxy_version=v1.13&" \
    "sql_proxy_use_tcp=True".format(**mysql_kwargs)

# MySQL: connect via proxy over UNIX socket using pre-downloaded Cloud Sql Proxy␣
↪binary
try:
    sql_proxy_binary_path = subprocess.check_output(
        ['which', 'cloud_sql_proxy']).decode('utf-8').rstrip()
except subprocess.CalledProcessError:
    sql_proxy_binary_path = "/tmp/anyhow_download_cloud_sql_proxy"

os.environ['AIRFLOW_CONN_PROXY_MYSQL_SOCKET'] = \
    "gcpcloudsql://{user}:{password}@{public_ip}:{public_port}/{database}?" \
    "database_type=mysql&" \
    "project_id={project_id}&" \
    "location={location}&" \
    "instance={instance}&" \
    "use_proxy=True&" \
    "sql_proxy_binary_path={sql_proxy_binary_path}&" \
    "sql_proxy_use_tcp=False".format(
        sql_proxy_binary_path=quote_plus(sql_proxy_binary_path), **mysql_kwargs)

# MySQL: connect directly via TCP (non-SSL)
os.environ['AIRFLOW_CONN_PUBLIC_MYSQL_TCP'] = \
    "gcpcloudsql://{user}:{password}@{public_ip}:{public_port}/{database}?" \
    "database_type=mysql&" \
    "project_id={project_id}&" \
    "location={location}&" \
    "instance={instance}&" \
    "use_proxy=False&" \
    "use_ssl=False".format(**mysql_kwargs)

# MySQL: connect directly via TCP (SSL) and with fixed Cloud Sql Proxy binary path
os.environ['AIRFLOW_CONN_PUBLIC_MYSQL_TCP_SSL'] = \
    "gcpcloudsql://{user}:{password}@{public_ip}:{public_port}/{database}?" \
    "database_type=mysql&" \
    "project_id={project_id}&" \
    "location={location}&" \
    "instance={instance}&" \
    "use_proxy=False&" \
    "use_ssl=True&" \
    "sslcert={client_cert_file}&" \
    "sslkey={client_key_file}&" \
    "sslrootcert={server_ca_file}".format(**mysql_kwargs)

# Special case: MySQL: connect directly via TCP (SSL) and with fixed Cloud Sql
# Proxy binary path AND with missing project_id

os.environ['AIRFLOW_CONN_PUBLIC_MYSQL_TCP_SSL_NO_PROJECT_ID'] = \
    "gcpcloudsql://{user}:{password}@{public_ip}:{public_port}/{database}?" \
    "database_type=mysql&" \
    "location={location}&" \
    "instance={instance}&" \
    "use_proxy=False&" \
```

(continues on next page)

(continued from previous page)

```
    "use_ssl=True&" \
    "sslcert={client_cert_file}&" \
    "sslkey={client_key_file}&" \
    "sslrootcert={server_ca_file}".format(**mysql_kwargs)
```

Using the operator

Example operators below are using all connectivity options. Note connection id from the operator matches the *AIRFLOW_CONN_** postfix uppercase. This is standard AIRFLOW notation for defining connection via environment variables):

```
connection_names = [
    "proxy_postgres_tcp",
    "proxy_postgres_socket",
    "public_postgres_tcp",
    "public_postgres_tcp_ssl",
    "proxy_mysql_tcp",
    "proxy_mysql_socket",
    "public_mysql_tcp",
    "public_mysql_tcp_ssl",
    "public_mysql_tcp_ssl_no_project_id"
]

tasks = []


with models.DAG(
    dag_id='example_gcp_sql_query',
    default_args=default_args,
    schedule_interval=None
) as dag:
    prev_task = None

    for connection_name in connection_names:
        task = CloudSqlQueryOperator(
            gcp_cloudsql_conn_id=connection_name,
            task_id="example_gcp_sql_task_" + connection_name,
            sql=SQL
        )
        tasks.append(task)
        if prev_task:
            prev_task >> task
        prev_task = task
```

Templating

```
template_fields = ('sql', 'gcp_cloudsql_conn_id', 'gcp_conn_id')
template_ext = ('.sql',)
```

More information

See Google Cloud SQL Proxy documentation.

3.6.3.9 Google Cloud Storage Operators

GoogleCloudStorageBucketCreateAclEntryOperator

Creates a new ACL entry on the specified bucket.

For parameter definition, take a look at *GoogleCloudStorageBucketCreateAclEntryOperator*

Arguments

Some arguments in the example DAG are taken from the OS environment variables:

```
GCS_ACL_BUCKET = os.environ.get('GCS_ACL_BUCKET', 'example-bucket')
GCS_ACL_OBJECT = os.environ.get('GCS_ACL_OBJECT', 'example-object')
GCS_ACL_ENTITY = os.environ.get('GCS_ACL_ENTITY', 'example-entity')
GCS_ACL_BUCKET_ROLE = os.environ.get('GCS_ACL_BUCKET_ROLE', 'example-bucket-role')
GCS_ACL_OBJECT_ROLE = os.environ.get('GCS_ACL_OBJECT_ROLE', 'example-object-role')
```

Using the operator

```
gcs_bucket_create_acl_entry_task = GoogleCloudStorageBucketCreateAclEntryOperator(
    bucket=GCS_ACL_BUCKET,
    entity=GCS_ACL_ENTITY,
    role=GCS_ACL_BUCKET_ROLE,
    task_id="gcs_bucket_create_acl_entry_task"
)
```

Templating

```
template_fields = ('bucket', 'entity', 'role', 'user_project')
```

More information

See Google Cloud Storage BucketAccessControls insert documentation.

GoogleCloudStorageObjectCreateAclEntryOperator

Creates a new ACL entry on the specified object.

For parameter definition, take a look at *GoogleCloudStorageObjectCreateAclEntryOperator*

Arguments

Some arguments in the example DAG are taken from the OS environment variables:

```
GCS_ACL_BUCKET = os.environ.get('GCS_ACL_BUCKET', 'example-bucket')
GCS_ACL_OBJECT = os.environ.get('GCS_ACL_OBJECT', 'example-object')
GCS_ACL_ENTITY = os.environ.get('GCS_ACL_ENTITY', 'example-entity')
GCS_ACL_BUCKET_ROLE = os.environ.get('GCS_ACL_BUCKET_ROLE', 'example-bucket-role')
GCS_ACL_OBJECT_ROLE = os.environ.get('GCS_ACL_OBJECT_ROLE', 'example-object-role')
```

Using the operator

```
gcs_object_create_acl_entry_task = GoogleCloudStorageObjectCreateAclEntryOperator(
    bucket=GCS_ACL_BUCKET,
    object_name=GCS_ACL_OBJECT,
    entity=GCS_ACL_ENTITY,
    role=GCS_ACL_OBJECT_ROLE,
    task_id="gcs_object_create_acl_entry_task"
)
```

Templating

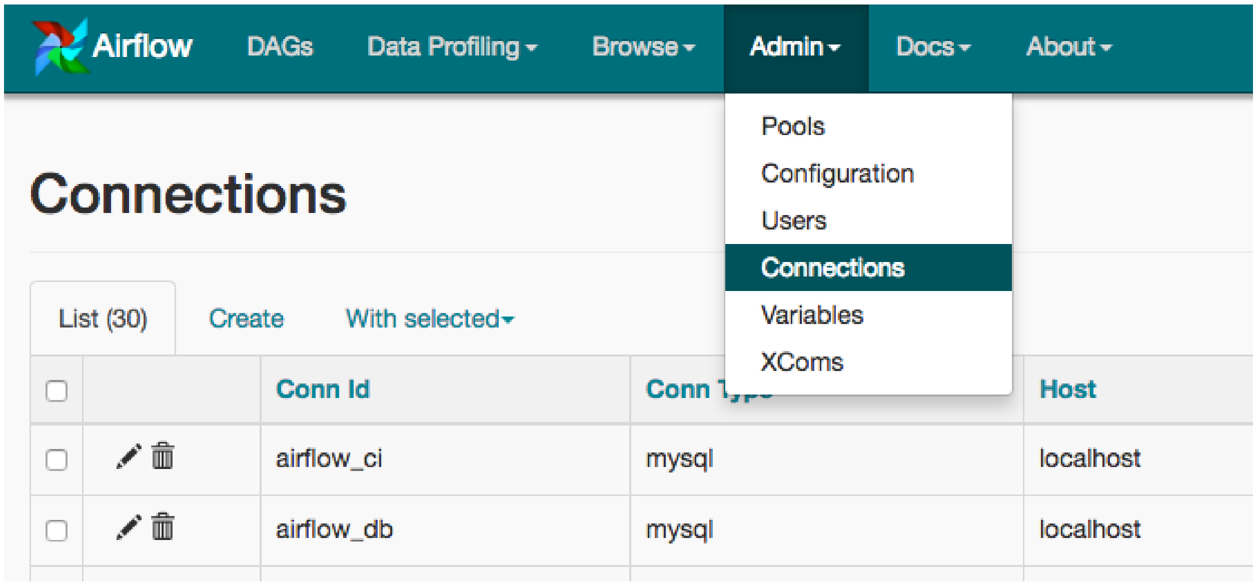
```
template_fields = ('bucket', 'object_name', 'entity', 'role', 'generation',
                   'user_project')
```

More information

See Google Cloud Storage ObjectAccessControls insert documentation

3.6.4 Managing Connections

Airflow needs to know how to connect to your environment. Information such as hostname, port, login and passwords to other systems and services is handled in the `Admin->Connections` section of the UI. The pipeline code you will author will reference the 'conn_id' of the Connection objects.



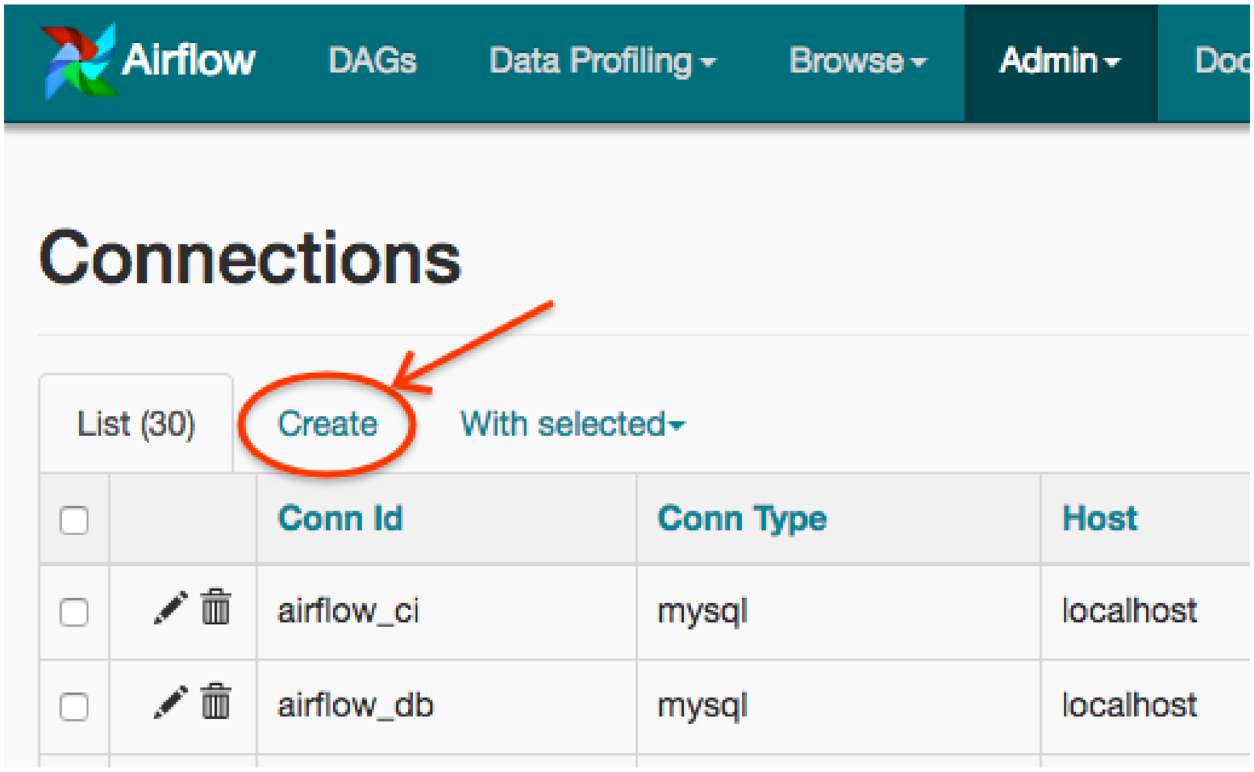
		Conn Id	Conn Type	Host
☐				
☐		airflow_ci	mysql	localhost
☐		airflow_db	mysql	localhost

Connections can be created and managed using either the UI or environment variables.

See the *Connections Concepts* documentation for more information.

3.6.4.1 Creating a Connection with the UI

Open the `Admin->Connections` section of the UI. Click the `Create` link to create a new connection.



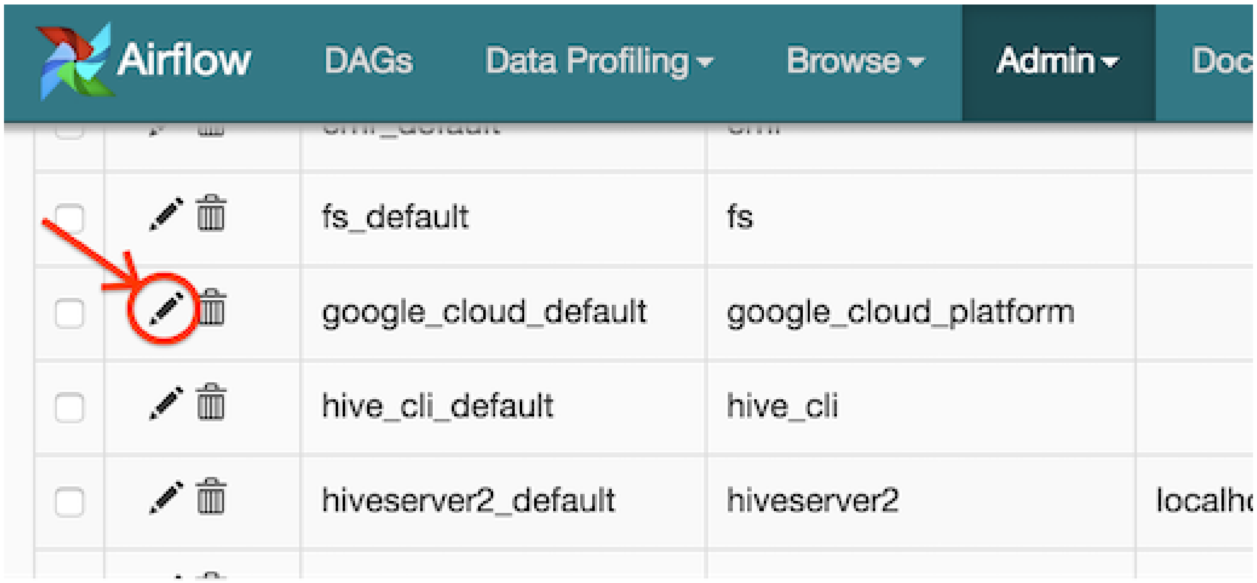
		Conn Id	Conn Type	Host
☐		airflow_ci	mysql	localhost
☐		airflow_db	mysql	localhost

1. Fill in the `Conn Id` field with the desired connection ID. It is recommended that you use lower-case characters and separate words with underscores.

2. Choose the connection type with the `Conn Type` field.
3. Fill in the remaining fields. See *Connection Types* for a description of the fields belonging to the different connection types.
4. Click the `Save` button to create the connection.

3.6.4.2 Editing a Connection with the UI

Open the `Admin->Connections` section of the UI. Click the pencil icon next to the connection you wish to edit in the connection list.



fs_default	fs		
google_cloud_default	google_cloud_platform		
hive_cli_default	hive_cli		
hiveserver2_default	hiveserver2	localh	

Modify the connection properties and click the `Save` button to save your changes.

3.6.4.3 Creating a Connection with Environment Variables

Connections in Airflow pipelines can be created using environment variables. The environment variable needs to have a prefix of `AIRFLOW_CONN_` for Airflow with the value in a URI format to use the connection properly.

When referencing the connection in the Airflow pipeline, the `conn_id` should be the name of the variable without the prefix. For example, if the `conn_id` is named `postgres_master` the environment variable should be named `AIRFLOW_CONN_POSTGRES_MASTER` (note that the environment variable must be all uppercase). Airflow assumes the value returned from the environment variable to be in a URI format (e.g. `postgres://user:password@localhost:5432/master` or `s3://accesskey:secretkey@S3`).

3.6.4.4 Connection Types

Google Cloud Platform

The Google Cloud Platform connection type enables the *GCP Integrations*.

Authenticating to GCP

There are two ways to connect to GCP using Airflow.

1. Use Application Default Credentials, such as via the metadata server when running on Google Compute Engine.
2. Use a service account key file (JSON format) on disk.

Default Connection IDs

The following connection IDs are used by default.

`bigquery_default` Used by the *`BigQueryHook`* hook.

`google_cloud_datastore_default` Used by the *`DatastoreHook`* hook.

`google_cloud_default` Used by the *`GoogleCloudBaseHook`*, *`DataFlowHook`*, *`DataProcHook`*, *`MLEngineHook`*, and *`GoogleCloudStorageHook`* hooks.

Configuring the Connection

Project Id (required) The Google Cloud project ID to connect to.

Keyfile Path Path to a service account key file (JSON format) on disk.

Not required if using application default credentials.

Keyfile JSON Contents of a service account key file (JSON format) on disk. It is recommended to *Secure your connections* if using this method to authenticate.

Not required if using application default credentials.

Scopes (comma separated) A list of comma-separated Google Cloud scopes to authenticate with.

Note: Scopes are ignored when using application default credentials. See issue AIRFLOW-2522.

MySQL

The MySQL connection type provides connection to a MySQL database.

Configuring the Connection

Host (required) The host to connect to.

Schema (optional) Specify the schema name to be used in the database.

Login (required) Specify the user name to connect.

Password (required) Specify the password to connect.

Extra (optional) Specify the extra parameters (as json dictionary) that can be used in MySQL connection. The following parameters are supported:

- **charset**: specify charset of the connection
- **cursor**: one of "sscursor", "dictcursor, "ssdictcursor" . Specifies cursor class to be used
- **local_infile**: controls MySQL's LOCAL capability (permitting local data loading by clients). See MySQLdb docs for details.
- **unix_socket**: UNIX socket used instead of the default socket.

- **ssl**: Dictionary of SSL parameters that control connecting using SSL. Those parameters are server specific and should contain "ca", "cert", "key", "capath", "cipher" parameters. See MySQLdb docs for details. Note that to be useful in URL notation, this parameter might also be a string where the SSL dictionary is a string-encoded JSON dictionary.

Example "extras" field:

```
{
   "charset": "utf8",
   "cursorclass": "sscursor",
   "local_infile": true,
   "unix_socket": "/var/socket",
   "ssl": {
     "cert": "/tmp/client-cert.pem",
     "ca": "/tmp/server-ca.pem'",
     "key": "/tmp/client-key.pem"
   }
}
```

or

```
{
   "charset": "utf8",
   "cursorclass": "sscursor",
   "local_infile": true,
   "unix_socket": "/var/socket",
   "ssl": "{\"cert\": \"/tmp/client-cert.pem\", \"ca\": \"/tmp/server-ca.pem\", \
↪"key\": \"/tmp/client-key.pem\"}"
}
```

When specifying the connection as URI (in AIRFLOW_CONN_* variable) you should specify it following the standard syntax of DB connections - where extras are passed as parameters of the URI. Note that all components of the URI should be URL-encoded.

For example:

```
mysql://mysql_user:XXXXXXXXXXXX@1.1.1.1:3306/mysqldb?ssl=%7B%22cert%22%3A+%22
↪%2Ftmp%2Fclient-cert.pem%22%2C+%22ca%22%3A+%22%2Ftmp%2Fserver-ca.pem%22%2C+
↪%22key%22%3A+%22%2Ftmp%2Fclient-key.pem%22%7D
```

Note: If encounter UnicodeDecodeError while working with MySQL connection, check the charset defined is matched to the database charset.

Postgres

The Postgres connection type provides connection to a Postgres database.

Configuring the Connection

Host (required) The host to connect to.

Schema (optional) Specify the schema name to be used in the database.

Login (required) Specify the user name to connect.

Password (required) Specify the password to connect.

Extra (optional) Specify the extra parameters (as json dictionary) that can be used in postgres connection. The following parameters out of the standard python parameters are supported:

- **sslmode** - This option determines whether or with what priority a secure SSL TCP/IP connection will be negotiated with the server. There are six modes: 'disable', 'allow', 'prefer', 'require', 'verify-ca', 'verify-full'.
- **sslcert** - This parameter specifies the file name of the client SSL certificate, replacing the default.
- **sslkey** - This parameter specifies the file name of the client SSL key, replacing the default.
- **sslrootcert** - This parameter specifies the name of a file containing SSL certificate authority (CA) certificate(s).
- **sslcrl** - This parameter specifies the file name of the SSL certificate revocation list (CRL).
- **application_name** - Specifies a value for the application_name configuration parameter.
- **keepalives_idle** - Controls the number of seconds of inactivity after which TCP should send a keepalive message to the server.

More details on all Postgres parameters supported can be found in Postgres documentation.

Example "extras" field:

```
{
   "sslmode": "verify-ca",
   "sslcert": "/tmp/client-cert.pem",
   "sslca": "/tmp/server-ca.pem",
   "sslkey": "/tmp/client-key.pem"
}
```

When specifying the connection as URI (in AIRFLOW_CONN_* variable) you should specify it following the standard syntax of DB connections, where extras are passed as parameters of the URI (note that all components of the URI should be URL-encoded).

For example:

```
postgresql://postgres_user:XXXXXXXXXXXX@1.1.1.1:5432/postgresdb?sslmode=verify-ca&
↪sslcert=%2Ftmp%2Fclient-cert.pem&sslkey=%2Ftmp%2Fclient-key.pem&sslrootcert=
↪%2Ftmp%2Fserver-ca.pem
```

Cloudsql

The gcpcloudsql:// connection is used by `airflow.contrib.operators.gcp_sql_operator.CloudSqlQueryOperator` to perform query on a Google Cloud SQL database. Google Cloud SQL database can be either Postgres or MySQL, so this is a "meta" connection type. It introduces common schema for both MySQL and Postgres, including what kind of connectivity should be used. Google Cloud SQL supports connecting via public IP or via Cloud SQL Proxy. In the latter case the `CloudSqlDatabaseHook` uses `CloudSqlProxyRunner` to automatically prepare and use temporary Postgres or MySQL connection that will use the proxy to connect (either via TCP or UNIX socket.

Configuring the Connection

Host (required) The host to connect to.

Schema (optional) Specify the schema name to be used in the database.

Login (required) Specify the user name to connect.

Password (required) Specify the password to connect.

Extra (optional) Specify the extra parameters (as JSON dictionary) that can be used in Google Cloud SQL connection.

Details of all the parameters supported in extra field can be found in `CloudSqlDatabaseHook`

Example "extras" field:

```
{
   "database_type": "mysql",
   "project_id": "example-project",
   "location": "europe-west1",
   "instance": "testinstance",
   "use_proxy": true,
   "sql_proxy_use_tcp": false
}
```

When specifying the connection as URI (in AIRFLOW_CONN_* variable), you should specify it following the standard syntax of DB connection, where extras are passed as parameters of the URI. Note that all components of the URI should be URL-encoded.

For example:

```
gcpcloudsql://user:XXXXXXXXX@1.1.1.1:3306/mydb?database_type=mysql&project_
↪id=example-project&location=europe-west1&instance=testinstance&use_proxy=True&
↪sql_proxy_use_tcp=False
```

SSH

The SSH connection type provides connection to use `SSHHook` to run commands on a remote server using `SSHOperator` or transfer file from/to the remote server using `SFTPOperator`.

Configuring the Connection

Host (required) The Remote host to connect.

Username (optional) The Username to connect to the remote_host.

Password (optional) Specify the password of the username to connect to the remote_host.

Port (optional) Port of remote host to connect. Default is 22.

Extra (optional) Specify the extra parameters (as json dictionary) that can be used in ssh connection. The following parameters out of the standard python parameters are supported:

- **timeout** - An optional timeout (in seconds) for the TCP connect. Default is `10`.
- **compress** - `true` to ask the remote client/server to compress traffic; *false* to refuse compression. Default is `true`.
- **no_host_key_check** - Set to `false` to restrict connecting to hosts with no entries in `~/.ssh/known_hosts` (Hosts file). This provides maximum protection against trojan horse attacks, but can be troublesome when the `/etc/ssh/ssh_known_hosts` file is poorly maintained or connections to new hosts are frequently made. This option forces the user to manually add all new hosts. Default is `true`, ssh will automatically add new host keys to the user known hosts files.

- **allow_host_key_change** - Set to `true` if you want to allow connecting to hosts that has host key changed or when you get 'REMOTE HOST IDENTIFICATION HAS CHANGED' error. This wont protect against Man-In-The-Middle attacks. Other possible solution is to remove the host entry from `~/.ssh/known_hosts` file. Default is `false`.

Example "extras" field:

```
{
   "timeout": "10",
   "compress": "false",
   "no_host_key_check": "false",
   "allow_host_key_change": "false"
}
```

When specifying the connection as URI (in AIRFLOW_CONN_* variable) you should specify it following the standard syntax of connections, where extras are passed as parameters of the URI (note that all components of the URI should be URL-encoded).

For example:

```
ssh://user:pass@localhost:22?timeout=10&compress=false&no_host_key_check=false&
↪allow_host_key_change=true
```

3.6.5 Securing Connections

By default, Airflow will save the passwords for the connection in plain text within the metadata database. The `crypto` package is highly recommended during installation. The `crypto` package does require that your operating system has `libffi-dev` installed.

If `crypto` package was not installed initially, it means that your Fernet key in `airflow.cfg` is empty.

You can still enable encryption for passwords within connections by following below steps:

1. Install crypto package `pip install apache-airflow[crypto]`
2. Generate fernet_key, using this code snippet below. `fernet_key` must be a base64-encoded 32-byte key.

```
from cryptography.fernet import Fernet
fernet_key= Fernet.generate_key()
print(fernet_key.decode()) # your fernet_key, keep it in secured place!
```

3. Replace `airflow.cfg` fernet_key value with the one from step 2. Alternatively, you can store your fernet_key in OS environment variable. You do not need to change `airflow.cfg` in this case as Airflow will use environment variable over the value in `airflow.cfg`:

```
# Note the double underscores
export AIRFLOW__CORE__FERNET_KEY=your_fernet_key
```

4. Restart Airflow webserver.
5. For existing connections (the ones that you had defined before installing `airflow[crypto]` and creating a Fernet key), you need to open each connection in the connection admin UI, re-type the password, and save it.

3.6.6 Writing Logs

3.6.6.1 Writing Logs Locally

Users can specify a logs folder in `airflow.cfg` using the `base_log_folder` setting. By default, it is in the `AIRFLOW_HOME` directory.

In addition, users can supply a remote location for storing logs and log backups in cloud storage.

In the Airflow Web UI, local logs take precedence over remote logs. If local logs can not be found or accessed, the remote logs will be displayed. Note that logs are only sent to remote storage once a task completes (including failure). In other words, remote logs for running tasks are unavailable. Logs are stored in the log folder as `{dag_id}/{task_id}/{execution_date}/{try_number}.log`.

3.6.6.2 Writing Logs to Amazon S3

Before you begin

Remote logging uses an existing Airflow connection to read/write logs. If you don't have a connection properly setup, this will fail.

Enabling remote logging

To enable this feature, `airflow.cfg` must be configured as in this example:

```
[core]
# Airflow can store logs remotely in AWS S3. Users must supply a remote
# location URL (starting with either 's3://...') and an Airflow connection
# id that provides access to the storage location.
remote_logging = True
remote_base_log_folder = s3://my-bucket/path/to/logs
remote_log_conn_id = MyS3Conn
# Use server-side encryption for logs stored in S3
encrypt_s3_logs = False
```

In the above example, Airflow will try to use `S3Hook('MyS3Conn')`.

3.6.6.3 Writing Logs to Azure Blob Storage

Airflow can be configured to read and write task logs in Azure Blob Storage. Follow the steps below to enable Azure Blob Storage logging.

1. Airflow's logging system requires a custom .py file to be located in the `PYTHONPATH`, so that it's importable from Airflow. Start by creating a directory to store the config file. `$AIRFLOW_HOME/config` is recommended.
2. Create empty files called `$AIRFLOW_HOME/config/log_config.py` and `$AIRFLOW_HOME/config/__init__.py`.
3. Copy the contents of `airflow/config_templates/airflow_local_settings.py` into the `log_config.py` file that was just created in the step above.
4. Customize the following portions of the template:

```
# wasb buckets should start with "wasb" just to help Airflow select␣
↪correct handler
REMOTE_BASE_LOG_FOLDER = 'wasb-<whatever you want here>'

# Rename DEFAULT_LOGGING_CONFIG to LOGGING CONFIG
LOGGING_CONFIG = ...
```

5. Make sure a Azure Blob Storage (Wasb) connection hook has been defined in Airflow. The hook should have read and write access to the Azure Blob Storage bucket defined above in `REMOTE_BASE_LOG_FOLDER`.
6. Update `$AIRFLOW_HOME/airflow.cfg` to contain:

```
remote_logging = True
logging_config_class = log_config.LOGGING_CONFIG
remote_log_conn_id = <name of the Azure Blob Storage connection>
```

7. Restart the Airflow webserver and scheduler, and trigger (or wait for) a new task execution.
8. Verify that logs are showing up for newly executed tasks in the bucket you've defined.

3.6.6.4 Writing Logs to Google Cloud Storage

Follow the steps below to enable Google Cloud Storage logging.

To enable this feature, `airflow.cfg` must be configured as in this example:

```
[core]
# Airflow can store logs remotely in AWS S3, Google Cloud Storage or Elastic Search.
# Users must supply an Airflow connection id that provides access to the storage
# location. If remote_logging is set to true, see UPDATING.md for additional
# configuration requirements.
remote_logging = True
remote_base_log_folder = gs://my-bucket/path/to/logs
remote_log_conn_id = MyGCSConn
```

1. Install the `gcp_api` package first, like so: `pip install apache-airflow[gcp_api]`.
2. Make sure a Google Cloud Platform connection hook has been defined in Airflow. The hook should have read and write access to the Google Cloud Storage bucket defined above in `remote_base_log_folder`.
3. Restart the Airflow webserver and scheduler, and trigger (or wait for) a new task execution.
4. Verify that logs are showing up for newly executed tasks in the bucket you've defined.
5. Verify that the Google Cloud Storage viewer is working in the UI. Pull up a newly executed task, and verify that you see something like:

```
*** Reading remote log from gs://<bucket where logs should be persisted>/
↪example_bash_operator/run_this_last/2017-10-03T00:00:00/16.log.
[2017-10-03 21:57:50,056] {cli.py:377} INFO - Running on host chrisr-00532
[2017-10-03 21:57:50,093] {base_task_runner.py:115} INFO - Running: ['bash
↪', '-c', u'airflow run example_bash_operator run_this_last 2017-10-
↪03T00:00:00 --job_id 47 --raw -sd DAGS_FOLDER/example_dags/example_bash_
↪operator.py']
[2017-10-03 21:57:51,264] {base_task_runner.py:98} INFO - Subtask: [2017-
↪10-03 21:57:51,263] {__init__.py:45} INFO - Using executor␣
↪SequentialExecutor
[2017-10-03 21:57:51,306] {base_task_runner.py:98} INFO - Subtask: [2017-
↪10-03 21:57:51,306] {models.py:186} INFO - Filling up the DagBag from /
↪airflow/dags/example_dags/example_bash_operator.py
```

(continues on next page)

(continued from previous page)

```
```

Note the top line that says it's reading from the remote log file.

3.6.7 Scaling Out with Celery

`CeleryExecutor` is one of the ways you can scale out the number of workers. For this to work, you need to setup a Celery backend (**RabbitMQ**, **Redis**, . . .) and change your `airflow.cfg` to point the executor parameter to `CeleryExecutor` and provide the related Celery settings.

For more information about setting up a Celery broker, refer to the exhaustive Celery documentation on the topic.

Here are a few imperative requirements for your workers:

- `airflow` needs to be installed, and the CLI needs to be in the path
- Airflow configuration settings should be homogeneous across the cluster
- Operators that are executed on the worker need to have their dependencies met in that context. For example, if you use the `HiveOperator`, the hive CLI needs to be installed on that box, or if you use the `MySqlOperator`, the required Python library needs to be available in the `PYTHONPATH` somehow
- The worker needs to have access to its `DAGS_FOLDER`, and you need to synchronize the filesystems by your own means. A common setup would be to store your DAGS_FOLDER in a Git repository and sync it across machines using Chef, Puppet, Ansible, or whatever you use to configure machines in your environment. If all your boxes have a common mount point, having your pipelines files shared there should work as well

To kick off a worker, you need to setup Airflow and kick off the worker subcommand

```
airflow worker
```

Your worker should start picking up tasks as soon as they get fired in its direction.

Note that you can also run "Celery Flower", a web UI built on top of Celery, to monitor your workers. You can use the shortcut command `airflow flower` to start a Flower web server.

Please note that you must have the `flower` python library already installed on your system. The recommend way is to install the airflow celery bundle.

```
pip install 'apache-airflow[celery]'
```

Some caveats:

- Make sure to use a database backed result backend
- Make sure to set a visibility timeout in [celery_broker_transport_options] that exceeds the ETA of your longest running task
- Tasks can consume resources. Make sure your worker has enough resources to run *worker_concurrency* tasks

3.6.8 Scaling Out with Dask

`DaskExecutor` allows you to run Airflow tasks in a Dask Distributed cluster.

Dask clusters can be run on a single machine or on remote networks. For complete details, consult the Distributed documentation.

To create a cluster, first start a Scheduler:

```
# default settings for a local cluster
DASK_HOST=127.0.0.1
DASK_PORT=8786

dask-scheduler --host $DASK_HOST --port $DASK_PORT
```

Next start at least one Worker on any machine that can connect to the host:

```
dask-worker $DASK_HOST:$DASK_PORT
```

Edit your `airflow.cfg` to set your executor to `DaskExecutor` and provide the Dask Scheduler address in the `[dask]` section.

Please note:

- Each Dask worker must be able to import Airflow and any dependencies you require.
- Dask does not support queues. If an Airflow task was created with a queue, a warning will be raised but the task will be submitted to the cluster.

3.6.9 Scaling Out with Mesos (community contributed)

There are two ways you can run airflow as a mesos framework:

1. Running airflow tasks directly on mesos slaves, requiring each mesos slave to have airflow installed and configured.
2. Running airflow tasks inside a docker container that has airflow installed, which is run on a mesos slave.

3.6.9.1 Tasks executed directly on mesos slaves

`MesosExecutor` allows you to schedule airflow tasks on a Mesos cluster. For this to work, you need a running mesos cluster and you must perform the following steps -

1. Install airflow on a mesos slave where web server and scheduler will run, let's refer to this as the "Airflow server".
2. On the Airflow server, install mesos python eggs from mesos downloads.
3. On the Airflow server, use a database (such as mysql) which can be accessed from all mesos slaves and add configuration in `airflow.cfg`.
4. Change your `airflow.cfg` to point executor parameter to *MesosExecutor* and provide related Mesos settings.
5. On all mesos slaves, install airflow. Copy the `airflow.cfg` from Airflow server (so that it uses same sql alchemy connection).
6. On all mesos slaves, run the following for serving logs:

```
airflow serve_logs
```

7. On Airflow server, to start processing/scheduling DAGs on mesos, run:

```
airflow scheduler -p
```

Note: We need -p parameter to pickle the DAGs.

You can now see the airflow framework and corresponding tasks in mesos UI. The logs for airflow tasks can be seen in airflow UI as usual.

For more information about mesos, refer to mesos documentation. For any queries/bugs on *MesosExecutor*, please contact @kapil-malik.

3.6.9.2 Tasks executed in containers on mesos slaves

This gist contains all files and configuration changes necessary to achieve the following:

1. Create a dockerized version of airflow with mesos python eggs installed.

   We recommend taking advantage of docker's multi stage builds in order to achieve this. We have one Dockerfile that defines building a specific version of mesos from source (Dockerfile-mesos), in order to create the python eggs. In the airflow Dockerfile (Dockerfile-airflow) we copy the python eggs from the mesos image.

2. Create a mesos configuration block within the `airflow.cfg`.

   The configuration block remains the same as the default airflow configuration (default_airflow.cfg), but has the addition of an option `docker_image_slave`. This should be set to the name of the image you would like mesos to use when running airflow tasks. Make sure you have the proper configuration of the DNS record for your mesos master and any sort of authorization if any exists.

3. Change your `airflow.cfg` to point the executor parameter to *MesosExecutor* (*executor* = *SequentialExecutor*).

4. Make sure your mesos slave has access to the docker repository you are using for your `docker_image_slave`.

   Instructions are available in the mesos docs.

The rest is up to you and how you want to work with a dockerized airflow configuration.

3.6.10 Running Airflow with systemd

Airflow can integrate with systemd based systems. This makes watching your daemons easy as systemd can take care of restarting a daemon on failure. In the `scripts/systemd` directory you can find unit files that have been tested on Redhat based systems. You can copy those to `/usr/lib/systemd/system`. It is assumed that Airflow will run under `airflow:airflow`. If not (or if you are running on a non Redhat based system) you probably need to adjust the unit files.

Environment configuration is picked up from `/etc/sysconfig/airflow`. An example file is supplied. Make sure to specify the `SCHEDULER_RUNS` variable in this file when you run the scheduler. You can also define here, for example, `AIRFLOW_HOME` or `AIRFLOW_CONFIG`.

3.6.11 Running Airflow with upstart

Airflow can integrate with upstart based systems. Upstart automatically starts all airflow services for which you have a corresponding `*.conf` file in `/etc/init` upon system boot. On failure, upstart automatically restarts the process (until it reaches re-spawn limit set in a `*.conf` file).

You can find sample upstart job files in the `scripts/upstart` directory. These files have been tested on Ubuntu 14.04 LTS. You may have to adjust `start on` and `stop on` stanzas to make it work on other upstart systems. Some of the possible options are listed in `scripts/upstart/README`.

Modify `*.conf` files as needed and copy to `/etc/init` directory. It is assumed that airflow will run under `airflow:airflow`. Change `setuid` and `setgid` in `*.conf` files if you use other user/group

You can use `initctl` to manually start, stop, view status of the airflow process that has been integrated with upstart

```
initctl airflow-webserver status
```

3.6.12 Using the Test Mode Configuration

Airflow has a fixed set of "test mode" configuration options. You can load these at any time by calling `airflow.configuration.load_test_config()` (note this operation is not reversible!). However, some options (like the DAG_FOLDER) are loaded before you have a chance to call load_test_config(). In order to eagerly load the test configuration, set test_mode in airflow.cfg:

```
[tests]
unit_test_mode = True
```

Due to Airflow's automatic environment variable expansion (see *Setting Configuration Options*), you can also set the env var `AIRFLOW__CORE__UNIT_TEST_MODE` to temporarily overwrite airflow.cfg.

3.6.13 Checking Airflow Health Status

To check the health status of your Airflow instance, you can simply access the endpoint `"/health"`. It will return a JSON object in which a high-level glance is provided.

```
{
  "metadatabase":{
    "status":"healthy"
  },
  "scheduler":{
    "status":"healthy",
    "latest_scheduler_heartbeat":"2018-12-26 17:15:11+00:00"
  }
}
```

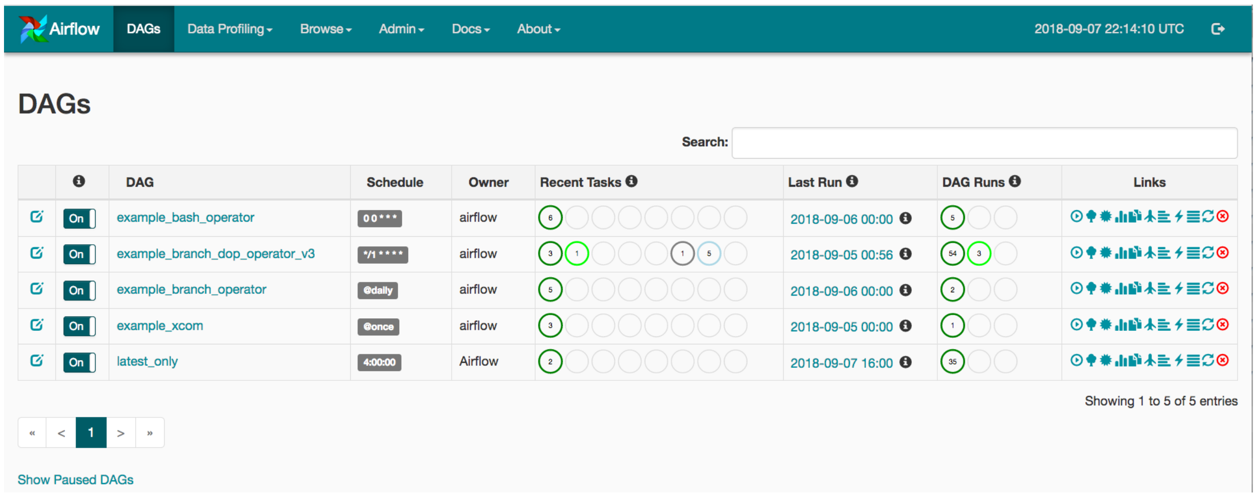
- The `status` of each component can be either "healthy" or "unhealthy".
  - The status of `metadatabase` is depending on whether a valid connection can be initiated with the database backend of Airflow.
  - The status of `scheduler` is depending on when the latest scheduler heartbeat happened. If the latest scheduler heartbeat happened 30 seconds (default value) earlier than the current time, scheduler component is considered unhealthy. You can also specify this threshold value by changing `scheduler_health_check_threshold` in `scheduler` section of the `airflow.cfg` file.
- The response code of `"/health"` endpoint is not used to label the health status of the application (it would always be 200). Hence please be reminded not to use the response code here for health-check purpose.

3.7 UI / Screenshots

The Airflow UI makes it easy to monitor and troubleshoot your data pipelines. Here's a quick overview of some of the features and visualizations you can find in the Airflow UI.

3.7.1 DAGs View

List of the DAGs in your environment, and a set of shortcuts to useful pages. You can see exactly how many tasks succeeded, failed, or are currently running at a glance.



DAGs

Search:

		DAG	Schedule	Owner	Recent Tasks	Last Run	DAG Runs	Links
	On	example_bash_operator	0 0 * * *	airflow	6	2018-09-06 00:00	5	
	On	example_branch_dop_operator_v3	*/1 * * * *	airflow	3 1 1 5	2018-09-05 00:56	54 3	
	On	example_branch_operator	@daily	airflow	5	2018-09-06 00:00	2	
	On	example_xcom	@once	airflow	3	2018-09-05 00:00	1	
	On	latest_only	4:00:00	Airflow	2	2018-09-07 16:00	35	

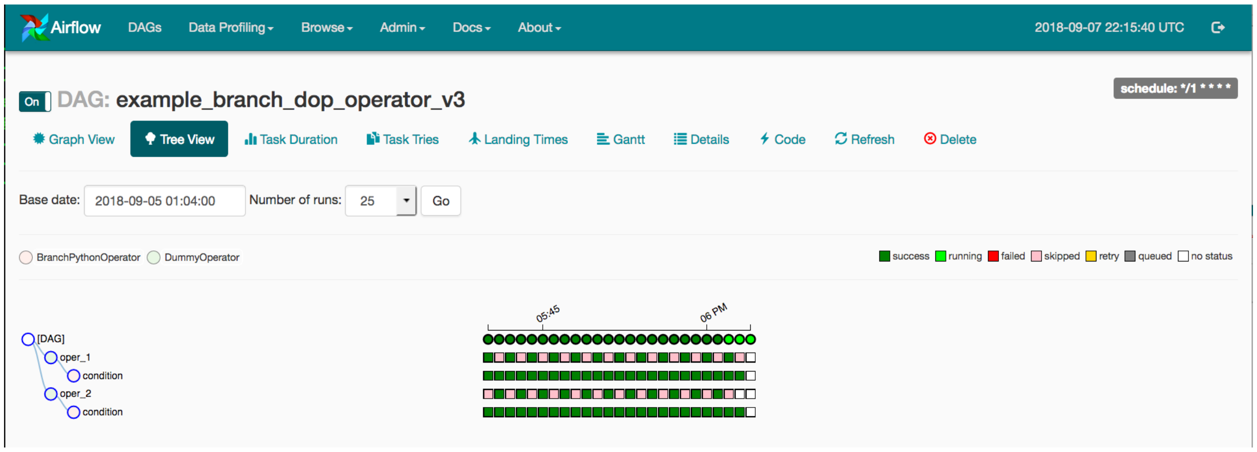
Showing 1 to 5 of 5 entries

« < 1 > »

Show Paused DAGs

3.7.2 Tree View

A tree representation of the DAG that spans across time. If a pipeline is late, you can quickly see where the different steps are and identify the blocking ones.

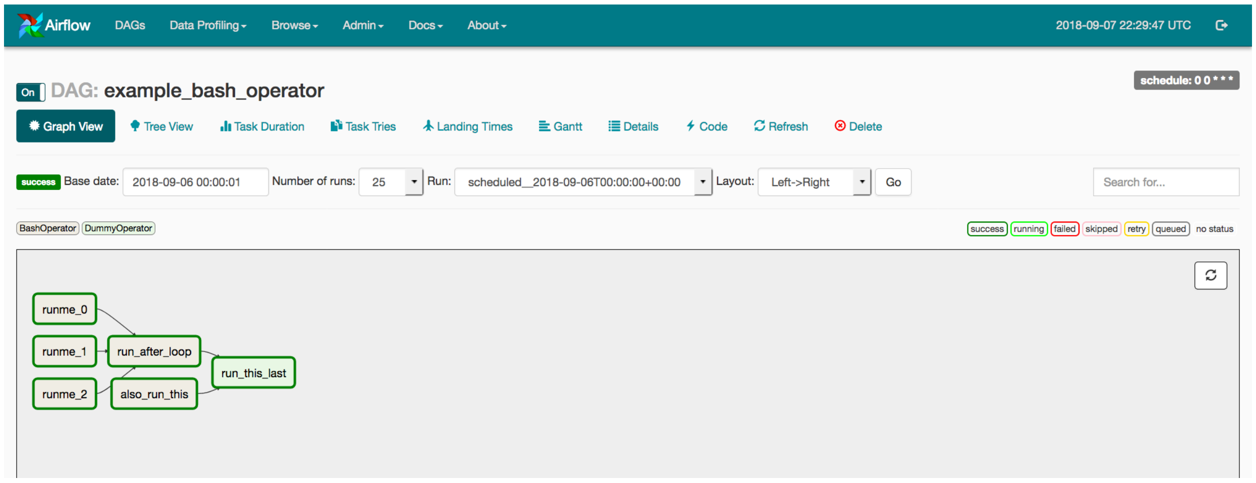


DAG: example_branch_dop_operator_v3

Base date: 2018-09-05 01:04:00 Number of runs: 25 Go

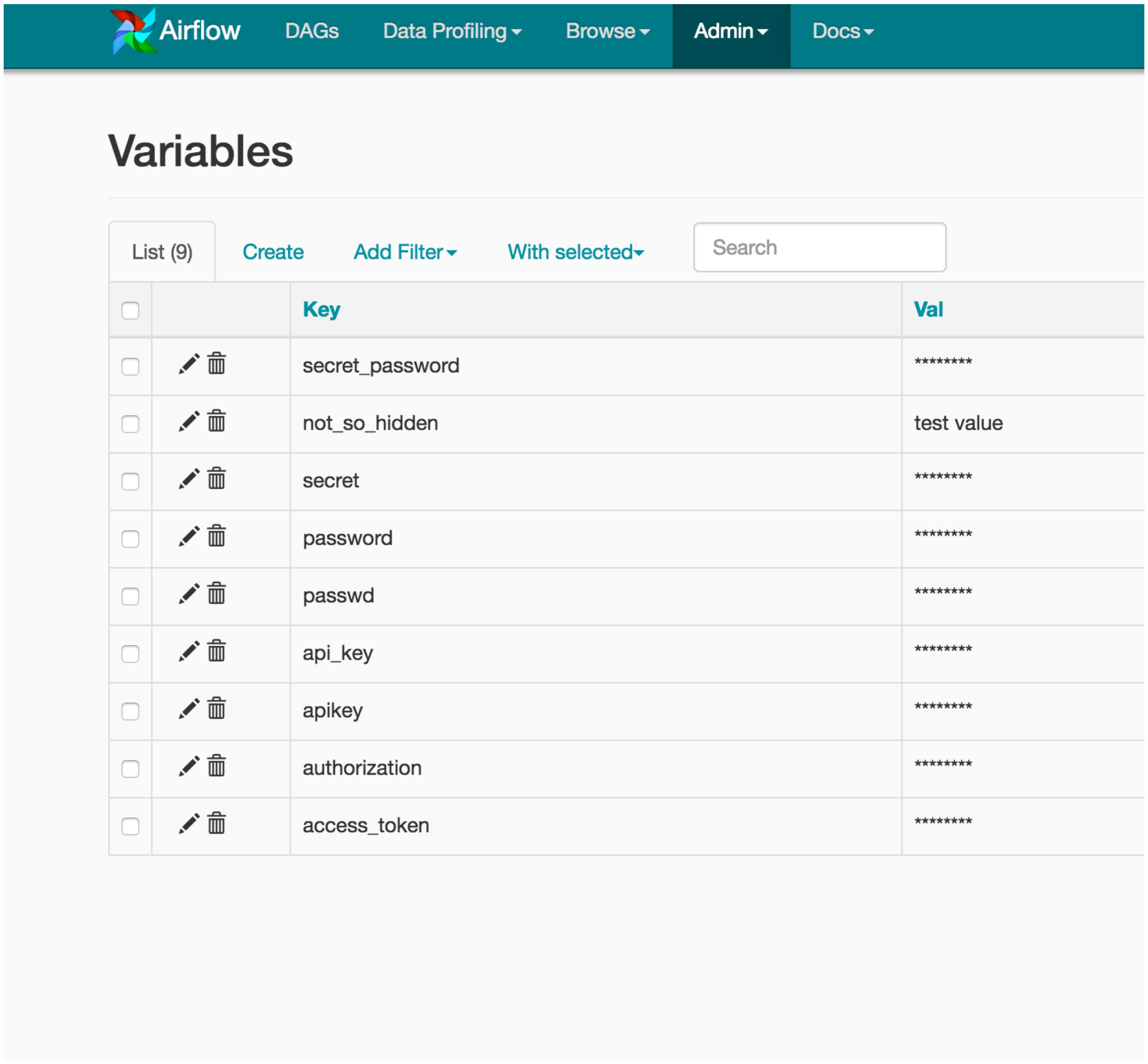
3.7.3 Graph View

The graph view is perhaps the most comprehensive. Visualize your DAG's dependencies and their current status for a specific run.



3.7.4 Variable View

The variable view allows you to list, create, edit or delete the key-value pair of a variable used during jobs. Value of a variable will be hidden if the key contains any words in ('password', 'secret', 'passwd', 'authorization', 'api_key', 'apikey', 'access_token') by default, but can be configured to show in clear-text.

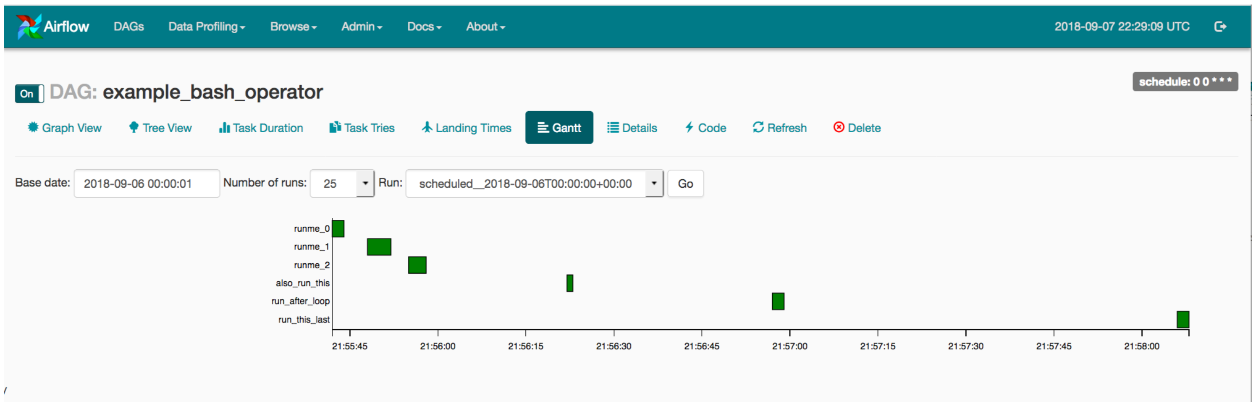


Variables

Key	Val
secret_password	********
not_so_hidden	test value
secret	********
password	********
passwd	********
api_key	********
apikey	********
authorization	********
access_token	********

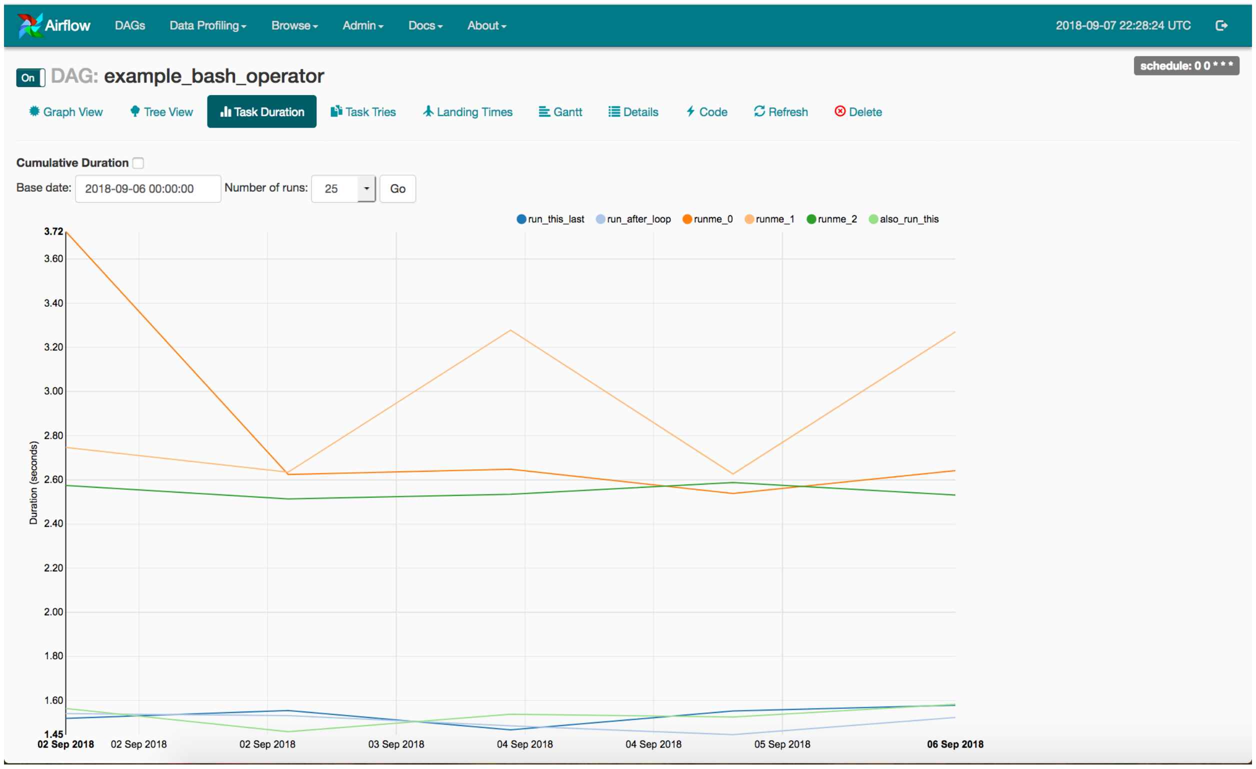
3.7.5 Gantt Chart

The Gantt chart lets you analyse task duration and overlap. You can quickly identify bottlenecks and where the bulk of the time is spent for specific DAG runs.



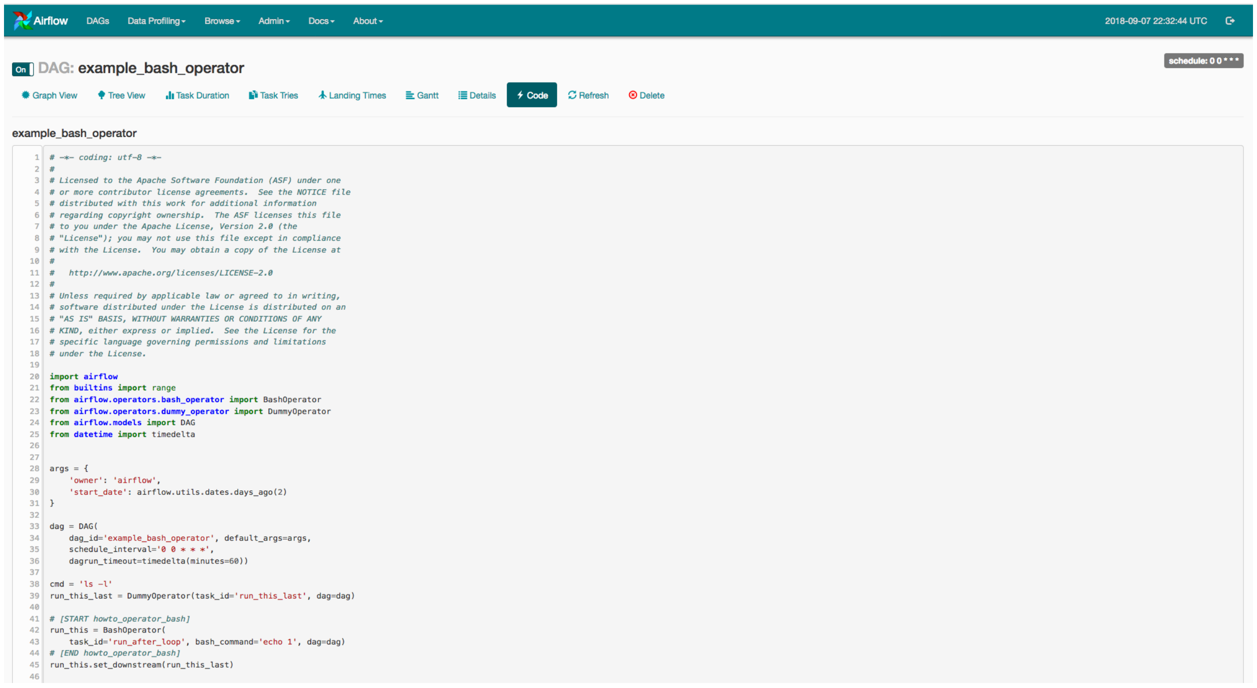
3.7.6 Task Duration

The duration of your different tasks over the past N runs. This view lets you find outliers and quickly understand where the time is spent in your DAG over many runs.



3.7.7 Code View

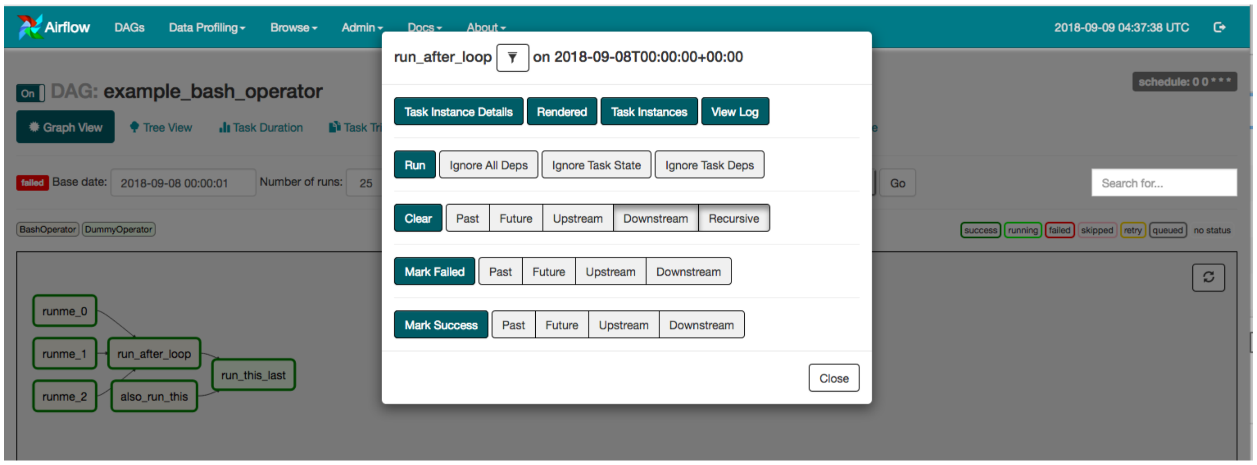
Transparency is everything. While the code for your pipeline is in source control, this is a quick way to get to the code that generates the DAG and provide yet more context.



```
# -*- coding: utf-8 -*-
#
# Licensed to the Apache Software Foundation (ASF) under one
# or more contributor license agreements.  See the NOTICE file
# distributed with this work for additional information
# regarding copyright ownership.  The ASF licenses this file
# to you under the Apache License, Version 2.0 (the
# "License"); you may not use this file except in compliance
# with the License.  You may obtain a copy of the License at
#
#   http://www.apache.org/licenses/LICENSE-2.0
#
# Unless required by applicable law or agreed to in writing,
# software distributed under the License is distributed on an
# "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY
# KIND, either express or implied.  See the License for the
# specific language governing permissions and limitations
# under the License.

import airflow
from builtins import range
from airflow.operators.bash_operator import BashOperator
from airflow.operators.dummy_operator import DummyOperator
from airflow.models import DAG
from datetime import timedelta


args = {
    'owner': 'airflow',
    'start_date': airflow.utils.dates.days_ago(2)
}

dag = DAG(
    dag_id='example_bash_operator', default_args=args,
    schedule_interval='0 0 * * *',
    dagrun_timeout=timedelta(minutes=60))

cmd = 'ls -l'
run_this_last = DummyOperator(task_id='run_this_last', dag=dag)

# [START howto_operator_bash]
run_this = BashOperator(
    task_id='run_after_loop', bash_command='echo 1', dag=dag)
# [END howto_operator_bash]
run_this.set_downstream(run_this_last)

```

3.7.8 Task Instance Context Menu

From the pages seen above (tree view, graph view, gantt, . . .), it is always possible to click on a task instance, and get to this rich context menu that can take you to more detailed metadata, and perform some actions.



3.8 Concepts

The Airflow Platform is a tool for describing, executing, and monitoring workflows.

3.8.1 Core Ideas

3.8.1.1 DAGs

In Airflow, a `DAG` – or a Directed Acyclic Graph – is a collection of all the tasks you want to run, organized in a way that reflects their relationships and dependencies.

For example, a simple DAG could consist of three tasks: A, B, and C. It could say that A has to run successfully before B can run, but C can run anytime. It could say that task A times out after 5 minutes, and B can be restarted up to 5 times in case it fails. It might also say that the workflow will run every night at 10pm, but shouldn't start until a certain date.

In this way, a DAG describes *how* you want to carry out your workflow; but notice that we haven't said anything about *what* we actually want to do! A, B, and C could be anything. Maybe A prepares data for B to analyze while C sends an email. Or perhaps A monitors your location so B can open your garage door while C turns on your house lights. The important thing is that the DAG isn't concerned with what its constituent tasks do; its job is to make sure that whatever they do happens at the right time, or in the right order, or with the right handling of any unexpected issues.

DAGs are defined in standard Python files that are placed in Airflow's `DAG_FOLDER`. Airflow will execute the code in each file to dynamically build the `DAG` objects. You can have as many DAGs as you want, each describing an arbitrary number of tasks. In general, each one should correspond to a single logical workflow.

Note: When searching for DAGs, Airflow will only consider files where the string "airflow" and "DAG" both appear in the contents of the `.py` file.

Scope

Airflow will load any `DAG` object it can import from a DAGfile. Critically, that means the DAG must appear in `globals()`. Consider the following two DAGs. Only `dag_1` will be loaded; the other one only appears in a local scope.

```
dag_1 = DAG('this_dag_will_be_discovered')

def my_function():
    dag_2 = DAG('but_this_dag_will_not')

my_function()
```

Sometimes this can be put to good use. For example, a common pattern with `SubDagOperator` is to define the subdag inside a function so that Airflow doesn't try to load it as a standalone DAG.

Default Arguments

If a dictionary of `default_args` is passed to a DAG, it will apply them to any of its operators. This makes it easy to apply a common parameter to many operators without having to type it many times.

```
default_args = {
    'start_date': datetime(2016, 1, 1),
    'owner': 'Airflow'
}

dag = DAG('my_dag', default_args=default_args)
```

(continues on next page)

(continued from previous page)

```
op = DummyOperator(task_id='dummy', dag=dag)
print(op.owner) # Airflow
```

Context Manager

Added in Airflow 1.8

DAGs can be used as context managers to automatically assign new operators to that DAG.

```
with DAG('my_dag', start_date=datetime(2016, 1, 1)) as dag:
    op = DummyOperator('op')

op.dag is dag # True
```

3.8.1.2 Operators

While DAGs describe *how* to run a workflow, `Operators` determine what actually gets done.

An operator describes a single task in a workflow. Operators are usually (but not always) atomic, meaning they can stand on their own and don't need to share resources with any other operators. The DAG will make sure that operators run in the correct certain order; other than those dependencies, operators generally run independently. In fact, they may run on two completely different machines.

This is a subtle but very important point: in general, if two operators need to share information, like a filename or small amount of data, you should consider combining them into a single operator. If it absolutely can't be avoided, Airflow does have a feature for operator cross-communication called XCom that is described elsewhere in this document.

Airflow provides operators for many common tasks, including:

- `BashOperator` - executes a bash command
- `PythonOperator` - calls an arbitrary Python function
- `EmailOperator` - sends an email
- `SimpleHttpOperator` - sends an HTTP request
- `MySqlOperator`, `SqliteOperator`, `PostgresOperator`, `MsSqlOperator`, `OracleOperator`, `JdbcOperator`, etc. - executes a SQL command
- `Sensor` - waits for a certain time, file, database row, S3 key, etc…

In addition to these basic building blocks, there are many more specific operators: `DockerOperator`, `HiveOperator`, `S3FileTransformOperator`, `PrestoToMysqlOperator`, `SlackOperator`… you get the idea!

The `airflow/contrib/` directory contains yet more operators built by the community. These operators aren't always as complete or well-tested as those in the main distribution, but allow users to more easily add new functionality to the platform.

Operators are only loaded by Airflow if they are assigned to a DAG.

See *Using Operators* for how to use Airflow operators.

DAG Assignment

Added in Airflow 1.8

Operators do not have to be assigned to DAGs immediately (previously `dag` was a required argument). However, once an operator is assigned to a DAG, it can not be transferred or unassigned. DAG assignment can be done explicitly when the operator is created, through deferred assignment, or even inferred from other operators.

```
dag = DAG('my_dag', start_date=datetime(2016, 1, 1))

# sets the DAG explicitly
explicit_op = DummyOperator(task_id='op1', dag=dag)

# deferred DAG assignment
deferred_op = DummyOperator(task_id='op2')
deferred_op.dag = dag

# inferred DAG assignment (linked operators must be in the same DAG)
inferred_op = DummyOperator(task_id='op3')
inferred_op.set_upstream(deferred_op)
```

Bitshift Composition

Added in Airflow 1.8

Traditionally, operator relationships are set with the `set_upstream()` and `set_downstream()` methods. In Airflow 1.8, this can be done with the Python bitshift operators >> and <<. The following four statements are all functionally equivalent:

```
op1 >> op2
op1.set_downstream(op2)

op2 << op1
op2.set_upstream(op1)
```

When using the bitshift to compose operators, the relationship is set in the direction that the bitshift operator points. For example, `op1 >> op2` means that `op1` runs first and `op2` runs second. Multiple operators can be composed – keep in mind the chain is executed left-to-right and the rightmost object is always returned. For example:

```
op1 >> op2 >> op3 << op4
```

is equivalent to:

```
op1.set_downstream(op2)
op2.set_downstream(op3)
op3.set_upstream(op4)
```

For convenience, the bitshift operators can also be used with DAGs. For example:

```
dag >> op1 >> op2
```

is equivalent to:

```
op1.dag = dag
op1.set_downstream(op2)
```

We can put this all together to build a simple pipeline:

```
with DAG('my_dag', start_date=datetime(2016, 1, 1)) as dag:
    (
        DummyOperator(task_id='dummy_1')
        >> BashOperator(
            task_id='bash_1',
            bash_command='echo "HELLO!"')
        >> PythonOperator(
            task_id='python_1',
            python_callable=lambda: print("GOODBYE!"))
    )
```

3.8.1.3 Tasks

Once an operator is instantiated, it is referred to as a "task". The instantiation defines specific values when calling the abstract operator, and the parameterized task becomes a node in a DAG.

3.8.1.4 Task Instances

A task instance represents a specific run of a task and is characterized as the combination of a dag, a task, and a point in time. Task instances also have an indicative state, which could be "running", "success", "failed", "skipped", "up for retry", etc.

3.8.1.5 Workflows

You're now familiar with the core building blocks of Airflow. Some of the concepts may sound very similar, but the vocabulary can be conceptualized like this:

- DAG: a description of the order in which work should take place
- Operator: a class that acts as a template for carrying out some work
- Task: a parameterized instance of an operator
- Task Instance: a task that 1) has been assigned to a DAG and 2) has a state associated with a specific run of the DAG

By combining `DAGs` and `Operators` to create `TaskInstances`, you can build complex workflows.

3.8.2 Additional Functionality

In addition to the core Airflow objects, there are a number of more complex features that enable behaviors like limiting simultaneous access to resources, cross-communication, conditional execution, and more.

3.8.2.1 Hooks

Hooks are interfaces to external platforms and databases like Hive, S3, MySQL, Postgres, HDFS, and Pig. Hooks implement a common interface when possible, and act as a building block for operators. They also use the `airflow.models.Connection` model to retrieve hostnames and authentication information. Hooks keep authentication code and information out of pipelines, centralized in the metadata database.

Hooks are also very useful on their own to use in Python scripts, Airflow airflow.operators.PythonOperator, and in interactive environments like iPython or Jupyter Notebook.

3.8.2.2 Pools

Some systems can get overwhelmed when too many processes hit them at the same time. Airflow pools can be used to **limit the execution parallelism** on arbitrary sets of tasks. The list of pools is managed in the UI (`Menu -> Admin -> Pools`) by giving the pools a name and assigning it a number of worker slots. Tasks can then be associated with one of the existing pools by using the `pool` parameter when creating tasks (i.e., instantiating operators).

```
aggregate_db_message_job = BashOperator(
    task_id='aggregate_db_message_job',
    execution_timeout=timedelta(hours=3),
    pool='ep_data_pipeline_db_msg_agg',
    bash_command=aggregate_db_message_job_cmd,
    dag=dag)
aggregate_db_message_job.set_upstream(wait_for_empty_queue)
```

The `pool` parameter can be used in conjunction with `priority_weight` to define priorities in the queue, and which tasks get executed first as slots open up in the pool. The default `priority_weight` is `1`, and can be bumped to any number. When sorting the queue to evaluate which task should be executed next, we use the `priority_weight`, summed up with all of the `priority_weight` values from tasks downstream from this task. You can use this to bump a specific important task and the whole path to that task gets prioritized accordingly.

Tasks will be scheduled as usual while the slots fill up. Once capacity is reached, runnable tasks get queued and their state will show as such in the UI. As slots free up, queued tasks start running based on the `priority_weight` (of the task and its descendants).

Note that by default tasks aren't assigned to any pool and their execution parallelism is only limited to the executor's setting.

3.8.2.3 Connections

The connection information to external systems is stored in the Airflow metadata database and managed in the UI (`Menu -> Admin -> Connections`). A `conn_id` is defined there and hostname / login / password / schema information attached to it. Airflow pipelines can simply refer to the centrally managed `conn_id` without having to hard code any of this information anywhere.

Many connections with the same `conn_id` can be defined and when that is the case, and when the **hooks** uses the `get_connection` method from `BaseHook`, Airflow will choose one connection randomly, allowing for some basic load balancing and fault tolerance when used in conjunction with retries.

Many hooks have a default `conn_id`, where operators using that hook do not need to supply an explicit connection ID. For example, the default `conn_id` for the `PostgresHook` is `postgres_default`.

See *Managing Connections* for how to create and manage connections.

3.8.2.4 Queues

When using the CeleryExecutor, the Celery queues that tasks are sent to can be specified. `queue` is an attribute of BaseOperator, so any task can be assigned to any queue. The default queue for the environment is defined in the `airflow.cfg`'s `celery -> default_queue`. This defines the queue that tasks get assigned to when not specified, as well as which queue Airflow workers listen to when started.

Workers can listen to one or multiple queues of tasks. When a worker is started (using the command `airflow worker`), a set of comma-delimited queue names can be specified (e.g. `airflow worker -q spark`). This worker will then only pick up tasks wired to the specified queue(s).

This can be useful if you need specialized workers, either from a resource perspective (for say very lightweight tasks where one worker could take thousands of tasks without a problem), or from an environment perspective (you want a worker running from within the Spark cluster itself because it needs a very specific environment and security rights).

3.8.2.5 XComs

XComs let tasks exchange messages, allowing more nuanced forms of control and shared state. The name is an abbreviation of "cross-communication". XComs are principally defined by a key, value, and timestamp, but also track attributes like the task/DAG that created the XCom and when it should become visible. Any object that can be pickled can be used as an XCom value, so users should make sure to use objects of appropriate size.

XComs can be "pushed" (sent) or "pulled" (received). When a task pushes an XCom, it makes it generally available to other tasks. Tasks can push XComs at any time by calling the `xcom_push()` method. In addition, if a task returns a value (either from its Operator's `execute()` method, or from a PythonOperator's `python_callable` function), then an XCom containing that value is automatically pushed.

Tasks call `xcom_pull()` to retrieve XComs, optionally applying filters based on criteria like `key`, source `task_ids`, and source `dag_id`. By default, `xcom_pull()` filters for the keys that are automatically given to XComs when they are pushed by being returned from execute functions (as opposed to XComs that are pushed manually).

If `xcom_pull` is passed a single string for `task_ids`, then the most recent XCom value from that task is returned; if a list of `task_ids` is passed, then a corresponding list of XCom values is returned.

```python
# inside a PythonOperator called 'pushing_task'
def push_function():
    return value

# inside another PythonOperator where provide_context=True
def pull_function(**context):
    value = context['task_instance'].xcom_pull(task_ids='pushing_task')
```

It is also possible to pull XCom directly in a template, here's an example of what this may look like:

```
SELECT * FROM {{ task_instance.xcom_pull(task_ids='foo', key='table_name') }}
```

Note that XComs are similar to *Variables*, but are specifically designed for inter-task communication rather than global settings.

3.8.2.6 Variables

Variables are a generic way to store and retrieve arbitrary content or settings as a simple key value store within Airflow. Variables can be listed, created, updated and deleted from the UI (`Admin -> Variables`), code or CLI. In addition, json settings files can be bulk uploaded through the UI. While your pipeline code definition and most of your constants and variables should be defined in code and stored in source control, it can be useful to have some variables or configuration items accessible and modifiable through the UI.

```python
from airflow.models import Variable
foo = Variable.get("foo")
bar = Variable.get("bar", deserialize_json=True)
```

The second call assumes `json` content and will be deserialized into `bar`. Note that `Variable` is a sqlalchemy model and can be used as such.

You can use a variable from a jinja template with the syntax :

```
echo {{ var.value.<variable_name> }}
```

or if you need to deserialize a json object from the variable :

```
echo {{ var.json.<variable_name> }}
```

3.8.2.7 Branching

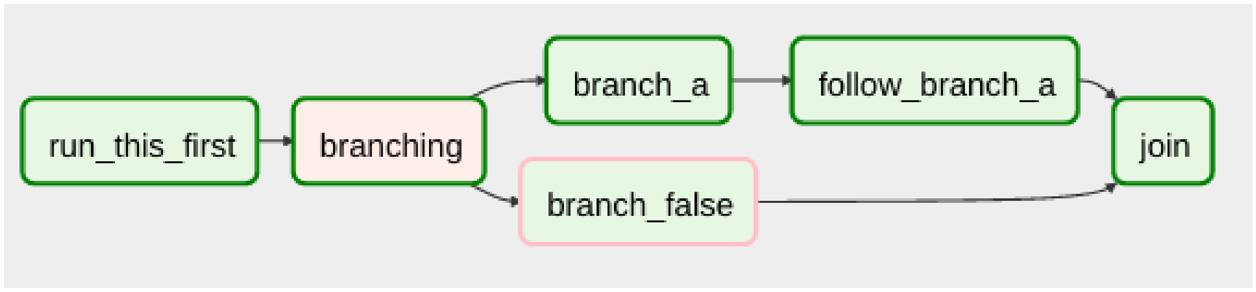
Sometimes you need a workflow to branch, or only go down a certain path based on an arbitrary condition which is typically related to something that happened in an upstream task. One way to do this is by using the `BranchPythonOperator`.

The `BranchPythonOperator` is much like the PythonOperator except that it expects a python_callable that returns a task_id. The task_id returned is followed, and all of the other paths are skipped. The task_id returned by the Python function has to be referencing a task directly downstream from the BranchPythonOperator task.

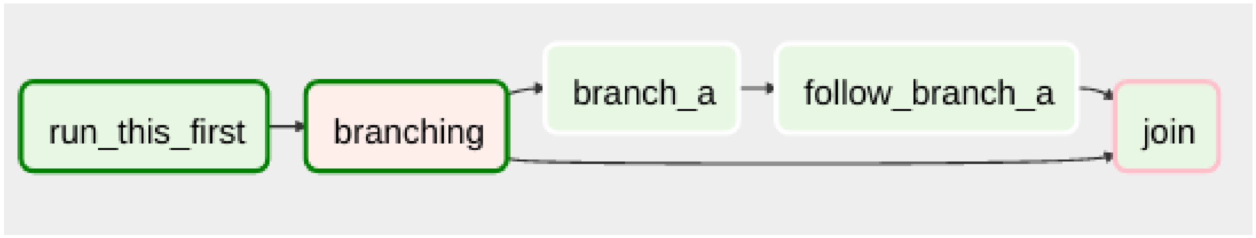
Note that using tasks with `depends_on_past=True` downstream from `BranchPythonOperator` is logically unsound as `skipped` status will invariably lead to block tasks that depend on their past successes. `skipped` states propagates where all directly upstream tasks are `skipped`.

If you want to skip some tasks, keep in mind that you can't have an empty path, if so make a dummy task.

like this, the dummy task "branch_false" is skipped



Not like this, where the join task is skipped

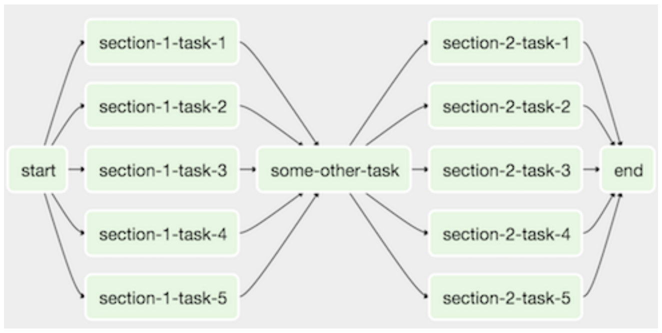


3.8.2.8 SubDAGs

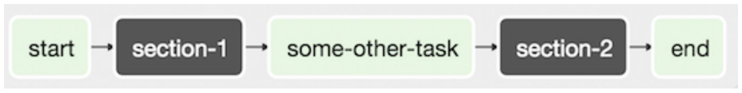
SubDAGs are perfect for repeating patterns. Defining a function that returns a DAG object is a nice design pattern when using Airflow.

Airbnb uses the *stage-check-exchange* pattern when loading data. Data is staged in a temporary table, after which data quality checks are performed against that table. Once the checks all pass the partition is moved into the production table.

As another example, consider the following DAG:



We can combine all of the parallel `task-*` operators into a single SubDAG, so that the resulting DAG resembles the following:



Note that SubDAG operators should contain a factory method that returns a DAG object. This will prevent the SubDAG from being treated like a separate DAG in the main UI. For example:

```
#dags/subdag.py
from airflow.models import DAG
from airflow.operators.dummy_operator import DummyOperator


# Dag is returned by a factory method
def sub_dag(parent_dag_name, child_dag_name, start_date, schedule_interval):
  dag = DAG(
    '%s.%s' % (parent_dag_name, child_dag_name),
    schedule_interval=schedule_interval,
    start_date=start_date,
  )

  dummy_operator = DummyOperator(
    task_id='dummy_task',
    dag=dag,
  )

  return dag
```

This SubDAG can then be referenced in your main DAG file:

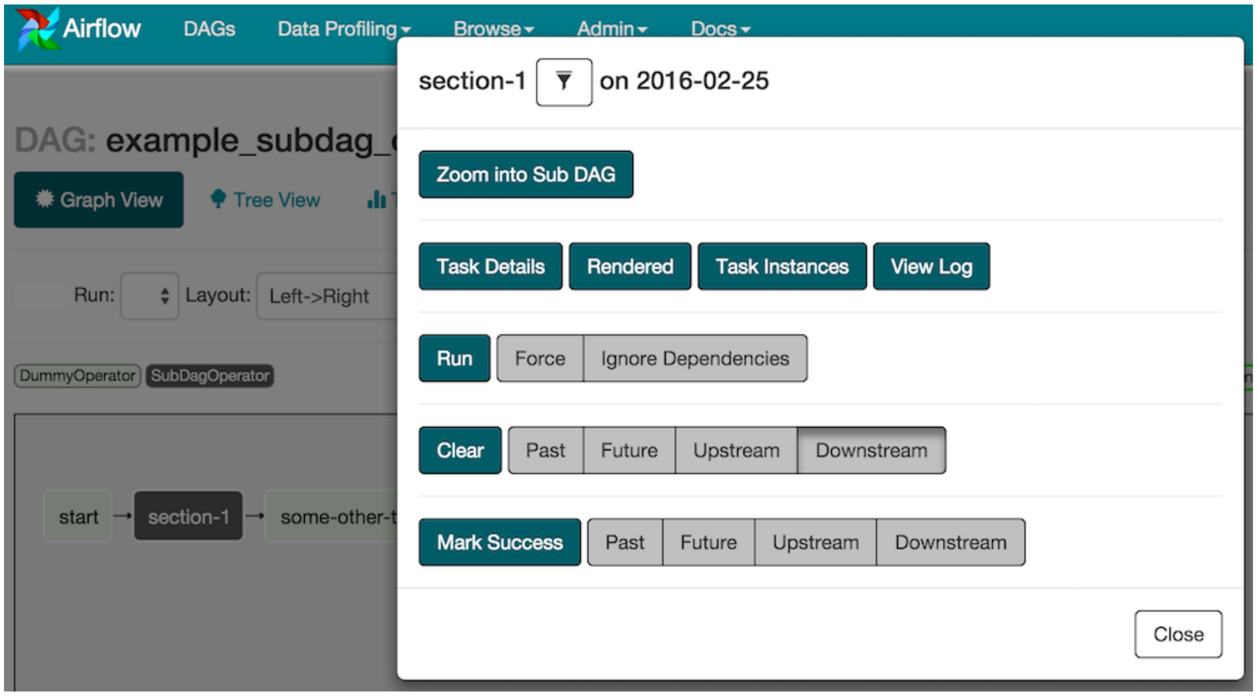
```
# main_dag.py
from datetime import datetime, timedelta
from airflow.models import DAG
from airflow.operators.subdag_operator import SubDagOperator
from dags.subdag import sub_dag


PARENT_DAG_NAME = 'parent_dag'
CHILD_DAG_NAME = 'child_dag'

main_dag = DAG(
  dag_id=PARENT_DAG_NAME,
  schedule_interval=timedelta(hours=1),
  start_date=datetime(2016, 1, 1)
)
```

(continues on next page)

(continued from previous page)

```
sub_dag = SubDagOperator(
  subdag=sub_dag(PARENT_DAG_NAME, CHILD_DAG_NAME, main_dag.start_date,
                 main_dag.schedule_interval),
  task_id=CHILD_DAG_NAME,
  dag=main_dag,
)
```

You can zoom into a SubDagOperator from the graph view of the main DAG to show the tasks contained within the SubDAG:



Some other tips when using SubDAGs:

- by convention, a SubDAG's `dag_id` should be prefixed by its parent and a dot. As in `parent.child`
- share arguments between the main DAG and the SubDAG by passing arguments to the SubDAG operator (as demonstrated above)
- SubDAGs must have a schedule and be enabled. If the SubDAG's schedule is set to `None` or `@once`, the SubDAG will succeed without having done anything
- clearing a SubDagOperator also clears the state of the tasks within
- marking success on a SubDagOperator does not affect the state of the tasks within
- refrain from using `depends_on_past=True` in tasks within the SubDAG as this can be confusing
- it is possible to specify an executor for the SubDAG. It is common to use the SequentialExecutor if you want to run the SubDAG in-process and effectively limit its parallelism to one. Using LocalExecutor can be problematic as it may over-subscribe your worker, running multiple tasks in a single slot

See `airflow/example_dags` for a demonstration.

3.8.2.9 SLAs

Service Level Agreements, or time by which a task or DAG should have succeeded, can be set at a task level as a `timedelta`. If one or many instances have not succeeded by that time, an alert email is sent detailing the list of tasks that missed their SLA. The event is also recorded in the database and made available in the web UI under `Browse->Missed SLAs` where events can be analyzed and documented.

3.8.2.10 Trigger Rules

Though the normal workflow behavior is to trigger tasks when all their directly upstream tasks have succeeded, Airflow allows for more complex dependency settings.

All operators have a `trigger_rule` argument which defines the rule by which the generated task get triggered. The default value for `trigger_rule` is `all_success` and can be defined as "trigger this task when all directly upstream tasks have succeeded". All other rules described here are based on direct parent tasks and are values that can be passed to any operator while creating tasks:

- `all_success`: (default) all parents have succeeded
- `all_failed`: all parents are in a `failed` or `upstream_failed` state
- `all_done`: all parents are done with their execution
- `one_failed`: fires as soon as at least one parent has failed, it does not wait for all parents to be done
- `one_success`: fires as soon as at least one parent succeeds, it does not wait for all parents to be done
- `none_failed`: all parents have not failed (`failed` or `upstream_failed`) i.e. all parents have succeeded or been skipped
- `dummy`: dependencies are just for show, trigger at will

Note that these can be used in conjunction with `depends_on_past` (boolean) that, when set to `True`, keeps a task from getting triggered if the previous schedule for the task hasn't succeeded.

3.8.2.11 Latest Run Only

Standard workflow behavior involves running a series of tasks for a particular date/time range. Some workflows, however, perform tasks that are independent of run time but need to be run on a schedule, much like a standard cron job. In these cases, backfills or running jobs missed during a pause just wastes CPU cycles.

For situations like this, you can use the `LatestOnlyOperator` to skip tasks that are not being run during the most recent scheduled run for a DAG. The `LatestOnlyOperator` skips all immediate downstream tasks, and itself, if the time right now is not between its `execution_time` and the next scheduled `execution_time`.

One must be aware of the interaction between skipped tasks and trigger rules. Skipped tasks will cascade through trigger rules `all_success` and `all_failed` but not `all_done`, `one_failed`, `one_success`, and `dummy`. If you would like to use the `LatestOnlyOperator` with trigger rules that do not cascade skips, you will need to ensure that the `LatestOnlyOperator` is **directly** upstream of the task you would like to skip.

It is possible, through use of trigger rules to mix tasks that should run in the typical date/time dependent mode and those using the `LatestOnlyOperator`.

For example, consider the following dag:

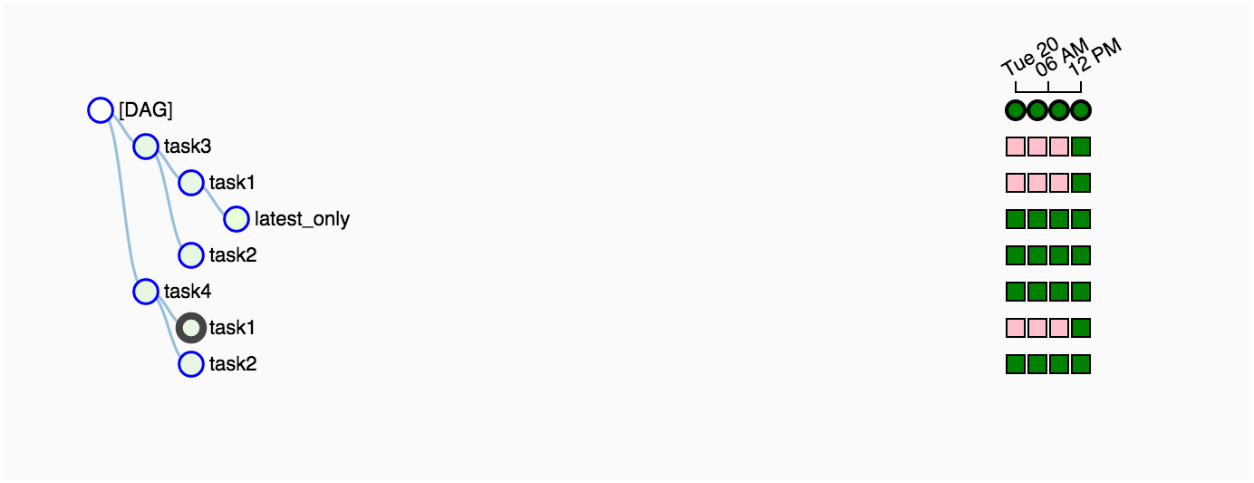
```python
#dags/latest_only_with_trigger.py
import datetime as dt

from airflow.models import DAG
```

(continues on next page)

(continued from previous page)

```
from airflow.operators.dummy_operator import DummyOperator
from airflow.operators.latest_only_operator import LatestOnlyOperator
from airflow.utils.trigger_rule import TriggerRule


dag = DAG(
    dag_id='latest_only_with_trigger',
    schedule_interval=dt.timedelta(hours=4),
    start_date=dt.datetime(2016, 9, 20),
)

latest_only = LatestOnlyOperator(task_id='latest_only', dag=dag)

task1 = DummyOperator(task_id='task1', dag=dag)
task1.set_upstream(latest_only)

task2 = DummyOperator(task_id='task2', dag=dag)

task3 = DummyOperator(task_id='task3', dag=dag)
task3.set_upstream([task1, task2])

task4 = DummyOperator(task_id='task4', dag=dag,
                      trigger_rule=TriggerRule.ALL_DONE)
task4.set_upstream([task1, task2])
```

In the case of this dag, the `latest_only` task will show up as skipped for all runs except the latest run. `task1` is directly downstream of `latest_only` and will also skip for all runs except the latest. `task2` is entirely independent of `latest_only` and will run in all scheduled periods. `task3` is downstream of `task1` and `task2` and because of the default `trigger_rule` being `all_success` will receive a cascaded skip from `task1`. `task4` is downstream of `task1` and `task2` but since its `trigger_rule` is set to `all_done` it will trigger as soon as `task1` has been skipped (a valid completion state) and `task2` has succeeded.



3.8.2.12 Zombies & Undeads

Task instances die all the time, usually as part of their normal life cycle, but sometimes unexpectedly.

Zombie tasks are characterized by the absence of an heartbeat (emitted by the job periodically) and a `running` status in the database. They can occur when a worker node can't reach the database, when Airflow processes are killed externally, or when a node gets rebooted for instance. Zombie killing is performed periodically by the scheduler's process.

Undead processes are characterized by the existence of a process and a matching heartbeat, but Airflow isn't aware of this task as `running` in the database. This mismatch typically occurs as the state of the database is altered, most likely by deleting rows in the "Task Instances" view in the UI. Tasks are instructed to verify their state as part of the heartbeat routine, and terminate themselves upon figuring out that they are in this "undead" state.

3.8.2.13 Cluster Policy

Your local airflow settings file can define a `policy` function that has the ability to mutate task attributes based on other task or DAG attributes. It receives a single argument as a reference to task objects, and is expected to alter its attributes.

For example, this function could apply a specific queue property when using a specific operator, or enforce a task timeout policy, making sure that no tasks run for more than 48 hours. Here's an example of what this may look like inside your `airflow_settings.py`:

```
def policy(task):
    if task.__class__.__name__ == 'HivePartitionSensor':
        task.queue = "sensor_queue"
    if task.timeout > timedelta(hours=48):
        task.timeout = timedelta(hours=48)
```

3.8.2.14 Documentation & Notes

It's possible to add documentation or notes to your dags & task objects that become visible in the web interface ("Graph View" for dags, "Task Details" for tasks). There are a set of special task attributes that get rendered as rich content if defined:

attribute	rendered to
doc	monospace
doc_json	json
doc_yaml	yaml
doc_md	markdown
doc_rst	reStructuredText

Please note that for dags, doc_md is the only attribute interpreted.

This is especially useful if your tasks are built dynamically from configuration files, it allows you to expose the configuration that led to the related tasks in Airflow.

```
"""
### My great DAG
"""

dag = DAG('my_dag', default_args=default_args)
dag.doc_md = __doc__

t = BashOperator("foo", dag=dag)
t.doc_md = """\
#Title"
Here's a [url](www.airbnb.com)
"""
```

This content will get rendered as markdown respectively in the "Graph View" and "Task Details" pages.

3.8.2.15 Jinja Templating

Airflow leverages the power of Jinja Templating and this can be a powerful tool to use in combination with macros (see the *Macros* section).

For example, say you want to pass the execution date as an environment variable to a Bash script using the `BashOperator`.

```
# The execution date as YYYY-MM-DD
date = "{{ ds }}"
t = BashOperator(
    task_id='test_env',
    bash_command='/tmp/test.sh ',
    dag=dag,
    env={'EXECUTION_DATE': date})
```

Here, `{{ ds }}` is a macro, and because the `env` parameter of the `BashOperator` is templated with Jinja, the execution date will be available as an environment variable named `EXECUTION_DATE` in your Bash script.

You can use Jinja templating with every parameter that is marked as "templated" in the documentation. Template substitution occurs just before the pre_execute function of your operator is called.

3.8.3 Packaged dags

While often you will specify dags in a single `.py` file it might sometimes be required to combine dag and its dependencies. For example, you might want to combine several dags together to version them together or you might want to manage them together or you might need an extra module that is not available by default on the system you are running airflow on. To allow this you can create a zip file that contains the dag(s) in the root of the zip file and have the extra modules unpacked in directories.

For instance you can create a zip file that looks like this:

```
my_dag1.py
my_dag2.py
package1/__init__.py
package1/functions.py
```

Airflow will scan the zip file and try to load `my_dag1.py` and `my_dag2.py`. It will not go into subdirectories as these are considered to be potential packages.

In case you would like to add module dependencies to your DAG you basically would do the same, but then it is more to use a virtualenv and pip.

```
virtualenv zip_dag
source zip_dag/bin/activate

mkdir zip_dag_contents
cd zip_dag_contents

pip install --install-option="--install-lib=$PWD" my_useful_package
cp ~/my_dag.py .

zip -r zip_dag.zip *
```

Note: the zip file will be inserted at the beginning of module search list (sys.path) and as such it will be available to any other code that resides within the same interpreter.

Note: packaged dags cannot be used with pickling turned on.

Note: packaged dags cannot contain dynamic libraries (eg. libz.so) these need to be available on the system if a module needs those. In other words only pure python modules can be packaged.

3.8.4 .airflowignore

A `.airflowignore` file specifies the directories or files in `DAG_FOLDER` that Airflow should intentionally ignore. Each line in `.airflowignore` specifies a regular expression pattern, and directories or files whose names (not DAG id) match any of the patterns would be ignored (under the hood, `re.findall()` is used to match the pattern). Overall it works like a `.gitignore` file.

`.airflowignore` file should be put in your `DAG_FOLDER`. For example, you can prepare a `.airflowignore` file with contents

```
project_a
tenant_[\d]
```

Then files like "project_a_dag_1.py", "TESTING_project_a.py", "tenant_1.py", "project_a/dag_1.py", and "tenant_1/dag_1.py" in your `DAG_FOLDER` would be ignored (If a directory's name matches any of the patterns, this directory and all its subfolders would not be scanned by Airflow at all. This improves efficiency of DAG finding).

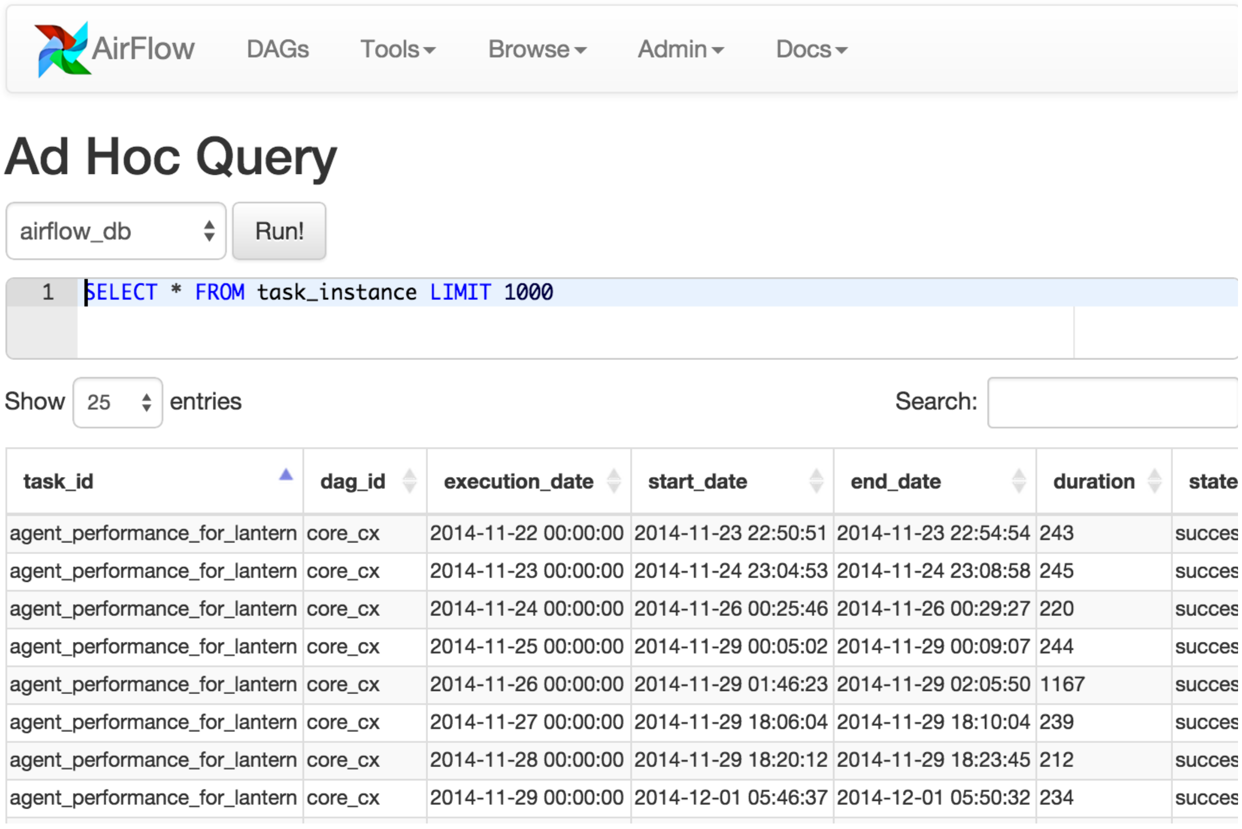
The scope of a `.airflowignore` file is the directory it is in plus all its subfolders. You can also prepare `.airflowignore` file for a subfolder in `DAG_FOLDER` and it would only be applicable for that subfolder.

3.9 Data Profiling

Part of being productive with data is having the right weapons to profile the data you are working with. Airflow provides a simple query interface to write SQL and get results quickly, and a charting application letting you visualize data.

3.9.1 Adhoc Queries

The adhoc query UI allows for simple SQL interactions with the database connections registered in Airflow.



Ad Hoc Query

airflow_db Run!

```
SELECT * FROM task_instance LIMIT 1000
```

Show 25 entries Search:

task_id	dag_id	execution_date	start_date	end_date	duration	state
agent_performance_for_lantern	core_cx	2014-11-22 00:00:00	2014-11-23 22:50:51	2014-11-23 22:54:54	243	succes
agent_performance_for_lantern	core_cx	2014-11-23 00:00:00	2014-11-24 23:04:53	2014-11-24 23:08:58	245	succes
agent_performance_for_lantern	core_cx	2014-11-24 00:00:00	2014-11-26 00:25:46	2014-11-26 00:29:27	220	succes
agent_performance_for_lantern	core_cx	2014-11-25 00:00:00	2014-11-29 00:05:02	2014-11-29 00:09:07	244	succes
agent_performance_for_lantern	core_cx	2014-11-26 00:00:00	2014-11-29 01:46:23	2014-11-29 02:05:50	1167	succes
agent_performance_for_lantern	core_cx	2014-11-27 00:00:00	2014-11-29 18:06:04	2014-11-29 18:10:04	239	succes
agent_performance_for_lantern	core_cx	2014-11-28 00:00:00	2014-11-29 18:20:12	2014-11-29 18:23:45	212	succes
agent_performance_for_lantern	core_cx	2014-11-29 00:00:00	2014-12-01 05:46:37	2014-12-01 05:50:32	234	succes

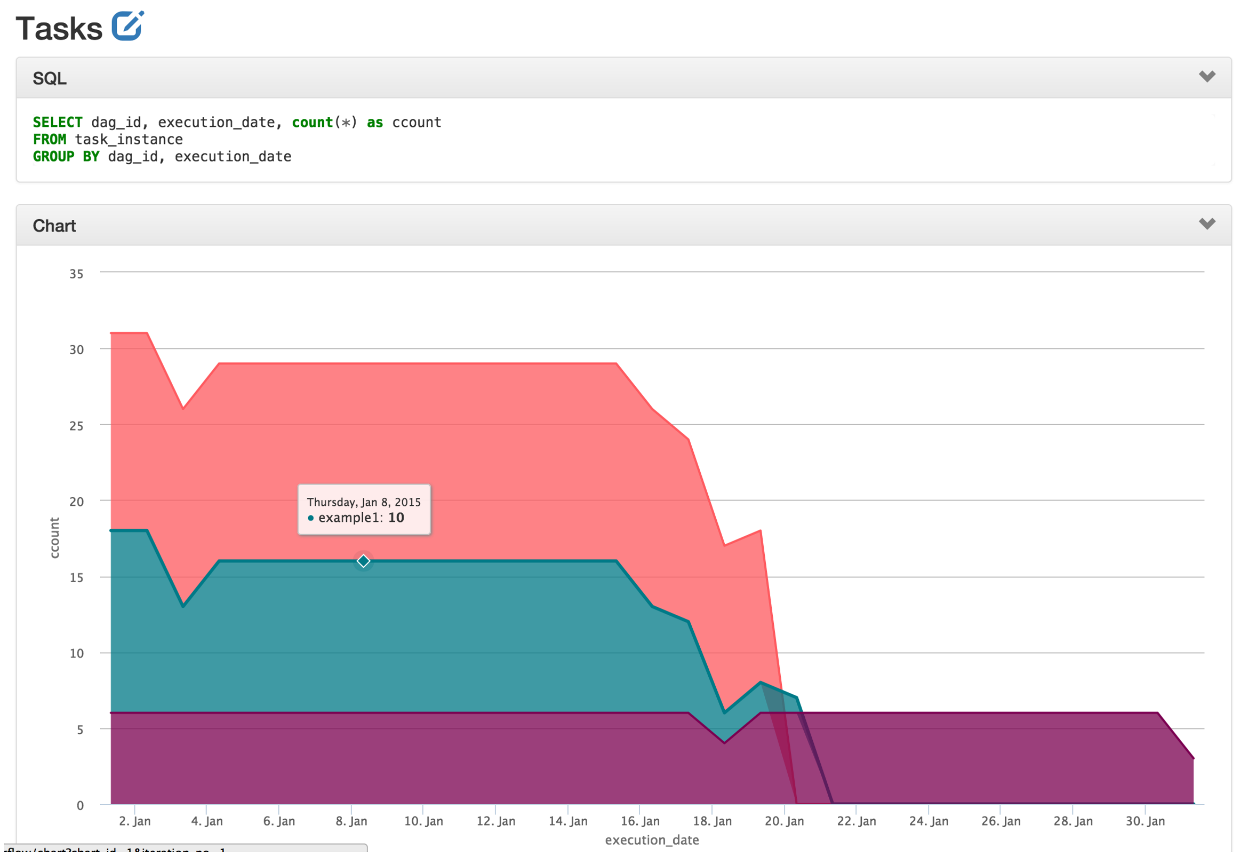
3.9.2 Charts

A simple UI built on top of flask-admin and highcharts allows building data visualizations and charts easily. Fill in a form with a label, SQL, chart type, pick a source database from your environment's connections, select a few other options, and save it for later use.

You can even use the same templating and macros available when writing airflow pipelines, parameterizing your queries and modifying parameters directly in the URL.

These charts are basic, but they're easy to create, modify and share.

3.9.2.1 Chart Screenshot



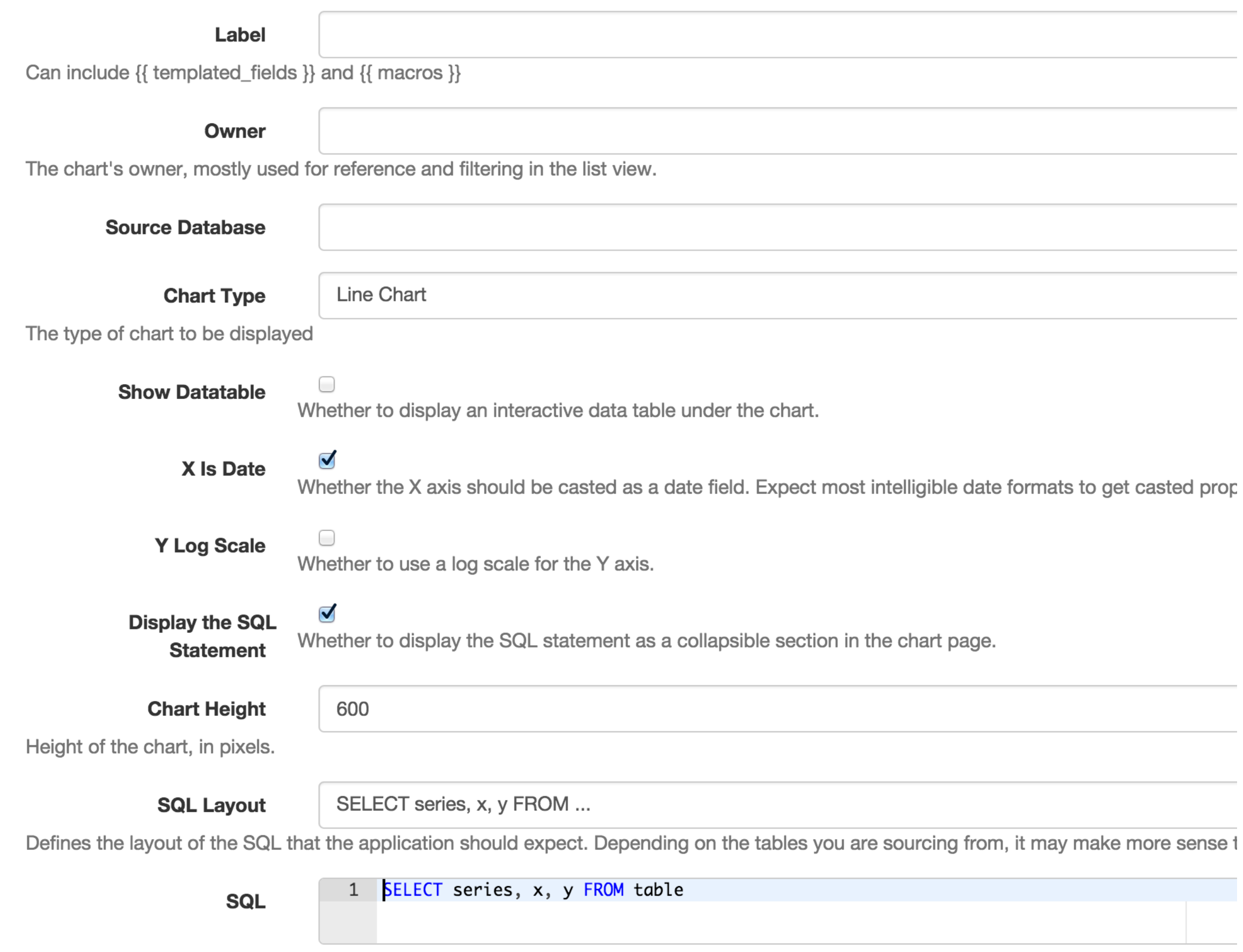
Tasks

SQL

```
SELECT dag_id, execution_date, count(*) as ccount
FROM task_instance
GROUP BY dag_id, execution_date
```

Chart

3.9.2.2 Chart Form Screenshot



Label	
Can include {{ templated_fields }} and {{ macros }}	
Owner	
The chart's owner, mostly used for reference and filtering in the list view.	
Source Database	
Chart Type	Line Chart
The type of chart to be displayed	
Show Datatable	☐ Whether to display an interactive data table under the chart.
X Is Date	✓ Whether the X axis should be casted as a date field. Expect most intelligible date formats to get casted prop
Y Log Scale	☐ Whether to use a log scale for the Y axis.
Display the SQL Statement	✓ Whether to display the SQL statement as a collapsible section in the chart page.
Chart Height	600
Height of the chart, in pixels.	
SQL Layout	SELECT series, x, y FROM ...
Defines the layout of the SQL that the application should expect. Depending on the tables you are sourcing from, it may make more sense t	
SQL	SELECT series, x, y FROM table

3.10 Command Line Interface

Airflow has a very rich command line interface that allows for many types of operation on a DAG, starting services, and supporting development and testing.

```
usage: airflow [-h]
               {resetdb,render,variables,delete_user,connections,create_user,pause,
↪sync_perm,task_failed_deps,version,trigger_dag,initdb,test,unpause,list_dag_runs,
↪dag_state,run,list_tasks,backfill,list_dags,kerberos,worker,webserver,flower,
↪scheduler,task_state,pool,serve_logs,clear,list_users,next_execution,upgradedb,
↪delete_dag}
               ...
```

3.10.1 Positional Arguments

subcommand	Possible choices: resetdb, render, variables, delete_user, connections, create_user, pause, sync_perm, task_failed_deps, version, trigger_dag, initdb,

test, unpause, list_dag_runs, dag_state, run, list_tasks, backfill, list_dags, kerberos, worker, webserver, flower, scheduler, task_state, pool, serve_logs, clear, list_users, next_execution, upgradedb, delete_dag

sub-command help

3.10.2 Sub-commands:

3.10.2.1 resetdb

Burn down and rebuild the metadata database

```
airflow resetdb [-h] [-y]
```

Named Arguments

-y, --yes	Do not prompt to confirm reset. Use with care! Default: False

3.10.2.2 render

Render a task instance's template(s)

```
airflow render [-h] [-sd SUBDIR] dag_id task_id execution_date
```

Positional Arguments

dag_id	The id of the dag
task_id	The id of the task
execution_date	The execution date of the DAG

Named Arguments

-sd, --subdir	File location or directory from which to look for the dag. Defaults to '[AIRFLOW_HOME]/dags' where [AIRFLOW_HOME] is the value you set for 'AIRFLOW_HOME' config you set in 'airflow.cfg' Default: "[AIRFLOW_HOME]/dags"

3.10.2.3 variables

CRUD operations on variables

```
airflow variables [-h] [-s KEY VAL] [-g KEY] [-j] [-d VAL] [-i FILEPATH]
                  [-e FILEPATH] [-x KEY]
```

Named Arguments

-s, --set	Set a variable
-g, --get	Get value of a variable
-j, --json	Deserialize JSON variable Default: False
-d, --default	Default value returned if variable does not exist
-i, --import	Import variables from JSON file
-e, --export	Export variables to JSON file
-x, --delete	Delete a variable

3.10.2.4 delete_user

Delete an account for the Web UI

```
airflow delete_user [-h] [-u USERNAME]
```

Named Arguments

-u, --username	Username of the user

3.10.2.5 connections

List/Add/Delete connections

```
airflow connections [-h] [-l] [-a] [-d] [--conn_id CONN_ID]
                    [--conn_uri CONN_URI] [--conn_extra CONN_EXTRA]
                    [--conn_type CONN_TYPE] [--conn_host CONN_HOST]
                    [--conn_login CONN_LOGIN] [--conn_password CONN_PASSWORD]
                    [--conn_schema CONN_SCHEMA] [--conn_port CONN_PORT]
```

Named Arguments

-l, --list	List all connections Default: False
-a, --add	Add a connection Default: False
-d, --delete	Delete a connection Default: False
--conn_id	Connection id, required to add/delete a connection
--conn_uri	Connection URI, required to add a connection without conn_type
--conn_extra	Connection *Extra* field, optional when adding a connection

--conn_type	Connection type, required to add a connection without conn_uri
--conn_host	Connection host, optional when adding a connection
--conn_login	Connection login, optional when adding a connection
--conn_password	Connection password, optional when adding a connection
--conn_schema	Connection schema, optional when adding a connection
--conn_port	Connection port, optional when adding a connection

3.10.2.6 create_user

Create an account for the Web UI (FAB-based)

```
airflow create_user [-h] [-r ROLE] [-u USERNAME] [-e EMAIL] [-f FIRSTNAME]
                    [-l LASTNAME] [-p PASSWORD] [--use_random_password]
```

Named Arguments

-r, --role	Role of the user. Existing roles include Admin, User, Op, Viewer, and Public
-u, --username	Username of the user
-e, --email	Email of the user
-f, --firstname	First name of the user
-l, --lastname	Last name of the user
-p, --password	Password of the user
--use_random_password	Do not prompt for password. Use random string instead Default: False

3.10.2.7 pause

Pause a DAG

```
airflow pause [-h] [-sd SUBDIR] dag_id
```

Positional Arguments

dag_id	The id of the dag

Named Arguments

-sd, --subdir	File location or directory from which to look for the dag. Defaults to '[AIRFLOW_HOME]/dags' where [AIRFLOW_HOME] is the value you set for 'AIRFLOW_HOME' config you set in 'airflow.cfg' Default: "[AIRFLOW_HOME]/dags"

3.10.2.8 sync_perm

Update existing role's permissions.

```
airflow sync_perm [-h]
```

3.10.2.9 task_failed_deps

Returns the unmet dependencies for a task instance from the perspective of the scheduler. In other words, why a task instance doesn't get scheduled and then queued by the scheduler, and then run by an executor).

```
airflow task_failed_deps [-h] [-sd SUBDIR] dag_id task_id execution_date
```

Positional Arguments

dag_id	The id of the dag
task_id	The id of the task
execution_date	The execution date of the DAG

Named Arguments

-sd, --subdir	File location or directory from which to look for the dag. Defaults to '[AIRFLOW_HOME]/dags' where [AIRFLOW_HOME] is the value you set for 'AIRFLOW_HOME' config you set in 'airflow.cfg' Default: "[AIRFLOW_HOME]/dags"

3.10.2.10 version

Show the version

```
airflow version [-h]
```

3.10.2.11 trigger_dag

Trigger a DAG run

```
airflow trigger_dag [-h] [-sd SUBDIR] [-r RUN_ID] [-c CONF] [-e EXEC_DATE]
                    dag_id
```

Positional Arguments

dag_id	The id of the dag

Named Arguments

-sd, --subdir	File location or directory from which to look for the dag. Defaults to '[AIRFLOW_HOME]/dags' where [AIRFLOW_HOME] is the value you set for 'AIRFLOW_HOME' config you set in 'airflow.cfg' Default: "[AIRFLOW_HOME]/dags"
-r, --run_id	Helps to identify this run
-c, --conf	JSON string that gets pickled into the DagRun's conf attribute
-e, --exec_date	The execution date of the DAG

3.10.2.12 initdb

Initialize the metadata database

```
airflow initdb [-h]
```

3.10.2.13 test

Test a task instance. This will run a task without checking for dependencies or recording its state in the database.

```
airflow test [-h] [-sd SUBDIR] [-dr] [-tp TASK_PARAMS]
             dag_id task_id execution_date
```

Positional Arguments

dag_id	The id of the dag
task_id	The id of the task
execution_date	The execution date of the DAG

Named Arguments

-sd, --subdir	File location or directory from which to look for the dag. Defaults to '[AIRFLOW_HOME]/dags' where [AIRFLOW_HOME] is the value you set for 'AIRFLOW_HOME' config you set in 'airflow.cfg' Default: "[AIRFLOW_HOME]/dags"
-dr, --dry_run	Perform a dry run Default: False
-tp, --task_params	Sends a JSON params dict to the task

3.10.2.14 unpause

Resume a paused DAG

```
airflow unpause [-h] [-sd SUBDIR] dag_id
```

Positional Arguments

dag_id	The id of the dag

Named Arguments

-sd, --subdir	File location or directory from which to look for the dag. Defaults to '[AIRFLOW_HOME]/dags' where [AIRFLOW_HOME] is the value you set for 'AIRFLOW_HOME' config you set in 'airflow.cfg' Default: "[AIRFLOW_HOME]/dags"

3.10.2.15 list_dag_runs

List dag runs given a DAG id. If state option is given, it will onlysearch for all the dagruns with the given state. If no_backfill option is given, it will filter outall backfill dagruns for given dag id.

```
airflow list_dag_runs [-h] [--no_backfill] [--state STATE] dag_id
```

Positional Arguments

dag_id	The id of the dag

Named Arguments

--no_backfill	filter all the backfill dagruns given the dag id Default: False
--state	Only list the dag runs corresponding to the state

3.10.2.16 dag_state

Get the status of a dag run

```
airflow dag_state [-h] [-sd SUBDIR] dag_id execution_date
```

Positional Arguments

dag_id	The id of the dag
execution_date	The execution date of the DAG

Named Arguments

-sd, --subdir	File location or directory from which to look for the dag. Defaults to '[AIRFLOW_HOME]/dags' where [AIRFLOW_HOME] is the value you set for 'AIRFLOW_HOME' config you set in 'airflow.cfg' Default: "[AIRFLOW_HOME]/dags"

3.10.2.17 run

Run a single task instance

```
airflow run [-h] [-sd SUBDIR] [-m] [-f] [--pool POOL] [--cfg_path CFG_PATH]
            [-l] [-A] [-i] [-I] [--ship_dag] [-p PICKLE] [-int]
            dag_id task_id execution_date
```

Positional Arguments

dag_id	The id of the dag
task_id	The id of the task
execution_date	The execution date of the DAG

Named Arguments

-sd, --subdir	File location or directory from which to look for the dag. Defaults to '[AIRFLOW_HOME]/dags' where [AIRFLOW_HOME] is the value you set for 'AIRFLOW_HOME' config you set in 'airflow.cfg' Default: "[AIRFLOW_HOME]/dags"
-m, --mark_success	Mark jobs as succeeded without running them Default: False
-f, --force	Ignore previous task instance state, rerun regardless if task already succeeded/failed Default: False
--pool	Resource pool to use
--cfg_path	Path to config file to use instead of airflow.cfg
-l, --local	Run the task using the LocalExecutor Default: False
-A, --ignore_all_dependencies	Ignores all non-critical dependencies, including ignore_ti_state and ignore_task_deps Default: False
-i, --ignore_dependencies	Ignore task-specific dependencies, e.g. upstream, depends_on_past, and retry delay dependencies Default: False

-I, --ignore_depends_on_past	Ignore depends_on_past dependencies (but respect upstream dependencies) Default: False
--ship_dag	Pickles (serializes) the DAG and ships it to the worker Default: False
-p, --pickle	Serialized pickle object of the entire dag (used internally)
-int, --interactive	Do not capture standard output and error streams (useful for interactive debugging) Default: False

3.10.2.18 list_tasks

List the tasks within a DAG

```
airflow list_tasks [-h] [-t] [-sd SUBDIR] dag_id
```

Positional Arguments

dag_id	The id of the dag

Named Arguments

-t, --tree	Tree view Default: False
-sd, --subdir	File location or directory from which to look for the dag. Defaults to '[AIRFLOW_HOME]/dags' where [AIRFLOW_HOME] is the value you set for 'AIRFLOW_HOME' config you set in 'airflow.cfg' Default: "[AIRFLOW_HOME]/dags"

3.10.2.19 backfill

Run subsections of a DAG for a specified date range. If reset_dag_run option is used, backfill will first prompt users whether airflow should clear all the previous dag_run and task_instances within the backfill date range. If rerun_failed_tasks is used, backfill will auto re-run the previous failed task instances within the backfill date range.

```
airflow backfill [-h] [-t TASK_REGEX] [-s START_DATE] [-e END_DATE] [-m] [-l]
                 [-x] [-i] [-I] [-sd SUBDIR] [--pool POOL]
                 [--delay_on_limit DELAY_ON_LIMIT] [-dr] [-v] [-c CONF]
                 [--reset_dagruns] [--rerun_failed_tasks]
                 dag_id
```

Positional Arguments

dag_id	The id of the dag

Named Arguments

-t, --task_regex The regex to filter specific task_ids to backfill (optional)

-s, --start_date Override start_date YYYY-MM-DD

-e, --end_date Override end_date YYYY-MM-DD

-m, --mark_success Mark jobs as succeeded without running them

Default: False

-l, --local Run the task using the LocalExecutor

Default: False

-x, --donot_pickle Do not attempt to pickle the DAG object to send over to the workers, just tell the workers to run their version of the code.

Default: False

-i, --ignore_dependencies Skip upstream tasks, run only the tasks matching the regexp. Only works in conjunction with task_regex

Default: False

-I, --ignore_first_depends_on_past Ignores depends_on_past dependencies for the first set of tasks only (subsequent executions in the backfill DO respect depends_on_past).

Default: False

-sd, --subdir File location or directory from which to look for the dag. Defaults to '[AIRFLOW_HOME]/dags' where [AIRFLOW_HOME] is the value you set for 'AIRFLOW_HOME' config you set in 'airflow.cfg'

Default: "[AIRFLOW_HOME]/dags"

--pool Resource pool to use

--delay_on_limit Amount of time in seconds to wait when the limit on maximum active dag runs (max_active_runs) has been reached before trying to execute a dag run again.

Default: 1.0

-dr, --dry_run Perform a dry run

Default: False

-v, --verbose Make logging output more verbose

Default: False

-c, --conf JSON string that gets pickled into the DagRun's conf attribute

--reset_dagruns if set, the backfill will delete existing backfill-related DAG runs and start anew with fresh, running DAG runs

Default: False

--rerun_failed_tasks if set, the backfill will auto-rerun all the failed tasks for the backfill date range instead of throwing exceptions

Default: False

3.10.2.20 list_dags

List all the DAGs

```
airflow list_dags [-h] [-sd SUBDIR] [-r]
```

Named Arguments

-sd, --subdir	File location or directory from which to look for the dag. Defaults to '[AIRFLOW_HOME]/dags' where [AIRFLOW_HOME] is the value you set for 'AIRFLOW_HOME' config you set in 'airflow.cfg' Default: "[AIRFLOW_HOME]/dags"
-r, --report	Show DagBag loading report Default: False

3.10.2.21 kerberos

Start a kerberos ticket renewer

```
airflow kerberos [-h] [-kt [KEYTAB]] [--pid [PID]] [-D] [--stdout STDOUT]
                 [--stderr STDERR] [-l LOG_FILE]
                 [principal]
```

Positional Arguments

principal	kerberos principal Default: airflow

Named Arguments

-kt, --keytab	keytab Default: airflow.keytab
--pid	PID file location
-D, --daemon	Daemonize instead of running in the foreground Default: False
--stdout	Redirect stdout to this file
--stderr	Redirect stderr to this file
-l, --log-file	Location of the log file

3.10.2.22 worker

Start a Celery worker node

```
airflow worker [-h] [-p] [-q QUEUES] [-c CONCURRENCY] [-cn CELERY_HOSTNAME]
               [--pid [PID]] [-D] [--stdout STDOUT] [--stderr STDERR]
               [-l LOG_FILE]
```

Named Arguments

-p, --do_pickle	Attempt to pickle the DAG object to send over to the workers, instead of letting workers run their version of the code. Default: False
-q, --queues	Comma delimited list of queues to serve Default: default
-c, --concurrency	The number of worker processes Default: 16
-cn, --celery_hostname	Set the hostname of celery worker if you have multiple workers on a single machine.
--pid	PID file location
-D, --daemon	Daemonize instead of running in the foreground Default: False
--stdout	Redirect stdout to this file
--stderr	Redirect stderr to this file
-l, --log-file	Location of the log file

3.10.2.23 webserver

Start a Airflow webserver instance

```
airflow webserver [-h] [-p PORT] [-w WORKERS]
                  [-k {sync,eventlet,gevent,tornado}] [-t WORKER_TIMEOUT]
                  [-hn HOSTNAME] [--pid [PID]] [-D] [--stdout STDOUT]
                  [--stderr STDERR] [-A ACCESS_LOGFILE] [-E ERROR_LOGFILE]
                  [-l LOG_FILE] [--ssl_cert SSL_CERT] [--ssl_key SSL_KEY] [-d]
```

Named Arguments

-p, --port	The port on which to run the server Default: 8080
-w, --workers	Number of workers to run the webserver on Default: 4

-k, --workerclass	Possible choices: sync, eventlet, gevent, tornado The worker class to use for Gunicorn Default: sync
-t, --worker_timeout	The timeout for waiting on webserver workers Default: 120
-hn, --hostname	Set the hostname on which to run the web server Default: 0.0.0.0
--pid	PID file location
-D, --daemon	Daemonize instead of running in the foreground Default: False
--stdout	Redirect stdout to this file
--stderr	Redirect stderr to this file
-A, --access_logfile	The logfile to store the webserver access log. Use '-' to print to stderr. Default: -
-E, --error_logfile	The logfile to store the webserver error log. Use '-' to print to stderr. Default: -
-l, --log-file	Location of the log file
--ssl_cert	Path to the SSL certificate for the webserver
--ssl_key	Path to the key to use with the SSL certificate
-d, --debug	Use the server that ships with Flask in debug mode Default: False

3.10.2.24 flower

Start a Celery Flower

```
airflow flower [-h] [-hn HOSTNAME] [-p PORT] [-fc FLOWER_CONF] [-u URL_PREFIX]
               [-ba BASIC_AUTH] [-a BROKER_API] [--pid [PID]] [-D]
               [--stdout STDOUT] [--stderr STDERR] [-l LOG_FILE]
```

Named Arguments

-hn, --hostname	Set the hostname on which to run the server Default: 0.0.0.0
-p, --port	The port on which to run the server Default: 5555
-fc, --flower_conf	Configuration file for flower
-u, --url_prefix	URL prefix for Flower

-ba, --basic_auth	Securing Flower with Basic Authentication. Accepts user:password pairs separated by a comma. Example: flower_basic_auth = user1:password1,user2:password2
-a, --broker_api	Broker api
--pid	PID file location
-D, --daemon	Daemonize instead of running in the foreground Default: False
--stdout	Redirect stdout to this file
--stderr	Redirect stderr to this file
-l, --log-file	Location of the log file

3.10.2.25 scheduler

Start a scheduler instance

```
airflow scheduler [-h] [-d DAG_ID] [-sd SUBDIR] [-r RUN_DURATION]
                  [-n NUM_RUNS] [-p] [--pid [PID]] [-D] [--stdout STDOUT]
                  [--stderr STDERR] [-l LOG_FILE]
```

Named Arguments

-d, --dag_id	The id of the dag to run
-sd, --subdir	File location or directory from which to look for the dag. Defaults to '[AIRFLOW_HOME]/dags' where [AIRFLOW_HOME] is the value you set for 'AIRFLOW_HOME' config you set in 'airflow.cfg' Default: "[AIRFLOW_HOME]/dags"
-r, --run-duration	Set number of seconds to execute before exiting
-n, --num_runs	Set the number of runs to execute before exiting Default: -1
-p, --do_pickle	Attempt to pickle the DAG object to send over to the workers, instead of letting workers run their version of the code. Default: False
--pid	PID file location
-D, --daemon	Daemonize instead of running in the foreground Default: False
--stdout	Redirect stdout to this file
--stderr	Redirect stderr to this file
-l, --log-file	Location of the log file

3.10.2.26 task_state

Get the status of a task instance

```
airflow task_state [-h] [-sd SUBDIR] dag_id task_id execution_date
```

Positional Arguments

dag_id	The id of the dag
task_id	The id of the task
execution_date	The execution date of the DAG

Named Arguments

-sd, --subdir	File location or directory from which to look for the dag. Defaults to '[AIRFLOW_HOME]/dags' where [AIRFLOW_HOME] is the value you set for 'AIRFLOW_HOME' config you set in 'airflow.cfg' Default: "[AIRFLOW_HOME]/dags"

3.10.2.27 pool

CRUD operations on pools

```
airflow pool [-h] [-s NAME SLOT_COUNT POOL_DESCRIPTION] [-g NAME] [-x NAME]
             [-i FILEPATH] [-e FILEPATH]
```

Named Arguments

-s, --set	Set pool slot count and description, respectively
-g, --get	Get pool info
-x, --delete	Delete a pool
-i, --import	Import pool from JSON file
-e, --export	Export pool to JSON file

3.10.2.28 serve_logs

Serve logs generate by worker

```
airflow serve_logs [-h]
```

3.10.2.29 clear

Clear a set of task instance, as if they never ran

```
airflow clear [-h] [-t TASK_REGEX] [-s START_DATE] [-e END_DATE] [-sd SUBDIR]
              [-u] [-d] [-c] [-f] [-r] [-x] [-xp] [-dx]
              dag_id
```

Positional Arguments

dag_id	The id of the dag

Named Arguments

-t, --task_regex	The regex to filter specific task_ids to backfill (optional)
-s, --start_date	Override start_date YYYY-MM-DD
-e, --end_date	Override end_date YYYY-MM-DD
-sd, --subdir	File location or directory from which to look for the dag. Defaults to '[AIRFLOW_HOME]/dags' where [AIRFLOW_HOME] is the value you set for 'AIRFLOW_HOME' config you set in 'airflow.cfg' Default: "[AIRFLOW_HOME]/dags"
-u, --upstream	Include upstream tasks Default: False
-d, --downstream	Include downstream tasks Default: False
-c, --no_confirm	Do not request confirmation Default: False
-f, --only_failed	Only failed jobs Default: False
-r, --only_running	Only running jobs Default: False
-x, --exclude_subdags	Exclude subdags Default: False
-xp, --exclude_parentdag	Exclude ParentDAGS if the task cleared is a part of a SubDAG Default: False
-dx, --dag_regex	Search dag_id as regex instead of exact string Default: False

3.10.2.30 list_users

List accounts for the Web UI

```
airflow list_users [-h]
```

3.10.2.31 next_execution

Get the next execution datetime of a DAG.

```
airflow next_execution [-h] [-sd SUBDIR] dag_id
```

Positional Arguments

dag_id	The id of the dag

Named Arguments

-sd, --subdir	File location or directory from which to look for the dag. Defaults to '[AIRFLOW_HOME]/dags' where [AIRFLOW_HOME] is the value you set for 'AIRFLOW_HOME' config you set in 'airflow.cfg' Default: "[AIRFLOW_HOME]/dags"

3.10.2.32 upgradedb

Upgrade the metadata database to latest version

```
airflow upgradedb [-h]
```

3.10.2.33 delete_dag

Delete all DB records related to the specified DAG

```
airflow delete_dag [-h] [-y] dag_id
```

Positional Arguments

dag_id	The id of the dag

Named Arguments

-y, --yes	Do not prompt to confirm reset. Use with care! Default: False

3.11 Scheduling & Triggers

The Airflow scheduler monitors all tasks and all DAGs, and triggers the task instances whose dependencies have been met. Behind the scenes, it spins up a subprocess, which monitors and stays in sync with a folder for all DAG objects it may contain, and periodically (every minute or so) collects DAG parsing results and inspects active tasks to see whether they can be triggered.

The Airflow scheduler is designed to run as a persistent service in an Airflow production environment. To kick it off, all you need to do is execute `airflow scheduler`. It will use the configuration specified in `airflow.cfg`.

Note that if you run a DAG on a `schedule_interval` of one day, the run stamped `2016-01-01` will be trigger soon after `2016-01-01T23:59`. In other words, the job instance is started once the period it covers has ended.

Let's Repeat That The scheduler runs your job one `schedule_interval` AFTER the start date, at the END of the period.

The scheduler starts an instance of the executor specified in the your `airflow.cfg`. If it happens to be the `LocalExecutor`, tasks will be executed as subprocesses; in the case of `CeleryExecutor` and `MesosExecutor`, tasks are executed remotely.

To start a scheduler, simply run the command:

```
airflow scheduler
```

3.11.1 DAG Runs

A DAG Run is an object representing an instantiation of the DAG in time.

Each DAG may or may not have a schedule, which informs how `DAG Runs` are created. `schedule_interval` is defined as a DAG arguments, and receives preferably a cron expression as a `str`, or a `datetime.timedelta` object. Alternatively, you can also use one of these cron "preset":

preset	meaning	cron
`None`	Don't schedule, use for exclusively "externally triggered" DAGs	
`@once`	Schedule once and only once	
`@hourly`	Run once an hour at the beginning of the hour	`0 * * * *`
`@daily`	Run once a day at midnight	`0 0 * * *`
`@weekly`	Run once a week at midnight on Sunday morning	`0 0 * * 0`
`@monthly`	Run once a month at midnight of the first day of the month	`0 0 1 * *`
`@yearly`	Run once a year at midnight of January 1	`0 0 1 1 *`

Note: Use `schedule_interval=None` and not `schedule_interval='None'` when you don't want to schedule your DAG.

Your DAG will be instantiated for each schedule, while creating a `DAG Run` entry for each schedule.

DAG runs have a state associated to them (running, failed, success) and informs the scheduler on which set of schedules should be evaluated for task submissions. Without the metadata at the DAG run level, the Airflow scheduler would have much more work to do in order to figure out what tasks should be triggered and come to a crawl. It might also create undesired processing when changing the shape of your DAG, by say adding in new tasks.

3.11.2 Backfill and Catchup

An Airflow DAG with a `start_date`, possibly an `end_date`, and a `schedule_interval` defines a series of intervals which the scheduler turn into individual Dag Runs and execute. A key capability of Airflow is that these

DAG Runs are atomic, idempotent items, and the scheduler, by default, will examine the lifetime of the DAG (from start to end/now, one interval at a time) and kick off a DAG Run for any interval that has not been run (or has been cleared). This concept is called Catchup.

If your DAG is written to handle its own catchup (IE not limited to the interval, but instead to "Now" for instance.), then you will want to turn catchup off (Either on the DAG itself with `dag.catchup = False`) or by default at the configuration file level with `catchup_by_default = False`. What this will do, is to instruct the scheduler to only create a DAG Run for the most current instance of the DAG interval series.

```
"""
Code that goes along with the Airflow tutorial located at:
https://github.com/apache/airflow/blob/master/airflow/example_dags/tutorial.py
"""
from airflow import DAG
from airflow.operators.bash_operator import BashOperator
from datetime import datetime, timedelta


default_args = {
    'owner': 'airflow',
    'depends_on_past': False,
    'start_date': datetime(2015, 12, 1),
    'email': ['airflow@example.com'],
    'email_on_failure': False,
    'email_on_retry': False,
    'retries': 1,
    'retry_delay': timedelta(minutes=5),
    'schedule_interval': '@hourly',
}

dag = DAG('tutorial', catchup=False, default_args=default_args)
```

In the example above, if the DAG is picked up by the scheduler daemon on 2016-01-02 at 6 AM, (or from the command line), a single DAG Run will be created, with an `execution_date` of 2016-01-01, and the next one will be created just after midnight on the morning of 2016-01-03 with an execution date of 2016-01-02.

If the `dag.catchup` value had been True instead, the scheduler would have created a DAG Run for each completed interval between 2015-12-01 and 2016-01-02 (but not yet one for 2016-01-02, as that interval hasn't completed) and the scheduler will execute them sequentially. This behavior is great for atomic datasets that can easily be split into periods. Turning catchup off is great if your DAG Runs perform backfill internally.

3.11.3 External Triggers

Note that `DAG Runs` can also be created manually through the CLI while running an `airflow trigger_dag` command, where you can define a specific `run_id`. The `DAG Runs` created externally to the scheduler get associated to the trigger's timestamp, and will be displayed in the UI alongside scheduled `DAG runs`.

3.11.4 To Keep in Mind

- The first `DAG Run` is created based on the minimum `start_date` for the tasks in your DAG.
- Subsequent `DAG Runs` are created by the scheduler process, based on your DAG's `schedule_interval`, sequentially.
- When clearing a set of tasks' state in hope of getting them to re-run, it is important to keep in mind the `DAG Run`'s state too as it defines whether the scheduler should look into triggering tasks for that run.

Here are some of the ways you can **unblock tasks**:

- From the UI, you can **clear** (as in delete the status of) individual task instances from the task instances dialog, while defining whether you want to includes the past/future and the upstream/downstream dependencies. Note that a confirmation window comes next and allows you to see the set you are about to clear. You can also clear all task instances associated with the dag.
- The CLI command `airflow clear -h` has lots of options when it comes to clearing task instance states, including specifying date ranges, targeting task_ids by specifying a regular expression, flags for including upstream and downstream relatives, and targeting task instances in specific states (`failed`, or `success`)
- Clearing a task instance will no longer delete the task instance record. Instead it updates max_tries and set the current task instance state to be None.
- Marking task instances as failed can be done through the UI. This can be used to stop running task instances.
- Marking task instances as successful can be done through the UI. This is mostly to fix false negatives, or for instance when the fix has been applied outside of Airflow.
- The `airflow backfill` CLI subcommand has a flag to `--mark_success` and allows selecting subsections of the DAG as well as specifying date ranges.

3.12 Plugins

Airflow has a simple plugin manager built-in that can integrate external features to its core by simply dropping files in your `$AIRFLOW_HOME/plugins` folder.

The python modules in the `plugins` folder get imported, and **hooks**, **operators**, **sensors**, **macros**, **executors** and web **views** get integrated to Airflow's main collections and become available for use.

3.12.1 What for?

Airflow offers a generic toolbox for working with data. Different organizations have different stacks and different needs. Using Airflow plugins can be a way for companies to customize their Airflow installation to reflect their ecosystem.

Plugins can be used as an easy way to write, share and activate new sets of features.

There's also a need for a set of more complex applications to interact with different flavors of data and metadata.

Examples:

- A set of tools to parse Hive logs and expose Hive metadata (CPU /IO / phases/ skew /. . .)
- An anomaly detection framework, allowing people to collect metrics, set thresholds and alerts
- An auditing tool, helping understand who accesses what
- A config-driven SLA monitoring tool, allowing you to set monitored tables and at what time they should land, alert people, and expose visualizations of outages
- . . .

3.12.2 Why build on top of Airflow?

Airflow has many components that can be reused when building an application:

- A web server you can use to render your views

- A metadata database to store your models
- Access to your databases, and knowledge of how to connect to them
- An array of workers that your application can push workload to
- Airflow is deployed, you can just piggy back on its deployment logistics
- Basic charting capabilities, underlying libraries and abstractions

3.12.3 Interface

To create a plugin you will need to derive the `airflow.plugins_manager.AirflowPlugin` class and reference the objects you want to plug into Airflow. Here's what the class you need to derive looks like:

```
class AirflowPlugin(object):
    # The name of your plugin (str)
    name = None
    # A list of class(es) derived from BaseOperator
    operators = []
    # A list of class(es) derived from BaseSensorOperator
    sensors = []
    # A list of class(es) derived from BaseHook
    hooks = []
    # A list of class(es) derived from BaseExecutor
    executors = []
    # A list of references to inject into the macros namespace
    macros = []
    # A list of objects created from a class derived
    # from flask_admin.BaseView
    admin_views = []
    # A list of Blueprint object created from flask.Blueprint. For use with the flask_
↪admin based GUI
    flask_blueprints = []
    # A list of menu links (flask_admin.base.MenuLink). For use with the flask_admin␣
↪based GUI
    menu_links = []
    # A list of dictionaries containing FlaskAppBuilder BaseView object and some␣
↪metadata. See example below
    appbuilder_views = []
    # A list of dictionaries containing FlaskAppBuilder BaseView object and some␣
↪metadata. See example below
    appbuilder_menu_items = []
```

3.12.4 Example

The code below defines a plugin that injects a set of dummy object definitions in Airflow.

```
# This is the class you derive to create a plugin
from airflow.plugins_manager import AirflowPlugin

from flask import Blueprint
from flask_admin import BaseView, expose
from flask_admin.base import MenuLink

# Importing base classes that we need to derive
```

(continues on next page)

(continued from previous page)

```
from airflow.hooks.base_hook import BaseHook
from airflow.models import BaseOperator
from airflow.sensors.base_sensor_operator import BaseSensorOperator
from airflow.executors.base_executor import BaseExecutor

# Will show up under airflow.hooks.test_plugin.PluginHook
class PluginHook(BaseHook):
    pass

# Will show up under airflow.operators.test_plugin.PluginOperator
class PluginOperator(BaseOperator):
    pass

# Will show up under airflow.sensors.test_plugin.PluginSensorOperator
class PluginSensorOperator(BaseSensorOperator):
    pass

# Will show up under airflow.executors.test_plugin.PluginExecutor
class PluginExecutor(BaseExecutor):
    pass

# Will show up under airflow.macros.test_plugin.plugin_macro
def plugin_macro():
    pass

# Creating a flask admin BaseView
class TestView(BaseView):
    @expose('/')
    def test(self):
        # in this example, put your test_plugin/test.html template at airflow/plugins/
↪templates/test_plugin/test.html
        return self.render("test_plugin/test.html", content="Hello galaxy!")
v = TestView(category="Test Plugin", name="Test View")

# Creating a flask blueprint to integrate the templates and static folder
bp = Blueprint(
    "test_plugin", __name__,
    template_folder='templates', # registers airflow/plugins/templates as a Jinja␣
↪template folder
    static_folder='static',
    static_url_path='/static/test_plugin')

ml = MenuLink(
    category='Test Plugin',
    name='Test Menu Link',
    url='https://airflow.apache.org/')

# Creating a flask appbuilder BaseView
class TestAppBuilderBaseView(AppBuilderBaseView):
    @expose("/")
    def test(self):
        return self.render("test_plugin/test.html", content="Hello galaxy!")
v_appbuilder_view = TestAppBuilderBaseView()
v_appbuilder_package = {"name": "Test View",
                        "category": "Test Plugin",
                        "view": v_appbuilder_view}
```

(continues on next page)

(continued from previous page)

```
# Creating a flask appbuilder Menu Item
appbuilder_mitem = {"name": "Google",
                    "category": "Search",
                    "category_icon": "fa-th",
                    "href": "https://www.google.com"}

# Defining the plugin class
class AirflowTestPlugin(AirflowPlugin):
    name = "test_plugin"
    operators = [PluginOperator]
    sensors = [PluginSensorOperator]
    hooks = [PluginHook]
    executors = [PluginExecutor]
    macros = [plugin_macro]
    admin_views = [v]
    flask_blueprints = [bp]
    menu_links = [ml]
    appbuilder_views = [v_appbuilder_package]
    appbuilder_menu_items = [appbuilder_mitem]
```

3.12.5 Note on role based views

Airflow 1.10 introduced role based views using FlaskAppBuilder. You can configure which UI is used by setting rbac = True. To support plugin views and links for both versions of the UI and maintain backwards compatibility, the fields appbuilder_views and appbuilder_menu_items were added to the AirflowTestPlugin class.

3.12.6 Plugins as Python packages

It is possible to load plugins via **'setuptools' entrypoint<https://packaging.python.org/guides/creating-and-discovering-plugins/#using-package-metadata>'_** mechanism. To do this link your plugin using an entrypoint in your package. If the package is installed, airflow will automatically load the registered plugins from the entrypoint list.

Note: Neither the entrypoint name (eg, *my_plugin*) nor the name of the plugin class will contribute towards the module and class name of the plugin itself. The structure is determined by *airflow.plugins_manager.AirflowPlugin.name* and the class name of the plugin component with the pattern *airflow.{component}.{name}.{component_class_name}*.

```
# my_package/my_plugin.py
from airflow.plugins_manager import AirflowPlugin
from airflow.models import BaseOperator
from airflow.hooks.base_hook import BaseHook

class MyOperator(BaseOperator):
  pass

class MyHook(BaseHook):
  pass

class MyAirflowPlugin(AirflowPlugin):
  name = 'my_namespace'
  operators = [MyOperator]
  hooks = [MyHook]
```

```
from setuptools import setup

setup(
    name="my-package",
    ...
    entry_points = {
        'airflow.plugins': [
            'my_plugin = my_package.my_plugin:MyAirflowPlugin'
        ]
    }
)
```

This will create a hook, and an operator accessible at:

- *airflow.hooks.my_namespace.MyHook*
- *airflow.operators.my_namespace.MyOperator*

3.13 Security

By default, all gates are opened. An easy way to restrict access to the web application is to do it at the network level, or by using SSH tunnels.

It is however possible to switch on authentication by either using one of the supplied backends or creating your own.

Be sure to checkout *Experimental Rest API* for securing the API.

Note: Airflow uses the config parser of Python. This config parser interpolates '%'-signs. Make sure escape any `%` signs in your config file (but not environment variables) as `%%`, otherwise Airflow might leak these passwords on a config parser exception to a log.

3.13.1 Web Authentication

3.13.1.1 Password

Note: This is for flask-admin based web UI only. If you are using FAB-based web UI with RBAC feature, please use command line interface `create_user` to create accounts, or do that in the FAB-based UI itself.

One of the simplest mechanisms for authentication is requiring users to specify a password before logging in. Password authentication requires the used of the `password` subpackage in your requirements file. Password hashing uses `bcrypt` before storing passwords.

```
[webserver]
authenticate = True
auth_backend = airflow.contrib.auth.backends.password_auth
```

When password auth is enabled, an initial user credential will need to be created before anyone can login. An initial user was not created in the migrations for this authentication backend to prevent default Airflow installations from attack. Creating a new user has to be done via a Python REPL on the same machine Airflow is installed.

```
# navigate to the airflow installation directory
$ cd ~/airflow
$ python
Python 2.7.9 (default, Feb 10 2015, 03:28:08)
Type "help", "copyright", "credits" or "license" for more information.
>>> import airflow
>>> from airflow import models, settings
>>> from airflow.contrib.auth.backends.password_auth import PasswordUser
>>> user = PasswordUser(models.User())
>>> user.username = 'new_user_name'
>>> user.email = 'new_user_email@example.com'
>>> user.password = 'set_the_password'
>>> session = settings.Session()
>>> session.add(user)
>>> session.commit()
>>> session.close()
>>> exit()
```

3.13.1.2 LDAP

To turn on LDAP authentication configure your `airflow.cfg` as follows. Please note that the example uses an encrypted connection to the ldap server as we do not want passwords be readable on the network level.

Additionally, if you are using Active Directory, and are not explicitly specifying an OU that your users are in, you will need to change `search_scope` to “SUBTREE”.

Valid search_scope options can be found in the ldap3 Documentation

```
[webserver]
authenticate = True
auth_backend = airflow.contrib.auth.backends.ldap_auth

[ldap]
# set a connection without encryption: uri = ldap://<your.ldap.server>:<port>
uri = ldaps://<your.ldap.server>:<port>
user_filter = objectClass=*
# in case of Active Directory you would use: user_name_attr = sAMAccountName
user_name_attr = uid
# group_member_attr should be set accordingly with *_filter
# eg :
#     group_member_attr = groupMembership
#     superuser_filter = groupMembership=CN=airflow-super-users...
group_member_attr = memberOf
superuser_filter = memberOf=CN=airflow-super-users,OU=Groups,OU=RWC,OU=US,OU=NORAM,
↪DC=example,DC=com
data_profiler_filter = memberOf=CN=airflow-data-profilers,OU=Groups,OU=RWC,OU=US,
↪OU=NORAM,DC=example,DC=com
bind_user = cn=Manager,dc=example,dc=com
bind_password = insecure
basedn = dc=example,dc=com
cacert = /etc/ca/ldap_ca.crt
# Set search_scope to one of them:  BASE, LEVEL , SUBTREE
# Set search_scope to SUBTREE if using Active Directory, and not specifying an␣
↪Organizational Unit
search_scope = LEVEL
```

The superuser_filter and data_profiler_filter are optional. If defined, these configurations allow you to specify LDAP groups that users must belong to in order to have superuser (admin) and data-profiler permissions. If undefined, all users will be superusers and data profilers.

3.13.1.3 Roll your own

Airflow uses `flask_login` and exposes a set of hooks in the `airflow.default_login` module. You can alter the content and make it part of the `PYTHONPATH` and configure it as a backend in `airflow.cfg`.

```
[webserver]
authenticate = True
auth_backend = mypackage.auth
```

3.13.2 Multi-tenancy

You can filter the list of dags in webserver by owner name when authentication is turned on by setting `webserver:filter_by_owner` in your config. With this, a user will see only the dags which it is owner of, unless it is a superuser.

```
[webserver]
filter_by_owner = True
```

3.13.3 Kerberos

Airflow has initial support for Kerberos. This means that airflow can renew kerberos tickets for itself and store it in the ticket cache. The hooks and dags can make use of ticket to authenticate against kerberized services.

3.13.3.1 Limitations

Please note that at this time, not all hooks have been adjusted to make use of this functionality. Also it does not integrate kerberos into the web interface and you will have to rely on network level security for now to make sure your service remains secure.

Celery integration has not been tried and tested yet. However, if you generate a key tab for every host and launch a ticket renewer next to every worker it will most likely work.

3.13.3.2 Enabling kerberos

Airflow

To enable kerberos you will need to generate a (service) key tab.

```
# in the kadmin.local or kadmin shell, create the airflow principal
kadmin:  addprinc -randkey airflow/fully.qualified.domain.name@YOUR-REALM.COM

# Create the airflow keytab file that will contain the airflow principal
kadmin:  xst -norandkey -k airflow.keytab airflow/fully.qualified.domain.name
```

Now store this file in a location where the airflow user can read it (chmod 600). And then add the following to your `airflow.cfg`

```
[core]
security = kerberos

[kerberos]
keytab = /etc/airflow/airflow.keytab
reinit_frequency = 3600
principal = airflow
```

Launch the ticket renewer by

```
# run ticket renewer
airflow kerberos
```

Hadoop

If want to use impersonation this needs to be enabled in `core-site.xml` of your hadoop config.

```
<property>
  <name>hadoop.proxyuser.airflow.groups</name>
  <value>*</value>
</property>

<property>
  <name>hadoop.proxyuser.airflow.users</name>
  <value>*</value>
</property>

<property>
  <name>hadoop.proxyuser.airflow.hosts</name>
  <value>*</value>
</property>
```

Of course if you need to tighten your security replace the asterisk with something more appropriate.

3.13.3.3 Using kerberos authentication

The hive hook has been updated to take advantage of kerberos authentication. To allow your DAGs to use it, simply update the connection details with, for example:

```
{ "use_beeline": true, "principal": "hive/_HOST@EXAMPLE.COM"}
```

Adjust the principal to your settings. The _HOST part will be replaced by the fully qualified domain name of the server.

You can specify if you would like to use the dag owner as the user for the connection or the user specified in the login section of the connection. For the login user, specify the following as extra:

```
{ "use_beeline": true, "principal": "hive/_HOST@EXAMPLE.COM", "proxy_user": "login"}
```

For the DAG owner use:

```
{ "use_beeline": true, "principal": "hive/_HOST@EXAMPLE.COM", "proxy_user": "owner"}
```

and in your DAG, when initializing the HiveOperator, specify:

```
run_as_owner=True
```

To use kerberos authentication, you must install Airflow with the *kerberos* extras group:

```
pip install airflow[kerberos]
```

3.13.4 OAuth Authentication

3.13.4.1 GitHub Enterprise (GHE) Authentication

The GitHub Enterprise authentication backend can be used to authenticate users against an installation of GitHub Enterprise using OAuth2. You can optionally specify a team whitelist (composed of slug cased team names) to restrict login to only members of those teams.

```
[webserver]
authenticate = True
auth_backend = airflow.contrib.auth.backends.github_enterprise_auth

[github_enterprise]
host = github.example.com
client_id = oauth_key_from_github_enterprise
client_secret = oauth_secret_from_github_enterprise
oauth_callback_route = /example/ghe_oauth/callback
allowed_teams = 1, 345, 23
```

Note: If you do not specify a team whitelist, anyone with a valid account on your GHE installation will be able to login to Airflow.

To use GHE authentication, you must install Airflow with the *github_enterprise* extras group:

```
pip install airflow[github_enterprise]
```

Setting up GHE Authentication

An application must be setup in GHE before you can use the GHE authentication backend. In order to setup an application:

1. Navigate to your GHE profile
2. Select 'Applications' from the left hand nav
3. Select the 'Developer Applications' tab
4. Click 'Register new application'
5. Fill in the required information (the 'Authorization callback URL' must be fully qualified e.g. http://airflow.example.com/example/ghe_oauth/callback)
6. Click 'Register application'
7. Copy 'Client ID', 'Client Secret', and your callback route to your airflow.cfg according to the above example

Using GHE Authentication with github.com

It is possible to use GHE authentication with github.com:

1. Create an Oauth App
2. Copy 'Client ID', 'Client Secret' to your airflow.cfg according to the above example
3. Set `host = github.com` and `oauth_callback_route = /oauth/callback` in airflow.cfg

3.13.4.2 Google Authentication

The Google authentication backend can be used to authenticate users against Google using OAuth2. You must specify the domains to restrict login, separated with a comma, to only members of those domains.

```
[webserver]
authenticate = True
auth_backend = airflow.contrib.auth.backends.google_auth

[google]
client_id = google_client_id
client_secret = google_client_secret
oauth_callback_route = /oauth2callback
domain = "example1.com,example2.com"
```

To use Google authentication, you must install Airflow with the *google_auth* extras group:

```
pip install airflow[google_auth]
```

Setting up Google Authentication

An application must be setup in the Google API Console before you can use the Google authentication backend. In order to setup an application:

1. Navigate to https://console.developers.google.com/apis/
2. Select 'Credentials' from the left hand nav
3. Click 'Create credentials' and choose 'OAuth client ID'
4. Choose 'Web application'
5. Fill in the required information (the 'Authorized redirect URIs' must be fully qualified e.g. http://airflow.example.com/oauth2callback)
6. Click 'Create'
7. Copy 'Client ID', 'Client Secret', and your redirect URI to your airflow.cfg according to the above example

3.13.5 SSL

SSL can be enabled by providing a certificate and key. Once enabled, be sure to use "https://" in your browser.

```
[webserver]
web_server_ssl_cert = <path to cert>
web_server_ssl_key = <path to key>
```

Enabling SSL will not automatically change the web server port. If you want to use the standard port 443, you'll need to configure that too. Be aware that super user privileges (or cap_net_bind_service on Linux) are required to listen on port 443.

```
# Optionally, set the server to listen on the standard SSL port.
web_server_port = 443
base_url = http://<hostname or IP>:443
```

Enable CeleryExecutor with SSL. Ensure you properly generate client and server certs and keys.

```
[celery]
ssl_active = True
ssl_key = <path to key>
ssl_cert = <path to cert>
ssl_cacert = <path to cacert>
```

3.13.6 Impersonation

Airflow has the ability to impersonate a unix user while running task instances based on the task's `run_as_user` parameter, which takes a user's name.

NOTE: For impersonations to work, Airflow must be run with *sudo* as subtasks are run with *sudo -u* and permissions of files are changed. Furthermore, the unix user needs to exist on the worker. Here is what a simple sudoers file entry could look like to achieve this, assuming as airflow is running as the *airflow* user. Note that this means that the airflow user must be trusted and treated the same way as the root user.

```
airflow ALL=(ALL) NOPASSWD: ALL
```

Subtasks with impersonation will still log to the same folder, except that the files they log to will have permissions changed such that only the unix user can write to it.

3.13.6.1 Default Impersonation

To prevent tasks that don't use impersonation to be run with *sudo* privileges, you can set the `core:default_impersonation` config which sets a default user impersonate if *run_as_user* is not set.

```
[core]
default_impersonation = airflow
```

3.13.7 Flower Authentication

Basic authentication for Celery Flower is supported.

You can specify the details either as an optional argument in the Flower process launching command, or as a configuration item in your `airflow.cfg`. For both cases, please provide *user:password* pairs separated by a comma.

```
airflow flower --basic_auth=user1:password1,user2:password2
```

```
[celery]
flower_basic_auth = user1:password1,user2:password2
```

3.14 Time zones

Support for time zones is enabled by default. Airflow stores datetime information in UTC internally and in the database. It allows you to run your DAGs with time zone dependent schedules. At the moment Airflow does not convert them to the end user's time zone in the user interface. There it will always be displayed in UTC. Also templates used in Operators are not converted. Time zone information is exposed and it is up to the writer of DAG what do with it.

This is handy if your users live in more than one time zone and you want to display datetime information according to each user's wall clock.

Even if you are running Airflow in only one time zone it is still good practice to store data in UTC in your database (also before Airflow became time zone aware this was also to recommended or even required setup). The main reason is Daylight Saving Time (DST). Many countries have a system of DST, where clocks are moved forward in spring and backward in autumn. If you're working in local time, you're likely to encounter errors twice a year, when the transitions happen. (The pendulum and pytz documentation discusses these issues in greater detail.) This probably doesn't matter for a simple DAG, but it's a problem if you are in, for example, financial services where you have end of day deadlines to meet.

The time zone is set in *airflow.cfg*. By default it is set to utc, but you change it to use the system's settings or an arbitrary IANA time zone, e.g. *Europe/Amsterdam*. It is dependent on *pendulum*, which is more accurate than *pytz*. Pendulum is installed when you install Airflow.

Please note that the Web UI currently only runs in UTC.

3.14.1 Concepts

3.14.1.1 Naïve and aware datetime objects

Python's datetime.datetime objects have a tzinfo attribute that can be used to store time zone information, represented as an instance of a subclass of datetime.tzinfo. When this attribute is set and describes an offset, a datetime object is aware. Otherwise, it's naive.

You can use timezone.is_aware() and timezone.is_naive() to determine whether datetimes are aware or naive.

Because Airflow uses time-zone-aware datetime objects. If your code creates datetime objects they need to be aware too.

```python
from airflow.utils import timezone

now = timezone.utcnow()
a_date = timezone.datetime(2017,1,1)
```

3.14.1.2 Interpretation of naive datetime objects

Although Airflow operates fully time zone aware, it still accepts naive date time objects for *start_dates* and *end_dates* in your DAG definitions. This is mostly in order to preserve backwards compatibility. In case a naive *start_date* or *end_date* is encountered the default time zone is applied. It is applied in such a way that it is assumed that the naive date time is already in the default time zone. In other words if you have a default time zone setting of *Europe/Amsterdam* and create a naive datetime *start_date* of *datetime(2017,1,1)* it is assumed to be a *start_date* of Jan 1, 2017 Amsterdam time.

```
default_args=dict(
    start_date=datetime(2016, 1, 1),
    owner='Airflow'
)

dag = DAG('my_dag', default_args=default_args)
op = DummyOperator(task_id='dummy', dag=dag)
print(op.owner) # Airflow
```

Unfortunately, during DST transitions, some datetimes don't exist or are ambiguous. In such situations, pendulum raises an exception. That's why you should always create aware datetime objects when time zone support is enabled.

In practice, this is rarely an issue. Airflow gives you aware datetime objects in the models and DAGs, and most often, new datetime objects are created from existing ones through timedelta arithmetic. The only datetime that's often created in application code is the current time, and timezone.utcnow() automatically does the right thing.

3.14.1.3 Default time zone

The default time zone is the time zone defined by the *default_timezone* setting under *[core]*. If you just installed Airflow it will be set to *utc*, which is recommended. You can also set it to *system* or an IANA time zone (e.g.'Europe/Amsterdam'). DAGs are also evaluated on Airflow workers, it is therefore important to make sure this setting is equal on all Airflow nodes.

```
[core]
default_timezone = utc
```

3.14.2 Time zone aware DAGs

Creating a time zone aware DAG is quite simple. Just make sure to supply a time zone aware *start_date*. It is recommended to use *pendulum* for this, but *pytz* (to be installed manually) can also be used for this.

```
import pendulum

local_tz = pendulum.timezone("Europe/Amsterdam")

default_args=dict(
    start_date=datetime(2016, 1, 1, tzinfo=local_tz),
    owner='Airflow'
)

dag = DAG('my_tz_dag', default_args=default_args)
op = DummyOperator(task_id='dummy', dag=dag)
print(dag.timezone) # <Timezone [Europe/Amsterdam]>
```

Please note that while it is possible to set a *start_date* and *end_date* for Tasks always the DAG timezone or global timezone (in that order) will be used to calculate the next execution date. Upon first encounter the start date or end date will be converted to UTC using the timezone associated with start_date or end_date, then for calculations this timezone information will be disregarded.

3.14.2.1 Templates

Airflow returns time zone aware datetimes in templates, but does not convert them to local time so they remain in UTC. It is left up to the DAG to handle this.

```
import pendulum

local_tz = pendulum.timezone("Europe/Amsterdam")
local_tz.convert(execution_date)
```

3.14.2.2 Cron schedules

In case you set a cron schedule, Airflow assumes you will always want to run at the exact same time. It will then ignore day light savings time. Thus, if you have a schedule that says run at end of interval every day at 08:00 GMT+1 it will always run end of interval 08:00 GMT+1, regardless if day light savings time is in place.

3.14.2.3 Time deltas

For schedules with time deltas Airflow assumes you always will want to run with the specified interval. So if you specify a timedelta(hours=2) you will always want to run to hours later. In this case day light savings time will be taken into account.

3.15 Experimental Rest API

Airflow exposes an experimental Rest API. It is available through the webserver. Endpoints are available at /api/experimental/. Please note that we expect the endpoint definitions to change.

3.15.1 Endpoints

POST /api/experimental/dags/<DAG_ID>/dag_runs
Creates a dag_run for a given dag id.

Trigger DAG with config, example:

```
curl -X POST \
  http://localhost:8080/api/experimental/dags/<DAG_ID>/dag_runs \
  -H 'Cache-Control: no-cache' \
  -H 'Content-Type: application/json' \
  -d '{"conf":"{\"key\":\"value\"}"}'
```

GET /api/experimental/dags/<DAG_ID>/dag_runs
Returns a list of Dag Runs for a specific DAG ID.

GET /api/experimental/dags/<string:dag_id>/dag_runs/<string:execution_date>
Returns a JSON with a dag_run's public instance variables. The format for the <string:execution_date> is expected to be "YYYY-mm-DDTHH:MM:SS", for example: "2016-11-16T11:34:15".

GET /api/experimental/test
To check REST API server correct work. Return status 'OK'.

GET /api/experimental/dags/<DAG_ID>/tasks/<TASK_ID>
Returns info for a task.

GET /api/experimental/dags/<DAG_ID>/dag_runs/<string:execution_date>/tasks/<TASK_ID>
Returns a JSON with a task instance's public instance variables. The format for the <string:execution_date> is expected to be "YYYY-mm-DDTHH:MM:SS", for example: "2016-11-16T11:34:15".

GET /api/experimental/dags/<DAG_ID>/paused/<string:paused>
‘<string:paused>’ must be a ‘true’ to pause a DAG and ‘false’ to unpause.

GET /api/experimental/latest_runs
Returns the latest DagRun for each DAG formatted for the UI.

GET /api/experimental/pools
Get all pools.

GET /api/experimental/pools/<string:name>
Get pool by a given name.

POST /api/experimental/pools
Create a pool.

DELETE /api/experimental/pools/<string:name>
Delete pool.

3.15.2 CLI

For some functions the cli can use the API. To configure the CLI to use the API when available configure as follows:

```
[cli]
api_client = airflow.api.client.json_client
endpoint_url = http://<WEBSERVER>:<PORT>
```

3.15.3 Authentication

Authentication for the API is handled separately to the Web Authentication. The default is to not require any authentication on the API – i.e. wide open by default. This is not recommended if your Airflow webserver is publicly accessible, and you should probably use the deny all backend:

```
[api]
auth_backend = airflow.api.auth.backend.deny_all
```

Two “real” methods for authentication are currently supported for the API.

To enabled Password authentication, set the following in the configuration:

```
[api]
auth_backend = airflow.contrib.auth.backends.password_auth
```

It’s usage is similar to the Password Authentication used for the Web interface.

To enable Kerberos authentication, set the following in the configuration:

```
[api]
auth_backend = airflow.api.auth.backend.kerberos_auth

[kerberos]
keytab = <KEYTAB>
```

The Kerberos service is configured as `airflow/fully.qualified.domainname@REALM`. Make sure this principal exists in the keytab file.

3.16 Integration

3.16.1 Reverse Proxy

Airflow can be set up behind a reverse proxy, with the ability to set its endpoint with great flexibility.

For example, you can configure your reverse proxy to get:

```
https://lab.mycompany.com/myorg/airflow/
```

To do so, you need to set the following setting in your *airflow.cfg*:

```
base_url = http://my_host/myorg/airflow
```

Additionally if you use Celery Executor, you can get Flower in */myorg/flower* with:

```
flower_url_prefix = /myorg/flower
```

Your reverse proxy (ex: nginx) should be configured as follow:

- pass the url and http header as it for the Airflow webserver, without any rewrite, for example:

```
server {
  listen 80;
  server_name lab.mycompany.com;

  location /myorg/airflow/ {
      proxy_pass http://localhost:8080;
      proxy_set_header Host $host;
      proxy_redirect off;
      proxy_http_version 1.1;
      proxy_set_header Upgrade $http_upgrade;
      proxy_set_header Connection "upgrade";
  }
}
```

- rewrite the url for the flower endpoint:

```
server {
    listen 80;
    server_name lab.mycompany.com;

    location /myorg/flower/ {
        rewrite ^/myorg/flower/(.*)$ /$1 break;  # remove prefix from http header
        proxy_pass http://localhost:5555;
        proxy_set_header Host $host;
```

(continues on next page)

(continued from previous page)

```
        proxy_redirect off;
        proxy_http_version 1.1;
        proxy_set_header Upgrade $http_upgrade;
        proxy_set_header Connection "upgrade";
    }
}
```

To ensure that Airflow generates URLs with the correct scheme when running behind a TLS-terminating proxy, you should configure the proxy to set the *X-Forwarded-Proto* header, and enable the *ProxyFix* middleware in your *airflow.cfg*:

```
enable_proxy_fix = True
```

Note: you should only enable the *ProxyFix* middleware when running Airflow behind a trusted proxy (AWS ELB, nginx, etc.).

3.16.2 Azure: Microsoft Azure

Airflow has limited support for Microsoft Azure: interfaces exist only for Azure Blob Storage and Azure Data Lake. Hook, Sensor and Operator for Blob Storage and Azure Data Lake Hook are in contrib section.

3.16.2.1 Azure Blob Storage

All classes communicate via the Window Azure Storage Blob protocol. Make sure that a Airflow connection of type *wasb* exists. Authorization can be done by supplying a login (=Storage account name) and password (=KEY), or login and SAS token in the extra field (see connection *wasb_default* for an example).

- *WasbBlobSensor*: Checks if a blob is present on Azure Blob storage.
- *WasbPrefixSensor*: Checks if blobs matching a prefix are present on Azure Blob storage.
- *FileToWasbOperator*: Uploads a local file to a container as a blob.
- *WasbHook*: Interface with Azure Blob Storage.

WasbBlobSensor

WasbPrefixSensor

FileToWasbOperator

WasbHook

3.16.2.2 Azure File Share

Cloud variant of a SMB file share. Make sure that a Airflow connection of type *wasb* exists. Authorization can be done by supplying a login (=Storage account name) and password (=Storage account key), or login and SAS token in the extra field (see connection *wasb_default* for an example).

AzureFileShareHook

3.16.2.3 Logging

Airflow can be configured to read and write task logs in Azure Blob Storage. See *Writing Logs to Azure Blob Storage*.

3.16.2.4 Azure CosmosDB

AzureCosmosDBHook communicates via the Azure Cosmos library. Make sure that a Airflow connection of type *azure_cosmos* exists. Authorization can be done by supplying a login (=Endpoint uri), password (=secret key) and extra fields database_name and collection_name to specify the default database and collection to use (see connection *azure_cosmos_default* for an example).

- *AzureCosmosDBHook*: Interface with Azure CosmosDB.
- AzureCosmosInsertDocumentOperator: Simple operator to insert document into CosmosDB.
- AzureCosmosDocumentSensor: Simple sensor to detect document existence in CosmosDB.

AzureCosmosDBHook

AzureCosmosInsertDocumentOperator

AzureCosmosDocumentSensor

3.16.2.5 Azure Data Lake

AzureDataLakeHook communicates via a REST API compatible with WebHDFS. Make sure that a Airflow connection of type *azure_data_lake* exists. Authorization can be done by supplying a login (=Client ID), password (=Client Secret) and extra fields tenant (Tenant) and account_name (Account Name)

(see connection *azure_data_lake_default* for an example).

- *AzureDataLakeHook*: Interface with Azure Data Lake.
- *AzureDataLakeStorageListOperator*: Lists the files located in a specified Azure Data Lake path.
- *AdlsToGoogleCloudStorageOperator*: Copies files from an Azure Data Lake path to a Google Cloud Storage bucket.

AzureDataLakeHook

AzureDataLakeStorageListOperator

AdlsToGoogleCloudStorageOperator

3.16.3 AWS: Amazon Web Services

Airflow has extensive support for Amazon Web Services. But note that the Hooks, Sensors and Operators are in the contrib section.

3.16.3.1 AWS EMR

- *EmrAddStepsOperator* : Adds steps to an existing EMR JobFlow.
- *EmrCreateJobFlowOperator* : Creates an EMR JobFlow, reading the config from the EMR connection.
- *EmrTerminateJobFlowOperator* : Terminates an EMR JobFlow.
- *EmrHook* : Interact with AWS EMR.

EmrAddStepsOperator

class airflow.contrib.operators.emr_add_steps_operator.**EmrAddStepsOperator**(***kwargs*)
Bases: `airflow.models.BaseOperator`

An operator that adds steps to an existing EMR job_flow.

Parameters

- **job_flow_id** (*str*) – id of the JobFlow to add steps to. (templated)
- **aws_conn_id** (*str*) – aws connection to uses
- **steps** (*list*) – boto3 style steps to be added to the jobflow. (templated)

EmrCreateJobFlowOperator

class airflow.contrib.operators.emr_create_job_flow_operator.**EmrCreateJobFlowOperator**(***kwa
Bases: `airflow.models.BaseOperator`

Creates an EMR JobFlow, reading the config from the EMR connection. A dictionary of JobFlow overrides can be passed that override the config from the connection.

Parameters

- **aws_conn_id** (*str*) – aws connection to uses
- **emr_conn_id** (*str*) – emr connection to use
- **job_flow_overrides** (*dict*) – boto3 style arguments to override emr_connection extra. (templated)

EmrTerminateJobFlowOperator

class airflow.contrib.operators.emr_terminate_job_flow_operator.**EmrTerminateJobFlowOperato
Bases: `airflow.models.BaseOperator`

Operator to terminate EMR JobFlows.

Parameters

- **job_flow_id** (*str*) – id of the JobFlow to terminate. (templated)
- **aws_conn_id** (*str*) – aws connection to uses

EmrHook

class airflow.contrib.hooks.emr_hook.**EmrHook**(*emr_conn_id=None*, *region_name=None*, **args*, ***kwargs*)

Bases: *airflow.contrib.hooks.aws_hook.AwsHook*

Interact with AWS EMR. emr_conn_id is only necessary for using the create_job_flow method.

create_job_flow(*job_flow_overrides*)

Creates a job flow using the config from the EMR connection. Keys of the json extra hash may have the arguments of the boto3 run_job_flow method. Overrides for this config may be passed as the job_flow_overrides.

3.16.3.2 AWS S3

- *S3Hook* : Interact with AWS S3.
- *S3FileTransformOperator* : Copies data from a source S3 location to a temporary location on the local filesystem.
- *S3ListOperator* : Lists the files matching a key prefix from a S3 location.
- *S3ToGoogleCloudStorageOperator* : Syncs an S3 location with a Google Cloud Storage bucket.
- *S3ToGoogleCloudStorageTransferOperator* : Syncs an S3 bucket with a Google Cloud Storage bucket using the GCP Storage Transfer Service.
- *S3ToHiveTransfer* : Moves data from S3 to Hive. The operator downloads a file from S3, stores the file locally before loading it into a Hive table.

S3Hook

class airflow.hooks.S3_hook.**S3Hook**(*aws_conn_id='aws_default'*, *verify=None*)

Bases: *airflow.contrib.hooks.aws_hook.AwsHook*

Interact with AWS S3, using the boto3 library.

check_for_bucket(*bucket_name*)

Check if bucket_name exists.

Parameters **bucket_name** (*str*) – the name of the bucket

check_for_key(*key*, *bucket_name=None*)

Checks if a key exists in a bucket

Parameters

- **key** (*str*) – S3 key that will point to the file
- **bucket_name** (*str*) – Name of the bucket in which the file is stored

check_for_prefix(*bucket_name*, *prefix*, *delimiter*)

Checks that a prefix exists in a bucket

Parameters

- **bucket_name** (*str*) – the name of the bucket
- **prefix** (*str*) – a key prefix
- **delimiter** (*str*) – the delimiter marks key hierarchy.

check_for_wildcard_key(*wildcard_key*, *bucket_name=None*, *delimiter=''*)
Checks that a key matching a wildcard expression exists in a bucket

Parameters

- **wildcard_key** (`str`) – the path to the key
- **bucket_name** (`str`) – the name of the bucket
- **delimiter** (`str`) – the delimiter marks key hierarchy

copy_object(*source_bucket_key*, *dest_bucket_key*, *source_bucket_name=None*, *dest_bucket_name=None*, *source_version_id=None*)
Creates a copy of an object that is already stored in S3.

Note: the S3 connection used here needs to have access to both source and destination bucket/key.

Parameters

- **source_bucket_key** (`str`) – The key of the source object.

  It can be either full s3:// style url or relative path from root level.

  When it's specified as a full s3:// url, please omit source_bucket_name.
- **dest_bucket_key** (`str`) – The key of the object to copy to.

  The convention to specify *dest_bucket_key* is the same as *source_bucket_key*.
- **source_bucket_name** (`str`) – Name of the S3 bucket where the source object is in.

  It should be omitted when *source_bucket_key* is provided as a full s3:// url.
- **dest_bucket_name** (`str`) – Name of the S3 bucket to where the object is copied.

  It should be omitted when *dest_bucket_key* is provided as a full s3:// url.
- **source_version_id** (`str`) – Version ID of the source object (OPTIONAL)

create_bucket(*bucket_name*, *region_name=None*)
Creates an Amazon S3 bucket.

Parameters

- **bucket_name** (`str`) – The name of the bucket
- **region_name** (`str`) – The name of the aws region in which to create the bucket.

delete_objects(*bucket*, *keys*)

Parameters

- **bucket** (`str`) – Name of the bucket in which you are going to delete object(s)
- **keys** (`str or list`) – The key(s) to delete from S3 bucket.

  When `keys` is a string, it's supposed to be the key name of the single object to delete.

  When `keys` is a list, it's supposed to be the list of the keys to delete.

get_bucket(*bucket_name*)
Returns a boto3.S3.Bucket object

Parameters **bucket_name** (`str`) – the name of the bucket

get_key(*key*, *bucket_name=None*)
Returns a boto3.s3.Object

Parameters

- **key** (*str*) – the path to the key
- **bucket_name** (*str*) – the name of the bucket

get_wildcard_key (*wildcard_key*, *bucket_name=None*, *delimiter="*)
Returns a boto3.s3.Object object matching the wildcard expression

Parameters

- **wildcard_key** (*str*) – the path to the key
- **bucket_name** (*str*) – the name of the bucket
- **delimiter** (*str*) – the delimiter marks key hierarchy

list_keys (*bucket_name*, *prefix="*, *delimiter="*, *page_size=None*, *max_items=None*)
Lists keys in a bucket under prefix and not containing delimiter

Parameters

- **bucket_name** (*str*) – the name of the bucket
- **prefix** (*str*) – a key prefix
- **delimiter** (*str*) – the delimiter marks key hierarchy.
- **page_size** (*int*) – pagination size
- **max_items** (*int*) – maximum items to return

list_prefixes (*bucket_name*, *prefix="*, *delimiter="*, *page_size=None*, *max_items=None*)
Lists prefixes in a bucket under prefix

Parameters

- **bucket_name** (*str*) – the name of the bucket
- **prefix** (*str*) – a key prefix
- **delimiter** (*str*) – the delimiter marks key hierarchy.
- **page_size** (*int*) – pagination size
- **max_items** (*int*) – maximum items to return

load_bytes (*bytes_data*, *key*, *bucket_name=None*, *replace=False*, *encrypt=False*)
Loads bytes to S3

This is provided as a convenience to drop a string in S3. It uses the boto infrastructure to ship a file to s3.

Parameters

- **bytes_data** (*bytes*) – bytes to set as content for the key.
- **key** (*str*) – S3 key that will point to the file
- **bucket_name** (*str*) – Name of the bucket in which to store the file
- **replace** (*bool*) – A flag to decide whether or not to overwrite the key if it already exists
- **encrypt** (*bool*) – If True, the file will be encrypted on the server-side by S3 and will be stored in an encrypted form while at rest in S3.

load_file (*filename*, *key*, *bucket_name=None*, *replace=False*, *encrypt=False*)
Loads a local file to S3

Parameters

- **filename** (*str*) – name of the file to load.

- **key** (*str*) – S3 key that will point to the file
- **bucket_name** (*str*) – Name of the bucket in which to store the file
- **replace** (*bool*) – A flag to decide whether or not to overwrite the key if it already exists. If replace is False and the key exists, an error will be raised.
- **encrypt** (*bool*) – If True, the file will be encrypted on the server-side by S3 and will be stored in an encrypted form while at rest in S3.

load_file_obj(*file_obj*, *key*, *bucket_name=None*, *replace=False*, *encrypt=False*)

Loads a file object to S3

Parameters

- **file_obj** (*file-like object*) – The file-like object to set as the content for the S3 key.
- **key** (*str*) – S3 key that will point to the file
- **bucket_name** (*str*) – Name of the bucket in which to store the file
- **replace** (*bool*) – A flag that indicates whether to overwrite the key if it already exists.
- **encrypt** (*bool*) – If True, S3 encrypts the file on the server, and the file is stored in encrypted form at rest in S3.

load_string(*string_data*, *key*, *bucket_name=None*, *replace=False*, *encrypt=False*, *encoding='utf-8'*)

Loads a string to S3

This is provided as a convenience to drop a string in S3. It uses the boto infrastructure to ship a file to s3.

Parameters

- **string_data** (*str*) – string to set as content for the key.
- **key** (*str*) – S3 key that will point to the file
- **bucket_name** (*str*) – Name of the bucket in which to store the file
- **replace** (*bool*) – A flag to decide whether or not to overwrite the key if it already exists
- **encrypt** (*bool*) – If True, the file will be encrypted on the server-side by S3 and will be stored in an encrypted form while at rest in S3.

read_key(*key*, *bucket_name=None*)

Reads a key from S3

Parameters

- **key** (*str*) – S3 key that will point to the file
- **bucket_name** (*str*) – Name of the bucket in which the file is stored

select_key(*key*, *bucket_name=None*, *expression='SELECT * FROM S3Object'*, *expression_type='SQL'*, *input_serialization=None*, *output_serialization=None*)

Reads a key with S3 Select.

Parameters

- **key** (*str*) – S3 key that will point to the file
- **bucket_name** (*str*) – Name of the bucket in which the file is stored
- **expression** (*str*) – S3 Select expression
- **expression_type** (*str*) – S3 Select expression type

- **input_serialization** (*dict*) – S3 Select input data serialization format
- **output_serialization** (*dict*) – S3 Select output data serialization format

Returns retrieved subset of original data by S3 Select

Return type str

See also:

For more details about S3 Select parameters: http://boto3.readthedocs.io/en/latest/reference/services/s3.html#S3.Client.select_object_content

S3FileTransformOperator

class airflow.operators.s3_file_transform_operator.**S3FileTransformOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Copies data from a source S3 location to a temporary location on the local filesystem. Runs a transformation on this file as specified by the transformation script and uploads the output to a destination S3 location.

The locations of the source and the destination files in the local filesystem is provided as an first and second arguments to the transformation script. The transformation script is expected to read the data from source, transform it and write the output to the local destination file. The operator then takes over control and uploads the local destination file to S3.

S3 Select is also available to filter the source contents. Users can omit the transformation script if S3 Select expression is specified.

Parameters

- **source_s3_key** (*str*) – The key to be retrieved from S3. (templated)
- **source_aws_conn_id** (*str*) – source s3 connection
- **source_verify** (*bool or str*) – Whether or not to verify SSL certificates for S3 connetion. By default SSL certificates are verified. You can provide the following values:
  - **False: do not validate SSL certificates. SSL will still be used** (unless use_ssl is False), but SSL certificates will not be verified.
  - **path/to/cert/bundle.pem: A filename of the CA cert bundle to uses.** You can specify this argument if you want to use a different CA cert bundle than the one used by botocore.

  This is also applicable to `dest_verify`.
- **dest_s3_key** (*str*) – The key to be written from S3. (templated)
- **dest_aws_conn_id** (*str*) – destination s3 connection
- **replace** (*bool*) – Replace dest S3 key if it already exists
- **transform_script** (*str*) – location of the executable transformation script
- **select_expression** (*str*) – S3 Select expression

S3ListOperator

class airflow.contrib.operators.s3_list_operator.**S3ListOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

List all objects from the bucket with the given string prefix in name.

This operator returns a python list with the name of objects which can be used by *xcom* in the downstream task.

Parameters

- **bucket** (*string*) – The S3 bucket where to find the objects. (templated)
- **prefix** (*string*) – Prefix string to filters the objects whose name begin with such prefix. (templated)
- **delimiter** (*string*) – the delimiter marks key hierarchy. (templated)
- **aws_conn_id** (*string*) – The connection ID to use when connecting to S3 storage.

Parame verify Whether or not to verify SSL certificates for S3 connection. By default SSL certificates are verified. You can provide the following values: - False: do not validate SSL certificates. SSL will still be used

(unless use_ssl is False), but SSL certificates will not be verified.

- **path/to/cert/bundle.pem: A filename of the CA cert bundle to uses.** You can specify this argument if you want to use a different CA cert bundle than the one used by botocore.

Example: The following operator would list all the files (excluding subfolders) from the S3 `customers/2018/04/` key in the `data` bucket.

```
s3_file = S3ListOperator(
    task_id='list_3s_files',
    bucket='data',
    prefix='customers/2018/04/',
    delimiter='/',
    aws_conn_id='aws_customers_conn'
)
```

S3ToGoogleCloudStorageOperator

class airflow.contrib.operators.s3_to_gcs_operator.**S3ToGoogleCloudStorageOperator**(***kwargs*)

Bases: *airflow.contrib.operators.s3_list_operator.S3ListOperator*

Synchronizes an S3 key, possibly a prefix, with a Google Cloud Storage destination path.

Parameters

- **bucket** (*string*) – The S3 bucket where to find the objects. (templated)
- **prefix** (*string*) – Prefix string which filters objects whose name begin with such prefix. (templated)
- **delimiter** (*string*) – the delimiter marks key hierarchy. (templated)
- **aws_conn_id** (*string*) – The source S3 connection
- **dest_gcs_conn_id** (*string*) – The destination connection ID to use when connecting to Google Cloud Storage.
- **dest_gcs** (*string*) – The destination Google Cloud Storage bucket and prefix where you want to store the files. (templated)
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

- **replace** (*bool*) – Whether you want to replace existing destination files or not.

Parame verify Whether or not to verify SSL certificates for S3 connection. By default SSL certificates are verified. You can provide the following values: - False: do not validate SSL certificates. SSL will still be used

(unless use_ssl is False), but SSL certificates will not be verified.

- **path/to/cert/bundle.pem: A filename of the CA cert bundle to uses.** You can specify this argument if you want to use a different CA cert bundle than the one used by botocore.

Example:

```
s3_to_gcs_op = S3ToGoogleCloudStorageOperator(
     task_id='s3_to_gcs_example',
     bucket='my-s3-bucket',
     prefix='data/customers-201804',
     dest_gcs_conn_id='google_cloud_default',
     dest_gcs='gs://my.gcs.bucket/some/customers/',
     replace=False,
     dag=my-dag)
```

Note that `bucket`, `prefix`, `delimiter` and `dest_gcs` are templated, so you can use variables in them if you wish.

S3ToGoogleCloudStorageTransferOperator

S3ToHiveTransfer

class airflow.operators.s3_to_hive_operator.**S3ToHiveTransfer**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Moves data from S3 to Hive. The operator downloads a file from S3, stores the file locally before loading it into a Hive table. If the `create` or `recreate` arguments are set to `True`, a `CREATE TABLE` and `DROP TABLE` statements are generated. Hive data types are inferred from the cursor's metadata from.

Note that the table generated in Hive uses `STORED AS textfile` which isn't the most efficient serialization format. If a large amount of data is loaded and/or if the tables gets queried considerably, you may want to use this operator only to stage the data into a temporary table before loading it into its final destination using a `HiveOperator`.

Parameters

- **s3_key** (*str*) – The key to be retrieved from S3. (templated)
- **field_dict** (*dict*) – A dictionary of the fields name in the file as keys and their Hive types as values
- **hive_table** (*str*) – target Hive table, use dot notation to target a specific database. (templated)
- **create** (*bool*) – whether to create the table if it doesn't exist
- **recreate** (*bool*) – whether to drop and recreate the table at every execution
- **partition** (*dict*) – target partition as a dict of partition columns and values. (templated)
- **headers** (*bool*) – whether the file contains column names on the first line

- **check_headers** (*bool*) – whether the column names on the first line should be checked against the keys of field_dict
- **wildcard_match** (*bool*) – whether the s3_key should be interpreted as a Unix wildcard pattern
- **delimiter** (*str*) – field delimiter in the file
- **aws_conn_id** (*str*) – source s3 connection
- **hive_cli_conn_id** (*str*) – destination hive connection
- **input_compressed** (*bool*) – Boolean to determine if file decompression is required to process headers
- **tblproperties** (*dict*) – TBLPROPERTIES of the hive table being created
- **select_expression** (*str*) – S3 Select expression

Parame verify Whether or not to verify SSL certificates for S3 connection. By default SSL certificates are verified. You can provide the following values: - False: do not validate SSL certificates. SSL will still be used

(unless use_ssl is False), but SSL certificates will not be verified.

- **path/to/cert/bundle.pem: A filename of the CA cert bundle to uses.** You can specify this argument if you want to use a different CA cert bundle than the one used by botocore.

3.16.3.3 AWS EC2 Container Service

- *ECSOperator* : Execute a task on AWS EC2 Container Service.

ECSOperator

class airflow.contrib.operators.ecs_operator.**ECSOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Execute a task on AWS EC2 Container Service

Parameters

- **task_definition** (*str*) – the task definition name on EC2 Container Service
- **cluster** (*str*) – the cluster name on EC2 Container Service
- **overrides** (*dict*) – the same parameter that boto3 will receive (templated): http://boto3.readthedocs.org/en/latest/reference/services/ecs.html#ECS.Client.run_task
- **aws_conn_id** (*str*) – connection id of AWS credentials / region name. If None, credential boto3 strategy will be used (http://boto3.readthedocs.io/en/latest/guide/configuration.html).
- **region_name** (*str*) – region name to use in AWS Hook. Override the region_name in connection (if provided)
- **launch_type** (*str*) – the launch type on which to run your task ('EC2' or 'FARGATE')

3.16.3.4 AWS Batch Service

- *AWSBatchOperator* : Execute a task on AWS Batch Service.

AWSBatchOperator

class airflow.contrib.operators.awsbatch_operator.**AWSBatchOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Execute a job on AWS Batch Service

Parameters

- **job_name** (*str*) – the name for the job that will run on AWS Batch
- **job_definition** (*str*) – the job definition name on AWS Batch
- **job_queue** (*str*) – the queue name on AWS Batch
- **overrides** (*dict*) – the same parameter that boto3 will receive on containerOverrides (templated): http://boto3.readthedocs.io/en/latest/reference/services/batch.html#submit_job
- **max_retries** (*int*) – exponential backoff retries while waiter is not merged, 4200 = 48 hours
- **aws_conn_id** (*str*) – connection id of AWS credentials / region name. If None, credential boto3 strategy will be used (http://boto3.readthedocs.io/en/latest/guide/configuration.html).
- **region_name** (*str*) – region name to use in AWS Hook. Override the region_name in connection (if provided)

3.16.3.5 AWS RedShift

- *AwsRedshiftClusterSensor* : Waits for a Redshift cluster to reach a specific status.
- *RedshiftHook* : Interact with AWS Redshift, using the boto3 library.
- *RedshiftToS3Transfer* : Executes an unload command to S3 as CSV with or without headers.
- *S3ToRedshiftTransfer* : Executes an copy command from S3 as CSV with or without headers.

AwsRedshiftClusterSensor

class airflow.contrib.sensors.aws_redshift_cluster_sensor.**AwsRedshiftClusterSensor**(***kwargs*)

Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Waits for a Redshift cluster to reach a specific status.

Parameters

- **cluster_identifier** (*str*) – The identifier for the cluster being pinged.
- **target_status** (*str*) – The cluster status desired.

poke(*context*)

Function that the sensors defined while deriving this class should override.

RedshiftHook

class airflow.contrib.hooks.redshift_hook.**RedshiftHook**(*aws_conn_id='aws_default'*, *verify=None*)

Bases: *airflow.contrib.hooks.aws_hook.AwsHook*

Interact with AWS Redshift, using the boto3 library

cluster_status (*cluster_identifier*)
Return status of a cluster

Parameters **cluster_identifier** (*str*) – unique identifier of a cluster

create_cluster_snapshot (*snapshot_identifier*, *cluster_identifier*)
Creates a snapshot of a cluster

Parameters

- **snapshot_identifier** (*str*) – unique identifier for a snapshot of a cluster
- **cluster_identifier** (*str*) – unique identifier of a cluster

delete_cluster (*cluster_identifier*, *skip_final_cluster_snapshot=True*, *final_cluster_snapshot_identifier=''*)
Delete a cluster and optionally create a snapshot

Parameters

- **cluster_identifier** (*str*) – unique identifier of a cluster
- **skip_final_cluster_snapshot** (*bool*) – determines cluster snapshot creation
- **final_cluster_snapshot_identifier** (*str*) – name of final cluster snapshot

describe_cluster_snapshots (*cluster_identifier*)
Gets a list of snapshots for a cluster

Parameters **cluster_identifier** (*str*) – unique identifier of a cluster

restore_from_cluster_snapshot (*cluster_identifier*, *snapshot_identifier*)
Restores a cluster from its snapshot

Parameters

- **cluster_identifier** (*str*) – unique identifier of a cluster
- **snapshot_identifier** (*str*) – unique identifier for a snapshot of a cluster

RedshiftToS3Transfer

S3ToRedshiftTransfer

3.16.3.6 Amazon SageMaker

For more instructions on using Amazon SageMaker in Airflow, please see the SageMaker Python SDK README.

- SageMakerHook : Interact with Amazon SageMaker.
- SageMakerTrainingOperator : Create a SageMaker training job.
- SageMakerTuningOperator : Create a SageMaker tuning job.
- SageMakerModelOperator : Create a SageMaker model.
- SageMakerTransformOperator : Create a SageMaker transform job.
- SageMakerEndpointConfigOperator : Create a SageMaker endpoint config.
- SageMakerEndpointOperator : Create a SageMaker endpoint.

SageMakerHook

class `airflow.contrib.hooks.sagemaker_hook.`**`SageMakerHook`**(**args*, ***kwargs*)

Bases: `airflow.contrib.hooks.aws_hook.AwsHook`

Interact with Amazon SageMaker.

`check_s3_url`(*s3url*)

Check if an S3 URL exists

Parameters **`s3url`** (`str`) – S3 url

Return type bool

`check_status`(*job_name*, *key*, *describe_function*, *check_interval*, *max_ingestion_time*, *non_terminal_states=None*)

Check status of a SageMaker job

Parameters

- **`job_name`** (`str`) – name of the job to check status
- **`key`** (`str`) – the key of the response dict that points to the state
- **`describe_function`** (`python callable`) – the function used to retrieve the status
- **`args`** – the arguments for the function
- **`check_interval`** (`int`) – the time interval in seconds which the operator will check the status of any SageMaker job
- **`max_ingestion_time`** (`int`) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.
- **`non_terminal_states`** (`set`) – the set of nonterminal states

Returns response of describe call after job is done

`check_training_config`(*training_config*)

Check if a training configuration is valid

Parameters **`training_config`** (`dict`) – training_config

Returns None

`check_training_status_with_log`(*job_name*, *non_terminal_states*, *failed_states*, *wait_for_completion*, *check_interval*, *max_ingestion_time*)

Display the logs for a given training job, optionally tailing them until the job is complete.

Parameters

- **`job_name`** (`str`) – name of the training job to check status and display logs for
- **`non_terminal_states`** (`set`) – the set of non_terminal states
- **`failed_states`** (`set`) – the set of failed states
- **`wait_for_completion`** (`bool`) – Whether to keep looking for new log entries until the job completes
- **`check_interval`** (`int`) – The interval in seconds between polling for new log entries and job completion

- **max_ingestion_time** (*int*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns None

check_tuning_config(*tuning_config*)
Check if a tuning configuration is valid

Parameters **tuning_config** (*dict*) – tuning_config

Returns None

configure_s3_resources(*config*)
Extract the S3 operations from the configuration and execute them.

Parameters **config** (*dict*) – config of SageMaker operation

Return type dict

create_endpoint(*config*, *wait_for_completion=True*, *check_interval=30*, *max_ingestion_time=None*)
Create an endpoint

Parameters

- **config** (*dict*) – the config for endpoint
- **wait_for_completion** (*bool*) – if the program should keep running until job finishes
- **check_interval** (*int*) – the time interval in seconds which the operator will check the status of any SageMaker job
- **max_ingestion_time** (*int*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns A response to endpoint creation

create_endpoint_config(*config*)
Create an endpoint config

Parameters **config** (*dict*) – the config for endpoint-config

Returns A response to endpoint config creation

create_model(*config*)
Create a model job

Parameters **config** (*dict*) – the config for model

Returns A response to model creation

create_training_job(*config*, *wait_for_completion=True*, *print_log=True*, *check_interval=30*, *max_ingestion_time=None*)
Create a training job

Parameters

- **config** (*dict*) – the config for training
- **wait_for_completion** (*bool*) – if the program should keep running until job finishes
- **check_interval** (*int*) – the time interval in seconds which the operator will check the status of any SageMaker job

- **max_ingestion_time** (*int*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns A response to training job creation

create_transform_job(*config*, *wait_for_completion=True*, *check_interval=30*, *max_ingestion_time=None*)

Create a transform job

Parameters

- **config** (*dict*) – the config for transform job
- **wait_for_completion** (*bool*) – if the program should keep running until job finishes
- **check_interval** (*int*) – the time interval in seconds which the operator will check the status of any SageMaker job
- **max_ingestion_time** (*int*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns A response to transform job creation

create_tuning_job(*config*, *wait_for_completion=True*, *check_interval=30*, *max_ingestion_time=None*)

Create a tuning job

Parameters

- **config** (*dict*) – the config for tuning
- **wait_for_completion** – if the program should keep running until job finishes
- **wait_for_completion** – bool
- **check_interval** (*int*) – the time interval in seconds which the operator will check the status of any SageMaker job
- **max_ingestion_time** (*int*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns A response to tuning job creation

describe_endpoint(*name*)

Parameters **name** (*string*) – the name of the endpoint

Returns A dict contains all the endpoint info

describe_endpoint_config(*name*)

Return the endpoint config info associated with the name

Parameters **name** (*string*) – the name of the endpoint config

Returns A dict contains all the endpoint config info

describe_model(*name*)

Return the SageMaker model info associated with the name

Parameters **name** (*string*) – the name of the SageMaker model

Returns A dict contains all the model info

describe_training_job(*name*)

Return the training job info associated with the name

Parameters **name** (*str*) – the name of the training job

Returns A dict contains all the training job info

describe_training_job_with_log(*job_name*, *positions*, *stream_names*, *instance_count*, *state*, *last_description*, *last_describe_job_call*)

Return the training job info associated with job_name and print CloudWatch logs

describe_transform_job(*name*)

Return the transform job info associated with the name

Parameters **name** (*string*) – the name of the transform job

Returns A dict contains all the transform job info

describe_tuning_job(*name*)

Return the tuning job info associated with the name

Parameters **name** (*string*) – the name of the tuning job

Returns A dict contains all the tuning job info

get_conn()

Establish an AWS connection for SageMaker

Return type SageMaker.Client

get_log_conn()

Establish an AWS connection for retrieving logs during training

Return type CloudWatchLog.Client

log_stream(*log_group*, *stream_name*, *start_time=0*, *skip=0*)

A generator for log items in a single stream. This will yield all the items that are available at the current moment.

Parameters

- **log_group** (*str*) – The name of the log group.
- **stream_name** (*str*) – The name of the specific stream.
- **start_time** (*int*) – The time stamp value to start reading the logs from (default: 0).
- **skip** (*int*) – The number of log entries to skip at the start (default: 0). This is for when there are multiple entries at the same timestamp.

Return type dict

Returns

A CloudWatch log event with the following key-value pairs:

’timestamp’ (int): The time in milliseconds of the event.

’message’ (str): The log event data.

’ingestionTime’ (int): The time in milliseconds the event was ingested.

multi_stream_iter(*log_group*, *streams*, *positions=None*)

Iterate over the available events coming from a set of log streams in a single log group interleaving the events from each stream so they’re yielded in timestamp order.

Parameters

- **`log_group`** (*`str`*) – The name of the log group.
- **`streams`** (*`list`*) – A list of the log stream names. The position of the stream in this list is the stream number.
- **`positions`** (*`list`*) – A list of pairs of (timestamp, skip) which represents the last record read from each stream.

Returns A tuple of (stream number, cloudwatch log event).

`tar_and_s3_upload`(*path*, *key*, *bucket*)
Tar the local file or directory and upload to s3

Parameters

- **`path`** (*`str`*) – local file or directory
- **`key`** (*`str`*) – s3 key
- **`bucket`** (*`str`*) – s3 bucket

Returns None

`update_endpoint`(*config*, *wait_for_completion=True*, *check_interval=30*, *max_ingestion_time=None*)
Update an endpoint

Parameters

- **`config`** (*`dict`*) – the config for endpoint
- **`wait_for_completion`** (*`bool`*) – if the program should keep running until job finishes
- **`check_interval`** (*`int`*) – the time interval in seconds which the operator will check the status of any SageMaker job
- **`max_ingestion_time`** (*`int`*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns A response to endpoint update

SageMakerTrainingOperator

class `airflow.contrib.operators.sagemaker_training_operator.`**`SageMakerTrainingOperator`**(***kwa*
Bases: *`airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator`*

Initiate a SageMaker training job.

This operator returns The ARN of the training job created in Amazon SageMaker.

Parameters

- **`config`** (*`dict`*) – The configuration necessary to start a training job (templated).

  For details of the configuration parameter see `SageMaker.Client.create_training_job()`
- **`aws_conn_id`** (*`str`*) – The AWS connection ID to use.

- **wait_for_completion** (*bool*) – If wait is set to True, the time interval, in seconds, that the operation waits to check the status of the training job.
- **print_log** (*bool*) – if the operator should print the cloudwatch log during training
- **check_interval** (*int*) – if wait is set to be true, this is the time interval in seconds which the operator will check the status of the training job
- **max_ingestion_time** (*int*) – If wait is set to True, the operation fails if the training job doesn't finish within max_ingestion_time seconds. If you set this parameter to None, the operation does not timeout.

SageMakerTuningOperator

class airflow.contrib.operators.sagemaker_tuning_operator.**SageMakerTuningOperator**(***kwargs*)

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Initiate a SageMaker hyperparameter tuning job.

This operator returns The ARN of the tuning job created in Amazon SageMaker.

Parameters

- **config** (*dict*) – The configuration necessary to start a tuning job (templated).

  For details of the configuration parameter see `SageMaker.Client.create_hyper_parameter_tuning_job()`
- **aws_conn_id** (*str*) – The AWS connection ID to use.
- **wait_for_completion** (*bool*) – Set to True to wait until the tuning job finishes.
- **check_interval** (*int*) – If wait is set to True, the time interval, in seconds, that this operation waits to check the status of the tuning job.
- **max_ingestion_time** (*int*) – If wait is set to True, the operation fails if the tuning job doesn't finish within max_ingestion_time seconds. If you set this parameter to None, the operation does not timeout.

SageMakerModelOperator

class airflow.contrib.operators.sagemaker_model_operator.**SageMakerModelOperator**(***kwargs*)

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Create a SageMaker model.

This operator returns The ARN of the model created in Amazon SageMaker

Parameters

- **config** (*dict*) – The configuration necessary to create a model.

  For details of the configuration parameter see `SageMaker.Client.create_model()`
- **aws_conn_id** (*str*) – The AWS connection ID to use.

SageMakerTransformOperator

class airflow.contrib.operators.sagemaker_transform_operator.**SageMakerTransformOperator**(***k*

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Initiate a SageMaker transform job.

This operator returns The ARN of the model created in Amazon SageMaker.

Parameters

- **config** (*dict*) – The configuration necessary to start a transform job (templated).

  If you need to create a SageMaker transform job based on an existed SageMaker model:

  ```
  config = transform_config
  ```

  If you need to create both SageMaker model and SageMaker Transform job:

  ```
  config = {
      'Model': model_config,
      'Transform': transform_config
  }
  ```

  For details of the configuration parameter of transform_config see `SageMaker.Client.create_transform_job()`

  For details of the configuration parameter of model_config, See: `SageMaker.Client.create_model()`

- **aws_conn_id** (*string*) – The AWS connection ID to use.
- **wait_for_completion** (*bool*) – Set to True to wait until the transform job finishes.
- **check_interval** (*int*) – If wait is set to True, the time interval, in seconds, that this operation waits to check the status of the transform job.
- **max_ingestion_time** (*int*) – If wait is set to True, the operation fails if the transform job doesn't finish within max_ingestion_time seconds. If you set this parameter to None, the operation does not timeout.

SageMakerEndpointConfigOperator

class airflow.contrib.operators.sagemaker_endpoint_config_operator.**SageMakerEndpointConfigO**

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Create a SageMaker endpoint config.

This operator returns The ARN of the endpoint config created in Amazon SageMaker

Parameters

- **config** (*dict*) – The configuration necessary to create an endpoint config.

  For details of the configuration parameter see `SageMaker.Client.create_endpoint_config()`

- **aws_conn_id** (*str*) – The AWS connection ID to use.

SageMakerEndpointOperator

class airflow.contrib.operators.sagemaker_endpoint_operator.**SageMakerEndpointOperator**(***kwa*

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Create a SageMaker endpoint.

This operator returns The ARN of the endpoint created in Amazon SageMaker

Parameters

- **config** (*dict*) – The configuration necessary to create an endpoint.

  If you need to create a SageMaker endpoint based on an existed SageMaker model and an existed SageMaker endpoint config:

  ```
  config = endpoint_configuration;
  ```

  If you need to create all of SageMaker model, SageMaker endpoint-config and SageMaker endpoint:

  ```
  config = {
      'Model': model_configuration,
      'EndpointConfig': endpoint_config_configuration,
      'Endpoint': endpoint_configuration
  }
  ```

  For details of the configuration parameter of model_configuration see `SageMaker.Client.create_model()`

  For details of the configuration parameter of endpoint_config_configuration see `SageMaker.Client.create_endpoint_config()`

  For details of the configuration parameter of endpoint_configuration see `SageMaker.Client.create_endpoint()`

- **aws_conn_id** (*str*) – The AWS connection ID to use.
- **wait_for_completion** (*bool*) – Whether the operator should wait until the endpoint creation finishes.
- **check_interval** (*int*) – If wait is set to True, this is the time interval, in seconds, that this operation waits before polling the status of the endpoint creation.
- **max_ingestion_time** (*int*) – If wait is set to True, this operation fails if the endpoint creation doesn't finish within max_ingestion_time seconds. If you set this parameter to None it never times out.
- **operation** (*str*) – Whether to create an endpoint or update an endpoint. Must be either 'create or 'update'.

3.16.3.7 Amazon SageMaker

For more instructions on using Amazon SageMaker in Airflow, please see the SageMaker Python SDK README.

- SageMakerHook : Interact with Amazon SageMaker.
- SageMakerTrainingOperator : Create a SageMaker training job.
- SageMakerTuningOperator : Create a SageMaker tuning job.

- SageMakerModelOperator : Create a SageMaker model.
- SageMakerTransformOperator : Create a SageMaker transform job.
- SageMakerEndpointConfigOperator : Create a SageMaker endpoint config.
- SageMakerEndpointOperator : Create a SageMaker endpoint.

SageMakerHook

class `airflow.contrib.hooks.sagemaker_hook.`**`SageMakerHook`**(**args*, ***kwargs*)
Bases: `airflow.contrib.hooks.aws_hook.AwsHook`

Interact with Amazon SageMaker.

`check_s3_url`(*s3url*)
Check if an S3 URL exists

Parameters **`s3url`** (`str`) – S3 url

Return type bool

`check_status`(*job_name*, *key*, *describe_function*, *check_interval*, *max_ingestion_time*, *non_terminal_states=None*)
Check status of a SageMaker job

Parameters

- **`job_name`** (`str`) – name of the job to check status
- **`key`** (`str`) – the key of the response dict that points to the state
- **`describe_function`** (`python callable`) – the function used to retrieve the status
- **`args`** – the arguments for the function
- **`check_interval`** (`int`) – the time interval in seconds which the operator will check the status of any SageMaker job
- **`max_ingestion_time`** (`int`) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.
- **`non_terminal_states`** (`set`) – the set of nonterminal states

Returns response of describe call after job is done

`check_training_config`(*training_config*)
Check if a training configuration is valid

Parameters **`training_config`** (`dict`) – training_config

Returns None

`check_training_status_with_log`(*job_name*, *non_terminal_states*, *failed_states*, *wait_for_completion*, *check_interval*, *max_ingestion_time*)
Display the logs for a given training job, optionally tailing them until the job is complete.

Parameters

- **`job_name`** (`str`) – name of the training job to check status and display logs for
- **`non_terminal_states`** (`set`) – the set of non_terminal states
- **`failed_states`** (`set`) – the set of failed states

- **wait_for_completion** (*bool*) – Whether to keep looking for new log entries until the job completes
- **check_interval** (*int*) – The interval in seconds between polling for new log entries and job completion
- **max_ingestion_time** (*int*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns None

check_tuning_config(*tuning_config*)
Check if a tuning configuration is valid

Parameters **tuning_config** (*dict*) – tuning_config

Returns None

configure_s3_resources(*config*)
Extract the S3 operations from the configuration and execute them.

Parameters **config** (*dict*) – config of SageMaker operation

Return type dict

create_endpoint(*config*, *wait_for_completion=True*, *check_interval=30*, *max_ingestion_time=None*)
Create an endpoint

Parameters

- **config** (*dict*) – the config for endpoint
- **wait_for_completion** (*bool*) – if the program should keep running until job finishes
- **check_interval** (*int*) – the time interval in seconds which the operator will check the status of any SageMaker job
- **max_ingestion_time** (*int*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns A response to endpoint creation

create_endpoint_config(*config*)
Create an endpoint config

Parameters **config** (*dict*) – the config for endpoint-config

Returns A response to endpoint config creation

create_model(*config*)
Create a model job

Parameters **config** (*dict*) – the config for model

Returns A response to model creation

create_training_job(*config*, *wait_for_completion=True*, *print_log=True*, *check_interval=30*, *max_ingestion_time=None*)
Create a training job

Parameters

- **config** (*dict*) – the config for training

- **`wait_for_completion`** (*`bool`*) – if the program should keep running until job finishes
- **`check_interval`** (*`int`*) – the time interval in seconds which the operator will check the status of any SageMaker job
- **`max_ingestion_time`** (*`int`*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns A response to training job creation

`create_transform_job`(*config*, *wait_for_completion=True*, *check_interval=30*, *max_ingestion_time=None*)
Create a transform job

Parameters

- **`config`** (*`dict`*) – the config for transform job
- **`wait_for_completion`** (*`bool`*) – if the program should keep running until job finishes
- **`check_interval`** (*`int`*) – the time interval in seconds which the operator will check the status of any SageMaker job
- **`max_ingestion_time`** (*`int`*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns A response to transform job creation

`create_tuning_job`(*config*, *wait_for_completion=True*, *check_interval=30*, *max_ingestion_time=None*)
Create a tuning job

Parameters

- **`config`** (*`dict`*) – the config for tuning
- **`wait_for_completion`** – if the program should keep running until job finishes
- **`wait_for_completion`** – bool
- **`check_interval`** (*`int`*) – the time interval in seconds which the operator will check the status of any SageMaker job
- **`max_ingestion_time`** (*`int`*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns A response to tuning job creation

`describe_endpoint`(*name*)

Parameters **`name`** (*`string`*) – the name of the endpoint

Returns A dict contains all the endpoint info

`describe_endpoint_config`(*name*)
Return the endpoint config info associated with the name

Parameters **`name`** (*`string`*) – the name of the endpoint config

Returns A dict contains all the endpoint config info

`describe_model`(*name*)
Return the SageMaker model info associated with the name

Parameters **`name`** (*`string`*) – the name of the SageMaker model

Returns A dict contains all the model info

`describe_training_job`(*name*)
Return the training job info associated with the name

Parameters **`name`** (*`str`*) – the name of the training job

Returns A dict contains all the training job info

`describe_training_job_with_log`(*job_name*, *positions*, *stream_names*, *instance_count*, *state*, *last_description*, *last_describe_job_call*)
Return the training job info associated with job_name and print CloudWatch logs

`describe_transform_job`(*name*)
Return the transform job info associated with the name

Parameters **`name`** (*`string`*) – the name of the transform job

Returns A dict contains all the transform job info

`describe_tuning_job`(*name*)
Return the tuning job info associated with the name

Parameters **`name`** (*`string`*) – the name of the tuning job

Returns A dict contains all the tuning job info

`get_conn`()
Establish an AWS connection for SageMaker

Return type `SageMaker.Client`

`get_log_conn`()
Establish an AWS connection for retrieving logs during training

Return type `CloudWatchLog.Client`

`log_stream`(*log_group*, *stream_name*, *start_time=0*, *skip=0*)
A generator for log items in a single stream. This will yield all the items that are available at the current moment.

Parameters

- **`log_group`** (*`str`*) – The name of the log group.
- **`stream_name`** (*`str`*) – The name of the specific stream.
- **`start_time`** (*`int`*) – The time stamp value to start reading the logs from (default: 0).
- **`skip`** (*`int`*) – The number of log entries to skip at the start (default: 0). This is for when there are multiple entries at the same timestamp.

Return type dict

Returns

A CloudWatch log event with the following key-value pairs:
’timestamp’ (int): The time in milliseconds of the event.
’message’ (str): The log event data.
’ingestionTime’ (int): The time in milliseconds the event was ingested.

multi_stream_iter(*log_group*, *streams*, *positions=None*)

Iterate over the available events coming from a set of log streams in a single log group interleaving the events from each stream so they're yielded in timestamp order.

Parameters

- **log_group** (*str*) – The name of the log group.
- **streams** (*list*) – A list of the log stream names. The position of the stream in this list is the stream number.
- **positions** (*list*) – A list of pairs of (timestamp, skip) which represents the last record read from each stream.

Returns A tuple of (stream number, cloudwatch log event).

tar_and_s3_upload(*path*, *key*, *bucket*)

Tar the local file or directory and upload to s3

Parameters

- **path** (*str*) – local file or directory
- **key** (*str*) – s3 key
- **bucket** (*str*) – s3 bucket

Returns None

update_endpoint(*config*, *wait_for_completion=True*, *check_interval=30*, *max_ingestion_time=None*)

Update an endpoint

Parameters

- **config** (*dict*) – the config for endpoint
- **wait_for_completion** (*bool*) – if the program should keep running until job finishes
- **check_interval** (*int*) – the time interval in seconds which the operator will check the status of any SageMaker job
- **max_ingestion_time** (*int*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns A response to endpoint update

SageMakerTrainingOperator

class airflow.contrib.operators.sagemaker_training_operator.**SageMakerTrainingOperator**(***kwa

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Initiate a SageMaker training job.

This operator returns The ARN of the training job created in Amazon SageMaker.

Parameters

- **config** (*dict*) – The configuration necessary to start a training job (templated).

  For details of the configuration parameter see `SageMaker.Client.create_training_job()`

- **aws_conn_id** (*str*) – The AWS connection ID to use.
- **wait_for_completion** (*bool*) – If wait is set to True, the time interval, in seconds, that the operation waits to check the status of the training job.
- **print_log** (*bool*) – if the operator should print the cloudwatch log during training
- **check_interval** (*int*) – if wait is set to be true, this is the time interval in seconds which the operator will check the status of the training job
- **max_ingestion_time** (*int*) – If wait is set to True, the operation fails if the training job doesn't finish within max_ingestion_time seconds. If you set this parameter to None, the operation does not timeout.

SageMakerTuningOperator

class airflow.contrib.operators.sagemaker_tuning_operator.**SageMakerTuningOperator**(***kwargs*)

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Initiate a SageMaker hyperparameter tuning job.

This operator returns The ARN of the tuning job created in Amazon SageMaker.

Parameters

- **config** (*dict*) – The configuration necessary to start a tuning job (templated).

  For details of the configuration parameter see `SageMaker.Client.create_hyper_parameter_tuning_job()`
- **aws_conn_id** (*str*) – The AWS connection ID to use.
- **wait_for_completion** (*bool*) – Set to True to wait until the tuning job finishes.
- **check_interval** (*int*) – If wait is set to True, the time interval, in seconds, that this operation waits to check the status of the tuning job.
- **max_ingestion_time** (*int*) – If wait is set to True, the operation fails if the tuning job doesn't finish within max_ingestion_time seconds. If you set this parameter to None, the operation does not timeout.

SageMakerModelOperator

class airflow.contrib.operators.sagemaker_model_operator.**SageMakerModelOperator**(***kwargs*)

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Create a SageMaker model.

This operator returns The ARN of the model created in Amazon SageMaker

Parameters

- **config** (*dict*) – The configuration necessary to create a model.

  For details of the configuration parameter see `SageMaker.Client.create_model()`
- **aws_conn_id** (*str*) – The AWS connection ID to use.

SageMakerTransformOperator

class airflow.contrib.operators.sagemaker_transform_operator.**SageMakerTransformOperator**(***k*

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Initiate a SageMaker transform job.

This operator returns The ARN of the model created in Amazon SageMaker.

Parameters

- **config** (*dict*) – The configuration necessary to start a transform job (templated).

  If you need to create a SageMaker transform job based on an existed SageMaker model:

  ```
  config = transform_config
  ```

  If you need to create both SageMaker model and SageMaker Transform job:

  ```
  config = {
      'Model': model_config,
      'Transform': transform_config
  }
  ```

  For details of the configuration parameter of transform_config see SageMaker.Client.create_transform_job()

  For details of the configuration parameter of model_config, See: SageMaker.Client.create_model()
- **aws_conn_id** (*string*) – The AWS connection ID to use.
- **wait_for_completion** (*bool*) – Set to True to wait until the transform job finishes.
- **check_interval** (*int*) – If wait is set to True, the time interval, in seconds, that this operation waits to check the status of the transform job.
- **max_ingestion_time** (*int*) – If wait is set to True, the operation fails if the transform job doesn't finish within max_ingestion_time seconds. If you set this parameter to None, the operation does not timeout.

SageMakerEndpointConfigOperator

class airflow.contrib.operators.sagemaker_endpoint_config_operator.**SageMakerEndpointConfigO**

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Create a SageMaker endpoint config.

This operator returns The ARN of the endpoint config created in Amazon SageMaker

Parameters

- **config** (*dict*) – The configuration necessary to create an endpoint config.

  For details of the configuration parameter see SageMaker.Client.create_endpoint_config()
- **aws_conn_id** (*str*) – The AWS connection ID to use.

SageMakerEndpointOperator

class airflow.contrib.operators.sagemaker_endpoint_operator.**SageMakerEndpointOperator**(***kwa*

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Create a SageMaker endpoint.

This operator returns The ARN of the endpoint created in Amazon SageMaker

Parameters

- **config** (*dict*) – The configuration necessary to create an endpoint.

  If you need to create a SageMaker endpoint based on an existed SageMaker model and an existed SageMaker endpoint config:

  ```
  config = endpoint_configuration;
  ```

  If you need to create all of SageMaker model, SageMaker endpoint-config and SageMaker endpoint:

  ```
  config = {
      'Model': model_configuration,
      'EndpointConfig': endpoint_config_configuration,
      'Endpoint': endpoint_configuration
  }
  ```

  For details of the configuration parameter of model_configuration see `SageMaker.Client.create_model()`

  For details of the configuration parameter of endpoint_config_configuration see `SageMaker.Client.create_endpoint_config()`

  For details of the configuration parameter of endpoint_configuration see `SageMaker.Client.create_endpoint()`

- **aws_conn_id** (*str*) – The AWS connection ID to use.
- **wait_for_completion** (*bool*) – Whether the operator should wait until the endpoint creation finishes.
- **check_interval** (*int*) – If wait is set to True, this is the time interval, in seconds, that this operation waits before polling the status of the endpoint creation.
- **max_ingestion_time** (*int*) – If wait is set to True, this operation fails if the endpoint creation doesn't finish within max_ingestion_time seconds. If you set this parameter to None it never times out.
- **operation** (*str*) – Whether to create an endpoint or update an endpoint. Must be either 'create or 'update'.

3.16.4 Databricks

Databricks has contributed an Airflow operator which enables submitting runs to the Databricks platform. Internally the operator talks to the `api/2.0/jobs/runs/submit` endpoint.

3.16.4.1 DatabricksSubmitRunOperator

class `airflow.contrib.operators.databricks_operator.`**`DatabricksSubmitRunOperator`**`(**kwargs)`

Bases: *`airflow.models.BaseOperator`*

Submits a Spark job run to Databricks using the api/2.0/jobs/runs/submit API endpoint.

There are two ways to instantiate this operator.

In the first way, you can take the JSON payload that you typically use to call the `api/2.0/jobs/runs/submit` endpoint and pass it directly to our `DatabricksSubmitRunOperator` through the `json` parameter. For example

```
json = {
  'new_cluster': {
    'spark_version': '2.1.0-db3-scala2.11',
    'num_workers': 2
  },
  'notebook_task': {
    'notebook_path': '/Users/airflow@example.com/PrepareData',
  },
}
notebook_run = DatabricksSubmitRunOperator(task_id='notebook_run', json=json)
```

Another way to accomplish the same thing is to use the named parameters of the `DatabricksSubmitRunOperator` directly. Note that there is exactly one named parameter for each top level parameter in the `runs/submit` endpoint. In this method, your code would look like this:

```
new_cluster = {
  'spark_version': '2.1.0-db3-scala2.11',
  'num_workers': 2
}
notebook_task = {
  'notebook_path': '/Users/airflow@example.com/PrepareData',
}
notebook_run = DatabricksSubmitRunOperator(
    task_id='notebook_run',
    new_cluster=new_cluster,
    notebook_task=notebook_task)
```

In the case where both the json parameter **AND** the named parameters are provided, they will be merged together. If there are conflicts during the merge, the named parameters will take precedence and override the top level `json` keys.

Currently the named parameters that `DatabricksSubmitRunOperator` supports are

- `spark_jar_task`
- `notebook_task`
- `new_cluster`
- `existing_cluster_id`
- `libraries`
- `run_name`
- `timeout_seconds`

Parameters

- **json** (*dict*) – A JSON object containing API parameters which will be passed directly to the `api/2.0/jobs/runs/submit` endpoint. The other named parameters (i.e. `spark_jar_task`, `notebook_task`..) to this operator will be merged with this json dictionary if they are provided. If there are conflicts during the merge, the named parameters will take precedence and override the top level json keys. (templated)

  See also:

  For more information about templating see *Jinja Templating*. https://docs.databricks.com/api/latest/jobs.html#runs-submit

- **spark_jar_task** (*dict*) – The main class and parameters for the JAR task. Note that the actual JAR is specified in the `libraries`. *EITHER* `spark_jar_task` *OR* `notebook_task` should be specified. This field will be templated.

  See also:

  https://docs.databricks.com/api/latest/jobs.html#jobssparkjartask

- **notebook_task** (*dict*) – The notebook path and parameters for the notebook task. *EITHER* `spark_jar_task` *OR* `notebook_task` should be specified. This field will be templated.

  See also:

  https://docs.databricks.com/api/latest/jobs.html#jobsnotebooktask

- **new_cluster** (*dict*) – Specs for a new cluster on which this task will be run. *EITHER* `new_cluster` *OR* `existing_cluster_id` should be specified. This field will be templated.

  See also:

  https://docs.databricks.com/api/latest/jobs.html#jobsclusterspecnewcluster

- **existing_cluster_id** (*string*) – ID for existing cluster on which to run this task. *EITHER* `new_cluster` *OR* `existing_cluster_id` should be specified. This field will be templated.

- **libraries** (*list of dicts*) – Libraries which this run will use. This field will be templated.

  See also:

  https://docs.databricks.com/api/latest/libraries.html#managedlibrarieslibrary

- **run_name** (*string*) – The run name used for this task. By default this will be set to the Airflow `task_id`. This `task_id` is a required parameter of the superclass `BaseOperator`. This field will be templated.

- **timeout_seconds** (*int32*) – The timeout for this run. By default a value of 0 is used which means to have no timeout. This field will be templated.

- **databricks_conn_id** (*string*) – The name of the Airflow connection to use. By default and in the common case this will be `databricks_default`. To use token based authentication, provide the key `token` in the extra field for the connection.

- **polling_period_seconds** (*int*) – Controls the rate which we poll for the result of this run. By default the operator will poll every 30 seconds.

- **databricks_retry_limit** (*int*) – Amount of times retry if the Databricks backend is unreachable. Its value must be greater than or equal to 1.

- **databricks_retry_delay** (*float*) – Number of seconds to wait between retries (it might be a floating point number).
- **do_xcom_push** (*boolean*) – Whether we should push run_id and run_page_url to xcom.

3.16.5 GCP: Google Cloud Platform

Airflow has extensive support for the Google Cloud Platform. But note that most Hooks and Operators are in the contrib section. Meaning that they have a *beta* status, meaning that they can have breaking changes between minor releases.

See the *GCP connection type* documentation to configure connections to GCP.

3.16.5.1 Logging

Airflow can be configured to read and write task logs in Google Cloud Storage. See *Writing Logs to Google Cloud Storage*.

3.16.5.2 GoogleCloudBaseHook

class airflow.contrib.hooks.gcp_api_base_hook.**GoogleCloudBaseHook**(*gcp_conn_id='google_cloud_defaul dele-gate_to=None*)

Bases: airflow.hooks.base_hook.BaseHook, airflow.utils.log.logging_mixin.LoggingMixin

A base hook for Google cloud-related hooks. Google cloud has a shared REST API client that is built in the same way no matter which service you use. This class helps construct and authorize the credentials needed to then call googleapiclient.discovery.build() to actually discover and build a client for a Google cloud service.

The class also contains some miscellaneous helper functions.

All hook derived from this base hook use the 'Google Cloud Platform' connection type. Three ways of authentication are supported:

Default credentials: Only the 'Project Id' is required. You'll need to have set up default credentials, such as by the `GOOGLE_APPLICATION_DEFAULT` environment variable or from the metadata server on Google Compute Engine.

JSON key file: Specify 'Project Id', 'Keyfile Path' and 'Scope'.

Legacy P12 key files are not supported.

JSON data provided in the UI: Specify 'Keyfile JSON'.

static fallback_to_default_project_id(*func*)

Decorator that provides fallback for Google Cloud Platform project id. If the project is None it will be replaced with the project_id from the service account the Hook is authenticated with. Project id can be specified either via project_id kwarg or via first parameter in positional args.

Parameters **func** – function to wrap

Returns result of the function call

3.16.5.3 BigQuery

BigQuery Operators

- *BigQueryCheckOperator* : Performs checks against a SQL query that will return a single row with different values.
- *BigQueryValueCheckOperator* : Performs a simple value check using SQL code.
- *BigQueryIntervalCheckOperator* : Checks that the values of metrics given as SQL expressions are within a certain tolerance of the ones from days_back before.
- *BigQueryGetDataOperator* : Fetches the data from a BigQuery table and returns data in a python list
- *BigQueryCreateEmptyDatasetOperator* : Creates an empty BigQuery dataset.
- *BigQueryCreateEmptyTableOperator* : Creates a new, empty table in the specified BigQuery dataset optionally with schema.
- *BigQueryCreateExternalTableOperator* : Creates a new, external table in the dataset with the data in Google Cloud Storage.
- *BigQueryDeleteDatasetOperator* : Deletes an existing BigQuery dataset.
- *BigQueryTableDeleteOperator* : Deletes an existing BigQuery table.
- *BigQueryOperator* : Executes BigQuery SQL queries in a specific BigQuery database.
- *BigQueryToBigQueryOperator* : Copy a BigQuery table to another BigQuery table.
- *BigQueryToCloudStorageOperator* : Transfers a BigQuery table to a Google Cloud Storage bucket

BigQueryCheckOperator

class `airflow.contrib.operators.bigquery_check_operator.`**`BigQueryCheckOperator`**`(`*`**kwargs`*`)`

Bases: `airflow.operators.check_operator.CheckOperator`

Performs checks against BigQuery. The `BigQueryCheckOperator` expects a sql query that will return a single row. Each value on that first row is evaluated using python `bool` casting. If any of the values return `False` the check is failed and errors out.

Note that Python bool casting evals the following as `False`:

- `False`
- `0`
- Empty string (`""`)
- Empty list (`[]`)
- Empty dictionary or set (`{}`)

Given a query like `SELECT COUNT(*) FROM foo`, it will fail only if the count `== 0`. You can craft much more complex query that could, for instance, check that the table has the same number of rows as the source table upstream, or that the count of today's partition is greater than yesterday's partition, or that a set of metrics are less than 3 standard deviation for the 7 day average.

This operator can be used as a data quality check in your pipeline, and depending on where you put it in your DAG, you have the choice to stop the critical path, preventing from publishing dubious data, or on the side and receive email alterts without stopping the progress of the DAG.

Parameters

- **sql** (*string*) – the sql to be executed
- **bigquery_conn_id** (*string*) – reference to the BigQuery database
- **use_legacy_sql** (*boolean*) – Whether to use legacy SQL (true) or standard SQL (false).

BigQueryValueCheckOperator

class airflow.contrib.operators.bigquery_check_operator.**BigQueryValueCheckOperator**(***kwargs*)

Bases: *airflow.operators.check_operator.ValueCheckOperator*

Performs a simple value check using sql code.

Parameters

- **sql** (*string*) – the sql to be executed
- **use_legacy_sql** (*boolean*) – Whether to use legacy SQL (true) or standard SQL (false).

BigQueryIntervalCheckOperator

class airflow.contrib.operators.bigquery_check_operator.**BigQueryIntervalCheckOperator**(***kwa

Bases: *airflow.operators.check_operator.IntervalCheckOperator*

Checks that the values of metrics given as SQL expressions are within a certain tolerance of the ones from days_back before.

This method constructs a query like so

```
SELECT {metrics_threshold_dict_key} FROM {table}
WHERE {date_filter_column}=<date>
```

Parameters

- **table** (*str*) – the table name
- **days_back** (*int*) – number of days between ds and the ds we want to check against. Defaults to 7 days
- **metrics_threshold** (*dict*) – a dictionary of ratios indexed by metrics, for example 'COUNT(*)': 1.5 would require a 50 percent or less difference between the current day, and the prior days_back.
- **use_legacy_sql** (*boolean*) – Whether to use legacy SQL (true) or standard SQL (false).

BigQueryGetDataOperator

class airflow.contrib.operators.bigquery_get_data.**BigQueryGetDataOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Fetches the data from a BigQuery table (alternatively fetch data for selected columns) and returns data in a python list. The number of elements in the returned list will be equal to the number of rows fetched. Each element in the list will again be a list where element would represent the columns values for that row.

Example Result: `[['Tony', '10'], ['Mike', '20'], ['Steve', '15']]`

Note: If you pass fields to `selected_fields` which are in different order than the order of columns already in BQ table, the data will still be in the order of BQ table. For example if the BQ table has 3 columns as `[A,B,C]` and you pass 'B,A' in the `selected_fields` the data would still be of the form `'A,B'`.

Example:

```
get_data = BigQueryGetDataOperator(
    task_id='get_data_from_bq',
    dataset_id='test_dataset',
    table_id='Transaction_partitions',
    max_results='100',
    selected_fields='DATE',
    bigquery_conn_id='airflow-service-account'
)
```

Parameters

- **`dataset_id`** (*string*) – The dataset ID of the requested table. (templated)
- **`table_id`** (*string*) – The table ID of the requested table. (templated)
- **`max_results`** (*string*) – The maximum number of records (rows) to be fetched from the table. (templated)
- **`selected_fields`** (*string*) – List of fields to return (comma-separated). If unspecified, all fields are returned.
- **`bigquery_conn_id`** (*string*) – reference to a specific BigQuery hook.
- **`delegate_to`** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

BigQueryCreateEmptyTableOperator

class `airflow.contrib.operators.bigquery_operator.`**`BigQueryCreateEmptyTableOperator`**(***kwargs*)

Bases: *`airflow.models.BaseOperator`*

Creates a new, empty table in the specified BigQuery dataset, optionally with schema.

The schema to be used for the BigQuery table may be specified in one of two ways. You may either directly pass the schema fields in, or you may point the operator to a Google cloud storage object name. The object in Google cloud storage must be a JSON file with the schema fields in it. You can also create a table without schema.

Parameters

- **`project_id`** (*string*) – The project to create the table into. (templated)
- **`dataset_id`** (*string*) – The dataset to create the table into. (templated)
- **`table_id`** (*string*) – The Name of the table to be created. (templated)
- **`schema_fields`** (*list*) – If set, the schema field list as defined here: https://cloud.google.com/bigquery/docs/reference/rest/v2/jobs#configuration.load.schema

  Example:

```
schema_fields=[{"name": "emp_name", "type": "STRING", "mode":
↪"REQUIRED"},
               {"name": "salary", "type": "INTEGER", "mode":
↪"NULLABLE"}]
```

- **gcs_schema_object** (*string*) – Full path to the JSON file containing schema (templated). For example: `gs://test-bucket/dir1/dir2/employee_schema.json`
- **time_partitioning** (*dict*) – configure optional time partitioning fields i.e. partition by field, type and expiration as per API specifications.

  See also:

  https://cloud.google.com/bigquery/docs/reference/rest/v2/tables#timePartitioning
- **bigquery_conn_id** (*string*) – Reference to a specific BigQuery hook.
- **google_cloud_storage_conn_id** (*string*) – Reference to a specific Google cloud storage hook.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **labels** (*dict*) – a dictionary containing labels for the table, passed to BigQuery

  Example (with schema JSON in GCS):

```
CreateTable = BigQueryCreateEmptyTableOperator(
    task_id='BigQueryCreateEmptyTableOperator_task',
    dataset_id='ODS',
    table_id='Employees',
    project_id='internal-gcp-project',
    gcs_schema_object='gs://schema-bucket/employee_schema.json',
    bigquery_conn_id='airflow-service-account',
    google_cloud_storage_conn_id='airflow-service-account'
)
```

Corresponding Schema file (`employee_schema.json`):

```
[
  {
    "mode": "NULLABLE",
    "name": "emp_name",
    "type": "STRING"
  },
  {
    "mode": "REQUIRED",
    "name": "salary",
    "type": "INTEGER"
  }
]
```

Example (with schema in the DAG):

```
CreateTable = BigQueryCreateEmptyTableOperator(
    task_id='BigQueryCreateEmptyTableOperator_task',
    dataset_id='ODS',
    table_id='Employees',
    project_id='internal-gcp-project',
```

(continues on next page)

(continued from previous page)

```
    schema_fields=[{"name": "emp_name", "type": "STRING", "mode":
↪"REQUIRED"},
                   {"name": "salary", "type": "INTEGER", "mode":
↪"NULLABLE"}],
    bigquery_conn_id='airflow-service-account',
    google_cloud_storage_conn_id='airflow-service-account'
)
```

BigQueryCreateExternalTableOperator

class `airflow.contrib.operators.bigquery_operator.`**`BigQueryCreateExternalTableOperator`**(***kwa*

Bases: *`airflow.models.BaseOperator`*

Creates a new external table in the dataset with the data in Google Cloud Storage.

The schema to be used for the BigQuery table may be specified in one of two ways. You may either directly pass the schema fields in, or you may point the operator to a Google cloud storage object name. The object in Google cloud storage must be a JSON file with the schema fields in it.

Parameters

- **`bucket`** (*string*) – The bucket to point the external table to. (templated)
- **`source_objects`** (*list*) – List of Google cloud storage URIs to point table to. (templated) If source_format is 'DATASTORE_BACKUP', the list must only contain a single URI.
- **`destination_project_dataset_table`** (*string*) – The dotted (<project>.)<dataset>.<table> BigQuery table to load data into (templated). If <project> is not included, project will be the project defined in the connection json.
- **`schema_fields`** (*list*) – If set, the schema field list as defined here: https://cloud.google.com/bigquery/docs/reference/rest/v2/jobs#configuration.load.schema

  Example:

  ```
  schema_fields=[{"name": "emp_name", "type": "STRING", "mode":
  ↪"REQUIRED"},
                 {"name": "salary", "type": "INTEGER", "mode":
  ↪"NULLABLE"}]
  ```

  Should not be set when source_format is 'DATASTORE_BACKUP'.
- **`schema_object`** (*string*) – If set, a GCS object path pointing to a .json file that contains the schema for the table. (templated)
- **`source_format`** (*string*) – File format of the data.
- **`compression`** (*string*) – [Optional] The compression type of the data source. Possible values include GZIP and NONE. The default value is NONE. This setting is ignored for Google Cloud Bigtable, Google Cloud Datastore backups and Avro formats.
- **`skip_leading_rows`** (*int*) – Number of rows to skip when loading from a CSV.
- **`field_delimiter`** (*string*) – The delimiter to use for the CSV.
- **`max_bad_records`** (*int*) – The maximum number of bad records that BigQuery can ignore when running the job.

- **quote_character** (*string*) – The value that is used to quote data sections in a CSV file.
- **allow_quoted_newlines** (*boolean*) – Whether to allow quoted newlines (true) or not (false).
- **allow_jagged_rows** (*bool*) – Accept rows that are missing trailing optional columns. The missing values are treated as nulls. If false, records with missing trailing columns are treated as bad records, and if there are too many bad records, an invalid error is returned in the job result. Only applicable to CSV, ignored for other formats.
- **bigquery_conn_id** (*string*) – Reference to a specific BigQuery hook.
- **google_cloud_storage_conn_id** (*string*) – Reference to a specific Google cloud storage hook.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **src_fmt_configs** (*dict*) – configure optional fields specific to the source format

:param labels a dictionary containing labels for the table, passed to BigQuery :type labels: dict

BigQueryCreateEmptyDatasetOperator

class airflow.contrib.operators.bigquery_operator.**BigQueryCreateEmptyDatasetOperator**(***kwarg*

Bases: *airflow.models.BaseOperator*

” This operator is used to create new dataset for your Project in Big query. https://cloud.google.com/bigquery/docs/reference/rest/v2/datasets#resource

Parameters

- **project_id** (*str*) – The name of the project where we want to create the dataset. Don’t need to provide, if projectId in dataset_reference.
- **dataset_id** (*str*) – The id of dataset. Don’t need to provide, if datasetId in dataset_reference.
- **dataset_reference** – Dataset reference that could be provided with request body. More info: https://cloud.google.com/bigquery/docs/reference/rest/v2/datasets#resource

BigQueryDeleteDatasetOperator

class airflow.contrib.operators.bigquery_operator.**BigQueryDeleteDatasetOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

” This operator deletes an existing dataset from your Project in Big query. https://cloud.google.com/bigquery/docs/reference/rest/v2/datasets/delete :param project_id: The project id of the dataset. :type project_id: string :param dataset_id: The dataset to be deleted. :type dataset_id: string

Example:

```
delete_temp_data = BigQueryDeleteDatasetOperator(dataset_id = 'temp-dataset',
                                                 project_id = 'temp-project',
                                                 bigquery_conn_id='_my_gcp_conn_',
                                                 task_id='Deletetemp',
                                                 dag=dag)
```

BigQueryTableDeleteOperator

class airflow.contrib.operators.bigquery_table_delete_operator.**BigQueryTableDeleteOperator**

Bases: *airflow.models.BaseOperator*

Deletes BigQuery tables

Parameters

- **deletion_dataset_table** (*string*) – A dotted (<project>.|<project>:)<dataset>.<table> that indicates which table will be deleted. (templated)
- **bigquery_conn_id** (*string*) – reference to a specific BigQuery hook.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **ignore_if_missing** (*boolean*) – if True, then return success even if the requested table does not exist.

BigQueryOperator

class airflow.contrib.operators.bigquery_operator.**BigQueryOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Executes BigQuery SQL queries in a specific BigQuery database

Parameters

- **bql** (*Can receive a str representing a sql statement, a list of str (sql statements), or reference to a template file. Template reference are recognized by str ending in '.sql'.*) – (Deprecated. Use *sql* parameter instead) the sql code to be executed (templated)
- **sql** (*Can receive a str representing a sql statement, a list of str (sql statements), or reference to a template file. Template reference are recognized by str ending in '.sql'.*) – the sql code to be executed (templated)
- **destination_dataset_table** (*string*) – A dotted (<project>.|<project>:)<dataset>.<table> that, if set, will store the results of the query. (templated)
- **write_disposition** (*string*) – Specifies the action that occurs if the destination table already exists. (default: 'WRITE_EMPTY')
- **create_disposition** (*string*) – Specifies whether the job is allowed to create new tables. (default: 'CREATE_IF_NEEDED')
- **allow_large_results** (*boolean*) – Whether to allow large results.
- **flatten_results** (*boolean*) – If true and query uses legacy SQL dialect, flattens all nested and repeated fields in the query results. `allow_large_results` must be `true` if this is set to `false`. For standard SQL queries, this flag is ignored and results are never flattened.
- **bigquery_conn_id** (*string*) – reference to a specific BigQuery hook.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

- **udf_config** (*list*) – The User Defined Function configuration for the query. See https://cloud.google.com/bigquery/user-defined-functions for details.
- **use_legacy_sql** (*boolean*) – Whether to use legacy SQL (true) or standard SQL (false).
- **maximum_billing_tier** (*integer*) – Positive integer that serves as a multiplier of the basic price. Defaults to None, in which case it uses the value set in the project.
- **maximum_bytes_billed** (*float*) – Limits the bytes billed for this job. Queries that will have bytes billed beyond this limit will fail (without incurring a charge). If unspecified, this will be set to your project default.
- **api_resource_configs** (*dict*) – a dictionary that contain params 'configuration' applied for Google BigQuery Jobs API: https://cloud.google.com/bigquery/docs/reference/rest/v2/jobs for example, {'query': {'useQueryCache': False}}. You could use it if you need to provide some params that are not supported by BigQueryOperator like args.
- **schema_update_options** (*tuple*) – Allows the schema of the destination table to be updated as a side effect of the load job.
- **query_params** (*dict*) – a dictionary containing query parameter types and values, passed to BigQuery.
- **labels** (*dict*) – a dictionary containing labels for the job/query, passed to BigQuery
- **priority** (*string*) – Specifies a priority for the query. Possible values include INTERACTIVE and BATCH. The default value is INTERACTIVE.
- **time_partitioning** (*dict*) – configure optional time partitioning fields i.e. partition by field, type and expiration as per API specifications.
- **cluster_fields** (*list of str*) – Request that the result of this query be stored sorted by one or more columns. This is only available in conjunction with time_partitioning. The order of columns given determines the sort order.
- **location** (*str*) – The geographic location of the job. Required except for US and EU. See details at https://cloud.google.com/bigquery/docs/locations#specifying_your_location

BigQueryToBigQueryOperator

class airflow.contrib.operators.bigquery_to_bigquery.**BigQueryToBigQueryOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Copies data from one BigQuery table to another.

See also:

For more details about these parameters: https://cloud.google.com/bigquery/docs/reference/v2/jobs#configuration.copy

Parameters

- **source_project_dataset_tables** (*list|string*) – One or more dotted (project:|project.)<dataset>.<table> BigQuery tables to use as the source data. If <project> is not included, project will be the project defined in the connection json. Use a list if there are multiple source tables. (templated)
- **destination_project_dataset_table** (*string*) – The destination BigQuery table. Format is: (project:|project.)<dataset>.<table> (templated)

- **write_disposition** (*string*) – The write disposition if the table already exists.
- **create_disposition** (*string*) – The create disposition if the table doesn't exist.
- **bigquery_conn_id** (*string*) – reference to a specific BigQuery hook.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **labels** (*dict*) – a dictionary containing labels for the job/query, passed to BigQuery

BigQueryToCloudStorageOperator

class `airflow.contrib.operators.bigquery_to_gcs.`**`BigQueryToCloudStorageOperator`**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Transfers a BigQuery table to a Google Cloud Storage bucket.

See also:

For more details about these parameters: https://cloud.google.com/bigquery/docs/reference/v2/jobs

Parameters

- **source_project_dataset_table** (*string*) – The dotted `(<project>.|<project>:)<dataset>.<table>` BigQuery table to use as the source data. If <project> is not included, project will be the project defined in the connection json. (templated)
- **destination_cloud_storage_uris** (*list*) – The destination Google Cloud Storage URI (e.g. gs://some-bucket/some-file.txt). (templated) Follows convention defined here: https://cloud.google.com/bigquery/exporting-data-from-bigquery#exportingmultiple
- **compression** (*string*) – Type of compression to use.
- **export_format** (*string*) – File format to export.
- **field_delimiter** (*string*) – The delimiter to use when extracting to a CSV.
- **print_header** (*boolean*) – Whether to print a header for a CSV file extract.
- **bigquery_conn_id** (*string*) – reference to a specific BigQuery hook.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **labels** (*dict*) – a dictionary containing labels for the job/query, passed to BigQuery

BigQueryHook

class `airflow.contrib.hooks.bigquery_hook.`**`BigQueryHook`**(*bigquery_conn_id='bigquery_default', delegate_to=None, use_legacy_sql=True, location=None*)

Bases: *airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook*, *airflow.hooks.dbapi_hook.DbApiHook*, `airflow.utils.log.logging_mixin.LoggingMixin`

Interact with BigQuery. This hook uses the Google Cloud Platform connection.

get_conn()

Returns a BigQuery PEP 249 connection object.

get_pandas_df(*sql*, *parameters=None*, *dialect=None*)

Returns a Pandas DataFrame for the results produced by a BigQuery query. The DbApiHook method must be overridden because Pandas doesn't support PEP 249 connections, except for SQLite. See:

https://github.com/pydata/pandas/blob/master/pandas/io/sql.py#L447 https://github.com/pydata/pandas/issues/6900

Parameters

- **sql** (`string`) – The BigQuery SQL to execute.
- **parameters** (`mapping or iterable`) – The parameters to render the SQL query with (not used, leave to override superclass method)
- **dialect** (`string in {'legacy', 'standard'}`) – Dialect of BigQuery SQL – legacy SQL or standard SQL defaults to use *self.use_legacy_sql* if not specified

get_service()

Returns a BigQuery service object.

insert_rows(*table*, *rows*, *target_fields=None*, *commit_every=1000*)

Insertion is currently unsupported. Theoretically, you could use BigQuery's streaming API to insert rows into a table, but this hasn't been implemented.

table_exists(*project_id*, *dataset_id*, *table_id*)

Checks for the existence of a table in Google BigQuery.

Parameters

- **project_id** (`string`) – The Google cloud project in which to look for the table. The connection supplied to the hook must provide access to the specified project.
- **dataset_id** (`string`) – The name of the dataset in which to look for the table.
- **table_id** (`string`) – The name of the table to check the existence of.

3.16.5.4 Cloud Spanner

Cloud Spanner Operators

- *CloudSpannerInstanceDatabaseDeleteOperator* : deletes an existing database from a Google Cloud Spanner instance or returns success if the database is missing.
- *CloudSpannerInstanceDatabaseDeployOperator* : creates a new database in a Google Cloud instance or returns success if the database already exists.
- *CloudSpannerInstanceDatabaseUpdateOperator* : updates the structure of a Google Cloud Spanner database.
- *CloudSpannerInstanceDatabaseQueryOperator* : executes an arbitrary DML query (INSERT, UPDATE, DELETE).
- *CloudSpannerInstanceDeployOperator* : creates a new Google Cloud Spanner instance, or if an instance with the same name exists, updates the instance.
- *CloudSpannerInstanceDeleteOperator* : deletes a Google Cloud Spanner instance.

CloudSpannerInstanceDatabaseDeleteOperator

CloudSpannerInstanceDatabaseDeployOperator

CloudSpannerInstanceDatabaseUpdateOperator

CloudSpannerInstanceDatabaseQueryOperator

CloudSpannerInstanceDeployOperator

CloudSpannerInstanceDeleteOperator

CloudSpannerHook

3.16.5.5 Cloud SQL

Cloud SQL Operators

- *CloudSqlInstanceDatabaseDeleteOperator* : deletes a database from a Cloud SQL instance.
- *CloudSqlInstanceDatabaseCreateOperator* : creates a new database inside a Cloud SQL instance.
- *CloudSqlInstanceDatabasePatchOperator* : updates a database inside a Cloud SQL instance.
- *CloudSqlInstanceDeleteOperator* : delete a Cloud SQL instance.
- *CloudSqlInstanceExportOperator* : exports data from a Cloud SQL instance.
- *CloudSqlInstanceImportOperator* : imports data into a Cloud SQL instance.
- *CloudSqlInstanceCreateOperator* : create a new Cloud SQL instance.
- *CloudSqlInstancePatchOperator* : patch a Cloud SQL instance.
- *CloudSqlQueryOperator* : run query in a Cloud SQL instance.

CloudSqlInstanceDatabaseDeleteOperator

CloudSqlInstanceDatabaseCreateOperator

CloudSqlInstanceDatabasePatchOperator

CloudSqlInstanceDeleteOperator

CloudSqlInstanceExportOperator

CloudSqlInstanceImportOperator

CloudSqlInstanceCreateOperator

CloudSqlInstancePatchOperator

CloudSqlQueryOperator

Cloud SQL Hooks

3.16.5.6 Cloud Bigtable

Cloud Bigtable Operators

- *BigtableInstanceCreateOperator* : creates a Cloud Bigtable instance.
- *BigtableInstanceDeleteOperator* : deletes a Google Cloud Bigtable instance.
- *BigtableClusterUpdateOperator* : updates the number of nodes in a Google Cloud Bigtable cluster.
- *BigtableTableCreateOperator* : creates a table in a Google Cloud Bigtable instance.
- *BigtableTableDeleteOperator* : deletes a table in a Google Cloud Bigtable instance.
- *BigtableTableWaitForReplicationSensor* : (sensor) waits for a table to be fully replicated.

BigtableInstanceCreateOperator

BigtableInstanceDeleteOperator

BigtableClusterUpdateOperator

BigtableTableCreateOperator

BigtableTableDeleteOperator

BigtableTableWaitForReplicationSensor

Cloud Bigtable Hook

3.16.5.7 Compute Engine

Compute Engine Operators

- *GceInstanceStartOperator* : start an existing Google Compute Engine instance.
- *GceInstanceStopOperator* : stop an existing Google Compute Engine instance.
- *GceSetMachineTypeOperator* : change the machine type for a stopped instance.
- *GceInstanceTemplateCopyOperator* : copy the Instance Template, applying specified changes.
- *GceInstanceGroupManagerUpdateTemplateOperator* : patch the Instance Group Manager, replacing source Instance Template URL with the destination one.

The operators have the common base operator:

class `airflow.contrib.operators.gcp_compute_operator.`**`GceBaseOperator`**(***kwargs*)

Bases: `airflow.models.BaseOperator`

Abstract base operator for Google Compute Engine operators to inherit from.

They also use *Compute Engine Hook* to communicate with Google Cloud Platform.

GceInstanceStartOperator

class `airflow.contrib.operators.gcp_compute_operator.`**`GceInstanceStartOperator`**(***kwargs*)

Bases: `airflow.contrib.operators.gcp_compute_operator.GceBaseOperator`

Starts an instance in Google Compute Engine.

Parameters

- **zone** (*str*) – Google Cloud Platform zone where the instance exists.
- **resource_id** (*str*) – Name of the Compute Engine instance resource.
- **project_id** (*str*) – Optional, Google Cloud Platform Project ID where the Compute Engine Instance exists. If set to None or missing, the default project_id from the GCP connection is used.
- **gcp_conn_id** (*str*) – Optional, The connection ID used to connect to Google Cloud Platform. Defaults to 'google_cloud_default'.

- **api_version** (*str*) – Optional, API version used (for example v1 - or beta). Defaults to v1.
- **validate_body** – Optional, If set to False, body validation is not performed. Defaults to False.

GceInstanceStopOperator

class airflow.contrib.operators.gcp_compute_operator.**GceInstanceStopOperator**(***kwargs*)
Bases: *airflow.contrib.operators.gcp_compute_operator.GceBaseOperator*

Stops an instance in Google Compute Engine.

Parameters

- **zone** (*str*) – Google Cloud Platform zone where the instance exists.
- **resource_id** (*str*) – Name of the Compute Engine instance resource.
- **project_id** (*str*) – Optional, Google Cloud Platform Project ID where the Compute Engine Instance exists. If set to None or missing, the default project_id from the GCP connection is used.
- **gcp_conn_id** (*str*) – Optional, The connection ID used to connect to Google Cloud Platform. Defaults to 'google_cloud_default'.
- **api_version** (*str*) – Optional, API version used (for example v1 - or beta). Defaults to v1.
- **validate_body** – Optional, If set to False, body validation is not performed. Defaults to False.

GceSetMachineTypeOperator

class airflow.contrib.operators.gcp_compute_operator.**GceSetMachineTypeOperator**(***kwargs*)
Bases: *airflow.contrib.operators.gcp_compute_operator.GceBaseOperator*

Changes the machine type for a stopped instance to the machine type specified in the request.

Parameters

- **zone** (*str*) – Google Cloud Platform zone where the instance exists.
- **resource_id** (*str*) – Name of the Compute Engine instance resource.
- **body** (*dict*) – Body required by the Compute Engine setMachineType API, as described in https://cloud.google.com/compute/docs/reference/rest/v1/instances/setMachineType#request-body
- **project_id** (*str*) – Optional, Google Cloud Platform Project ID where the Compute Engine Instance exists. If set to None or missing, the default project_id from the GCP connection is used.
- **gcp_conn_id** (*str*) – Optional, The connection ID used to connect to Google Cloud Platform. Defaults to 'google_cloud_default'.
- **api_version** (*str*) – Optional, API version used (for example v1 - or beta). Defaults to v1.
- **validate_body** (*bool*) – Optional, If set to False, body validation is not performed. Defaults to False.

GceInstanceTemplateCopyOperator

class airflow.contrib.operators.gcp_compute_operator.**GceInstanceTemplateCopyOperator**(***kwarg*

Bases: *airflow.contrib.operators.gcp_compute_operator.GceBaseOperator*

Copies the instance template, applying specified changes.

Parameters

- **resource_id** (*str*) – Name of the Instance Template
- **body_patch** (*dict*) – Patch to the body of instanceTemplates object following rfc7386 PATCH semantics. The body_patch content follows https://cloud.google.com/compute/docs/reference/rest/v1/instanceTemplates Name field is required as we need to rename the template, all the other fields are optional. It is important to follow PATCH semantics - arrays are replaced fully, so if you need to update an array you should provide the whole target array as patch element.
- **project_id** (*str*) – Optional, Google Cloud Platform Project ID where the Compute Engine Instance exists. If set to None or missing, the default project_id from the GCP connection is used.
- **request_id** (*str*) – Optional, unique request_id that you might add to achieve full idempotence (for example when client call times out repeating the request with the same request id will not create a new instance template again). It should be in UUID format as defined in RFC 4122.
- **gcp_conn_id** (*str*) – Optional, The connection ID used to connect to Google Cloud Platform. Defaults to 'google_cloud_default'.
- **api_version** (*str*) – Optional, API version used (for example v1 - or beta). Defaults to v1.
- **validate_body** (*bool*) – Optional, If set to False, body validation is not performed. Defaults to False.

GceInstanceGroupManagerUpdateTemplateOperator

class airflow.contrib.operators.gcp_compute_operator.**GceInstanceGroupManagerUpdateTemplate**

Bases: *airflow.contrib.operators.gcp_compute_operator.GceBaseOperator*

Patches the Instance Group Manager, replacing source template URL with the destination one. API V1 does not have update/patch operations for Instance Group Manager, so you must use beta or newer API version. Beta is the default.

Parameters

- **resource_id** (*str*) – Name of the Instance Group Manager
- **zone** (*str*) – Google Cloud Platform zone where the Instance Group Manager exists.
- **source_template** (*str*) – URL of the template to replace.
- **destination_template** (*str*) – URL of the target template.
- **project_id** (*str*) – Optional, Google Cloud Platform Project ID where the Compute Engine Instance exists. If set to None or missing, the default project_id from the GCP connection is used.
- **request_id** (*str*) – Optional, unique request_id that you might add to achieve full idempotence (for example when client call times out repeating the request with the same request

id will not create a new instance template again). It should be in UUID format as defined in RFC 4122.

- **gcp_conn_id** (*str*) – Optional, The connection ID used to connect to Google Cloud Platform. Defaults to 'google_cloud_default'.
- **api_version** (*str*) – Optional, API version used (for example v1 - or beta). Defaults to v1.
- **validate_body** (*bool*) – Optional, If set to False, body validation is not performed. Defaults to False.

Compute Engine Hook

class airflow.contrib.hooks.gcp_compute_hook.**GceHook**(*api_version='v1'*, *gcp_conn_id='google_cloud_default'*, *delegate_to=None*)

Bases: *airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook*

Hook for Google Compute Engine APIs.

All the methods in the hook where project_id is used must be called with keyword arguments rather than positional.

get_conn()

Retrieves connection to Google Compute Engine.

Returns Google Compute Engine services object

Return type dict

get_instance_group_manager(**args*, ***kwargs*)

Retrieves Instance Group Manager by project_id, zone and resource_id. Must be called with keyword arguments rather than positional.

Parameters

- **zone** (*str*) – Google Cloud Platform zone where the Instance Group Manager exists
- **resource_id** (*str*) – Name of the Instance Group Manager
- **project_id** (*str*) – Optional, Google Cloud Platform project ID where the Compute Engine Instance exists. If set to None or missing, the default project_id from the GCP connection is used.

Returns Instance group manager representation as object according to https://cloud.google.com/compute/docs/reference/rest/beta/instanceGroupManagers

Return type dict

get_instance_template(**args*, ***kwargs*)

Retrieves instance template by project_id and resource_id. Must be called with keyword arguments rather than positional.

Parameters

- **resource_id** (*str*) – Name of the instance template
- **project_id** (*str*) – Optional, Google Cloud Platform project ID where the Compute Engine Instance exists. If set to None or missing, the default project_id from the GCP connection is used.

Returns Instance template representation as object according to https://cloud.google.com/compute/docs/reference/rest/v1/instanceTemplates

Return type dict

insert_instance_template(**args*, ***kwargs*)

Inserts instance template using body specified Must be called with keyword arguments rather than positional.

Parameters

- **body** (*dict*) – Instance template representation as object according to https://cloud.google.com/compute/docs/reference/rest/v1/instanceTemplates
- **request_id** (*str*) – Optional, unique request_id that you might add to achieve full idempotence (for example when client call times out repeating the request with the same request id will not create a new instance template again) It should be in UUID format as defined in RFC 4122
- **project_id** (*str*) – Optional, Google Cloud Platform project ID where the Compute Engine Instance exists. If set to None or missing, the default project_id from the GCP connection is used.

Returns None

patch_instance_group_manager(**args*, ***kwargs*)

Patches Instance Group Manager with the specified body. Must be called with keyword arguments rather than positional.

Parameters

- **zone** (*str*) – Google Cloud Platform zone where the Instance Group Manager exists
- **resource_id** (*str*) – Name of the Instance Group Manager
- **body** (*dict*) – Instance Group Manager representation as json-merge-patch object according to https://cloud.google.com/compute/docs/reference/rest/beta/instanceTemplates/patch
- **request_id** (*str*) – Optional, unique request_id that you might add to achieve full idempotence (for example when client call times out repeating the request with the same request id will not create a new instance template again). It should be in UUID format as defined in RFC 4122
- **project_id** (*str*) – Optional, Google Cloud Platform project ID where the Compute Engine Instance exists. If set to None or missing, the default project_id from the GCP connection is used.

:return None

set_machine_type(**args*, ***kwargs*)

Sets machine type of an instance defined by project_id, zone and resource_id. Must be called with keyword arguments rather than positional.

Parameters

- **zone** (*str*) – Google Cloud Platform zone where the instance exists.
- **resource_id** (*str*) – Name of the Compute Engine instance resource
- **body** (*dict*) – Body required by the Compute Engine setMachineType API, as described in https://cloud.google.com/compute/docs/reference/rest/v1/instances/setMachineType

- **project_id** (*str*) – Optional, Google Cloud Platform project ID where the Compute Engine Instance exists. If set to None or missing, the default project_id from the GCP connection is used.

Returns None

start_instance(**args*, ***kwargs*)

Starts an existing instance defined by project_id, zone and resource_id. Must be called with keyword arguments rather than positional.

Parameters

- **zone** (*str*) – Google Cloud Platform zone where the instance exists
- **resource_id** (*str*) – Name of the Compute Engine instance resource
- **project_id** (*str*) – Optional, Google Cloud Platform project ID where the Compute Engine Instance exists. If set to None or missing, the default project_id from the GCP connection is used.

Returns None

stop_instance(**args*, ***kwargs*)

Stops an instance defined by project_id, zone and resource_id Must be called with keyword arguments rather than positional.

Parameters

- **zone** (*str*) – Google Cloud Platform zone where the instance exists
- **resource_id** (*str*) – Name of the Compute Engine instance resource
- **project_id** (*str*) – Optional, Google Cloud Platform project ID where the Compute Engine Instance exists. If set to None or missing, the default project_id from the GCP connection is used.

Returns None

members

3.16.5.8 Cloud Functions

Cloud Functions Operators

- *GcfFunctionDeployOperator* : deploy Google Cloud Function to Google Cloud Platform
- *GcfFunctionDeleteOperator* : delete Google Cloud Function in Google Cloud Platform

They also use *Cloud Functions Hook* to communicate with Google Cloud Platform.

GcfFunctionDeployOperator

class airflow.contrib.operators.gcp_function_operator.**GcfFunctionDeployOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Creates a function in Google Cloud Functions. If a function with this name already exists, it will be updated.

Parameters

- **location** (*str*) – Google Cloud Platform region where the function should be created.

- **body** (*dict or google.cloud.functions.v1.CloudFunction*) – Body of the Cloud Functions definition. The body must be a Cloud Functions dictionary as described in: https://cloud.google.com/functions/docs/reference/rest/v1/projects.locations.functions . Different API versions require different variants of the Cloud Functions dictionary.
- **project_id** (*str*) – (Optional) Google Cloud Platform project ID where the function should be created.
- **gcp_conn_id** (*str*) – (Optional) The connection ID used to connect to Google Cloud Platform - default 'google_cloud_default'.
- **api_version** (*str*) – (Optional) API version used (for example v1 - default - or v1beta1).
- **zip_path** (*str*) – Path to zip file containing source code of the function. If the path is set, the sourceUploadUrl should not be specified in the body or it should be empty. Then the zip file will be uploaded using the upload URL generated via generateUploadUrl from the Cloud Functions API.
- **validate_body** (*bool*) – If set to False, body validation is not performed.

GcfFunctionDeleteOperator

class airflow.contrib.operators.gcp_function_operator.**GcfFunctionDeleteOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Deletes the specified function from Google Cloud Functions.

Parameters

- **name** (*str*) – A fully-qualified function name, matching the pattern: *^projects/[^/]+/locations/[^/]+/functions/[^/]+$*
- **gcp_conn_id** (*str*) – The connection ID to use to connect to Google Cloud Platform.
- **api_version** (*str*) – API version used (for example v1 or v1beta1).

Cloud Functions Hook

class airflow.contrib.hooks.gcp_function_hook.**GcfHook**(*api_version, gcp_conn_id='google_cloud_default', delegate_to=None*)

Bases: *airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook*

Hook for the Google Cloud Functions APIs.

create_new_function(**args, **kwargs*)

Creates a new function in Cloud Function in the location specified in the body.

Parameters

- **location** (*str*) – The location of the function.
- **body** (*dict*) – The body required by the Cloud Functions insert API.
- **project_id** (*str*) – Optional, Google Cloud Project project_id where the function belongs. If set to None or missing, the default project_id from the GCP connection is used.

Returns None

delete_function(*name*)

Deletes the specified Cloud Function.

Parameters **name** (*str*) – The name of the function.

Returns None

get_conn()

Retrieves the connection to Cloud Functions.

Returns Google Cloud Function services object.

Return type dict

get_function(*name*)

Returns the Cloud Function with the given name.

Parameters **name** (*str*) – Name of the function.

Returns A Cloud Functions object representing the function.

Return type dict

update_function(*name*, *body*, *update_mask*)

Updates Cloud Functions according to the specified update mask.

Parameters

- **name** (*str*) – The name of the function.
- **body** (*dict*) – The body required by the cloud function patch API.
- **update_mask** (*[str]*) – The update mask - array of fields that should be patched.

Returns None

upload_function_zip(**args*, ***kwargs*)

Uploads zip file with sources.

Parameters

- **location** (*str*) – The location where the function is created.
- **zip_path** (*str*) – The path of the valid .zip file to upload.
- **project_id** (*str*) – Optional, Google Cloud Project project_id where the function belongs. If set to None or missing, the default project_id from the GCP connection is used.

Returns The upload URL that was returned by generateUploadUrl method.

3.16.5.9 Cloud DataFlow

DataFlow Operators

- *DataFlowJavaOperator* : launching Cloud Dataflow jobs written in Java.
- *DataflowTemplateOperator* : launching a templated Cloud DataFlow batch job.
- *DataFlowPythonOperator* : launching Cloud Dataflow jobs written in python.

DataFlowJavaOperator

class airflow.contrib.operators.dataflow_operator.**DataFlowJavaOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Start a Java Cloud DataFlow batch job. The parameters of the operation will be passed to the job.

See also:

For more detail on job submission have a look at the reference: https://cloud.google.com/dataflow/pipelines/specifying-exec-params

Parameters

- **jar** (*string*) – The reference to a self executing DataFlow jar.
- **dataflow_default_options** (*dict*) – Map of default job options.
- **options** (*dict*) – Map of job specific options.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **poll_sleep** (*int*) – The time in seconds to sleep between polling Google Cloud Platform for the dataflow job status while the job is in the JOB_STATE_RUNNING state.
- **job_class** (*string*) – The name of the dataflow job class to be executued, it is often not the main class configured in the dataflow jar file.

Both `jar` and `options` are templated so you can use variables in them.

Note that both `dataflow_default_options` and `options` will be merged to specify pipeline execution parameter, and `dataflow_default_options` is expected to save high-level options, for instances, project and zone information, which apply to all dataflow operators in the DAG.

It's a good practice to define dataflow_* parameters in the default_args of the dag like the project, zone and staging location.

```
default_args = {
    'dataflow_default_options': {
        'project': 'my-gcp-project',
        'zone': 'europe-west1-d',
        'stagingLocation': 'gs://my-staging-bucket/staging/'
    }
}
```

You need to pass the path to your dataflow as a file reference with the `jar` parameter, the jar needs to be a self executing jar (see documentation here: https://beam.apache.org/documentation/runners/dataflow/#self-executing-jar). Use `options` to pass on options to your job.

```
t1 = DataFlowJavaOperator(
    task_id='datapflow_example',
    jar='{{var.value.gcp_dataflow_base}}pipeline/build/libs/pipeline-example-1.0.
↪jar',
    options={
        'autoscalingAlgorithm': 'BASIC',
        'maxNumWorkers': '50',
```

(continues on next page)

(continued from previous page)

```
        'start': '{{ds}}',
        'partitionType': 'DAY',
        'labels': {'foo' : 'bar'}
    },
    gcp_conn_id='gcp-airflow-service-account',
    dag=my-dag)
```

```
default_args = {
    'owner': 'airflow',
    'depends_on_past': False,
    'start_date':
        (2016, 8, 1),
    'email': ['alex@vanboxel.be'],
    'email_on_failure': False,
    'email_on_retry': False,
    'retries': 1,
    'retry_delay': timedelta(minutes=30),
    'dataflow_default_options': {
        'project': 'my-gcp-project',
        'zone': 'us-central1-f',
        'stagingLocation': 'gs://bucket/tmp/dataflow/staging/',
    }
}

dag = DAG('test-dag', default_args=default_args)

task = DataFlowJavaOperator(
    gcp_conn_id='gcp_default',
    task_id='normalize-cal',
    jar='{{var.value.gcp_dataflow_base}}pipeline-ingress-cal-normalize-1.0.jar',
    options={
        'autoscalingAlgorithm': 'BASIC',
        'maxNumWorkers': '50',
        'start': '{{ds}}',
        'partitionType': 'DAY'

    },
    dag=dag)
```

DataflowTemplateOperator

class `airflow.contrib.operators.dataflow_operator.`**`DataflowTemplateOperator`**(***kwargs*)

Bases: *`airflow.models.BaseOperator`*

Start a Templated Cloud DataFlow batch job. The parameters of the operation will be passed to the job.

Parameters

- **`template`** (*`string`*) – The reference to the DataFlow template.
- **`dataflow_default_options`** (*`dict`*) – Map of default job environment options.
- **`parameters`** (*`dict`*) – Map of job specific parameters for the template.
- **`gcp_conn_id`** (*`string`*) – The connection ID to use connecting to Google Cloud Platform.

- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **poll_sleep** (*int*) – The time in seconds to sleep between polling Google Cloud Platform for the dataflow job status while the job is in the JOB_STATE_RUNNING state.

It's a good practice to define dataflow_* parameters in the default_args of the dag like the project, zone and staging location.

See also:

https://cloud.google.com/dataflow/docs/reference/rest/v1b3/LaunchTemplateParameters https://cloud.google.com/dataflow/docs/reference/rest/v1b3/RuntimeEnvironment

```
default_args = {
    'dataflow_default_options': {
        'project': 'my-gcp-project'
        'zone': 'europe-west1-d',
        'tempLocation': 'gs://my-staging-bucket/staging/'
        }
    }
}
```

You need to pass the path to your dataflow template as a file reference with the `template` parameter. Use `parameters` to pass on parameters to your job. Use `environment` to pass on runtime environment variables to your job.

```
t1 = DataflowTemplateOperator(
    task_id='datapflow_example',
    template='{{var.value.gcp_dataflow_base}}',
    parameters={
        'inputFile': "gs://bucket/input/my_input.txt",
        'outputFile': "gs://bucket/output/my_output.txt"
    },
    gcp_conn_id='gcp-airflow-service-account',
    dag=my-dag)
```

`template`, `dataflow_default_options` and `parameters` are templated so you can use variables in them.

Note that `dataflow_default_options` is expected to save high-level options for project information, which apply to all dataflow operators in the DAG.

See also:

https://cloud.google.com/dataflow/docs/reference/rest/v1b3 /LaunchTemplateParameters https://cloud.google.com/dataflow/docs/reference/rest/v1b3/RuntimeEnvironment For more detail on job template execution have a look at the reference: https://cloud.google.com/dataflow/docs/templates/executing-templates

DataFlowPythonOperator

class `airflow.contrib.operators.dataflow_operator.`**`DataFlowPythonOperator`**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Launching Cloud Dataflow jobs written in python. Note that both dataflow_default_options and options will be merged to specify pipeline execution parameter, and dataflow_default_options is expected to save high-level options, for instances, project and zone information, which apply to all dataflow operators in the DAG.

See also:

For more detail on job submission have a look at the reference: https://cloud.google.com/dataflow/pipelines/specifying-exec-params

Parameters

- **py_file** (*string*) – Reference to the python dataflow pipleline file.py, e.g., /some/local/file/path/to/your/python/pipeline/file.
- **py_options** – Additional python options.
- **dataflow_default_options** (*dict*) – Map of default job options.
- **options** (*dict*) – Map of job specific options.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **poll_sleep** (*int*) – The time in seconds to sleep between polling Google Cloud Platform for the dataflow job status while the job is in the JOB_STATE_RUNNING state.

execute(*context*)
Execute the python dataflow job.

DataFlowHook

class airflow.contrib.hooks.gcp_dataflow_hook.**DataFlowHook**(*gcp_conn_id='google_cloud_default', delegate_to=None, poll_sleep=10*)

Bases: *airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook*

get_conn()
Returns a Google Cloud Dataflow service object.

3.16.5.10 Cloud DataProc

DataProc Operators

- *DataprocClusterCreateOperator* : Create a new cluster on Google Cloud Dataproc.
- *DataprocClusterDeleteOperator* : Delete a cluster on Google Cloud Dataproc.
- *DataprocClusterScaleOperator* : Scale up or down a cluster on Google Cloud Dataproc.
- *DataProcPigOperator* : Start a Pig query Job on a Cloud DataProc cluster.
- *DataProcHiveOperator* : Start a Hive query Job on a Cloud DataProc cluster.
- *DataProcSparkSqlOperator* : Start a Spark SQL query Job on a Cloud DataProc cluster.
- *DataProcSparkOperator* : Start a Spark Job on a Cloud DataProc cluster.
- *DataProcHadoopOperator* : Start a Hadoop Job on a Cloud DataProc cluster.
- *DataProcPySparkOperator* : Start a PySpark Job on a Cloud DataProc cluster.
- *DataprocWorkflowTemplateInstantiateOperator* : Instantiate a WorkflowTemplate on Google Cloud Dataproc.

- *DataprocWorkflowTemplateInstantiateInlineOperator* : Instantiate a WorkflowTemplate Inline on Google Cloud Dataproc.

DataprocClusterCreateOperator

class `airflow.contrib.operators.dataproc_operator.`**`DataprocClusterCreateOperator`**(***kwargs*)

Bases: `airflow.models.BaseOperator`

Create a new cluster on Google Cloud Dataproc. The operator will wait until the creation is successful or an error occurs in the creation process.

The parameters allow to configure the cluster. Please refer to

https://cloud.google.com/dataproc/docs/reference/rest/v1/projects.regions.clusters

for a detailed explanation on the different parameters. Most of the configuration parameters detailed in the link are available as a parameter to this operator.

Parameters

- **cluster_name** (*string*) – The name of the DataProc cluster to create. (templated)
- **project_id** (*str*) – The ID of the google cloud project in which to create the cluster. (templated)
- **num_workers** (*int*) – The # of workers to spin up. If set to zero will spin up cluster in a single node mode
- **storage_bucket** (*string*) – The storage bucket to use, setting to None lets dataproc generate a custom one for you
- **init_actions_uris** (*list[string]*) – List of GCS uri's containing dataproc initialization scripts
- **init_action_timeout** (*string*) – Amount of time executable scripts in init_actions_uris has to complete
- **metadata** (*dict*) – dict of key-value google compute engine metadata entries to add to all instances
- **image_version** (*string*) – the version of software inside the Dataproc cluster
- **custom_image** – custom Dataproc image for more info see https://cloud.google.com/dataproc/docs/guides/dataproc-images
- **properties** (*dict*) – dict of properties to set on config files (e.g. spark-defaults.conf), see https://cloud.google.com/dataproc/docs/reference/rest/v1/projects.regions.clusters#SoftwareConfig
- **master_machine_type** (*string*) – Compute engine machine type to use for the master node
- **master_disk_type** (*string*) – Type of the boot disk for the master node (default is `pd-standard`). Valid values: `pd-ssd` (Persistent Disk Solid State Drive) or `pd-standard` (Persistent Disk Hard Disk Drive).
- **master_disk_size** (*int*) – Disk size for the master node
- **worker_machine_type** (*string*) – Compute engine machine type to use for the worker nodes

- **worker_disk_type** (*string*) – Type of the boot disk for the worker node (default is `pd-standard`). Valid values: `pd-ssd` (Persistent Disk Solid State Drive) or `pd-standard` (Persistent Disk Hard Disk Drive).
- **worker_disk_size** (*int*) – Disk size for the worker nodes
- **num_preemptible_workers** (*int*) – The # of preemptible worker nodes to spin up
- **labels** (*dict*) – dict of labels to add to the cluster
- **zone** (*string*) – The zone where the cluster will be located. (templated)
- **network_uri** (*string*) – The network uri to be used for machine communication, cannot be specified with subnetwork_uri
- **subnetwork_uri** (*string*) – The subnetwork uri to be used for machine communication, cannot be specified with network_uri
- **internal_ip_only** (*bool*) – If true, all instances in the cluster will only have internal IP addresses. This can only be enabled for subnetwork enabled networks
- **tags** (*list[string]*) – The GCE tags to add to all instances
- **region** – leave as 'global', might become relevant in the future. (templated)
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **service_account** (*string*) – The service account of the dataproc instances.
- **service_account_scopes** (*list[string]*) – The URIs of service account scopes to be included.
- **idle_delete_ttl** (*int*) – The longest duration that cluster would keep alive while staying idle. Passing this threshold will cause cluster to be auto-deleted. A duration in seconds.
- **auto_delete_time** (*datetime.datetime*) – The time when cluster will be auto-deleted.
- **auto_delete_ttl** (*int*) – The life duration of cluster, the cluster will be auto-deleted at the end of this duration. A duration in seconds. (If auto_delete_time is set this parameter will be ignored)

Type custom_image: string

DataprocClusterScaleOperator

class airflow.contrib.operators.dataproc_operator.**DataprocClusterScaleOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Scale, up or down, a cluster on Google Cloud Dataproc. The operator will wait until the cluster is re-scaled.

Example:

```
t1 = DataprocClusterScaleOperator(
        task_id='dataproc_scale',
        project_id='my-project',
        cluster_name='cluster-1',
```

(continues on next page)

(continued from previous page)

```
        num_workers=10,
        num_preemptible_workers=10,
        graceful_decommission_timeout='1h',
        dag=dag)
```

See also:

For more detail on about scaling clusters have a look at the reference: https://cloud.google.com/dataproc/docs/concepts/configuring-clusters/scaling-clusters

Parameters

- **cluster_name** (*string*) – The name of the cluster to scale. (templated)
- **project_id** (*string*) – The ID of the google cloud project in which the cluster runs. (templated)
- **region** (*string*) – The region for the dataproc cluster. (templated)
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **num_workers** (*int*) – The new number of workers
- **num_preemptible_workers** (*int*) – The new number of preemptible workers
- **graceful_decommission_timeout** (*string*) – Timeout for graceful YARN decomissioning. Maximum value is 1d
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

DataprocClusterDeleteOperator

class airflow.contrib.operators.dataproc_operator.**DataprocClusterDeleteOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Delete a cluster on Google Cloud Dataproc. The operator will wait until the cluster is destroyed.

Parameters

- **cluster_name** (*string*) – The name of the cluster to create. (templated)
- **project_id** (*string*) – The ID of the google cloud project in which the cluster runs. (templated)
- **region** (*string*) – leave as 'global', might become relevant in the future. (templated)
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

DataProcPigOperator

class airflow.contrib.operators.dataproc_operator.**DataProcPigOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Start a Pig query Job on a Cloud DataProc cluster. The parameters of the operation will be passed to the cluster.

It's a good practice to define dataproc_* parameters in the default_args of the dag like the cluster name and UDFs.

```
default_args = {
    'cluster_name': 'cluster-1',
    'dataproc_pig_jars': [
        'gs://example/udf/jar/datafu/1.2.0/datafu.jar',
        'gs://example/udf/jar/gpig/1.2/gpig.jar'
    ]
}
```

You can pass a pig script as string or file reference. Use variables to pass on variables for the pig script to be resolved on the cluster or use the parameters to be resolved in the script as template parameters.

Example:

```
t1 = DataProcPigOperator(
        task_id='dataproc_pig',
        query='a_pig_script.pig',
        variables={'out': 'gs://example/output/{{ds}}'},
        dag=dag)
```

See also:

For more detail on about job submission have a look at the reference: https://cloud.google.com/dataproc/reference/rest/v1/projects.regions.jobs

Parameters

- **query** (*string*) – The query or reference to the query file (pg or pig extension). (templated)
- **query_uri** (*string*) – The uri of a pig script on Cloud Storage.
- **variables** (*dict*) – Map of named parameters for the query. (templated)
- **job_name** (*string*) – The job name used in the DataProc cluster. This name by default is the task_id appended with the execution data, but can be templated. The name will always be appended with a random number to avoid name clashes. (templated)
- **cluster_name** (*string*) – The name of the DataProc cluster. (templated)
- **dataproc_pig_properties** (*dict*) – Map for the Pig properties. Ideal to put in default arguments
- **dataproc_pig_jars** (*list*) – URIs to jars provisioned in Cloud Storage (example: for UDFs and libs) and are ideal to put in default arguments.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **region** (*str*) – The specified region where the dataproc cluster is created.
- **job_error_states** (*list*) – Job states that should be considered error states. Any states in this list will result in an error being raised and failure of the task. Eg, if the `CANCELLED` state should also be considered a task failure, pass in `['ERROR', 'CANCELLED']`. Possible values are currently only `'ERROR'` and `'CANCELLED'`, but could change in the future. Defaults to `['ERROR']`.

Variables **dataproc_job_id** (*string*) – The actual "jobId" as submitted to the Dataproc API. This is useful for identifying or linking to the job in the Google Cloud Console Dataproc UI, as the actual "jobId" submitted to the Dataproc API is appended with an 8 character random string.

DataProcHiveOperator

class airflow.contrib.operators.dataproc_operator.**DataProcHiveOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Start a Hive query Job on a Cloud DataProc cluster.

Parameters

- **query** (*string*) – The query or reference to the query file (q extension).
- **query_uri** (*string*) – The uri of a hive script on Cloud Storage.
- **variables** (*dict*) – Map of named parameters for the query.
- **job_name** (*string*) – The job name used in the DataProc cluster. This name by default is the task_id appended with the execution data, but can be templated. The name will always be appended with a random number to avoid name clashes.
- **cluster_name** (*string*) – The name of the DataProc cluster.
- **dataproc_hive_properties** (*dict*) – Map for the Pig properties. Ideal to put in default arguments
- **dataproc_hive_jars** (*list*) – URIs to jars provisioned in Cloud Storage (example: for UDFs and libs) and are ideal to put in default arguments.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **region** (*str*) – The specified region where the dataproc cluster is created.
- **job_error_states** (*list*) – Job states that should be considered error states. Any states in this list will result in an error being raised and failure of the task. Eg, if the `CANCELLED` state should also be considered a task failure, pass in `['ERROR', 'CANCELLED']`. Possible values are currently only `'ERROR'` and `'CANCELLED'`, but could change in the future. Defaults to `['ERROR']`.

Variables **dataproc_job_id** (*string*) – The actual "jobId" as submitted to the Dataproc API. This is useful for identifying or linking to the job in the Google Cloud Console Dataproc UI, as the actual "jobId" submitted to the Dataproc API is appended with an 8 character random string.

DataProcSparkSqlOperator

class airflow.contrib.operators.dataproc_operator.**DataProcSparkSqlOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Start a Spark SQL query Job on a Cloud DataProc cluster.

Parameters

- **query** (*string*) – The query or reference to the query file (q extension). (templated)
- **query_uri** (*string*) – The uri of a spark sql script on Cloud Storage.

- **variables** (*dict*) – Map of named parameters for the query. (templated)
- **job_name** (*string*) – The job name used in the DataProc cluster. This name by default is the task_id appended with the execution data, but can be templated. The name will always be appended with a random number to avoid name clashes. (templated)
- **cluster_name** (*string*) – The name of the DataProc cluster. (templated)
- **dataproc_spark_properties** (*dict*) – Map for the Pig properties. Ideal to put in default arguments
- **dataproc_spark_jars** (*list*) – URIs to jars provisioned in Cloud Storage (example: for UDFs and libs) and are ideal to put in default arguments.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **region** (*str*) – The specified region where the dataproc cluster is created.
- **job_error_states** (*list*) – Job states that should be considered error states. Any states in this list will result in an error being raised and failure of the task. Eg, if the `CANCELLED` state should also be considered a task failure, pass in `['ERROR', 'CANCELLED']`. Possible values are currently only `'ERROR'` and `'CANCELLED'`, but could change in the future. Defaults to `['ERROR']`.

Variables dataproc_job_id (*string*) – The actual “jobId” as submitted to the Dataproc API. This is useful for identifying or linking to the job in the Google Cloud Console Dataproc UI, as the actual “jobId” submitted to the Dataproc API is appended with an 8 character random string.

DataProcSparkOperator

class `airflow.contrib.operators.dataproc_operator.`**`DataProcSparkOperator`**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Start a Spark Job on a Cloud DataProc cluster.

Parameters

- **main_jar** (*string*) – URI of the job jar provisioned on Cloud Storage. (use this or the main_class, not both together).
- **main_class** (*string*) – Name of the job class. (use this or the main_jar, not both together).
- **arguments** (*list*) – Arguments for the job. (templated)
- **archives** (*list*) – List of archived files that will be unpacked in the work directory. Should be stored in Cloud Storage.
- **files** (*list*) – List of files to be copied to the working directory
- **job_name** (*string*) – The job name used in the DataProc cluster. This name by default is the task_id appended with the execution data, but can be templated. The name will always be appended with a random number to avoid name clashes. (templated)
- **cluster_name** (*string*) – The name of the DataProc cluster. (templated)
- **dataproc_spark_properties** (*dict*) – Map for the Pig properties. Ideal to put in default arguments

- **dataproc_spark_jars** (*list*) – URIs to jars provisioned in Cloud Storage (example: for UDFs and libs) and are ideal to put in default arguments.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **region** (*str*) – The specified region where the dataproc cluster is created.
- **job_error_states** (*list*) – Job states that should be considered error states. Any states in this list will result in an error being raised and failure of the task. Eg, if the `CANCELLED` state should also be considered a task failure, pass in `['ERROR', 'CANCELLED']`. Possible values are currently only `'ERROR'` and `'CANCELLED'`, but could change in the future. Defaults to `['ERROR']`.

Variables **dataproc_job_id** (*string*) – The actual "jobId" as submitted to the Dataproc API. This is useful for identifying or linking to the job in the Google Cloud Console Dataproc UI, as the actual "jobId" submitted to the Dataproc API is appended with an 8 character random string.

DataProcHadoopOperator

class airflow.contrib.operators.dataproc_operator.**DataProcHadoopOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Start a Hadoop Job on a Cloud DataProc cluster.

Parameters

- **main_jar** (*string*) – URI of the job jar provisioned on Cloud Storage. (use this or the main_class, not both together).
- **main_class** (*string*) – Name of the job class. (use this or the main_jar, not both together).
- **arguments** (*list*) – Arguments for the job. (templated)
- **archives** (*list*) – List of archived files that will be unpacked in the work directory. Should be stored in Cloud Storage.
- **files** (*list*) – List of files to be copied to the working directory
- **job_name** (*string*) – The job name used in the DataProc cluster. This name by default is the task_id appended with the execution data, but can be templated. The name will always be appended with a random number to avoid name clashes. (templated)
- **cluster_name** (*string*) – The name of the DataProc cluster. (templated)
- **dataproc_hadoop_properties** (*dict*) – Map for the Pig properties. Ideal to put in default arguments
- **dataproc_hadoop_jars** (*list*) – URIs to jars provisioned in Cloud Storage (example: for UDFs and libs) and are ideal to put in default arguments.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **region** (*str*) – The specified region where the dataproc cluster is created.

- **job_error_states** (*list*) – Job states that should be considered error states. Any states in this list will result in an error being raised and failure of the task. Eg, if the `CANCELLED` state should also be considered a task failure, pass in `['ERROR', 'CANCELLED']`. Possible values are currently only `'ERROR'` and `'CANCELLED'`, but could change in the future. Defaults to `['ERROR']`.

Variables **dataproc_job_id** (*string*) – The actual "jobId" as submitted to the Dataproc API. This is useful for identifying or linking to the job in the Google Cloud Console Dataproc UI, as the actual "jobId" submitted to the Dataproc API is appended with an 8 character random string.

DataProcPySparkOperator

class airflow.contrib.operators.dataproc_operator.**DataProcPySparkOperator**(***kwargs*)

Bases: `airflow.models.BaseOperator`

Start a PySpark Job on a Cloud DataProc cluster.

Parameters

- **main** (*string*) – [Required] The Hadoop Compatible Filesystem (HCFS) URI of the main Python file to use as the driver. Must be a .py file.
- **arguments** (*list*) – Arguments for the job. (templated)
- **archives** (*list*) – List of archived files that will be unpacked in the work directory. Should be stored in Cloud Storage.
- **files** (*list*) – List of files to be copied to the working directory
- **pyfiles** (*list*) – List of Python files to pass to the PySpark framework. Supported file types: .py, .egg, and .zip
- **job_name** (*string*) – The job name used in the DataProc cluster. This name by default is the task_id appended with the execution data, but can be templated. The name will always be appended with a random number to avoid name clashes. (templated)
- **cluster_name** (*string*) – The name of the DataProc cluster.
- **dataproc_pyspark_properties** (*dict*) – Map for the Pig properties. Ideal to put in default arguments
- **dataproc_pyspark_jars** (*list*) – URIs to jars provisioned in Cloud Storage (example: for UDFs and libs) and are ideal to put in default arguments.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **region** (*str*) – The specified region where the dataproc cluster is created.
- **job_error_states** (*list*) – Job states that should be considered error states. Any states in this list will result in an error being raised and failure of the task. Eg, if the `CANCELLED` state should also be considered a task failure, pass in `['ERROR', 'CANCELLED']`. Possible values are currently only `'ERROR'` and `'CANCELLED'`, but could change in the future. Defaults to `['ERROR']`.

Variables **dataproc_job_id** (*string*) – The actual "jobId" as submitted to the Dataproc API. This is useful for identifying or linking to the job in the Google Cloud Console Dataproc UI, as the actual "jobId" submitted to the Dataproc API is appended with an 8 character random string.

DataprocWorkflowTemplateInstantiateOperator

class airflow.contrib.operators.dataproc_operator.**DataprocWorkflowTemplateInstantiateOperat**

Bases: *airflow.contrib.operators.dataproc_operator.DataprocWorkflowTemplateBaseOperator*

Instantiate a WorkflowTemplate on Google Cloud Dataproc. The operator will wait until the WorkflowTemplate is finished executing.

See also:

Please refer to: https://cloud.google.com/dataproc/docs/reference/rest/v1beta2/projects.regions.workflowTemplates/instantiate

Parameters

- **template_id** (*string*) – The id of the template. (templated)
- **project_id** (*string*) – The ID of the google cloud project in which the template runs
- **region** (*string*) – leave as 'global', might become relevant in the future
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

DataprocWorkflowTemplateInstantiateInlineOperator

class airflow.contrib.operators.dataproc_operator.**DataprocWorkflowTemplateInstantiateInline**

Bases: *airflow.contrib.operators.dataproc_operator.DataprocWorkflowTemplateBaseOperator*

Instantiate a WorkflowTemplate Inline on Google Cloud Dataproc. The operator will wait until the WorkflowTemplate is finished executing.

See also:

Please refer to: https://cloud.google.com/dataproc/docs/reference/rest/v1beta2/projects.regions.workflowTemplates/instantiateInline

Parameters

- **template** (*map*) – The template contents. (templated)
- **project_id** (*string*) – The ID of the google cloud project in which the template runs
- **region** (*string*) – leave as 'global', might become relevant in the future
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

3.16.5.11 Cloud Datastore

Datastore Operators

- *DatastoreExportOperator* : Export entities from Google Cloud Datastore to Cloud Storage.

- *DatastoreImportOperator* : Import entities from Cloud Storage to Google Cloud Datastore.

DatastoreExportOperator

class `airflow.contrib.operators.datastore_export_operator.`**`DatastoreExportOperator`**(***kwargs*)

Bases: `airflow.models.BaseOperator`

Export entities from Google Cloud Datastore to Cloud Storage

Parameters

- **bucket** (*string*) – name of the cloud storage bucket to backup data
- **namespace** (*str*) – optional namespace path in the specified Cloud Storage bucket to backup data. If this namespace does not exist in GCS, it will be created.
- **datastore_conn_id** (*string*) – the name of the Datastore connection id to use
- **cloud_storage_conn_id** (*string*) – the name of the cloud storage connection id to force-write backup
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **entity_filter** (*dict*) – description of what data from the project is included in the export, refer to https://cloud.google.com/datastore/docs/reference/rest/Shared.Types/EntityFilter
- **labels** (*dict*) – client-assigned labels for cloud storage
- **polling_interval_in_seconds** (*int*) – number of seconds to wait before polling for execution status again
- **overwrite_existing** (*bool*) – if the storage bucket + namespace is not empty, it will be emptied prior to exports. This enables overwriting existing backups.
- **xcom_push** (*bool*) – push operation name to xcom for reference

DatastoreImportOperator

class `airflow.contrib.operators.datastore_import_operator.`**`DatastoreImportOperator`**(***kwargs*)

Bases: `airflow.models.BaseOperator`

Import entities from Cloud Storage to Google Cloud Datastore

Parameters

- **bucket** (*string*) – container in Cloud Storage to store data
- **file** (*string*) – path of the backup metadata file in the specified Cloud Storage bucket. It should have the extension .overall_export_metadata
- **namespace** (*str*) – optional namespace of the backup metadata file in the specified Cloud Storage bucket.
- **entity_filter** (*dict*) – description of what data from the project is included in the export, refer to https://cloud.google.com/datastore/docs/reference/rest/Shared.Types/EntityFilter
- **labels** (*dict*) – client-assigned labels for cloud storage
- **datastore_conn_id** (*string*) – the name of the connection id to use

- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **polling_interval_in_seconds** (*int*) – number of seconds to wait before polling for execution status again
- **xcom_push** (*bool*) – push operation name to xcom for reference

DatastoreHook

class airflow.contrib.hooks.datastore_hook.**DatastoreHook**(*datastore_conn_id='google_cloud_datastore_defa*
delegate_to=None)

Bases: *airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook*

Interact with Google Cloud Datastore. This hook uses the Google Cloud Platform connection.

This object is not threads safe. If you want to make multiple requests simultaneously, you will need to create a hook per thread.

allocate_ids(*partialKeys*)

Allocate IDs for incomplete keys. see https://cloud.google.com/datastore/docs/reference/rest/v1/projects/allocateIds

Parameters **partialKeys** – a list of partial keys

Returns a list of full keys.

begin_transaction()

Get a new transaction handle

See also:

https://cloud.google.com/datastore/docs/reference/rest/v1/projects/beginTransaction

Returns a transaction handle

commit(*body*)

Commit a transaction, optionally creating, deleting or modifying some entities.

See also:

https://cloud.google.com/datastore/docs/reference/rest/v1/projects/commit

Parameters **body** – the body of the commit request

Returns the response body of the commit request

delete_operation(*name*)

Deletes the long-running operation

Parameters **name** – the name of the operation resource

export_to_storage_bucket(*bucket*, *namespace=None*, *entity_filter=None*, *labels=None*)

Export entities from Cloud Datastore to Cloud Storage for backup

get_conn(*version='v1'*)

Returns a Google Cloud Datastore service object.

get_operation(*name*)

Gets the latest state of a long-running operation

Parameters **name** – the name of the operation resource

import_from_storage_bucket (*bucket*, *file*, *namespace=None*, *entity_filter=None*, *labels=None*)
Import a backup from Cloud Storage to Cloud Datastore

lookup (*keys*, *read_consistency=None*, *transaction=None*)
Lookup some entities by key

See also:

https://cloud.google.com/datastore/docs/reference/rest/v1/projects/lookup

Parameters

- **keys** – the keys to lookup
- **read_consistency** – the read consistency to use. default, strong or eventual. Cannot be used with a transaction.
- **transaction** – the transaction to use, if any.

Returns the response body of the lookup request.

poll_operation_until_done (*name*, *polling_interval_in_seconds*)
Poll backup operation state until it's completed

rollback (*transaction*)
Roll back a transaction

See also:

https://cloud.google.com/datastore/docs/reference/rest/v1/projects/rollback

Parameters **transaction** – the transaction to roll back

run_query (*body*)
Run a query for entities.

See also:

https://cloud.google.com/datastore/docs/reference/rest/v1/projects/runQuery

Parameters **body** – the body of the query request

Returns the batch of query results.

3.16.5.12 Cloud ML Engine

Cloud ML Engine Operators

- *MLEngineBatchPredictionOperator* : Start a Cloud ML Engine batch prediction job.
- *MLEngineModelOperator* : Manages a Cloud ML Engine model.
- *MLEngineTrainingOperator* : Start a Cloud ML Engine training job.
- *MLEngineVersionOperator* : Manages a Cloud ML Engine model version.

MLEngineBatchPredictionOperator

class airflow.contrib.operators.mlengine_operator.**MLEngineBatchPredictionOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Start a Google Cloud ML Engine prediction job.

NOTE: For model origin, users should consider exactly one from the three options below: 1. Populate 'uri' field only, which should be a GCS location that points to a tensorflow savedModel directory. 2. Populate 'model_name' field only, which refers to an existing model, and the default version of the model will be used. 3. Populate both 'model_name' and 'version_name' fields, which refers to a specific version of a specific model.

In options 2 and 3, both model and version name should contain the minimal identifier. For instance, call

```
MLEngineBatchPredictionOperator(
    ...,
    model_name='my_model',
    version_name='my_version',
    ...)
```

if the desired model version is "projects/my_project/models/my_model/versions/my_version".

See https://cloud.google.com/ml-engine/reference/rest/v1/projects.jobs for further documentation on the parameters.

Parameters

- **project_id** (*string*) – The Google Cloud project name where the prediction job is submitted. (templated)
- **job_id** (*string*) – A unique id for the prediction job on Google Cloud ML Engine. (templated)
- **data_format** (*string*) – The format of the input data. It will default to 'DATA_FORMAT_UNSPECIFIED' if is not provided or is not one of ["TEXT", "TF_RECORD", "TF_RECORD_GZIP"].
- **input_paths** (*list of string*) – A list of GCS paths of input data for batch prediction. Accepting wildcard operator *, but only at the end. (templated)
- **output_path** (*string*) – The GCS path where the prediction results are written to. (templated)
- **region** (*string*) – The Google Compute Engine region to run the prediction job in. (templated)
- **model_name** (*string*) – The Google Cloud ML Engine model to use for prediction. If version_name is not provided, the default version of this model will be used. Should not be None if version_name is provided. Should be None if uri is provided. (templated)
- **version_name** (*string*) – The Google Cloud ML Engine model version to use for prediction. Should be None if uri is provided. (templated)
- **uri** (*string*) – The GCS path of the saved model to use for prediction. Should be None if model_name is provided. It should be a GCS path pointing to a tensorflow SavedModel. (templated)
- **max_worker_count** (*int*) – The maximum number of workers to be used for parallel processing. Defaults to 10 if not specified.
- **runtime_version** (*string*) – The Google Cloud ML Engine runtime version to use for batch prediction.

- **gcp_conn_id** (*string*) – The connection ID used for connection to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have doamin-wide delegation enabled.

Raises: `ValueError`: if a unique model/version origin cannot be determined.

MLEngineModelOperator

class `airflow.contrib.operators.mlengine_operator.`**`MLEngineModelOperator`**(***kwargs*)
Bases: *`airflow.models.BaseOperator`*

Operator for managing a Google Cloud ML Engine model.

Parameters

- **project_id** (*string*) – The Google Cloud project name to which MLEngine model belongs. (templated)
- **model** (*dict*) – A dictionary containing the information about the model. If the *operation* is *create*, then the *model* parameter should contain all the information about this model such as *name*.

  If the *operation* is *get*, the *model* parameter should contain the *name* of the model.
- **operation** (*string*) – The operation to perform. Available operations are:
  - `create`: Creates a new model as provided by the *model* parameter.
  - `get`: Gets a particular model where the name is specified in *model*.
- **gcp_conn_id** (*string*) – The connection ID to use when fetching connection info.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

MLEngineTrainingOperator

class `airflow.contrib.operators.mlengine_operator.`**`MLEngineTrainingOperator`**(***kwargs*)
Bases: *`airflow.models.BaseOperator`*

Operator for launching a MLEngine training job.

Parameters

- **project_id** (*string*) – The Google Cloud project name within which MLEngine training job should run (templated).
- **job_id** (*string*) – A unique templated id for the submitted Google MLEngine training job. (templated)
- **package_uris** (*string*) – A list of package locations for MLEngine training job, which should include the main training program + any additional dependencies. (templated)
- **training_python_module** (*string*) – The Python module name to run within MLEngine training job after installing 'package_uris' packages. (templated)
- **training_args** (*string*) – A list of templated command line arguments to pass to the MLEngine training program. (templated)

- **region** (*string*) – The Google Compute Engine region to run the MLEngine training job in (templated).
- **scale_tier** (*string*) – Resource tier for MLEngine training job. (templated)
- **runtime_version** (*string*) – The Google Cloud ML runtime version to use for training. (templated)
- **python_version** (*string*) – The version of Python used in training. (templated)
- **job_dir** (*string*) – A Google Cloud Storage path in which to store training outputs and other data needed for training. (templated)
- **gcp_conn_id** (*string*) – The connection ID to use when fetching connection info.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **mode** (*string*) – Can be one of 'DRY_RUN'/'CLOUD'. In 'DRY_RUN' mode, no real training job will be launched, but the MLEngine training job request will be printed out. In 'CLOUD' mode, a real MLEngine training job creation request will be issued.

MLEngineVersionOperator

class airflow.contrib.operators.mlengine_operator.**MLEngineVersionOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Operator for managing a Google Cloud ML Engine version.

Parameters

- **project_id** (*string*) – The Google Cloud project name to which MLEngine model belongs.
- **model_name** (*string*) – The name of the Google Cloud ML Engine model that the version belongs to. (templated)
- **version_name** (*string*) – A name to use for the version being operated upon. If not None and the *version* argument is None or does not have a value for the *name* key, then this will be populated in the payload for the *name* key. (templated)
- **version** (*dict*) – A dictionary containing the information about the version. If the *operation* is *create*, *version* should contain all the information about this version such as name, and deploymentUrl. If the *operation* is *get* or *delete*, the *version* parameter should contain the *name* of the version. If it is None, the only *operation* possible would be *list*. (templated)
- **operation** (*string*) – The operation to perform. Available operations are:
  - `create`: Creates a new version in the model specified by *model_name*, in which case the *version* parameter should contain all the information to create that version (e.g. *name*, *deploymentUrl*).
  - `get`: Gets full information of a particular version in the model specified by *model_name*. The name of the version should be specified in the *version* parameter.
  - `list`: Lists all available versions of the model specified by *model_name*.
  - `delete`: Deletes the version specified in *version* parameter from the model specified by *model_name*). The name of the version should be specified in the *version* parameter.
- **gcp_conn_id** (*string*) – The connection ID to use when fetching connection info.

- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

Cloud ML Engine Hook

MLEngineHook

class airflow.contrib.hooks.gcp_mlengine_hook.**MLEngineHook**(*gcp_conn_id='google_cloud_default', delegate_to=None*)

Bases: *airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook*

create_job(*project_id, job, use_existing_job_fn=None*)
Launches a MLEngine job and wait for it to reach a terminal state.

Parameters

- **project_id** (*string*) – The Google Cloud project id within which MLEngine job will be launched.
- **job** (*dict*) – MLEngine Job object that should be provided to the MLEngine API, such as:

```
{
  'jobId': 'my_job_id',
  'trainingInput': {
    'scaleTier': 'STANDARD_1',
    ...
  }
}
```

- **use_existing_job_fn** (*function*) – In case that a MLEngine job with the same job_id already exist, this method (if provided) will decide whether we should use this existing job, continue waiting for it to finish and returning the job object. It should accepts a MLEngine job object, and returns a boolean value indicating whether it is OK to reuse the existing job. If 'use_existing_job_fn' is not provided, we by default reuse the existing MLEngine job.

Returns The MLEngine job object if the job successfully reach a terminal state (which might be FAILED or CANCELLED state).

Return type dict

create_model(*project_id, model*)
Create a Model. Blocks until finished.

create_version(*project_id, model_name, version_spec*)
Creates the Version on Google Cloud ML Engine.

Returns the operation if the version was created successfully and raises an error otherwise.

delete_version(*project_id, model_name, version_name*)
Deletes the given version of a model. Blocks until finished.

get_conn()
Returns a Google MLEngine service object.

get_model(*project_id, model_name*)
Gets a Model. Blocks until finished.

list_versions(*project_id*, *model_name*)
Lists all available versions of a model. Blocks until finished.

set_default_version(*project_id*, *model_name*, *version_name*)
Sets a version to be the default. Blocks until finished.

3.16.5.13 Cloud Storage

Storage Operators

- *FileToGoogleCloudStorageOperator* : Uploads a file to Google Cloud Storage.
- *GoogleCloudStorageCreateBucketOperator* : Creates a new ACL entry on the specified bucket.
- *GoogleCloudStorageBucketCreateAclEntryOperator* : Creates a new cloud storage bucket.
- *GoogleCloudStorageDownloadOperator* : Downloads a file from Google Cloud Storage.
- *GoogleCloudStorageListOperator* : List all objects from the bucket with the give string prefix and delimiter in name.
- *GoogleCloudStorageToBigQueryOperator* : Creates a new ACL entry on the specified object.
- *GoogleCloudStorageObjectCreateAclEntryOperator* : Loads files from Google cloud storage into BigQuery.
- *GoogleCloudStorageToGoogleCloudStorageOperator* : Copies objects from a bucket to another, with renaming if requested.
- *GoogleCloudStorageToGoogleCloudStorageTransferOperator* : Copies objects from a bucket to another using Google Transfer service.
- *MySqlToGoogleCloudStorageOperator*: Copy data from any MySQL Database to Google cloud storage in JSON format.

FileToGoogleCloudStorageOperator

class airflow.contrib.operators.file_to_gcs.**FileToGoogleCloudStorageOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Uploads a file to Google Cloud Storage. Optionally can compress the file for upload.

Parameters

- **src** (*string*) – Path to the local file. (templated)
- **dst** (*string*) – Destination path within the specified bucket. (templated)
- **bucket** (*string*) – The bucket to upload to. (templated)
- **google_cloud_storage_conn_id** (*string*) – The Airflow connection ID to upload with
- **mime_type** (*string*) – The mime-type string
- **delegate_to** (*str*) – The account to impersonate, if any
- **gzip** (*bool*) – Allows for file to be compressed and uploaded as gzip

execute(*context*)
Uploads the file to Google cloud storage

GoogleCloudStorageBucketCreateAclEntryOperator

class airflow.contrib.operators.gcs_acl_operator.**GoogleCloudStorageBucketCreateAclEntryOper**

Bases: *airflow.models.BaseOperator*

Creates a new ACL entry on the specified bucket.

Parameters

- **bucket** (*str*) – Name of a bucket.
- **entity** (*str*) – The entity holding the permission, in one of the following forms: user-userId, user-email, group-groupId, group-email, domain-domain, project-team-projectId, allUsers, allAuthenticatedUsers
- **role** (*str*) – The access permission for the entity. Acceptable values are: "OWNER", "READER", "WRITER".
- **user_project** (*str*) – (Optional) The project to be billed for this request. Required for Requester Pays buckets.
- **google_cloud_storage_conn_id** (*str*) – The connection ID to use when connecting to Google Cloud Storage.

GoogleCloudStorageCreateBucketOperator

class airflow.contrib.operators.gcs_operator.**GoogleCloudStorageCreateBucketOperator**(***kwargs*

Bases: *airflow.models.BaseOperator*

Creates a new bucket. Google Cloud Storage uses a flat namespace, so you can't create a bucket with a name that is already in use.

See also:

For more information, see Bucket Naming Guidelines: https://cloud.google.com/storage/docs/bucketnaming.html#requirements

Parameters

- **bucket_name** (*string*) – The name of the bucket. (templated)
- **storage_class** (*string*) – This defines how objects in the bucket are stored and determines the SLA and the cost of storage (templated). Values include
  - MULTI_REGIONAL
  - REGIONAL
  - STANDARD
  - NEARLINE
  - COLDLINE.

  If this value is not specified when the bucket is created, it will default to STANDARD.
- **location** (*string*) – The location of the bucket. (templated) Object data for objects in the bucket resides in physical storage within this region. Defaults to US.

  See also:

  https://developers.google.com/storage/docs/bucket-locations
- **project_id** (*string*) – The ID of the GCP Project. (templated)

- **labels** (*dict*) – User-provided labels, in key/value pairs.
- **google_cloud_storage_conn_id** (*string*) – The connection ID to use when connecting to Google cloud storage.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

Example: The following Operator would create a new bucket `test-bucket` with `MULTI_REGIONAL` storage class in `EU` region

```
CreateBucket = GoogleCloudStorageCreateBucketOperator(
    task_id='CreateNewBucket',
    bucket_name='test-bucket',
    storage_class='MULTI_REGIONAL',
    location='EU',
    labels={'env': 'dev', 'team': 'airflow'},
    google_cloud_storage_conn_id='airflow-service-account'
)
```

GoogleCloudStorageDownloadOperator

class airflow.contrib.operators.gcs_download_operator.**GoogleCloudStorageDownloadOperator**(**

Bases: *airflow.models.BaseOperator*

Downloads a file from Google Cloud Storage.

Parameters

- **bucket** (*string*) – The Google cloud storage bucket where the object is. (templated)
- **object** (*string*) – The name of the object to download in the Google cloud storage bucket. (templated)
- **filename** (*string*) – The file path on the local file system (where the operator is being executed) that the file should be downloaded to. (templated) If no filename passed, the downloaded data will not be stored on the local file system.
- **store_to_xcom_key** (*string*) – If this param is set, the operator will push the contents of the downloaded file to XCom with the key set in this parameter. If not set, the downloaded data will not be pushed to XCom. (templated)
- **google_cloud_storage_conn_id** (*string*) – The connection ID to use when connecting to Google cloud storage.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

GoogleCloudStorageListOperator

class airflow.contrib.operators.gcs_list_operator.**GoogleCloudStorageListOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

List all objects from the bucket with the give string prefix and delimiter in name.

This operator returns a python list with the name of objects which can be used by *xcom* in the downstream task.

Parameters

- **bucket** (*string*) – The Google cloud storage bucket to find the objects. (templated)
- **prefix** (*string*) – Prefix string which filters objects whose name begin with this prefix. (templated)
- **delimiter** (*string*) – The delimiter by which you want to filter the objects. (templated) For e.g to lists the CSV files from in a directory in GCS you would use delimiter='.csv'.
- **google_cloud_storage_conn_id** (*string*) – The connection ID to use when connecting to Google cloud storage.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

Example: The following Operator would list all the Avro files from `sales/sales-2017` folder in `data` bucket.

```
GCS_Files = GoogleCloudStorageListOperator(
    task_id='GCS_Files',
    bucket='data',
    prefix='sales/sales-2017/',
    delimiter='.avro',
    google_cloud_storage_conn_id=google_cloud_conn_id
)
```

GoogleCloudStorageObjectCreateAclEntryOperator

class airflow.contrib.operators.gcs_acl_operator.**GoogleCloudStorageObjectCreateAclEntryOper**

Bases: *airflow.models.BaseOperator*

Creates a new ACL entry on the specified object.

Parameters

- **bucket** (*str*) – Name of a bucket.
- **object_name** (*str*) – Name of the object. For information about how to URL encode object names to be path safe, see: https://cloud.google.com/storage/docs/json_api/#encoding
- **entity** (*str*) – The entity holding the permission, in one of the following forms: user-userId, user-email, group-groupId, group-email, domain-domain, project-team-projectId, allUsers, allAuthenticatedUsers
- **role** (*str*) – The access permission for the entity. Acceptable values are: "OWNER", "READER".
- **generation** (*str*) – (Optional) If present, selects a specific revision of this object (as opposed to the latest version, the default).
- **user_project** (*str*) – (Optional) The project to be billed for this request. Required for Requester Pays buckets.
- **google_cloud_storage_conn_id** (*str*) – The connection ID to use when connecting to Google Cloud Storage.

GoogleCloudStorageToBigQueryOperator

class airflow.contrib.operators.gcs_to_bq.**GoogleCloudStorageToBigQueryOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Loads files from Google cloud storage into BigQuery.

The schema to be used for the BigQuery table may be specified in one of two ways. You may either directly pass the schema fields in, or you may point the operator to a Google cloud storage object name. The object in Google cloud storage must be a JSON file with the schema fields in it.

Parameters

- **bucket** (*string*) – The bucket to load from. (templated)
- **source_objects** (*list of str*) – List of Google cloud storage URIs to load from. (templated) If source_format is 'DATASTORE_BACKUP', the list must only contain a single URI.
- **destination_project_dataset_table** (*string*) – The dotted (<project>.)<dataset>.<table> BigQuery table to load data into. If <project> is not included, project will be the project defined in the connection json. (templated)
- **schema_fields** (*list*) – If set, the schema field list as defined here: https://cloud.google.com/bigquery/docs/reference/v2/jobs#configuration.load Should not be set when source_format is 'DATASTORE_BACKUP'.
- **schema_object** (*string*) – If set, a GCS object path pointing to a .json file that contains the schema for the table. (templated)
- **source_format** (*string*) – File format to export.
- **compression** (*string*) – [Optional] The compression type of the data source. Possible values include GZIP and NONE. The default value is NONE. This setting is ignored for Google Cloud Bigtable, Google Cloud Datastore backups and Avro formats.
- **create_disposition** (*string*) – The create disposition if the table doesn't exist.
- **skip_leading_rows** (*int*) – Number of rows to skip when loading from a CSV.
- **write_disposition** (*string*) – The write disposition if the table already exists.
- **field_delimiter** (*string*) – The delimiter to use when loading from a CSV.
- **max_bad_records** (*int*) – The maximum number of bad records that BigQuery can ignore when running the job.
- **quote_character** (*string*) – The value that is used to quote data sections in a CSV file.
- **ignore_unknown_values** (*bool*) – [Optional] Indicates if BigQuery should allow extra values that are not represented in the table schema. If true, the extra values are ignored. If false, records with extra columns are treated as bad records, and if there are too many bad records, an invalid error is returned in the job result.
- **allow_quoted_newlines** (*bool*) – Whether to allow quoted newlines (true) or not (false).
- **allow_jagged_rows** (*bool*) – Accept rows that are missing trailing optional columns. The missing values are treated as nulls. If false, records with missing trailing columns are treated as bad records, and if there are too many bad records, an invalid error is returned in the job result. Only applicable to CSV, ignored for other formats.

- **max_id_key** (*string*) – If set, the name of a column in the BigQuery table that's to be loaded. This will be used to select the MAX value from BigQuery after the load occurs. The results will be returned by the execute() command, which in turn gets stored in XCom for future operators to use. This can be helpful with incremental loads–during future executions, you can pick up from the max ID.
- **bigquery_conn_id** (*string*) – Reference to a specific BigQuery hook.
- **google_cloud_storage_conn_id** (*string*) – Reference to a specific Google cloud storage hook.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **schema_update_options** (*list*) – Allows the schema of the destination table to be updated as a side effect of the load job.
- **src_fmt_configs** (*dict*) – configure optional fields specific to the source format
- **external_table** (*bool*) – Flag to specify if the destination table should be a BigQuery external table. Default Value is False.
- **time_partitioning** (*dict*) – configure optional time partitioning fields i.e. partition by field, type and expiration as per API specifications. Note that 'field' is not available in concurrency with dataset.table$partition.
- **cluster_fields** (*list of str*) – Request that the result of this load be stored sorted by one or more columns. This is only available in conjunction with time_partitioning. The order of columns given determines the sort order. Not applicable for external tables.

GoogleCloudStorageToGoogleCloudStorageOperator

class airflow.contrib.operators.gcs_to_gcs.**GoogleCloudStorageToGoogleCloudStorageOperator**(

Bases: *airflow.models.BaseOperator*

Copies objects from a bucket to another, with renaming if requested.

Parameters

- **source_bucket** (*string*) – The source Google cloud storage bucket where the object is. (templated)
- **source_object** (*string*) – The source name of the object to copy in the Google cloud storage bucket. (templated) If wildcards are used in this argument:

  You can use only one wildcard for objects (filenames) within your bucket. The wildcard can appear inside the object name or at the end of the object name. Appending a wildcard to the bucket name is unsupported.

- **destination_bucket** (*string*) – The destination Google cloud storage bucket where the object should be. (templated)
- **destination_object** (*string*) – The destination name of the object in the destination Google cloud storage bucket. (templated) If a wildcard is supplied in the source_object argument, this is the prefix that will be prepended to the final destination objects' paths. Note that the source path's part before the wildcard will be removed; if it needs to be retained it should be appended to destination_object. For example, with prefix `foo/*` and destination_object `blah/`, the file `foo/baz` will be copied to `blah/baz`; to retain the prefix write the destination_object as e.g. `blah/foo`, in which case the copied file will be named `blah/foo/baz`.

- **move_object** (*bool*) – When move object is True, the object is moved instead of copied to the new location. This is the equivalent of a mv command as opposed to a cp command.
- **google_cloud_storage_conn_id** (*string*) – The connection ID to use when connecting to Google cloud storage.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

Examples: The following Operator would copy a single file named `sales/sales-2017/january.avro` in the `data` bucket to the file named `copied_sales/2017/january-backup.avro` in the ``data_backup` bucket

```
copy_single_file = GoogleCloudStorageToGoogleCloudStorageOperator(
    task_id='copy_single_file',
    source_bucket='data',
    source_object='sales/sales-2017/january.avro',
    destination_bucket='data_backup',
    destination_object='copied_sales/2017/january-backup.avro',
    google_cloud_storage_conn_id=google_cloud_conn_id
)
```

The following Operator would copy all the Avro files from `sales/sales-2017` folder (i.e. with names starting with that prefix) in `data` bucket to the `copied_sales/2017` folder in the `data_backup` bucket.

```
copy_files = GoogleCloudStorageToGoogleCloudStorageOperator(
    task_id='copy_files',
    source_bucket='data',
    source_object='sales/sales-2017/*.avro',
    destination_bucket='data_backup',
    destination_object='copied_sales/2017/',
    google_cloud_storage_conn_id=google_cloud_conn_id
)
```

The following Operator would move all the Avro files from `sales/sales-2017` folder (i.e. with names starting with that prefix) in `data` bucket to the same folder in the `data_backup` bucket, deleting the original files in the process.

```
move_files = GoogleCloudStorageToGoogleCloudStorageOperator(
    task_id='move_files',
    source_bucket='data',
    source_object='sales/sales-2017/*.avro',
    destination_bucket='data_backup',
    move_object=True,
    google_cloud_storage_conn_id=google_cloud_conn_id
)
```

GoogleCloudStorageToGoogleCloudStorageTransferOperator

class airflow.contrib.operators.gcs_to_gcs_transfer_operator.**GoogleCloudStorageToGoogleClou**

Bases: *airflow.models.BaseOperator*

Copies objects from a bucket to another using the GCP Storage Transfer Service.

Parameters

- **source_bucket** (*str*) – The source Google cloud storage bucket where the object is. (templated)
- **destination_bucket** (*str*) – The destination Google cloud storage bucket where the object should be. (templated)
- **project_id** (*str*) – The ID of the Google Cloud Platform Console project that owns the job
- **gcp_conn_id** (*str*) – Optional connection ID to use when connecting to Google Cloud Storage.
- **delegate_to** (*str*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **description** (*str*) – Optional transfer service job description
- **schedule** (*dict*) – Optional transfer service schedule; see https://cloud.google.com/storage-transfer/docs/reference/rest/v1/transferJobs. If not set, run transfer job once as soon as the operator runs
- **object_conditions** (*dict*) – Optional transfer service object conditions; see https://cloud.google.com/storage-transfer/docs/reference/rest/v1/TransferSpec#ObjectConditions
- **transfer_options** (*dict*) – Optional transfer service transfer options; see https://cloud.google.com/storage-transfer/docs/reference/rest/v1/TransferSpec#TransferOptions
- **wait** (*bool*) – Wait for transfer to finish; defaults to *True*

Example:

```
gcs_to_gcs_transfer_op = GoogleCloudStorageToGoogleCloudStorageTransferOperator(
     task_id='gcs_to_gcs_transfer_example',
     source_bucket='my-source-bucket',
     destination_bucket='my-destination-bucket',
     project_id='my-gcp-project',
     dag=my_dag)
```

MySqlToGoogleCloudStorageOperator

GoogleCloudStorageHook

class airflow.contrib.hooks.gcs_hook.**GoogleCloudStorageHook**(*google_cloud_storage_conn_id='google_clo*
delegate_to=None)

Bases: *airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook*

Interact with Google Cloud Storage. This hook uses the Google Cloud Platform connection.

copy(*source_bucket*, *source_object*, *destination_bucket=None*, *destination_object=None*)

Copies an object from a bucket to another, with renaming if requested.

destination_bucket or destination_object can be omitted, in which case source bucket/object is used, but not both.

Parameters

- **source_bucket** (*string*) – The bucket of the object to copy from.
- **source_object** (*string*) – The object to copy.
- **destination_bucket** (*string*) – The destination of the object to copied to. Can be omitted; then the same bucket is used.

- **destination_object** (*string*) – The (renamed) path of the object if given. Can be omitted; then the same name is used.

create_bucket (*bucket_name*, *storage_class='MULTI_REGIONAL'*, *location='US'*, *project_id=None*, *labels=None*)

Creates a new bucket. Google Cloud Storage uses a flat namespace, so you can't create a bucket with a name that is already in use.

See also:

For more information, see Bucket Naming Guidelines: https://cloud.google.com/storage/docs/bucketnaming.html#requirements

Parameters

- **bucket_name** (*string*) – The name of the bucket.
- **storage_class** (*string*) – This defines how objects in the bucket are stored and determines the SLA and the cost of storage. Values include
  - `MULTI_REGIONAL`
  - `REGIONAL`
  - `STANDARD`
  - `NEARLINE`
  - `COLDLINE`.

  If this value is not specified when the bucket is created, it will default to STANDARD.
- **location** (*string*) – The location of the bucket. Object data for objects in the bucket resides in physical storage within this region. Defaults to US.

  See also:

  https://developers.google.com/storage/docs/bucket-locations
- **project_id** (*string*) – The ID of the GCP Project.
- **labels** (*dict*) – User-provided labels, in key/value pairs.

Returns If successful, it returns the `id` of the bucket.

delete (*bucket*, *object*, *generation=None*)

Delete an object if versioning is not enabled for the bucket, or if generation parameter is used.

Parameters

- **bucket** (*string*) – name of the bucket, where the object resides
- **object** (*string*) – name of the object to delete
- **generation** (*string*) – if present, permanently delete the object of this generation

Returns True if succeeded

download (*bucket*, *object*, *filename=None*)

Get a file from Google Cloud Storage.

Parameters

- **bucket** (*string*) – The bucket to fetch from.
- **object** (*string*) – The object to fetch.
- **filename** (*string*) – If set, a local file path where the file should be written to.

exists(*bucket*, *object*)
Checks for the existence of a file in Google Cloud Storage.

Parameters

- **bucket** (*string*) – The Google cloud storage bucket where the object is.
- **object** (*string*) – The name of the object to check in the Google cloud storage bucket.

get_conn()
Returns a Google Cloud Storage service object.

get_crc32c(*bucket*, *object*)
Gets the CRC32c checksum of an object in Google Cloud Storage.

Parameters

- **bucket** (*string*) – The Google cloud storage bucket where the object is.
- **object** (*string*) – The name of the object to check in the Google cloud storage bucket.

get_md5hash(*bucket*, *object*)
Gets the MD5 hash of an object in Google Cloud Storage.

Parameters

- **bucket** (*string*) – The Google cloud storage bucket where the object is.
- **object** (*string*) – The name of the object to check in the Google cloud storage bucket.

get_size(*bucket*, *object*)
Gets the size of a file in Google Cloud Storage.

Parameters

- **bucket** (*string*) – The Google cloud storage bucket where the object is.
- **object** (*string*) – The name of the object to check in the Google cloud storage bucket.

insert_bucket_acl(*bucket*, *entity*, *role*, *user_project*)
Creates a new ACL entry on the specified bucket. See: https://cloud.google.com/storage/docs/json_api/v1/bucketAccessControls/insert

Parameters

- **bucket** (*str*) – Name of a bucket.
- **entity** (*str*) – The entity holding the permission, in one of the following forms: user-userId, user-email, group-groupId, group-email, domain-domain, project-team-projectId, allUsers, allAuthenticatedUsers. See: https://cloud.google.com/storage/docs/access-control/lists#scopes
- **role** (*str*) – The access permission for the entity. Acceptable values are: "OWNER", "READER", "WRITER".
- **user_project** (*str*) – (Optional) The project to be billed for this request. Required for Requester Pays buckets.

insert_object_acl(*bucket*, *object_name*, *entity*, *role*, *generation*, *user_project*)
Creates a new ACL entry on the specified object. See: https://cloud.google.com/storage/docs/json_api/v1/objectAccessControls/insert

Parameters

- **bucket** (*str*) – Name of a bucket.

- **object_name** (*str*) – Name of the object. For information about how to URL encode object names to be path safe, see: https://cloud.google.com/storage/docs/json_api/#encoding
- **entity** (*str*) – The entity holding the permission, in one of the following forms: user-userId, user-email, group-groupId, group-email, domain-domain, project-team-projectId, allUsers, allAuthenticatedUsers See: https://cloud.google.com/storage/docs/access-control/lists#scopes
- **role** (*str*) – The access permission for the entity. Acceptable values are: "OWNER", "READER".
- **generation** (*str*) – (Optional) If present, selects a specific revision of this object (as opposed to the latest version, the default).
- **user_project** (*str*) – (Optional) The project to be billed for this request. Required for Requester Pays buckets.

is_updated_after (*bucket*, *object*, *ts*)
Checks if an object is updated in Google Cloud Storage.

Parameters

- **bucket** (*string*) – The Google cloud storage bucket where the object is.
- **object** (*string*) – The name of the object to check in the Google cloud storage bucket.
- **ts** (*datetime*) – The timestamp to check against.

list (*bucket*, *versions=None*, *maxResults=None*, *prefix=None*, *delimiter=None*)
List all objects from the bucket with the give string prefix in name

Parameters

- **bucket** (*string*) – bucket name
- **versions** (*boolean*) – if true, list all versions of the objects
- **maxResults** (*integer*) – max count of items to return in a single page of responses
- **prefix** (*string*) – prefix string which filters objects whose name begin with this prefix
- **delimiter** (*string*) – filters objects based on the delimiter (for e.g '.csv')

Returns a stream of object names matching the filtering criteria

rewrite (*source_bucket*, *source_object*, *destination_bucket*, *destination_object=None*)
Has the same functionality as copy, except that will work on files over 5 TB, as well as when copying between locations and/or storage classes.

destination_object can be omitted, in which case source_object is used.

Parameters

- **source_bucket** (*string*) – The bucket of the object to copy from.
- **source_object** (*string*) – The object to copy.
- **destination_bucket** (*string*) – The destination of the object to copied to.
- **destination_object** – The (renamed) path of the object if given. Can be omitted; then the same name is used.

upload (*bucket*, *object*, *filename*, *mime_type='application/octet-stream'*, *gzip=False*, *multipart=False*, *num_retries=0*)
Uploads a local file to Google Cloud Storage.

Parameters

- **bucket** (*string*) – The bucket to upload to.
- **object** (*string*) – The object name to set when uploading the local file.
- **filename** (*string*) – The local file path to the file to be uploaded.
- **mime_type** (*str*) – The MIME type to set when uploading the file.
- **gzip** (*bool*) – Option to compress file for upload
- **multipart** (*bool or int*) – If True, the upload will be split into multiple HTTP requests. The default size is 256MiB per request. Pass a number instead of True to specify the request size, which must be a multiple of 262144 (256KiB).
- **num_retries** (*int*) – The number of times to attempt to re-upload the file (or individual chunks, in the case of multipart uploads). Retries are attempted with exponential backoff.

GCPTransferServiceHook

class airflow.contrib.hooks.gcp_transfer_hook.**GCPTransferServiceHook**(*api_version='v1', gcp_conn_id='google_cloud_de delegate_to=None*)

Bases: *airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook*

Hook for GCP Storage Transfer Service.

get_conn()

Retrieves connection to Google Storage Transfer service.

Returns Google Storage Transfer service object

Return type dict

3.16.5.14 Google Kubernetes Engine

Google Kubernetes Engine Cluster Operators

- *GKEClusterDeleteOperator* : Creates a Kubernetes Cluster in Google Cloud Platform
- *GKEPodOperator* : Deletes a Kubernetes Cluster in Google Cloud Platform

GKEClusterCreateOperator

GKEClusterDeleteOperator

GKEPodOperator

Google Kubernetes Engine Hook

3.16.6 Qubole

Apache Airflow has a native operator and hooks to talk to Qubole, which lets you submit your big data jobs directly to Qubole from Apache Airflow.

3.16.6.1 QuboleOperator

3.16.6.2 QubolePartitionSensor

3.16.6.3 QuboleFileSensor

3.16.6.4 QuboleCheckOperator

3.16.6.5 QuboleValueCheckOperator

3.17 Metrics

3.17.1 Configuration

Airflow can be set up to send metrics to StatsD:

```
[scheduler]
statsd_on = True
statsd_host = localhost
statsd_port = 8125
statsd_prefix = airflow
```

3.17.2 Counters

Name	Description
<job_name>_start	Number of started <job_name> job, ex. SchedulerJob, LocalTaskJob
<job_name>_end	Number of ended <job_name> job, ex. SchedulerJob, LocalTaskJob
operator_failures_<operator_name>	Operator <operator_name> failures
operator_successes_<operator_name>	Operator <operator_name> successes
ti_failures	Overall task instances failures
ti_successes	Overall task instances successes
zombies_killed	Zombie tasks killed
scheduler_heartbeat	Scheduler heartbeats

3.17.3 Gauges

Name	Description
collect_dags	Seconds taken to scan and import DAGs
dagbag_import_errors	DAG import errors
dagbag_size	DAG bag size

3.17.4 Timers

Name	Description
dagrun.dependency-check.<dag_id>	Seconds taken to check DAG dependencies

3.18 Kubernetes

3.18.1 Kubernetes Executor

The kubernetes executor is introduced in Apache Airflow 1.10.0. The Kubernetes executor will create a new pod for every task instance.

Example helm charts are available at *scripts/ci/kubernetes/kube/{airflow,volumes,postgres}.yaml* in the source distribution. The volumes are optional and depend on your configuration. There are two volumes available:

- Dags: by storing all the dags onto the persistent disks, all the workers can read the dags from there. Another option is using git-sync, before starting the container, a git pull of the dags repository will be performed and used throughout the lifecycle of the pod.
- Logs: by storing the logs onto a persistent disk, all the logs will be available for all the workers and the webserver itself. If you don't configure this, the logs will be lost after the worker pods shuts down. Another option is to use S3/GCS/etc to store the logs.

3.18.2 Kubernetes Operator

```
from airflow.contrib.operators import KubernetesOperator
from airflow.contrib.operators.kubernetes_pod_operator import KubernetesPodOperator
from airflow.contrib.kubernetes.secret import Secret

secret_file = Secret('volume', '/etc/sql_conn', 'airflow-secrets', 'sql_alchemy_conn')
secret_env  = Secret('env', 'SQL_CONN', 'airflow-secrets', 'sql_alchemy_conn')
volume_mount = VolumeMount('test-volume',
                            mount_path='/root/mount_file',
                            sub_path=None,
                            read_only=True)

volume_config= {
    'persistentVolumeClaim':
      {
        'claimName': 'test-volume'
      }
    }
volume = Volume(name='test-volume', configs=volume_config)
```

(continues on next page)

(continued from previous page)

```
affinity = {
    'nodeAffinity': {
      'preferredDuringSchedulingIgnoredDuringExecution': [
        {
          "weight": 1,
          "preference": {
            "matchExpressions": {
              "key": "disktype",
              "operator": "In",
              "values": ["ssd"]
            }
          }
        }
      ]
    },
    "podAffinity": {
      "requiredDuringSchedulingIgnoredDuringExecution": [
        {
          "labelSelector": {
            "matchExpressions": [
              {
                "key": "security",
                "operator": "In",
                "values": ["S1"]
              }
            ]
          },
          "topologyKey": "failure-domain.beta.kubernetes.io/zone"
        }
      ]
    },
    "podAntiAffinity": {
      "requiredDuringSchedulingIgnoredDuringExecution": [
        {
          "labelSelector": {
            "matchExpressions": [
              {
                "key": "security",
                "operator": "In",
                "values": ["S2"]
              }
            ]
          },
          "topologyKey": "kubernetes.io/hostname"
        }
      ]
    }
}

tolerations = [
    {
        'key': "key",
        'operator': 'Equal',
        'value': 'value'
     }
]
```

(continues on next page)

(continued from previous page)

```
k = KubernetesPodOperator(namespace='default',
                          image="ubuntu:16.04",
                          cmds=["bash", "-cx"],
                          arguments=["echo", "10"],
                          labels={"foo": "bar"},
                          secrets=[secret_file,secret_env]
                          volume=[volume],
                          volume_mounts=[volume_mount]
                          name="test",
                          task_id="task",
                          affinity=affinity,
                          is_delete_operator_pod=True,
                          hostnetwork=False,
                          tolerations=tolerations
                          )
```

class airflow.contrib.kubernetes.secret.**Secret**(*deploy_type*, *deploy_target*, *secret*, *key*)
Defines Kubernetes Secret Volume

3.19 Lineage

Note: Lineage support is very experimental and subject to change.

Airflow can help track origins of data, what happens to it and where it moves over time. This can aid having audit trails and data governance, but also debugging of data flows.

Airflow tracks data by means of inlets and outlets of the tasks. Let's work from an example and see how it works.

```
from airflow.operators.bash_operator import BashOperator
from airflow.operators.dummy_operator import DummyOperator
from airflow.lineage.datasets import File
from airflow.models import DAG
from datetime import timedelta

FILE_CATEGORIES = ["CAT1", "CAT2", "CAT3"]

args = {
    'owner': 'airflow',
    'start_date': airflow.utils.dates.days_ago(2)
}

dag = DAG(
    dag_id='example_lineage', default_args=args,
    schedule_interval='0 0 * * *',
    dagrun_timeout=timedelta(minutes=60))

f_final = File("/tmp/final")
run_this_last = DummyOperator(task_id='run_this_last', dag=dag,
    inlets={"auto": True},
    outlets={"datasets": [f_final,]})

f_in = File("/tmp/whole_directory/")
```

(continues on next page)

(continued from previous page)

```
outlets = []
for file in FILE_CATEGORIES:
    f_out = File("/tmp/{}/{{{{ execution_date }}}}".format(file))
    outlets.append(f_out)
run_this = BashOperator(
    task_id='run_me_first', bash_command='echo 1', dag=dag,
    inlets={"datasets": [f_in,]},
    outlets={"datasets": outlets}
    )
run_this.set_downstream(run_this_last)
```

Tasks take the parameters *inlets* and *outlets*. Inlets can be manually defined by a list of dataset *{"datasets": [dataset1, dataset2]}* or can be configured to look for outlets from upstream tasks *{"task_ids": ["task_id1", "task_id2"]}* or can be configured to pick up outlets from direct upstream tasks *{"auto": True}* or a combination of them. Outlets are defined as list of dataset *{"datasets": [dataset1, dataset2]}*. Any fields for the dataset are templated with the context when the task is being executed.

Note: Operators can add inlets and outlets automatically if the operator supports it.

In the example DAG task *run_me_first* is a BashOperator that takes 3 inlets: *CAT1*, *CAT2*, *CAT3*, that are generated from a list. Note that *execution_date* is a templated field and will be rendered when the task is running.

Note: Behind the scenes Airflow prepares the lineage metadata as part of the *pre_execute* method of a task. When the task has finished execution *post_execute* is called and lineage metadata is pushed into XCOM. Thus if you are creating your own operators that override this method make sure to decorate your method with *prepare_lineage* and *apply_lineage* respectively.

3.19.1 Apache Atlas

Airflow can send its lineage metadata to Apache Atlas. You need to enable the *atlas* backend and configure it properly, e.g. in your *airflow.cfg*:

```
[lineage]
backend = airflow.lineage.backend.atlas

[atlas]
username = my_username
password = my_password
host = host
port = 21000
```

Please make sure to have the *atlasclient* package installed.

3.20 Changelog

3.20.1 Airflow 1.10.2, 2019-01-19

3.20.1.1 New features

- [AIRFLOW-2658] Add GCP specific k8s pod operator (#3532)
- [AIRFLOW-2440] Google Cloud SQL import/export operator (#4251)
- [AIRFLOW-3212] Add AwsGlueCatalogPartitionSensor (#4112)
- [AIRFLOW-2750] Add subcommands to delete and list users
- [AIRFLOW-3480] Add GCP Spanner Database Operators (#4353)
- [AIRFLOW-3560] Add DayOfWeek Sensor (#4363)
- [AIRFLOW-3371] BigQueryHook's Ability to Create View (#4213)
- [AIRFLOW-3332] Add method to allow inserting rows into BQ table (#4179)
- [AIRFLOW-3055] add get_dataset and get_datasets_list to bigquery_hook (#3894)
- [AIRFLOW-2887] Added BigQueryCreateEmptyDatasetOperator and create_emty_dataset to bigquery_hook (#3876)
- [AIRFLOW-2758] Add a sensor for MongoDB
- [AIRFLOW-2640] Add Cassandra table sensor
- [AIRFLOW-3398] Google Cloud Spanner instance database query operator (#4314)
- [AIRFLOW-3310] Google Cloud Spanner deploy / delete operators (#4286)
- [AIRFLOW-3406] Implement an Azure CosmosDB operator (#4265)
- [AIRFLOW-3434] Allows creating intermediate dirs in SFTPOperator (#4270)
- [AIRFLOW-3345] Add Google Cloud Storage (GCS) operators for ACL (#4192)
- [AIRFLOW-3266] Add AWS Athena Hook and Operator (#4111)
- [AIRFLOW-3346] Add hook and operator for GCP transfer service (#4189)
- [AIRFLOW-2983] Add prev_ds_nodash and next_ds_nodash macro (#3821)
- [AIRFLOW-3403] Add AWS Athena Sensor (#4244)
- [AIRFLOW-3323] Support HTTP basic authentication for Airflow Flower (#4166)
- [AIRFLOW-3410] Add feature to allow Host Key Change for SSH Op (#4249)
- [AIRFLOW-3275] Add Google Cloud SQL Query operator (#4170)
- [AIRFLOW-2691] Manage JS dependencies via npm
- [AIRFLOW-2795] Oracle to Oracle Transfer Operator (#3639)
- [AIRFLOW-2596] Add Oracle to Azure Datalake Transfer Operator
- [AIRFLOW-3220] Add Instance Group Manager Operators for GCE (#4167)
- [AIRFLOW-2882] Add import and export for pool cli using JSON
- [AIRFLOW-2965] CLI tool to show the next execution datetime (#3834)
- [AIRFLOW-2874] Enables FAB's theme support (#3719)

- [AIRFLOW-3336] Add new TriggerRule for 0 upstream failures (#4182)

3.20.1.2 Improvements

- [AIRFLOW-3680] Consistency update in tests for All GCP-related operators (#4493)
- [AIRFLOW-3675] Use googlapiclient for google apis (#4484)
- [AIRFLOW-3205] Support multipart uploads to GCS (#4084)
- [AIRFLOW-2826] Add GoogleCloudKMSHook (#3677)
- [AIRFLOW-3676] Add required permission to CloudSQL export/import example (#4489)
- [AIRFLOW-3679] Added Google Cloud Base Hook to documentation (#4487)
- [AIRFLOW-3594] Unify different License Header
- [AIRFLOW-3197] Remove invalid parameter KeepJobFlowAliveWhenNoSteps in example DAG (#4404)
- [AIRFLOW-3504] Refine the functionality of "/health" endpoint (#4309)
- [AIRFLOW-3103][AIRFLOW-3147] Update flask-appbuilder (#3937)
- [AIRFLOW-3168] More resillient database use in CI (#4014)
- [AIRFLOW-3076] Remove preloading of MySQL testdata (#3911)
- [AIRFLOW-3035] Allow custom 'job_error_states' in dataproc ops (#3884)
- [AIRFLOW-3246] Make hmsclient optional in airflow.hooks.hive_hooks (#4080)
- [AIRFLOW-3059] Log how many rows are read from Postgres (#3905)
- [AIRFLOW-2463] Make task instance context available for hive queries
- [AIRFLOW-3190] Make flake8 compliant (#4035)
- [AIRFLOW-1998] Implemented DatabricksRunNowOperator for jobs/run-now … (#3813)
- [AIRFLOW-2267] Airflow DAG level access (#3197)
- [AIRFLOW-2359] Add set failed for DagRun and task in tree view (#3255)
- [AIRFLOW-3008] Move Kubernetes example DAGs to contrib
- [AIRFLOW-3402] Support global k8s affinity and toleration configs (#4247)
- [AIRFLOW-3610] Add region param for EMR jobflow creation (#4418)
- [AIRFLOW-3531] Fix test for GCS to GCS Transfer Hook (#4452)
- [AIRFLOW-3531] Add gcs to gcs transfer operator. (#4331)
- [AIRFLOW-3034]: Readme updates : Add Slack & Twitter, remove Gitter
- [AIRFLOW-3028] Update Text & Images in Readme.md
- [AIRFLOW-208] Add badge to show supported Python versions (#3839)
- [AIRFLOW-2238] Update PR tool to push directly to Github
- [AIRFLOW-2238] Flake8 fixes on dev/airflow-pr
- [AIRFLOW-2238] Update PR tool to remove outdated info (#3978)
- [AIRFLOW-3005] Replace 'Airbnb Airflow' with 'Apache Airflow' (#3845)
- [AIRFLOW-3150] Make execution_date templated in TriggerDagRunOperator (#4359)

- [AIRFLOW-1196][AIRFLOW-2399] Add templated field in TriggerDagRunOperator (#4228)
- [AIRFLOW-3340] Placeholder support in connections form (#4185)
- [AIRFLOW-3446] Add Google Cloud BigTable operators (#4354)
- [AIRFLOW-1921] Add support for https and user auth (#2879)
- [AIRFLOW-2770] Read *dags_in_image* config value as a boolean (#4319)
- [AIRFLOW-3022] Add volume mount to KubernetesExecutorConfig (#3855)
- [AIRFLOW-2917] Set AIRFLOW__CORE__SQL_ALCHEMY_CONN only when needed (#3766)
- [AIRFLOW-2712] Pass annotations to KubernetesExecutorConfig
- [AIRFLOW-461] Support autodetected schemas in BigQuery run_load (#3880)
- [AIRFLOW-2997] Support cluster fields in bigquery (#3838)
- [AIRFLOW-2916] Arg *verify* for AwsHook() & S3 sensors/operators (#3764)
- [AIRFLOW-491] Add feature to pass extra api configs to BQ Hook (#3733)
- [AIRFLOW-2889] Fix typos detected by github.com/client9/misspell (#3732)
- [AIRFLOW-850] Add a PythonSensor (#4349)
- [AIRFLOW-2747] Explicit re-schedule of sensors (#3596)
- [AIRFLOW-3392] Add index on dag_id in sla_miss table (#4235)
- [AIRFLOW-3001] Add index 'ti_dag_date' to taskinstance (#3885)
- [AIRFLOW-2861] Add index on log table (#3709)
- [AIRFLOW-3518] Performance fixes for topological_sort of Tasks (#4322)
- [AIRFLOW-3521] Fetch more than 50 items in *airflow-jira compare* script (#4300)
- [AIRFLOW-1919] Add option to query for DAG runs given a DAG ID
- [AIRFLOW-3444] Explicitly set transfer operator description. (#4279)
- [AIRFLOW-3411] Add OpenFaaS hook (#4267)
- [AIRFLOW-2785] Add context manager entry points to mongoHook
- [AIRFLOW-2524] Add SageMaker doc to AWS integration section (#4278)
- [AIRFLOW-3479] Keeps records in Log Table when DAG is deleted (#4287)
- [AIRFLOW-2948] Arg check & better doc - SSHOperator & SFTPOperator (#3793)
- [AIRFLOW-2245] Add remote_host of SSH/SFTP operator as templated field (#3765)
- [AIRFLOW-2670] Update SSH Operator's Hook to respect timeout (#3666)
- [AIRFLOW-3380] Add metrics documentation (#4219)
- [AIRFLOW-3361] Log the task_id in the PendingDeprecationWarning from BaseOperator (#4030)
- [AIRFLOW-3213] Create ADLS to GCS operator (#4134)
- [AIRFLOW-3395] added the REST API endpoints to the doc (#4236)
- [AIRFLOW-3294] Update connections form and integration docs (#4129)
- [AIRFLOW-3236] Create AzureDataLakeStorageListOperator (#4094)
- [AIRFLOW-3062] Add Qubole in integration docs (#3946)

- [AIRFLOW-3306] Disable flask-sqlalchemy modification tracking. (#4146)
- [AIRFLOW-2867] Refactor Code to conform standards (#3714)
- [AIRFLOW-2753] Add dataproc_job_id instance var holding actual DP jobId
- [AIRFLOW-3132] Enable specifying auto_remove option for DockerOperator (#3977)
- [AIRFLOW-2731] Raise psutil restriction to <6.0.0
- [AIRFLOW-3384] Allow higher versions of Sqlalchemy and Jinja2 (#4227)
- [Airflow-2760] Decouple DAG parsing loop from scheduler loop (#3873)
- [AIRFLOW-3004] Add config disabling scheduler cron (#3899)
- [AIRFLOW-3175] Fix docstring format in airflow/jobs.py (#4025)
- [AIRFLOW-3589] Visualize reschedule state in all views (#4408)
- [AIRFLOW-2698] Simplify Kerberos code (#3563)
- [AIRFLOW-2499] Dockerise CI pipeline (#3393)
- [AIRFLOW-3432] Add test for feature "Delete DAG in UI" (#4266)
- [AIRFLOW-3301] Update DockerOperator CI test for PR #3977 (#4138)
- [AIRFLOW-3478] Make sure that the session is closed
- [AIRFLOW-3687] Add missing @apply_defaults decorators (#4498)
- [AIRFLOW-3691] Update notice to 2019 (#4503)
- [AIRFLOW-3689] Update pop-up message when deleting DAG in RBAC UI (#4505)
- [AIRFLOW-2801] Skip test_mark_success_no_kill in PostgreSQL on CI (#3642)
- [AIRFLOW-3693] Replace psycopg2-binary by psycopg2 (#4508)
- [AIRFLOW-3700] Change the lowest allowed version of "requests" (#4517)
- [AIRFLOW-3704] Support SSL Protection When Redis is Used as Broker for CeleryExecutor (#4521)
- [AIRFLOW-3681] All GCP operators have now optional GCP Project ID (#4500)
- [Airflow 2782] Upgrades Dagre D3 version to latest possible
- [Airflow 2783] Implement eslint for JS code check (#3641)
- [AIRFLOW-2805] Display multiple timezones on UI (#3687)
- [AIRFLOW-3302] Small CSS fixes (#4140)
- [Airflow-2766] Respect shared datetime across tabs
- [AIRFLOW-2776] Compress tree view JSON
- [AIRFLOW-2407] Use feature detection for reload() (#3298)
- [AIRFLOW-3452] Removed an unused/dangerous display-none (#4295)
- [AIRFLOW-3348] Update run statistics on dag refresh (#4197)
- [AIRFLOW-3125] Monitor Task Instances creation rates (#3966)

3.20.1.3 Bug fixes

- [AIRFLOW-3191] Fix not being able to specify execution_date when creating dagrun (#4037)
- [AIRFLOW-3657] Fix zendesk integration (#4466)
- [AIRFLOW-3605] Load plugins from entry_points (#4412)
- [AIRFLOW-3646] Rename plugins_manager.py to test_xx to trigger tests (#4464)
- [AIRFLOW-3655] Escape links generated in model views (#4463)
- [AIRFLOW-3662] Add dependency for Enum (#4468)
- [AIRFLOW-3630] Cleanup of GCP Cloud SQL Connection (#4451)
- [AIRFLOW-1837] Respect task start_date when different from dag's (#4010)
- [AIRFLOW-2829] Brush up the CI script for minikube
- [AIRFLOW-3519] Fix example http operator (#4455)
- [AIRFLOW-2811] Fix scheduler_ops_metrics.py to work (#3653)
- [AIRFLOW-2751] add job properties update in hive to druid operator.
- [AIRFLOW-2918] Remove unused imports
- [AIRFLOW-2918] Fix Flake8 violations (#3931)
- [AIRFLOW-2771] Add except type to broad S3Hook try catch clauses
- [AIRFLOW-2918] Fix Flake8 violations (#3772)
- [AIRFLOW-2099] Handle getsource() calls gracefully
- [AIRFLOW-3397] Fix integrety error in rbac AirflowSecurityManager (#4305)
- [AIRFLOW-3281] Fix Kubernetes operator with git-sync (#3770)
- [AIRFLOW-2615] Limit DAGs parsing to once only
- [AIRFLOW-2952] Fix Kubernetes CI (#3922)
- [AIRFLOW-2933] Enable Codecov on Docker-CI Build (#3780)
- [AIRFLOW-2082] Resolve a bug in adding password_auth to api as auth method (#4343)
- [AIRFLOW-3612] Remove incubation/incubator mention (#4419)
- [AIRFLOW-3581] Fix next_ds/prev_ds semantics for manual runs (#4385)
- [AIRFLOW-3527] Update Cloud SQL Proxy to have shorter path for UNIX socket (#4350)
- [AIRFLOW-3316] For gcs_to_bq: add missing init of schema_fields var (#4430)
- [AIRFLOW-3583] Fix AirflowException import (#4389)
- [AIRFLOW-3578] Fix Type Error for BigQueryOperator (#4384)
- [AIRFLOW-2755] Added *kubernetes.worker_dags_folder* configuration (#3612)
- [AIRFLOW-2655] Fix inconsistency of default config of kubernetes worker
- [AIRFLOW-2645][AIRFLOW-2617] Add worker_container_image_pull_policy
- [AIRFLOW-2661] fix config dags_volume_subpath and logs_volume_subpath
- [AIRFLOW-3550] Standardize GKE hook (#4364)
- [AIRFLOW-2863] Fix GKEClusterHook catching wrong exception (#3711)

- [AIRFLOW-2939][AIRFLOW-3568] Fix TypeError in GCSToS3Op & S3ToGCSOp (#4371)
- [AIRFLOW-3327] Add support for location in BigQueryHook (#4324)
- [AIRFLOW-3438] Fix default values in BigQuery Hook & BigQueryOperator (…
- [AIRFLOW-3355] Fix BigQueryCursor.execute to work with Python3 (#4198)
- [AIRFLOW-3447] Add 2 options for ts_nodash Macro (#4323)
- [AIRFLOW-1552] Airflow Filter_by_owner not working with password_auth (#4276)
- [AIRFLOW-3484] Fix Over-logging in the k8s executor (#4296)
- [AIRFLOW-3309] Add MongoDB connection (#4154)
- [AIRFLOW-3414] Fix reload_module in DagFileProcessorAgent (#4253)
- [AIRFLOW-1252] API accept JSON when invoking a trigger dag (#2334)
- [AIRFLOW-3425] Fix setting default scope in hook (#4261)
- [AIRFLOW-3416] Fixes Python 3 compatibility with CloudSqlQueryOperator (#4254)
- [AIRFLOW-3263] Ignore exception when 'run' kills already killed job (#4108)
- [AIRFLOW-3264] URL decoding when parsing URI for connection (#4109)
- [AIRFLOW-3365][AIRFLOW-3366] Allow celery_broker_transport_options to be set with environment variables (#4211)
- [AIRFLOW-2642] fix wrong value git-sync initcontainer env GIT_SYNC_ROOT (#3519)
- [AIRFLOW-3353] Pin redis verison (#4195)
- [AIRFLOW-3251] KubernetesPodOperator now uses 'image_pull_secrets' argument when creating Pods (#4188)
- [AIRFLOW-2705] Move class-level moto decorator to method-level
- [AIRFLOW-3233] Fix deletion of DAGs in the UI (#4069)
- [AIRFLOW-2908] Allow retries with KubernetesExecutor. (#3758)
- [AIRFLOW-1561] Fix scheduler to pick up example DAGs without other DAGs (#2635)
- [AIRFLOW-3352] Fix expose_config not honoured on RBAC UI (#4194)
- [AIRFLOW-3592] Fix logs when task is in rescheduled state (#4492)
- [AIRFLOW-3634] Fix GCP Spanner Test (#4440)
- [AIRFLOW-XXX] Fix PythonVirtualenvOperator tests (#3968)
- [AIRFLOW-3239] Fix/refine tests for api/common/experimental/ (#4255)
- [AIRFLOW-2951] Update dag_run table end_date when state change (#3798)
- [AIRFLOW-2756] Fix bug in set DAG run state workflow (#3606)
- [AIRFLOW-3690] Fix bug to set state of a task for manually-triggered DAGs (#4504)
- [AIRFLOW-3319] KubernetsExecutor: Need in try_number in labels if getting them later (#4163)
- [AIRFLOW-3724] Fix the broken refresh button on Graph View in RBAC UI
- [AIRFLOW-3732] Fix issue when trying to edit connection in RBAC UI
- [AIRFLOW-2866] Fix missing CSRF token head when using RBAC UI (#3804)
- [AIRFLOW-3259] Fix internal server error when displaying charts (#4114)

- [AIRFLOW-3271] Fix issue with persistence of RBAC Permissions modified via UI (#4118)
- [AIRFLOW-3141] Handle duration View for missing dag (#3984)
- [AIRFLOW-2766] Respect shared datetime across tabs
- [AIRFLOW-1413] Fix FTPSensor failing on error message with unexpected (#2450)
- [AIRFLOW-3378] KubernetesPodOperator does not delete on timeout failure (#4218)
- [AIRFLOW-3245] Fix list processing in resolve_template_files (#4086)
- [AIRFLOW-2703] Catch transient DB exceptions from scheduler's heartbeat it does not crash (#3650)
- [AIRFLOW-1298] Clear UPSTREAM_FAILED using the clean cli (#3886)

3.20.1.4 Doc-only changes

- [AIRFLOW-XXX] GCP operators documentation clarifications (#4273)
- [AIRFLOW-XXX] Docs: Fix paths to GCS transfer operator (#4479)
- [AIRFLOW-XXX] Add missing GCP operators to Docs (#4260)
- [AIRFLOW-XXX] Fix Docstrings for Operators (#3820)
- [AIRFLOW-XXX] Fix inconsistent comment in example_python_operator.py (#4337)
- [AIRFLOW-XXX] Fix incorrect parameter in SFTPOperator example (#4344)
- [AIRFLOW-XXX] Add missing remote logging field (#4333)
- [AIRFLOW-XXX] Revise template variables documentation (#4172)
- [AIRFLOW-XXX] Fix typo in docstring of gcs_to_bq (#3833)
- [AIRFLOW-XXX] Fix display of SageMaker operators/hook docs (#4263)
- [AIRFLOW-XXX] Better instructions for airflow flower (#4214)
- [AIRFLOW-XXX] Make pip install commands consistent (#3752)
- [AIRFLOW-XXX] Add *BigQueryGetDataOperator* to Integration Docs (#4063)
- [AIRFLOW-XXX] Don't spam test logs with "bad cron expression" messages (#3973)
- [AIRFLOW-XXX] Update committer list based on latest TLP discussion (#4427)
- [AIRFLOW-XXX] Fix incorrect statement in contributing guide (#4104)
- [AIRFLOW-XXX] Fix Broken Link in CONTRIBUTING.md
- [AIRFLOW-XXX] Update Contributing Guide - Git Hooks (#4120)
- [AIRFLOW-3426] Correct Python Version Documentation Reference (#4259)
- [AIRFLOW-2663] Add instructions to install SSH dependencies
- [AIRFLOW-XXX] Clean up installation extra packages table (#3750)
- [AIRFLOW-XXX] Remove redundant space in Kerberos (#3866)
- [AIRFLOW-3086] Add extras group for google auth to setup.py (#3917)
- [AIRFLOW-XXX] Add Kubernetes Dependency in Extra Packages Doc (#4281)
- [AIRFLOW-3696] Add Version info to Airflow Documentation (#4512)
- [AIRFLOW-XXX] Correct Typo in sensor's exception (#4545)

- [AIRFLOW-XXX] Fix a typo of config (#4544)
- [AIRFLOW-XXX] Fix BashOperator Docstring (#4052)
- [AIRFLOW-3018] Fix Minor issues in Documentation
- [AIRFLOW-XXX] Fix Minor issues with Azure Cosmos Operator (#4289)
- [AIRFLOW-3382] Fix incorrect docstring in DatastoreHook (#4222)
- [AIRFLOW-XXX] Fix copy&paste mistake (#4212)
- [AIRFLOW-3260] Correct misleading BigQuery error (#4098)
- [AIRFLOW-XXX] Fix Typo in SFTPOperator docstring (#4016)
- [AIRFLOW-XXX] Fixing the issue in Documentation (#3998)
- [AIRFLOW-XXX] Fix undocumented params in S3_hook
- [AIRFLOW-XXX] Fix SlackWebhookOperator execute method comment (#3963)
- [AIRFLOW-3070] Refine web UI authentication-related docs (#3863)

3.20.2 Airflow 1.10.1, 2018-11-13

3.20.2.1 New features

- [AIRFLOW-2524] Airflow integration with AWS Sagemaker
- [AIRFLOW-2657] Add ability to delete DAG from web ui
- [AIRFLOW-2780] Adds IMAP Hook to interact with a mail server
- [AIRFLOW-2794] Add delete support for Azure blob
- [AIRFLOW-2912] Add operators for Google Cloud Functions
- [AIRFLOW-2974] Add Start/Restart/Terminate methods Databricks Hook
- [AIRFLOW-2989] No Parameter to change bootDiskType for DataprocClusterCreateOperator
- [AIRFLOW-3078] Basic operators for Google Compute Engine
- [AIRFLOW-3147] Update Flask-AppBuilder version
- [AIRFLOW-3231] Basic operators for Google Cloud SQL (deploy / patch / delete)
- [AIRFLOW-3276] Google Cloud SQL database create / patch / delete operators

3.20.2.2 Improvements

- [AIRFLOW-393] Add progress callbacks for FTP downloads
- [AIRFLOW-520] Show Airflow version on web page
- [AIRFLOW-843] Exceptions now available in context during on_failure_callback
- [AIRFLOW-2476] Update tabulate dependency to v0.8.2
- [AIRFLOW-2592] Bump Bleach dependency
- [AIRFLOW-2622] Add "confirm=False" option to SFTPOperator
- [AIRFLOW-2662] support affinity & nodeSelector policies for kubernetes executor/operator

- [AIRFLOW-2709] Improve error handling in Databricks hook
- [AIRFLOW-2723] Update lxml dependancy to >= 4.0.
- [AIRFLOW-2763] No precheck mechanism in place during worker initialisation for the connection to metadata database
- [AIRFLOW-2789] Add ability to create single node cluster to DataprocClusterCreateOperator
- [AIRFLOW-2797] Add ability to create Google Dataproc cluster with custom image
- [AIRFLOW-2854] kubernetes_pod_operator add more configuration items
- [AIRFLOW-2855] Need to Check Validity of Cron Expression When Process DAG File/Zip File
- [AIRFLOW-2904] Clean an unnecessary line in airflow/executors/celery_executor.py
- [AIRFLOW-2921] A trivial incorrectness in CeleryExecutor()
- [AIRFLOW-2922] Potential deal-lock bug in CeleryExecutor()
- [AIRFLOW-2932] GoogleCloudStorageHook - allow compression of file
- [AIRFLOW-2949] Syntax Highlight for Single Quote
- [AIRFLOW-2951] dag_run end_date Null after a dag is finished
- [AIRFLOW-2956] Kubernetes tolerations for pod operator
- [AIRFLOW-2997] Support for clustered tables in Bigquery hooks/operators
- [AIRFLOW-3006] Fix error when schedule_interval="None"
- [AIRFLOW-3008] Move Kubernetes related example DAGs to contrib/example_dags
- [AIRFLOW-3025] Allow to specify dns and dns-search parameters for DockerOperator
- [AIRFLOW-3067] (www_rbac) Flask flash messages are not displayed properly (no background color)
- [AIRFLOW-3069] Decode output of S3 file transform operator
- [AIRFLOW-3072] Assign permission get_logs_with_metadata to viewer role
- [AIRFLOW-3090] INFO logs are too verbose
- [AIRFLOW-3103] Update Flask-Login
- [AIRFLOW-3112] Align SFTP hook with SSH hook
- [AIRFLOW-3119] Enable loglevel on celery worker and inherit from airflow.cfg
- [AIRFLOW-3137] Make ProxyFix middleware optional
- [AIRFLOW-3173] Add _cmd options for more password config options
- [AIRFLOW-3177] Change scheduler_heartbeat metric from gauge to counter
- [AIRFLOW-3193] Pin docker requirement version to v3
- [AIRFLOW-3195] Druid Hook: Log ingestion spec and task id
- [AIRFLOW-3197] EMR Hook is missing some parameters to valid on the AWS API
- [AIRFLOW-3232] Make documentation for GCF Functions operator more readable
- [AIRFLOW-3262] Can't get log containing Response when using SimpleHttpOperator
- [AIRFLOW-3265] Add support for "unix_socket" in connection extra for Mysql Hook

3.20.2.3 Doc-only changes

- [AIRFLOW-1441] Tutorial Inconsistencies Between Example Pipeline Definition and Recap
- [AIRFLOW-2682] Add how-to guide(s) for how to use basic operators like BashOperator and PythonOperator
- [AIRFLOW-3104] .airflowignore feature is not mentioned at all in documentation
- [AIRFLOW-3237] Refactor example DAGs
- [AIRFLOW-3187] Update airflow.gif file with a slower version
- [AIRFLOW-3159] Update Airflow documentation on GCP Logging
- [AIRFLOW-3030] Command Line docs incorrect subdir
- [AIRFLOW-2990] Docstrings for Hooks/Operators are in incorrect format
- [AIRFLOW-3127] Celery SSL Documentation is out-dated
- [AIRFLOW-2779] Add license headers to doc files
- [AIRFLOW-2779] Add project version to license

3.20.2.4 Bug fixes

- [AIRFLOW-839] docker_operator.py attempts to log status key without first checking existence
- [AIRFLOW-1104] Concurrency check in scheduler should count queued tasks as well as running
- [AIRFLOW-1163] Add support for x-forwarded-* headers to support access behind AWS ELB
- [AIRFLOW-1195] Cleared tasks in SubDagOperator do not trigger Parent dag_runs
- [AIRFLOW-1508] Skipped state not part of State.task_states
- [AIRFLOW-1762] Use key_file in SSHHook.create_tunnel()
- [AIRFLOW-1837] Differing start_dates on tasks not respected by scheduler.
- [AIRFLOW-1874] Support standard SQL in Check, ValueCheck and IntervalCheck BigQuery operators
- [AIRFLOW-1917] print() from python operators end up with extra new line
- [AIRFLOW-1970] Database cannot be initialized if an invalid fernet key is provided
- [AIRFLOW-2145] Deadlock after clearing a running task
- [AIRFLOW-2216] Cannot specify a profile for AWS Hook to load with s3 config file
- [AIRFLOW-2574] initdb fails when mysql password contains percent sign
- [AIRFLOW-2707] Error accessing log files from web UI
- [AIRFLOW-2716] Replace new Python 3.7 keywords
- [AIRFLOW-2744] RBAC app doesn't integrate plugins (blueprints etc)
- [AIRFLOW-2772] BigQuery hook does not allow specifying both the partition field name and table name at the same time
- [AIRFLOW-2778] Bad Import in collect_dag in DagBag
- [AIRFLOW-2786] Variables view fails to render if a variable has an empty key
- [AIRFLOW-2799] Filtering UI objects by datetime is broken
- [AIRFLOW-2800] Remove airflow/ low-hanging linting errors

- [AIRFLOW-2825] S3ToHiveTransfer operator may not may able to handle GZIP file with uppercase ext in S3
- [AIRFLOW-2848] dag_id is missing in metadata table "job" for LocalTaskJob
- [AIRFLOW-2860] DruidHook: time variable is not updated correctly when checking for timeout
- [AIRFLOW-2865] Race condition between on_success_callback and LocalTaskJob's cleanup
- [AIRFLOW-2893] Stuck dataflow job due to jobName mismatch.
- [AIRFLOW-2895] Prevent scheduler from spamming heartbeats/logs
- [AIRFLOW-2900] Code not visible for Packaged DAGs
- [AIRFLOW-2905] Switch to regional dataflow job service.
- [AIRFLOW-2907] Sendgrid - Attachments - ERROR - Object of type 'bytes' is not JSON serializable
- [AIRFLOW-2938] Invalid 'extra' field in connection can raise an AttributeError when attempting to edit
- [AIRFLOW-2979] Deprecated Celery Option not in Options list
- [AIRFLOW-2981] TypeError in dataflow operators when using GCS jar or py_file
- [AIRFLOW-2984] Cannot convert naive_datetime when task has a naive start_date/end_date
- [AIRFLOW-2994] flatten_results in BigQueryOperator/BigQueryHook should default to None
- [AIRFLOW-3002] ValueError in dataflow operators when using GCS jar or py_file
- [AIRFLOW-3012] Email on sla miss is send only to first address on the list
- [AIRFLOW-3046] ECS Operator mistakenly reports success when task is killed due to EC2 host termination
- [AIRFLOW-3064] No output from *airflow test* due to default logging config
- [AIRFLOW-3072] Only admin can view logs in RBAC UI
- [AIRFLOW-3079] Improve initdb to support MSSQL Server
- [AIRFLOW-3089] Google auth doesn't work under http
- [AIRFLOW-3099] Errors raised when some blocs are missing in airflow.cfg
- [AIRFLOW-3109] Default user permission should contain 'can_clear'
- [AIRFLOW-3111] Confusing comments and instructions for log templates in UPDATING.md and default_airflow.cfg
- [AIRFLOW-3124] Broken webserver debug mode (RBAC)
- [AIRFLOW-3136] Scheduler Failing the Task retries run while processing Executor Events
- [AIRFLOW-3138] Migration cc1e65623dc7 creates issues with postgres
- [AIRFLOW-3161] Log Url link does not link to task instance logs in RBAC UI
- [AIRFLOW-3162] HttpHook fails to parse URL when port is specified
- [AIRFLOW-3183] Potential Bug in utils/dag_processing/DagFileProcessorManager.max_runs_reached()
- [AIRFLOW-3203] Bugs in DockerOperator & Some operator test scripts were named incorrectly
- [AIRFLOW-3238] Dags, removed from the filesystem, are not deactivated on initdb
- [AIRFLOW-3268] Cannot pass SSL dictionary to mysql connection via URL
- [AIRFLOW-3277] Invalid timezone transition handling for cron schedules
- [AIRFLOW-3295] Require encryption in DaskExecutor when certificates are configured.

- [AIRFLOW-3297] EmrStepSensor marks cancelled step as successful

3.20.3 Airflow 1.10.0, 2018-08-03

- [AIRFLOW-2870] Use abstract TaskInstance for migration
- [AIRFLOW-2859] Implement own UtcDateTime (#3708)
- [AIRFLOW-2140] Don't require kubernetes for the SparkSubmit hook
- [AIRFLOW-2869] Remove smart quote from default config
- [AIRFLOW-2857] Fix Read the Docs env
- [AIRFLOW-2817] Force explicit choice on GPL dependency
- [AIRFLOW-2716] Replace async and await py3.7 keywords
- [AIRFLOW-2810] Fix typo in Xcom model timestamp
- [AIRFLOW-2710] Clarify fernet key value in documentation
- [AIRFLOW-2606] Fix DB schema and SQLAlchemy model
- [AIRFLOW-2646] Fix setup.py not to install snakebite on Python3
- [AIRFLOW-2604] Add index to task_fail
- [AIRFLOW-2650] Mark SchedulerJob as succeed when hitting Ctrl-c
- [AIRFLOW-2678] Fix db schema unit test to remove checking fab models
- [AIRFLOW-2624] Fix webserver login as anonymous
- [AIRFLOW-2654] Fix incorret URL on refresh in Graph View of FAB UI
- [AIRFLOW-2668] Handle missing optional cryptography dependency
- [AIRFLOW-2681] Include last dag run of externally triggered DAGs in UI.
- [AIRFLOW-1840] Support back-compat on old celery config
- [AIRFLOW-2612][AIRFLOW-2534] Clean up Hive-related tests
- [AIRFLOW-2608] Implements/Standardize custom exceptions for experimental APIs
- [AIRFLOW-2607] Fix failing TestLocalClient
- [AIRFLOW-2638] dbapi_hook: support REPLACE INTO
- [AIRFLOW-2542][AIRFLOW-1790] Rename AWS Batch Operator queue to job_queue
- [AIRFLOW-2567] Extract result from the kubernetes pod as Xcom
- [AIRFLOW-XXX] Adding REA Group to readme
- [AIRFLOW-2601] Allow user to specify k8s config
- [AIRFLOW-2559] Azure Fileshare hook
- [AIRFLOW-1786] Enforce correct behavior for soft-fail sensors
- [AIRFLOW-2355] Airflow trigger tag parameters in subdag
- [AIRFLOW-2613] Fix Airflow searching .zip bug
- [AIRFLOW-2627] Add a sensor for Cassandra
- [AIRFLOW-2634][AIRFLOW-2534] Remove dependency for impyla

- [AIRFLOW-2611] Fix wrong dag volume mount path for kubernetes executor
- [AIRFLOW-2562] Add Google Kubernetes Engine Operators
- [AIRFLOW-2630] Fix classname in test_sql_sensor.py
- [AIRFLOW-2534] Fix bug in HiveServer2Hook
- [AIRFLOW-2586] Stop getting AIRFLOW_HOME value from config file in bash operator
- [AIRFLOW-2605] Fix autocommit for MySqlHook
- [AIRFLOW-2539][AIRFLOW-2359] Move remaing log config to configuration file
- [AIRFLOW-1656] Tree view dags query changed
- [AIRFLOW-2617] add imagePullPolicy config for kubernetes executor
- [AIRFLOW-2429] Fix security/task/sensors/ti_deps folders flake8 error
- [AIRFLOW-2550] Implements API endpoint to list DAG runs
- [AIRFLOW-2512][AIRFLOW-2522] Use google-auth instead of oauth2client
- [AIRFLOW-2429] Fix operators folder flake8 error
- [AIRFLOW-2585] Fix several bugs in CassandraHook and CassandraToGCSOperator
- [AIRFLOW-2597] Restore original dbapi.run() behavior
- [AIRFLOW-2590] Fix commit in DbApiHook.run() for no-autocommit DB
- [AIRFLOW-1115] fix github oauth api URL
- [AIRFLOW-2587] Add TIMESTAMP type mapping to MySqlToHiveTransfer
- [AIRFLOW-2591][AIRFLOW-2581] Set default value of autocommit to False in DbApiHook.run()
- [AIRFLOW-59] Implement bulk_dump and bulk_load for the Postgres hook
- [AIRFLOW-2533] Fix path to DAG's on kubernetes executor workers
- [AIRFLOW-2581] RFLOW-2581] Fix DbApiHook autocommit
- [AIRFLOW-2578] Add option to use proxies in JiraHook
- [AIRFLOW-2575] Make gcs to gcs operator work with large files
- [AIRFLOW-437] Send TI context in kill zombies
- [AIRFLOW-2566] Change backfill to rerun failed tasks
- [AIRFLOW-1021] Fix double login for new users with LDAP
- [AIRFLOW-XXX] Typo fix
- [AIRFLOW-2561] Fix typo in EmailOperator
- [AIRFLOW-2573] Cast BigQuery TIMESTAMP field to float
- [AIRFLOW-2560] Adding support for internalIpOnly to DataprocClusterCreateOperator
- [AIRFLOW-2565] templatize cluster_label
- [AIRFLOW-83] add mongo hook and operator
- [AIRFLOW-2558] Clear task/dag is clearing all executions
- [AIRFLOW-XXX] Fix doc typos
- [AIRFLOW-2513] Change *bql* to *sql* for BigQuery Hooks & Ops

- [AIRFLOW-2557] Fix pagination for s3
- [AIRFLOW-2545] Eliminate DeprecationWarning
- [AIRFLOW-2500] Fix MySqlToHiveTransfer to transfer unsigned type properly
- [AIRFLOW-2462] Change PasswordUser setter to correct syntax
- [AIRFLOW-2525] Fix a bug introduced by commit dabf1b9
- [AIRFLOW-2553] Add webserver.pid to .gitignore
- [AIRFLOW-1863][AIRFLOW-2529] Add dag run selection widgets to gantt view
- [AIRFLOW-2504] Log username correctly and add extra to search columns
- [AIRFLOW-2551] Encode binary data with base64 standard rather than base64 url
- [AIRFLOW-2537] Add reset-dagrun option to backfill command
- [AIRFLOW-2526] dag_run.conf can override params
- [AIRFLOW-2544][AIRFLOW-1967] Guard against next major release of Celery, Flower
- [AIRFLOW-XXX] Add Yieldr to who is using airflow
- [AIRFLOW-2547] Describe how to run tests using Docker
- [AIRFLOW-2538] Update faq doc on how to reduce airflow scheduler latency
- [AIRFLOW-2529] Improve graph view performance and usability
- [AIRFLOW-2517] backfill support passing key values through CLI
- [AIRFLOW-2532] Support logs_volume_subpath for KubernetesExecutor
- [AIRFLOW-2466] consider task_id in _change_state_for_tis_without_dagrun
- [AIRFLOW-2519] Fix CeleryExecutor with SQLAlchemy
- [AIRFLOW-2402] Fix RBAC task log
- [AIRFLOW-XXX] Add M4U to user list
- [AIRFLOW-2536] docs about how to deal with airflow initdb failure
- [AIRFLOW-2530] KubernetesOperator supports multiple clusters
- [AIRFLOW-1499] Eliminate duplicate and unneeded code
- [AIRFLOW-2521] backfill - make variable name and logging messages more acurate
- [AIRFLOW-2429] Fix hook, macros folder flake8 error
- [Airflow-XXX] add Prime to company list
- [AIRFLOW-2525] Fix PostgresHook.copy_expert to work with "COPY FROM"
- [AIRFLOW-2515] Add dependency on thrift_sasl to hive extra
- [AIRFLOW-2523] Add how-to for managing GCP connections
- [AIRFLOW-2510] Introduce new macros: prev_ds and next_ds
- [AIRFLOW-1730] Unpickle value of XCom queried from DB
- [AIRFLOW-2518] Fix broken ToC links in integration.rst
- [AIRFLOW-1472] Fix SLA misses triggering on skipped tasks.
- [AIRFLOW-2520] CLI - make backfill less verbose

- [AIRFLOW-2107] add time_partitioning to run_query on BigQueryBaseCursor
- [AIRFLOW-1057][AIRFLOW-1380][AIRFLOW-2362][2362] AIRFLOW Update DockerOperator to new API
- [AIRFLOW-2415] Make airflow DAG templating render numbers
- [AIRFLOW-2473] Fix wrong skip condition for TransferTests
- [AIRFLOW-2472] Implement MySqlHook.bulk_dump
- [AIRFLOW-2419] Use default view for subdag operator
- [AIRFLOW-2498] Fix Unexpected argument in SFTP Sensor
- [AIRFLOW-2509] Separate config docs into how-to guides
- [AIRFLOW-2429] Add BaseExecutor back
- [AIRFLOW-2429] Fix dag, example_dags, executors flake8 error
- [AIRFLOW-2502] Change Single triple quotes to double for docstrings
- [AIRFLOW-2503] Fix broken links in CONTRIBUTING.md
- [AIRFLOW-2501] Refer to devel instructions in docs contrib guide
- [AIRFLOW-2429] Fix contrib folder's flake8 errors
- [AIRFLOW-2471] Fix HiveCliHook.load_df to use unused parameters
- [AIRFLOW-2495] Update celery to 4.1.1
- [AIRFLOW-2429] Fix api, bin, config_templates folders flake8 error
- [AIRFLOW-2493] Mark template_fields of all Operators in the API document as "templated"
- [AIRFLOW-2489] Update FlaskAppBuilder to 1.11.1
- [AIRFLOW-2448] Enhance HiveCliHook.load_df to work with datetime
- [AIRFLOW-2487] Enhance druid ingestion hook
- [AIRFLOW-2397] Support affinity policies for Kubernetes executor/operator
- [AIRFLOW-2482] Add test for rewrite method in GCS Hook
- [AIRFLOW-2481] Fix flaky Kubernetes test
- [AIRFLOW-2479] Improve doc FAQ section
- [AIRFLOW-2485] Fix Incorrect logging for Qubole Sensor
- [AIRFLOW-2486] Remove unnecessary slash after port
- [AIRFLOW-2429] Make Airflow flake8 compliant
- [AIRFLOW-2491] Resolve flask version conflict
- [AIRFLOW-2484] Remove duplicate key in MySQL to GCS Op
- [ARIFLOW-2458] Add cassandra-to-gcs operator
- [AIRFLOW-2477] Improve time units for task duration and landing times charts for RBAC UI
- [AIRFLOW-2474] Only import snakebite if using py2
- [AIRFLOW-48] Parse connection uri querystring
- [AIRFLOW-2467][AIRFLOW-2] Update import direct warn message to use the module name
- [AIRFLOW-XXX] Fix order of companies

- [AIRFLOW-2452] Document field_dict must be OrderedDict
- [AIRFLOW-2420] Azure Data Lake Hook
- [AIRFLOW-2213] Add Quoble check operator
- [AIRFLOW-2465] Fix wrong module names in the doc
- [AIRFLOW-1929] Modifying TriggerDagRunOperator to accept execution_date
- [AIRFLOW-2460] Users can now use volume mounts and volumes
- [AIRFLOW-2110][AIRFLOW-2122] Enhance Http Hook
- [AIRFLOW-XXX] Updated contributors list
- [AIRFLOW-2435] Add launch_type to ECSOperator to allow FARGATE
- [AIRFLOW-2451] Remove extra slash ('/') char when using wildcard in gcs_to_gcs operator
- [AIRFLOW-2461] Add support for cluster scaling on dataproc operator
- [AIRFLOW-2376] Fix no hive section error
- [AIRFLOW-2425] Add lineage support
- [AIRFLOW-2430] Extend query batching to additional slow queries
- [AIRFLOW-2453] Add default nil value for kubernetes/git_subpath
- [AIRFLOW-2396] Add support for resources in kubernetes operator
- [AIRFLOW-2169] Encode binary data with base64 before importing to BigQuery
- [AIRFLOW-XXX] Add spotahome in user list
- [AIRFLOW-2457] Update FAB version requirement
- [AIRFLOW-2454][Airflow 2454] Support imagePullPolicy for k8s
- [AIRFLOW-2450] update supported k8s versions to 1.9 and 1.10
- [AIRFLOW-2333] Add Segment Hook and TrackEventOperator
- [AIRFLOW-2442][AIRFLOW-2] Airflow run command leaves database connections open
- [AIRFLOW-2016] assign template_fields for Dataproc Workflow Template sub-classes, not base class
- [AIRFLOW-2446] Add S3ToRedshiftTransfer into the "Integration" doc
- [AIRFLOW-2449] Fix operators.py to run all test cases
- [AIRFLOW-2424] Add dagrun status endpoint and increased k8s test coverage
- [AIRFLOW-2441] Fix bugs in HiveCliHook.load_df
- [AIRFLOW-2358][AIRFLOW-201804] Make the Kubernetes example optional
- [AIRFLOW-2436] Remove cli_logger in initdb
- [AIRFLOW-2444] Remove unused option(include_adhoc) in cli backfill command
- [AIRFLOW-2447] Fix TestHiveMetastoreHook to run all cases
- [AIRFLOW-2445] Allow templating in kubernetes operator
- [AIRFLOW-2086][AIRFLOW-2393] Customize default dagrun number in tree view
- [AIRFLOW-2437] Add PubNub to list of current airflow users
- [AIRFLOW-XXX] Add Quantopian to list of Airflow users

- [AIRFLOW-1978] Add WinRM windows operator and hook
- [AIRFLOW-2427] Add tests to named hive sensor
- [AIRFLOW-2412] Fix HiveCliHook.load_file to address HIVE-10541
- [AIRFLOW-2431] Add the navigation bar color parameter for RBAC UI
- [AIRFLOW-2407] Resolve Python undefined names
- [AIRFLOW-1952] Add the navigation bar color parameter
- [AIRFLOW-2222] Implement GoogleCloudStorageHook.rewrite
- [AIRFLOW-2426] Add Google Cloud Storage Hook tests
- [AIRFLOW-2418] Bump Flask-WTF
- [AIRFLOW-2417] Wait for pod is not running to end task
- [AIRFLOW-1914] Add other charset support to email utils
- [AIRFLOW-XXX] Update README.md with Craig@Work
- [AIRFLOW-1899] Fix Kubernetes tests
- [AIRFLOW-1812] Update logging example
- [AIRFLOW-2313] Add TTL parameters for Dataproc
- [AIRFLOW-2411] add dataproc_jars to templated_fields
- [AIRFLOW-XXX] Add Reddit to Airflow users
- [AIRFLOW-XXX] Fix wrong table header in scheduler.rst
- [AIRFLOW-2409] Supply password as a parameter
- [AIRFLOW-2410][AIRFLOW-75] Set the timezone in the RBAC Web UI
- [AIRFLOW-2394] default cmds and arguments in kubernetes operator
- [AIRFLOW-2406] Add Apache2 License Shield to Readme
- [AIRFLOW-2404] Add additional documentation for unqueued task
- [AIRFLOW-2400] Add Ability to set Environment Variables for K8s
- [AIRFLOW-XXX] Add Twine Labs as an Airflow user
- [AIRFLOW-1853] Show only the desired number of runs in tree view
- [AIRFLOW-2401] Document the use of variables in Jinja template
- [AIRFLOW-2403] Fix License Headers
- [AIRFLOW-1313] Fix license header
- [AIRFLOW-2398] Add BounceX to list of current airflow users
- [AIRFLOW-2363] Fix return type bug in TaskHandler
- [AIRFLOW-2389] Create a pinot db api hook
- [AIRFLOW-2390] Resolve FlaskWTFDeprecationWarning
- [AIRFLOW-1933] Fix some typos
- [AIRFLOW-1960] Add support for secrets in kubernetes operator
- [AIRFLOW-1313] Add vertica_to_mysql operator

- [AIRFLOW-1575] Add AWS Kinesis Firehose Hook for inserting batch records
- [AIRFLOW-2266][AIRFLOW-2343] Remove google-cloud-dataflow dependency
- [AIRFLOW-2370] Implement –use_random_password in create_user
- [AIRFLOW-2348] Strip path prefix from the destination_object when source_object contains a wildcard[]
- [AIRFLOW-2391] Fix to Flask 0.12.2
- [AIRFLOW-2381] Fix the flaky ApiPasswordTests test
- [AIRFLOW-2378] Add Groupon to list of current users
- [AIRFLOW-2382] Fix wrong description for delimiter
- [AIRFLOW-2380] Add support for environment variables in Spark submit operator.
- [AIRFLOW-2377] Improve Sendgrid sender support
- [AIRFLOW-2331] Support init action timeout on dataproc cluster create
- [AIRFLOW-1835] Update docs: Variable file is json
- [AIRFLOW-1781] Make search case-insensitive in LDAP group
- [AIRFLOW-2042] Fix browser menu appearing over the autocomplete menu
- [AIRFLOW-XXX] Remove wheelhouse files from travis not owned by travis
- [AIRFLOW-2336] Use hmsclient in hive_hook
- [AIRFLOW-2041] Correct Syntax in python examples
- [AIRFLOW-74] SubdagOperators can consume all celeryd worker processes
- [AIRFLOW-2369] Fix gcs tests
- [AIRFLOW-2365] Fix autocommit attribute check
- [AIRFLOW-2068] MesosExecutor allows optional Docker image
- [AIRFLOW-1652] Push DatabricksRunSubmitOperator metadata into XCOM
- [AIRFLOW-2234] Enable insert_rows for PrestoHook
- [AIRFLOW-2208][Airflow-22208] Link to same DagRun graph from TaskInstance view
- [AIRFLOW-1153] Allow HiveOperators to take hiveconfs
- [AIRFLOW-775] Fix autocommit settings with Jdbc hook
- [AIRFLOW-2364] Warn when setting autocommit on a connection which does not support it
- [AIRFLOW-2357] Add persistent volume for the logs
- [AIRFLOW-766] Skip conn.commit() when in Auto-commit
- [AIRFLOW-2351] Check for valid default_args start_date
- [AIRFLOW-1433] Set default rbac to initdb
- [AIRFLOW-2270] Handle removed tasks in backfill
- [AIRFLOW-2344] Fix *connections -l* to work with pipe/redirect
- [AIRFLOW-2300] Add S3 Select functionarity to S3ToHiveTransfer
- [AIRFLOW-1314] Cleanup the config
- [AIRFLOW-1314] Polish some of the Kubernetes docs/config

- [AIRFLOW-1314] Improve error handling
- [AIRFLOW-1999] Add per-task GCP service account support
- [AIRFLOW-1314] Rebasing against master
- [AIRFLOW-1314] Small cleanup to address PR comments (#24)
- [AIRFLOW-1314] Add executor_config and tests
- [AIRFLOW-1314] Improve k8s support
- [AIRFLOW-1314] Use VolumeClaim for transporting DAGs
- [AIRFLOW-1314] Create integration testing environment
- [AIRFLOW-1314] Git Mode to pull in DAGs for Kubernetes Executor
- [AIRFLOW-1314] Add support for volume mounts & Secrets in Kubernetes Executor
- [AIRFLOW=1314] Basic Kubernetes Mode
- [AIRFLOW-2326][AIRFLOW-2222] remove contrib.gcs_copy_operator
- [AIRFLOW-2328] Fix empty GCS blob in S3ToGoogleCloudStorageOperator
- [AIRFLOW-2350] Fix grammar in UPDATING.md
- [AIRFLOW-2302] Fix documentation
- [AIRFLOW-2345] pip is not used in this setup.py
- [AIRFLOW-2347] Add Banco de Formaturas to Readme
- [AIRFLOW-2346] Add Investorise as official user of Airflow
- [AIRFLOW-2330] Do not append destination prefix if not given
- [AIRFLOW-2240][DASK] Added TLS/SSL support for the dask-distributed scheduler.
- [AIRFLOW-2309] Fix duration calculation on TaskFail
- [AIRFLOW-2335] fix issue with jdk8 download for ci
- [AIRFLOW-2184] Add druid_checker_operator
- [AIRFLOW-2299] Add S3 Select functionarity to S3FileTransformOperator
- [AIRFLOW-2254] Put header as first row in unload
- [AIRFLOW-610] Respect _cmd option in config before defaults
- [AIRFLOW-2287] Fix incorrect ASF headers
- [AIRFLOW-XXX] Add Zego as an Apache Airflow user
- [AIRFLOW-952] fix save empty extra field in UI
- [AIRFLOW-1325] Add ElasticSearch log handler and reader
- [AIRFLOW-2301] Sync files of an S3 key with a GCS path
- [AIRFLOW-2293] Fix S3FileTransformOperator to work with boto3
- [AIRFLOW-3212][AIRFLOW-2314] Remove only leading slash in GCS path
- [AIRFLOW-1509][AIRFLOW-442] SFTP Sensor
- [AIRFLOW-2291] Add optional params to ML Engine
- [AIRFLOW-1774] Allow consistent templating of arguments in MLEngineBatchPredictionOperator

- [AIRFLOW-2302] Add missing operators and hooks
- [AIRFLOW-2312] Docs Typo Correction: Corresponding
- [AIRFLOW-1623] Trigger on_kill method in operators
- [AIRFLOW-2162] When impersonating another user, pass env variables to sudo
- [AIRFLOW-2304] Update quickstart doc to mention scheduler part
- [AIRFLOW-1633] docker_operator needs a way to set shm_size
- [AIRFLOW-1340] Add S3 to Redshift transfer operator
- [AIRFLOW-2303] Lists the keys inside an S3 bucket
- [AIRFLOW-2209] restore flask_login imports
- [AIRFLOW-2306] Add Bonnier Broadcasting to list of current users
- [AIRFLOW-2305][AIRFLOW-2027] Fix CI failure caused by []
- [AIRFLOW-2281] Add support for Sendgrid categories
- [AIRFLOW-2027] Only trigger sleep in scheduler after all files have parsed
- [AIRFLOW-2256] SparkOperator: Add Client Standalone mode and retry mechanism
- [AIRFLOW-2284] GCS to S3 operator
- [AIRFLOW-2287] Update license notices
- [AIRFLOW-2296] Add Cinimex DataLab to Readme
- [AIRFLOW-2298] Add Kalibrr to who uses airflow
- [AIRFLOW-2292] Fix docstring for S3Hook.get_wildcard_key
- [AIRFLOW-XXX] Update PR template
- [AIRFLOW-XXX] Remove outdated migrations.sql
- [AIRFLOW-2287] Add license header to docs/Makefile
- [AIRFLOW-2286] Add tokopedia to the readme
- [AIRFLOW-2273] Add Discord webhook operator/hook
- [AIRFLOW-2282] Fix grammar in UPDATING.md
- [AIRFLOW-2200] Add snowflake operator with tests
- [AIRFLOW-2178] Add handling on SLA miss errors
- [AIRFLOW-2169] Fix type 'bytes' is not JSON serializable in python3
- [AIRFLOW-2215] Pass environment to subproces.Popen in base_task_runner
- [AIRFLOW-2253] Add Airflow CLI instrumentation
- [AIRFLOW-2274] Fix Dataflow tests
- [AIRFLOW-2269] Add Custom Ink as an Airflow user
- [AIRFLOW-2259] Dataflow Hook Index out of range
- [AIRFLOW-2233] Update updating.md to include the info of hdfs_sensors renaming
- [AIRFLOW-2217] Add Slack webhook operator
- [AIRFLOW-1729] improve dagBag time

- [AIRFLOW-2264] Improve create_user cli help message
- [AIRFLOW-2260] [AIRFLOW-2260] SSHOperator add command template .sh files
- [AIRFLOW-2261] Check config/env for remote base log folder
- [AIRFLOW-2258] Allow import of Parquet-format files into BigQuery
- [AIRFLOW-1430] Include INSTALL instructions to avoid GPL
- [AIRFLOW-1430] Solve GPL dependency
- [AIRFLOW-2251] Add Thinknear as an Airflow user
- [AIRFLOW-2244] bugfix: remove legacy LongText code from models.py
- [AIRFLOW-2247] Fix RedshiftToS3Transfer not to fail with ValueError
- [AIRFLOW-2249] Add side-loading support for Zendesk Hook
- [AIRFLOW-XXX] Add Qplum to Airflow users
- [AIRFLOW-2228] Enhancements in ValueCheckOperator
- [AIRFLOW-1206] Typos
- [AIRFLOW-2060] Update pendulum version to 1.4.4
- [AIRFLOW-2248] Fix wrong param name in RedshiftToS3Transfer doc
- [AIRFLOW-1433][AIRFLOW-85] New Airflow Webserver UI with RBAC support
- [AIRFLOW-1235] Fix webserver's odd behaviour
- [AIRFLOW-1460] Allow restoration of REMOVED TI's
- [airflow-2235] Fix wrong docstrings in two operators
- [AIRFLOW-XXX] Fix chronological order for companies using Airflow
- [AIRFLOW-2124] Upload Python file to a bucket for Dataproc
- [AIRFLOW-2212] Fix ungenerated sensor API reference
- [AIRFLOW-2226] Rename google_cloud_storage_default to google_cloud_default
- [AIRFLOW-2211] Rename hdfs_sensors.py to hdfs_sensor.py for consistency
- [AIRFLOW-2225] Update document to include DruidDbApiHook
- [Airflow-2202] Add filter support in HiveMetastoreHook().max_partition()
- [AIRFLOW-2220] Remove duplicate numeric list entry in security.rst
- [AIRFLOW-XXX] Update tutorial documentation
- [AIRFLOW-2215] Update celery task to preserve environment variables and improve logging on exception
- [AIRFLOW-2185] Use state instead of query param
- [AIRFLOW-2183] Refactor DruidHook to enable sql
- [AIRFLOW-2203] Defer cycle detection
- [AIRFLOW-2203] Remove Useless Commands.
- [AIRFLOW-2203] Cache signature in apply_defaults
- [AIRFLOW-2203] Speed up Operator Resources
- [AIRFLOW-2203] Cache static rules (trigger/weight)

- [AIRFLOW-2203] Store task ids as sets not lists
- [AIRFLOW-2205] Remove unsupported args from JdbcHook doc
- [AIRFLOW-2207] Fix flaky test that uses app.cached_app()
- [AIRFLOW-2206] Remove unsupported args from JdbcOperator doc
- [AIRFLOW-2140] Add Kubernetes scheduler to SparkSubmitOperator
- [AIRFLOW-XXX] Add Xero to list of users
- [AIRFLOW-2204] Fix webserver debug mode
- [AIRFLOW-102] Fix test_complex_template always succeeds
- [AIRFLOW-442] Add SFTPHook
- [AIRFLOW-2169] Add schema to MySqlToGoogleCloudStorageOperator
- [AIRFLOW-2184][AIRFLOW-2138] Google Cloud Storage allow wildcards
- [AIRFLOW-1588] Cast Variable value to string
- [AIRFLOW-2199] Fix invalid reference to logger
- [AIRFLOW-2191] Change scheduler heartbeat logs from info to debug
- [AIRFLOW-2106] SalesForce hook sandbox option
- [AIRFLOW-2197] Silence hostname_callable config error message
- [AIRFLOW-2150] Use lighter call in HiveMetastoreHook().max_partition()
- [AIRFLOW-2186] Change the way logging is carried out in few ops
- [AIRFLOW-2181] Convert password_auth and test_password_endpoints from DOS to UNIX
- [AIRFLOW-2187] Fix Broken Travis CI due to AIRFLOW-2123
- [AIRFLOW-2175] Check that filepath is not None
- [AIRFLOW-2173] Don’t check task IDs for concurrency reached check
- [AIRFLOW-2168] Remote logging for Azure Blob Storage
- [AIRFLOW-XXX] Add DocuTAP to list of users
- [AIRFLOW-2176] Change the way logging is carried out in BQ Get Data Operator
- [AIRFLOW-2177] Add mock test for GCS Download op
- [AIRFLOW-2123] Install CI dependencies from setup.py
- [AIRFLOW-2129] Presto hook calls _parse_exception_message but defines _get_pretty_exception_message
- [AIRFLOW-2174] Fix typos and wrongly rendered documents
- [AIRFLOW-2171] Store delegated credentials
- [AIRFLOW-2166] Restore BQ run_query dialect param
- [AIRFLOW-2163] Add HBC Digital to users of airflow
- [AIRFLOW-2065] Fix race-conditions when creating loggers
- [AIRFLOW-2147] Plugin manager: added ‘sensors’ attribute
- [AIRFLOW-2059] taskinstance query is awful, un-indexed, and does not scale
- [AIRFLOW-2159] Fix a few typos in salesforce_hook

- [AIRFLOW-2132] Add step to initialize database
- [AIRFLOW-2160] Fix bad rowid deserialization
- [AIRFLOW-2161] Add Vevo to list of companies using Airflow
- [AIRFLOW-2149] Add link to apache Beam documentation to create self executing Jar
- [AIRFLOW-2151] Allow getting the session from AwsHook
- [AIRFLOW-2097] tz referenced before assignment
- [AIRFLOW-2152] Add Multiply to list of companies using Airflow
- [AIRFLOW-1551] Add operator to trigger Jenkins job
- [AIRFLOW-2034] Fix mixup between %s and {} when using str.format Convention is to use .format for string formating oustide logging, else use lazy format See comment in related issue https://github.com/apache/airflow/pull/2823/files Identified problematic case using following command line .git/COMMIT_EDITMSG:*grep -r '%s'./* | grep '.format('*
- [AIRFLOW-2102] Add custom_args to Sendgrid personalizations
- [AIRFLOW-1035][AIRFLOW-1053] import unicode_literals to parse Unicode in HQL
- [AIRFLOW-2127] Keep loggers during DB migrations
- [AIRFLOW-2146] Resolve issues with BQ using DbApiHook methods
- [AIRFLOW-2087] Scheduler Report shows incorrect Total task number
- [AIRFLOW-2139] Remove unncecessary boilerplate to get DataFrame using pandas_gbq
- [AIRFLOW-2125] Using binary package psycopg2-binary
- [AIRFLOW-2142] Include message on mkdir failure
- [AIRFLOW-1615] SSHHook: use port specified by Connection
- [AIRFLOW-2122] Handle boolean values in sshHook
- [AIRFLOW-XXX] Add Tile to the list of users
- [AIRFLOW-2130] Add missing Operators to API Reference docs
- [AIRFLOW-XXX] Add timeout units (seconds)
- [AIRFLOW-2134] Add Alan to the list of companies that use Airflow
- [AIRFLOW-2133] Remove references to GitHub issues in CONTRIBUTING
- [AIRFLOW-2131] Remove confusing AirflowImport docs
- [AIRFLOW-1852] Allow hostname to be overridable.
- [AIRFLOW-2126] Add Bluecore to active users
- [AIRFLOW-1618] Add feature to create GCS bucket
- [AIRFLOW-2108] Fix log indentation in BashOperator
- [AIRFLOW-2115] Fix doc links to PythonHosted
- [AIRFLOW-XXX] Add contributor from Easy company
- [AIRFLOW-1882] Add ignoreUnknownValues option to gcs_to_bq operator
- [AIRFLOW-2089] Add on kill for SparkSubmit in Standalone Cluster

- [AIRFLOW-2113] Address missing DagRun callbacks Given that the handle_callback method belongs to the DAG object, we are able to get the list of task directly with get_task and reduce the communication with the database, making airflow more lightweight.
- [AIRFLOW-2112] Fix svg width for Recent Tasks on UI.
- [AIRFLOW-2116] Set CI Cloudant version to <2.0
- [AIRFLOW-XXX] Add PMC to list of companies using Airflow
- [AIRFLOW-2100] Fix Broken Documentation Links
- [AIRFLOW-1404] Add 'flatten_results' & 'maximum_bytes_billed' to BQ Operator
- [AIRFLOW-800] Initialize valid Google BigQuery Connection
- [AIRFLOW-1319] Fix misleading SparkSubmitOperator and SparkSubmitHook docstring
- [AIRFLOW-1983] Parse environment parameter as template
- [AIRFLOW-2095] Add operator to create External BigQuery Table
- [AIRFLOW-2085] Add SparkJdbc operator
- [AIRFLOW-1002] Add ability to clean all dependencies of removed DAG
- [AIRFLOW-2094] Jinjafied project_id, region & zone in DataProc{*} Operators
- [AIRFLOW-2092] Fixed incorrect parameter in docstring for FTPHook
- [AIRFLOW-XXX] Add SocialCops to Airflow users
- [AIRFLOW-2088] Fix duplicate keys in MySQL to GCS Helper function
- [AIRFLOW-2091] Fix incorrect docstring parameter in BigQuery Hook
- [AIRFLOW-2090] Fix typo in DataStore Hook
- [AIRFLOW-1157] Fix missing pools crashing the scheduler
- [AIRFLOW-713] Jinjafy {EmrCreateJobFlow,EmrAddSteps}Operator attributes
- [AIRFLOW-2083] Docs: Use "its" instead of "it's" where appropriate
- [AIRFLOW-2066] Add operator to create empty BQ table
- [AIRFLOW-XXX] add Karmic to list of companies
- [AIRFLOW-2073] Make FileSensor fail when the file doesn't exist
- [AIRFLOW-2078] Improve task_stats and dag_stats performance
- [AIRFLOW-2080] Use a log-out icon instead of a power button
- [AIRFLOW-2077] Fetch all pages of list_objects_v2 response
- [AIRFLOW-XXX] Add TM to list of companies
- [AIRFLOW-1985] Impersonation fixes for using *run_as_user*
- [AIRFLOW-2018][AIRFLOW-2] Make Sensors backward compatible
- [AIRFLOW-XXX] Fix typo in concepts doc (dag_md)
- [AIRFLOW-2069] Allow Bytes to be uploaded to S3
- [AIRFLOW-2074] Fix log var name in GHE auth
- [AIRFLOW-1927] Convert naive datetimes for TaskInstances
- [AIRFLOW-1760] Password auth for experimental API

- [AIRFLOW-2038] Add missing kubernetes dependency for dev
- [AIRFLOW-2040] Escape special chars in task instance logs URL
- [AIRFLOW-1968][AIRFLOW-1520] Add role_arn and aws_account_id/aws_iam_role support back to aws hook
- [AIRFLOW-2048] Fix task instance failure string formatting
- [AIRFLOW-2046] Fix kerberos error to work with python 3.x
- [AIRFLOW-2063] Add missing docs for GCP
- [AIRFLOW-XXX] Fix typo in docs
- [AIRFLOW-1793] Use docker_url instead of invalid base_url
- [AIRFLOW-2055] Elaborate on slightly ambiguous documentation
- [AIRFLOW-2039] BigQueryOperator supports priority property
- [AIRFLOW-2053] Fix quote character bug in BQ hook
- [AIRFLOW-2057] Add Overstock to list of companies
- [AIRFLOW-XXX] Add Plaid to Airflow users
- [AIRFLOW-2044] Add SparkSubmitOperator to documentation
- [AIRFLOW-2037] Add methods to get Hash values of a GCS object
- [AIRFLOW-2050] Fix Travis permission problem
- [AIRFLOW-2043] Add Intercom to list of companies
- [AIRFLOW-2023] Add debug logging around number of queued files
- [AIRFLOW-XXX] Add Pernod-ricard as a airflow user
- [AIRFLOW-1453] Add 'steps' into template_fields in EmrAddSteps
- [AIRFLOW-2015] Add flag for interactive runs
- [AIRFLOW-1895] Fix primary key integrity for mysql
- [AIRFLOW-2030] Fix KeyError:*i* in DbApiHook for insert
- [AIRFLOW-1943] Add External BigQuery Table feature
- [AIRFLOW-2033] Add Google Cloud Storage List Operator
- [AIRFLOW-2006] Add local log catching to kubernetes operator
- [AIRFLOW-2031] Add missing gcp_conn_id in the example in DataFlow docstrings
- [AIRFLOW-2029] Fix AttributeError in BigQueryPandasConnector
- [AIRFLOW-2028] Add JobTeaser to official users list
- [AIRFLOW-2016] Add support for Dataproc Workflow Templates
- [AIRFLOW-2025] Reduced Logging verbosity
- [AIRFLOW-1267][AIRFLOW-1874] Add dialect parameter to BigQueryHook
- [AIRFLOW-XXX] Fixed a typo
- [AIRFLOW-XXX] Typo node to nodes
- [AIRFLOW-2019] Update DataflowHook for updating Streaming type job

- [AIRFLOW-2017][Airflow 2017] adding query output to PostgresOperator
- [AIRFLOW-1889] Split sensors into separate files
- [AIRFLOW-1950] Optionally pass xcom_pull task_ids
- [AIRFLOW-1755] Allow mount below root
- [AIRFLOW-511][Airflow 511] add success/failure callbacks on dag level
- [AIRFLOW-192] Add weight_rule param to BaseOperator
- [AIRFLOW-2008] Use callable for python column defaults
- [AIRFLOW-1984] Fix to AWS Batch operator
- [AIRFLOW-2000] Support non-main dataflow job class
- [AIRFLOW-2003] Use flask-caching instead of flask-cache
- [AIRFLOW-2002] Do not swallow exception on logging import
- [AIRFLOW-2004] Import flash from flask not flask.login
- [AIRFLOW-1997] Fix GCP operator doc strings
- [AIRFLOW-1996] Update DataflowHook waitfordone for Streaming type job[]
- [AIRFLOW-1995][Airflow 1995] add on_kill method to SqoopOperator
- [AIRFLOW-1770] Allow HiveOperator to take in a file
- [AIRFLOW-1994] Change background color of Scheduled state Task Instances
- [AIRFLOW-1436][AIRFLOW-1475] EmrJobFlowSensor considers Cancelled step as Successful
- [AIRFLOW-1517] Kubernetes operator PR fixes
- [AIRFLOW-1517] addressed PR comments
- [AIRFLOW-1517] started documentation of k8s operator
- [AIRFLOW-1517] Restore authorship of resources
- [AIRFLOW-1517] Remove authorship of resources
- [AIRFLOW-1517] Add minikube for kubernetes integration tests
- [AIRFLOW-1517] Restore authorship of resources
- [AIRFLOW-1517] fixed license issues
- [AIRFLOW-1517] Created more accurate failures for kube cluster issues
- [AIRFLOW-1517] Remove authorship of resources
- [AIRFLOW-1517] Add minikube for kubernetes integration tests
- [AIRFLOW-1988] Change BG color of None state TIs
- [AIRFLOW-790] Clean up TaskInstances without DagRuns
- [AIRFLOW-1949] Fix var upload, str() produces "b'. . . '" which is not json
- [AIRFLOW-1930] Convert func.now() to timezone.utcnow()
- [AIRFLOW-1688] Support load.time_partitioning in bigquery_hook
- [AIRFLOW-1975] Make TriggerDagRunOperator callback optional
- [AIRFLOW-1480] Render template attributes for ExternalTaskSensor fields

- [AIRFLOW-1958] Add **kwargs to send_email
- [AIRFLOW-1976] Fix for missing log/logger attribute FileProcessHandler
- [AIRFLOW-1982] Fix Executor event log formatting
- [AIRFLOW-1971] Propagate hive config on impersonation
- [AIRFLOW-1969] Always use HTTPS URIs for Google OAuth2
- [AIRFLOW-1954] Add DataFlowTemplateOperator
- [AIRFLOW-1963] Add config for HiveOperator mapred_queue
- [AIRFLOW-1946][AIRFLOW-1855] Create a BigQuery Get Data Operator
- [AIRFLOW-1953] Add labels to dataflow operators
- [AIRFLOW-1967] Update Celery to 4.0.2
- [AIRFLOW-1964] Add Upsight to list of Airflow users
- [AIRFLOW-XXX] Changelog for 1.9.0
- [AIRFLOW-1470] Implement BashSensor operator
- [AIRFLOW-XXX] Pin sqlalchemy dependency
- [AIRFLOW-1955] Do not reference unassigned variable
- [AIRFLOW-1957] Add contributor to BalanceHero in Readme
- [AIRFLOW-1517] Restore authorship of secrets and init container
- [AIRFLOW-1517] Remove authorship of secrets and init container
- [AIRFLOW-1935] Add BalanceHero to readme
- [AIRFLOW-1939] add astronomer contributors
- [AIRFLOW-1517] Kubernetes Operator
- [AIRFLOW-1928] Fix @once with catchup=False
- [AIRFLOW-1937] Speed up scheduling by committing in batch
- [AIRFLOW-1821] Enhance default logging config by removing extra loggers
- [AIRFLOW-1904] Correct DAG fileloc to the right filepath
- [AIRFLOW-1909] Update docs with supported versions of MySQL server
- [AIRFLOW-1915] Relax flask-wtf dependency specification
- [AIRFLOW-1920] Update CONTRIBUTING.md to reflect enforced linting rules
- [AIRFLOW-1942] Update Sphinx docs to remove deprecated import structure
- [AIRFLOW-1846][AIRFLOW-1697] Hide Ad Hoc Query behind secure_mode config
- [AIRFLOW-1948] Include details for on_kill failure
- [AIRFLOW-1938] Clean up unused exception
- [AIRFLOW-1932] Add GCP Pub/Sub Pull and Ack
- [AIRFLOW-XXX] Purge coveralls
- [AIRFLOW-XXX] Remove unused coveralls token
- [AIRFLOW-1938] Remove tag version check in setup.py

- [AIRFLOW-1916] Don't upload logs to remote from *run –raw*
- [AIRFLOW-XXX] Fix failing PubSub tests on Python3
- [AIRFLOW-XXX] Upgrade to python 3.5 and disable dask tests
- [AIRFLOW-1913] Add new GCP PubSub operators
- [AIRFLOW-1525] Fix minor LICENSE and NOTICE issues
- [AIRFLOW-1687] fix fernet error without encryption
- [AIRFLOW-1912] airflow.processor should not propagate logging
- [AIRFLOW-1911] Rename celeryd_concurrency
- [AIRFLOW-1885] Fix IndexError in ready_prefix_on_cmdline
- [AIRFLOW-1854] Improve Spark Submit operator for standalone cluster mode
- [AIRFLOW-1908] Fix celery broker options config load
- [AIRFLOW-1907] Pass max_ingestion_time to Druid hook
- [AIRFLOW-1909] Add away to list of users
- [AIRFLOW-1893][AIRFLOW-1901] Propagate PYTHONPATH when using impersonation
- [AIRFLOW-1892] Modify BQ hook to extract data filtered by column
- [AIRFLOW-1829] Support for schema updates in query jobs
- [AIRFLOW-1840] Make celery configuration congruent with Celery 4
- [AIRFLOW-1878] Fix stderr/stdout redirection for tasks
- [AIRFLOW-1897][AIRFLOW-1873] Task Logs for running instance not visible in WebUI
- [AIRFLOW-1896] FIX bleach <> html5lib incompatibility
- [AIRFLOW-1884][AIRFLOW-1059] Reset orphaned task state for external dagruns
- [AIRFLOW-XXX] Fix typo in comment
- [AIRFLOW-1869] Do not emit spurious warning on missing logs
- [AIRFLOW-1888] Add AWS Redshift Cluster Sensor
- [AIRFLOW-1887] Renamed endpoint url variable
- [AIRFLOW-1873] Set TI.try_number to right value depending TI state
- [AIRFLOW-1891] Fix non-ascii typo in default configuration template
- [AIRFLOW-1879] Handle ti log entirely within ti
- [AIRFLOW-1869] Write more error messages into gcs and file logs
- [AIRFLOW-1876] Write subtask id to task log header
- [AIRFLOW-1554] Fix wrong DagFileProcessor termination method call
- [AIRFLOW-342] Do not use amqp, rpc as result backend
- [AIRFLOW-966] Make celery broker_transport_options configurable
- [AIRFLOW-1881] Make operator log in task log
- [AIRFLOW-XXX] Added DataReply to the list of Airflow Users
- [AIRFLOW-1883] Get File Size for objects in Google Cloud Storage

- [AIRFLOW-1872] Set context for all handlers including parents
- [AIRFLOW-1855][AIRFLOW-1866] Add GCS Copy Operator to copy multiple files
- [AIRFLOW-1870] Enable flake8 tests
- [AIRFLOW-1785] Enable Python 3 tests
- [AIRFLOW-1850] Copy cmd before masking
- [AIRFLOW-1665] Reconnect on database errors
- [AIRFLOW-1559] Dispose SQLAlchemy engines on exit
- [AIRFLOW-1559] Close file handles in subprocesses
- [AIRFLOW-1559] Make database pooling optional
- [AIRFLOW-1848][Airflow-1848] Fix DataFlowPythonOperator py_file extension doc comment
- [AIRFLOW-1843] Add Google Cloud Storage Sensor with prefix
- [AIRFLOW-1803] Time zone documentation
- [AIRFLOW-1826] Update views to use timezone aware objects
- [AIRFLOW-1827] Fix api endpoint date parsing
- [AIRFLOW-1806] Use naive datetime when using cron
- [AIRFLOW-1809] Update tests to use timezone aware objects
- [AIRFLOW-1806] Use naive datetime for cron scheduling
- [AIRFLOW-1807] Force use of time zone aware db fields
- [AIRFLOW-1808] Convert all utcnow() to time zone aware
- [AIRFLOW-1804] Add time zone configuration options
- [AIRFLOW-1802] Convert database fields to timezone aware
- [AIRFLOW-XXX] Add dask lock files to excludes
- [AIRFLOW-1790] Add support for AWS Batch operator
- [AIRFLOW-XXX] Update README.md
- [AIRFLOW-1820] Remove timestamp from metric name
- [AIRFLOW-1810] Remove unused mysql import in migrations.
- [AIRFLOW-1838] Properly log collect_dags exception
- [AIRFLOW-1842] Fixed Super class name for the gcs to gcs copy operator
- [AIRFLOW-1845] Modal background now covers long or tall pages
- [AIRFLOW-1229] Add link to Run Id, incl execution_date
- [AIRFLOW-1842] Add gcs to gcs copy operator with renaming if required
- [AIRFLOW-1841] change False to None in operator and hook
- [AIRFLOW-1839] Fix more bugs in S3Hook boto -> boto3 migration
- [AIRFLOW-1830] Support multiple domains in Google authentication backend
- [AIRFLOW-1831] Add driver-classpath spark submit
- [AIRFLOW-1795] Correctly call S3Hook after migration to boto3

- [AIRFLOW-1811] Fix render Druid operator
- [AIRFLOW-1819] Fix slack operator unittest bug
- [AIRFLOW-1805] Allow Slack token to be passed through connection
- [AIRFLOW-1816] Add region param to Dataproc operators
- [AIRFLOW-868] Add postgres_to_gcs operator and unittests
- [AIRFLOW-1613] make mysql_to_gcs_operator py3 compatible
- [AIRFLOW-1817] use boto3 for s3 dependency
- [AIRFLOW-1813] Bug SSH Operator empty buffer
- [AIRFLOW-1801][AIRFLOW-288] Url encode execution dates
- [AIRFLOW-1563] Catch OSError while symlinking the latest log directory
- [AIRFLOW-1794] Remove uses of Exception.message for Python 3
- [AIRFLOW-1799] Fix logging line which raises errors
- [AIRFLOW-1102] Upgrade Gunicorn >=19.4.0
- [AIRFLOW-1756] Fix S3TaskHandler to work with Boto3-based S3Hook
- [AIRFLOW-1797] S3Hook.load_string didn't work on Python3
- [AIRFLOW-646] Add docutils to setup_requires
- [AIRFLOW-1792] Missing intervals DruidOperator
- [AIRFLOW-1789][AIRFLOW-1712] Log SSHOperator stderr to log.warning
- [AIRFLOW-1787] Fix task instance batch clear and set state bugs
- [AIRFLOW-1780] Fix long output lines with unicode from hanging parent
- [AIRFLOW-387] Close SQLAlchemy sessions properly
- [AIRFLOW-1779] Add keepalive packets to ssh hook
- [AIRFLOW-1669] Fix Docker and pin Moto to 1.1.19
- [AIRFLOW-71] Add support for private Docker images
- [AIRFLOW-XXX] Give a clue what the 'ds' variable is
- [AIRFLOW-XXX] Correct typos in the faq docs page
- [AIRFLOW-1571] Add AWS Lambda Hook
- [AIRFLOW-1675] Fix docstrings for API docs
- [AIRFLOW-1712][AIRFLOW-756][AIRFLOW-751] Log SSHOperator output
- [AIRFLOW-1776] Capture stdout and stderr for logging
- [AIRFLOW-1765] Make experimental API securable without needing Kerberos.
- [AIRFLOW-1764] The web interface should not use the experimental API
- [AIRFLOW-1771] Rename heartbeat to avoid confusion
- [AIRFLOW-1769] Add support for templates in VirtualenvOperator
- [AIRFLOW-1763] Fix S3TaskHandler unit tests
- [AIRFLOW-1315] Add Qubole File & Partition Sensors

- [AIRFLOW-1018] Make processor use logging framework
- [AIRFLOW-1695] Add RedshiftHook using boto3
- [AIRFLOW-1706] Fix query error for MSSQL backend
- [AIRFLOW-1711] Use ldap3 dict for group membership
- [AIRFLOW-1723] Make sendgrid a plugin
- [AIRFLOW-1757] Add missing options to SparkSubmitOperator
- [AIRFLOW-1734][Airflow 1734] Sqoop hook/operator enhancements
- [AIRFLOW-1761] Fix type in scheduler.rst
- [AIRFLOW-1731] Set pythonpath for logging
- [AIRFLOW-1641] Handle executor events in the scheduler
- [AIRFLOW-1744] Make sure max_tries can be set
- [AIRFLOW-1732] Improve dataflow hook logging
- [AIRFLOW-1736] Add HotelQuickly to Who Uses Airflow
- [AIRFLOW-1657] Handle failing qubole operator
- [AIRFLOW-1677] Fix typo in example_qubole_operator
- [AIRFLOW-926] Fix JDBC Hook
- [AIRFLOW-1520] Boto3 S3Hook, S3Log
- [AIRFLOW-1716] Fix multiple __init__ def in SimpleDag
- [AIRFLOW-XXX] Fix DateTime in Tree View
- [AIRFLOW-1719] Fix small typo
- [AIRFLOW-1432] Charts label for Y axis not visible
- [AIRFLOW-1743] Verify ldap filters correctly
- [AIRFLOW-1745] Restore default signal disposition
- [AIRFLOW-1741] Correctly hide second chart on task duration page
- [AIRFLOW-1728] Add networkUri, subnet, tags to Dataproc operator
- [AIRFLOW-1726] Add copy_expert psycopg2 method to PostgresHook
- [AIRFLOW-1330] Add conn_type argument to CLI when adding connection
- [AIRFLOW-1698] Remove SCHEDULER_RUNS env var in systemd
- [AIRFLOW-1694] Stop using itertools.izip
- [AIRFLOW-1692] Change test_views filename to support Windows
- [AIRFLOW-1722] Fix typo in scheduler autorestart output filename
- [AIRFLOW-1723] Support sendgrid in email backend
- [AIRFLOW-1718] Set num_retries on Dataproc job request execution
- [AIRFLOW-1727] Add unit tests for DataProcHook
- [AIRFLOW-1631] Fix timing issue in unit test
- [AIRFLOW-1631] Fix local executor unbound parallelism

- [AIRFLOW-1724] Add Fundera to Who uses Airflow?
- [AIRFLOW-1683] Cancel BigQuery job on timeout.
- [AIRFLOW-1714] Fix misspelling: s/seperate/separate/
- [AIRFLOW-1681] Add batch clear in task instance view
- [AIRFLOW-1696] Fix dataproc version label error
- [AIRFLOW-1613] Handle binary field in MySqlToGoogleCloudStorageOperator
- [AIRFLOW-1697] Mode to disable charts endpoint
- [AIRFLOW-1691] Add better Google cloud logging documentation
- [AIRFLOW-1690] Add detail to gcs error messages
- [AIRFLOW-1682] Make S3TaskHandler write to S3 on close
- [AIRFLOW-1634] Adds task_concurrency feature
- [AIRFLOW-1676] Make GCSTaskHandler write to GCS on close
- [AIRFLOW-1678] Fix erroneously repeated word in function docstrings
- [AIRFLOW-1323] Made Dataproc operator parameter names consistent
- [AIRFLOW-1590] fix unused module and variable
- [AIRFLOW-1671] Add @apply_defaults back to gcs download operator
- [AIRFLOW-988] Fix repeating SLA miss callbacks
- [AIRFLOW-1611] Customize logging
- [AIRFLOW-1668] Expose keepalives_idle for Postgres connections
- [AIRFLOW-1658] Kill Druid task on timeout
- [AIRFLOW-1669][AIRFLOW-1368] Fix Docker import
- [AIRFLOW-891] Make webserver clock include date
- [AIRFLOW-1560] Add AWS DynamoDB hook and operator for inserting batch items
- [AIRFLOW-1654] Show tooltips for link icons in DAGs view
- [AIRFLOW-1660] Change webpage width to full-width
- [AIRFLOW-1664] write file as binary instead of str
- [AIRFLOW-1659] Fix invalid obj attribute bug in file_task_handler.py
- [AIRFLOW-1635] Allow creating GCP connection without requiring a JSON file
- [AIRFLOW-1650] Fix custom celery config loading
- [AIRFLOW-1647] Fix Spark-sql hook
- [AIRFLOW-1587] Fix CeleryExecutor import error
- [Airflow-1640][AIRFLOW-1640] Add qubole default connection
- [AIRFLOW-1576] Added region param to Dataproc{*}Operators
- [AIRFLOW-1643] Add healthjump to officially using list
- [AIRFLOW-1626] Add Azri Solutions to Airflow users
- [AIRFLOW-1636] Add AWS and EMR connection type

- [AIRFLOW-1527] Refactor celery config
- [AIRFLOW-1639] Fix Fernet error handling
- [AIRFLOW-1637] Fix Travis CI build status link
- [AIRFLOW-1628] Fix docstring of sqlsensor
- [AIRFLOW-1331] add SparkSubmitOperator option
- [AIRFLOW-1627] Only query pool in SubDAG init when necessary
- [AIRFLOW-1629] Make extra a textarea in edit connections form
- [AIRFLOW-1368] Automatically remove Docker container on exit
- [AIRFLOW-289] Make airflow timezone independent
- [AIRFLOW-1356] Add *–celery_hostname* to *airflow worker*
- [AIRFLOW-1247] Fix ignore_all_dependencies argument ignored
- [AIRFLOW-1621] Add tests for server side paging
- [AIRFLOW-1591] Avoid attribute error when rendering logging filename
- [AIRFLOW-1031] Replace hard-code to DagRun.ID_PREFIX
- [AIRFLOW-1604] Rename logger to log
- [AIRFLOW-1512] Add PythonVirtualenvOperator
- [AIRFLOW-1617] Fix XSS vulnerability in Variable endpoint
- [AIRFLOW-1497] Reset hidden fields when changing connection type
- [AIRFLOW-1619] Add poll_sleep parameter to GCP dataflow operator
- [AIRFLOW-XXX] Remove landscape.io config
- [AIRFLOW-XXX] Remove non working service badges
- [AIRFLOW-1177] Fix Variable.setdefault w/existing JSON
- [AIRFLOW-1600] Fix exception handling in get_fernet
- [AIRFLOW-1614] Replace inspect.stack() with sys._getframe()
- [AIRFLOW-1519] Add server side paging in DAGs list
- [AIRFLOW-1309] Allow hive_to_druid to take tblproperties
- [AIRFLOW-1613] Make MySqlToGoogleCloudStorageOperator compaitible with python3
- [AIRFLOW-1603] add PAYMILL to companies list
- [AIRFLOW-1609] Fix gitignore to ignore all venvs
- [AIRFLOW-1601] Add configurable task cleanup time

3.20.4 Airflow 1.9.0, 2018-01-02

- [AIRFLOW-1525] Fix minor LICENSE and NOTICE issues
- [AIRFLOW-XXX] Bump version to 1.9.0
- [AIRFLOW-1897][AIRFLOW-1873] Task Logs for running instance not visible in WebUI
- [AIRFLOW-XXX] Make sure session is committed

- [AIRFLOW-1896] FIX bleach <> html5lib incompatibility
- [AIRFLOW-XXX] Fix log handler test
- [AIRFLOW-1873] Set TI.try_number to right value depending TI state
- [AIRFLOW-1554] Fix wrong DagFileProcessor termination method call
- [AIRFLOW-1872] Set context for all handlers including parents
- [AIRFLOW-XXX] Add dask lock files to excludes
- [AIRFLOW-1839] Fix more bugs in S3Hook boto -> boto3 migration
- [AIRFLOW-1795] Correctly call S3Hook after migration to boto3
- [AIRFLOW-1813] Bug SSH Operator empty buffer
- [AIRFLOW-1794] Remove uses of Exception.message for Python 3
- [AIRFLOW-1799] Fix logging line which raises errors
- [AIRFLOW-1102] Upgrade Gunicorn >=19.4.0
- [AIRFLOW-1756] Fix S3TaskHandler to work with Boto3-based S3Hook
- [AIRFLOW-1797] S3Hook.load_string didn't work on Python3
- [AIRFLOW-1792] Missing intervals DruidOperator
- [AIRFLOW-1789][AIRFLOW-1712] Log SSHOperator stderr to log.warning
- [AIRFLOW-1669] Fix Docker and pin Moto to 1.1.19
- [AIRFLOW-71] Add support for private Docker images
- [AIRFLOW-1779] Add keepalive packets to ssh hook
- [AIRFLOW-XXX] Give a clue what the 'ds' variable is
- [AIRFLOW-XXX] Correct typos in the faq docs page
- [AIRFLOW-1571] Add AWS Lambda Hook
- [AIRFLOW-1675] Fix docstrings for API docs
- [AIRFLOW-1712][AIRFLOW-756][AIRFLOW-751] Log SSHOperator output
- [AIRFLOW-1776] Capture stdout and stderr for logging
- [AIRFLOW-1765] Make experimental API securable without needing Kerberos.
- [AIRFLOW-1764] The web interface should not use the experimental API
- [AIRFLOW-1634] Adds task_concurrency feature
- [AIRFLOW-1018] Make processor use logging framework
- [AIRFLOW-1695] Add RedshiftHook using boto3
- [AIRFLOW-1706] Fix query error for MSSQL backend
- [AIRFLOW-1711] Use ldap3 dict for group membership
- [AIRFLOW-1757] Add missing options to SparkSubmitOperator
- [AIRFLOW-1734][Airflow 1734] Sqoop hook/operator enhancements
- [AIRFLOW-1731] Set pythonpath for logging
- [AIRFLOW-1641] Handle executor events in the scheduler

- [AIRFLOW-1744] Make sure max_tries can be set
- [AIRFLOW-1330] Add conn_type argument to CLI when adding connection
- [AIRFLOW-926] Fix JDBC Hook
- [AIRFLOW-1520] Boto3 S3Hook, S3Log
- [AIRFLOW-XXX] Fix DateTime in Tree View
- [AIRFLOW-1432] Charts label for Y axis not visible
- [AIRFLOW-1743] Verify ldap filters correctly
- [AIRFLOW-1745] Restore default signal disposition
- [AIRFLOW-1741] Correctly hide second chart on task duration page
- [AIRFLOW-1726] Add copy_expert psycopg2 method to PostgresHook
- [AIRFLOW-1698] Remove SCHEDULER_RUNS env var in systemd
- [AIRFLOW-1694] Stop using itertools.izip
- [AIRFLOW-1692] Change test_views filename to support Windows
- [AIRFLOW-1722] Fix typo in scheduler autorestart output filename
- [AIRFLOW-1691] Add better Google cloud logging documentation
- [AIRFLOW-1690] Add detail to gcs error messages
- [AIRFLOW-1682] Make S3TaskHandler write to S3 on close
- [AIRFLOW-1676] Make GCSTaskHandler write to GCS on close
- [AIRFLOW-1635] Allow creating GCP connection without requiring a JSON file
- [AIRFLOW-1323] Made Dataproc operator parameter names consistent
- [AIRFLOW-1590] fix unused module and variable
- [AIRFLOW-988] Fix repeating SLA miss callbacks
- [AIRFLOW-1611] Customize logging
- [AIRFLOW-1668] Expose keepalives_idle for Postgres connections
- [AIRFLOW-1658] Kill Druid task on timeout
- [AIRFLOW-1669][AIRFLOW-1368] Fix Docker import
- [AIRFLOW-1560] Add AWS DynamoDB hook and operator for inserting batch items
- [AIRFLOW-1654] Show tooltips for link icons in DAGs view
- [AIRFLOW-1660] Change webpage width to full-width
- [AIRFLOW-1664] write file as binary instead of str
- [AIRFLOW-1659] Fix invalid obj attribute bug in file_task_handler.py
- [AIRFLOW-1650] Fix custom celery config loading
- [AIRFLOW-1647] Fix Spark-sql hook
- [AIRFLOW-1587] Fix CeleryExecutor import error
- [AIRFLOW-1636] Add AWS and EMR connection type
- [AIRFLOW-1527] Refactor celery config

- [AIRFLOW-1639] Fix Fernet error handling
- [AIRFLOW-1628] Fix docstring of sqlsensor
- [AIRFLOW-1331] add SparkSubmitOperator option
- [AIRFLOW-1627] Only query pool in SubDAG init when necessary
- [AIRFLOW-1629] Make extra a textarea in edit connections form
- [AIRFLOW-1621] Add tests for server side paging
- [AIRFLOW-1519] Add server side paging in DAGs list
- [AIRFLOW-289] Make airflow timezone independent
- [AIRFLOW-1356] Add *–celery_hostname* to *airflow worker*
- [AIRFLOW-1591] Avoid attribute error when rendering logging filename
- [AIRFLOW-1031] Replace hard-code to DagRun.ID_PREFIX
- [AIRFLOW-1604] Rename logger to log
- [AIRFLOW-1512] Add PythonVirtualenvOperator
- [AIRFLOW-1617] Fix XSS vulnerability in Variable endpoint
- [AIRFLOW-1497] Reset hidden fields when changing connection type
- [AIRFLOW-1177] Fix Variable.setdefault w/existing JSON
- [AIRFLOW-1600] Fix exception handling in get_fernet
- [AIRFLOW-1614] Replace inspect.stack() with sys._getframe()
- [AIRFLOW-1613] Make MySqlToGoogleCloudStorageOperator compaitible with python3
- [AIRFLOW-1609] Fix gitignore to ignore all venvs
- [AIRFLOW-1601] Add configurable task cleanup time
- [AIRFLOW-XXX] Bumping Airflow 1.9.0alpha0 version
- [AIRFLOW-1608] Handle pending job state in GCP Dataflow hook
- [AIRFLOW-1606] Use non static DAG.sync_to_db
- [AIRFLOW-1606][Airflow-1606][AIRFLOW-1605][AIRFLOW-160] DAG.sync_to_db is now a normal method
- [AIRFLOW-1602] LoggingMixin in DAG class
- [AIRFLOW-1593] expose load_string in WasbHook
- [AIRFLOW-1597] Add GameWisp as Airflow user
- [AIRFLOW-1594] Don’t install test packages into python root.[]
- [AIRFLOW-1582] Improve logging within Airflow
- [AIRFLOW-1476] add INSTALL instruction for source releases
- [AIRFLOW-XXX] Save username and password in airflow-pr
- [AIRFLOW-1522] Increase text size for var field in variables for MySQL
- [AIRFLOW-950] Missing AWS integrations on documentation::integrations
- [AIRFLOW-XXX] 1.8.2 release notes

- [AIRFLOW-1573] Remove *thrift < 0.10.0* requirement
- [AIRFLOW-1584] Remove insecure /headers endpoint
- [AIRFLOW-1586] Add mapping for date type to mysql_to_gcs operator
- [AIRFLOW-1579] Adds support for jagged rows in Bigquery hook for BQ load jobs
- [AIRFLOW-1577] Add token support to DatabricksHook
- [AIRFLOW-1580] Error in string formating
- [AIRFLOW-1567] Updated docs for Google ML Engine operators/hooks
- [AIRFLOW-1574] add 'to' attribute to templated vars of email operator
- [AIRFLOW-1572] add carbonite to company list
- [AIRFLOW-1568] Fix typo in BigQueryHook
- [AIRFLOW-1493][AIRFLOW-XXXX][WIP] fixed dumb thing
- [AIRFLOW-1567][Airflow-1567] Renamed cloudml hook and operator to mlengine
- [AIRFLOW-1568] Add datastore export/import operators
- [AIRFLOW-1564] Use Jinja2 to render logging filename
- [AIRFLOW-1562] Spark-sql logging contains deadlock
- [AIRFLOW-1556][Airflow 1556] Add support for SQL parameters in BigQueryBaseCursor
- [AIRFLOW-108] Add CreditCards.com to companies list
- [AIRFLOW-1541] Add channel to template fields of slack_operator
- [AIRFLOW-1535] Add service account/scopes in dataproc
- [AIRFLOW-1384] Add to README.md CaDC/ARGO
- [AIRFLOW-1546] add Zymergen 80to org list in README
- [AIRFLOW-1545] Add Nextdoor to companies list
- [AIRFLOW-1544] Add DataFox to companies list
- [AIRFLOW-1529] Add logic supporting quoted newlines in Google BigQuery load jobs
- [AIRFLOW-1521] Fix emplate rendering for BigqueryTableDeleteOperator
- [AIRFLOW-1324] Generalize Druid operator and hook
- [AIRFLOW-1516] Fix error handling getting fernet
- [AIRFLOW-1420][AIRFLOW-1473] Fix deadlock check
- [AIRFLOW-1495] Fix migration on index on job_id
- [AIRFLOW-1483] Making page size consistent in list
- [AIRFLOW-1495] Add TaskInstance index on job_id
- [AIRFLOW-855] Replace PickleType with LargeBinary in XCom
- [AIRFLOW-1505] Document when Jinja substitution occurs
- [AIRFLOW-1504] Log dataproc cluster name
- [AIRFLOW-1239] Fix unicode error for logs in base_task_runner
- [AIRFLOW-1280] Fix Gantt chart height

- [AIRFLOW-1507] Template parameters in file_to_gcs operator
- [AIRFLOW-1452] workaround lock on method
- [AIRFLOW-1385] Make Airflow task logging configurable
- [AIRFLOW-940] Handle error on variable decrypt
- [AIRFLOW-1492] Add gauge for task successes/failures
- [AIRFLOW-1443] Update Airflow configuration documentation
- [AIRFLOW-1486] Unexpected S3 writing log error
- [AIRFLOW-1487] Added links to all companies officially using Airflow
- [AIRFLOW-1489] Fix typo in BigQueryCheckOperator
- [AIRFLOW-1349] Fix backfill to respect limits
- [AIRFLOW-1478] Chart owner column should be sortable
- [AIRFLOW-1397][AIRFLOW-1] No Last Run column data displyed in Airflow UI 1.8.1
- [AIRFLOW-1474] Add dag_id regex feature for *airflow clear* command
- [AIRFLOW-1445] Changing HivePartitionSensor UI color to lighter shade
- [AIRFLOW-1359] Use default_args in Cloud ML eval
- [AIRFLOW-1389] Support createDisposition in BigQueryOperator
- [AIRFLOW-1349] Refactor BackfillJob _execute
- [AIRFLOW-1459] Fixed broken integration .rst formatting
- [AIRFLOW-1448] Revert "Fix cli reading logfile in memory"
- [AIRFLOW-1398] Allow ExternalTaskSensor to wait on multiple runs of a task
- [AIRFLOW-1399] Fix cli reading logfile in memory
- [AIRFLOW-1442] Remove extra space from ignore_all_deps generated command
- [AIRFLOW-1438] Change batch size per query in scheduler
- [AIRFLOW-1439] Add max billing tier for the BQ Hook and Operator
- [AIRFLOW-1437] Modify BigQueryTableDeleteOperator
- [Airflow 1332] Split logs based on try number
- [AIRFLOW-1385] Create abstraction for Airflow task logging
- [AIRFLOW-756][AIRFLOW-751] Replace ssh hook, operator & sftp operator with paramiko based
- [AIRFLOW-1393][[AIRFLOW-1393] Enable Py3 tests in contrib/spark_submit_hook[
- [AIRFLOW-1345] Dont expire TIs on each scheduler loop
- [AIRFLOW-1059] Reset orphaned tasks in batch for scheduler
- [AIRFLOW-1255] Fix SparkSubmitHook output deadlock
- [AIRFLOW-1359] Add Google CloudML utils for model evaluation
- [AIRFLOW-1247] Fix ignore all dependencies argument ignored
- [AIRFLOW-1401] Standardize cloud ml operator arguments
- [AIRFLOW-1394] Add quote_character param to GCS hook and operator

- [AIRFLOW-1402] Cleanup SafeConfigParser DeprecationWarning
- [AIRFLOW-1326][[AIRFLOW-1326][AIRFLOW-1184] Don't split argument array – it's already an array.[
- [AIRFLOW-1384] Add ARGO/CaDC as a Airflow user
- [AIRFLOW-1357] Fix scheduler zip file support
- [AIRFLOW-1382] Add working dir option to DockerOperator
- [AIRFLOW-1388] Add Cloud ML Engine operators to integration doc
- [AIRFLOW-1387] Add unicode string prefix
- [AIRFLOW-1366] Add max_tries to task instance
- [AIRFLOW-1300] Enable table creation with TBLPROPERTIES
- [AIRFLOW-1271] Add Google CloudML Training Operator
- [AIRFLOW-300] Add Google Pubsub hook and operator
- [AIRFLOW-1343] Fix dataproc label format
- [AIRFLOW-1367] Pass Content-ID To reference inline images in an email, we need to be able to add <img src="cid:{}"/> to the HTML. However currently the Content-ID (cid) is not passed, so we need to add it
- [AIRFLOW-1265] Fix celery executor parsing CELERY_SSL_ACTIVE
- [AIRFLOW-1272] Google Cloud ML Batch Prediction Operator
- [AIRFLOW-1352][AIRFLOW-1335] Revert MemoryHandler change ()[]
- [AIRFLOW-1350] Add query_uri param to Hive/SparkSQL DataProc operator
- [AIRFLOW-1334] Check if tasks are backfill on scheduler in a join
- [AIRFLOW-1343] Add Airflow default label to the dataproc operator
- [AIRFLOW-1273] Add Google Cloud ML version and model operators
- [AIRFLOW-1273]AIRFLOW-1273] Add Google Cloud ML version and model operators
- [AIRFLOW-1321] Fix hidden field key to ignore case
- [AIRFLOW-1337] Make log_format key names lowercase
- [AIRFLOW-1338][AIRFLOW-782] Add GCP dataflow hook runner change to UPDATING.md
- [AIRFLOW-801] Remove outdated docstring on BaseOperator
- [AIRFLOW-1344] Fix text encoding bug when reading logs for Python 3.5
- [AIRFLOW-1338] Fix incompatible GCP dataflow hook
- [AIRFLOW-1333] Enable copy function for Google Cloud Storage Hook
- [AIRFLOW-1337] Allow log format customization via airflow.cfg
- [AIRFLOW-1320] Update LetsBonus users in README
- [AIRFLOW-1335] Use MemoryHandler for buffered logging
- [AIRFLOW-1339] Add Drivy to the list of users
- [AIRFLOW-1275] Put 'airflow pool' into API
- [AIRFLOW-1296] Propagate SKIPPED to all downstream tasks
- [AIRFLOW-1317] Fix minor issues in API reference

- [AIRFLOW-1308] Disable nanny usage for Dask
- [AIRFLOW-1172] Support nth weekday of the month cron expression
- [AIRFLOW-936] Add clear/mark success for DAG in the UI
- [AIRFLOW-1294] Backfills can loose tasks to execute
- [AIRFLOW-1299] Support imageVersion in Google Dataproc cluster
- [AIRFLOW-1291] Update NOTICE and LICENSE files to match ASF requirements
- [AIRFLOW-1301] Add New Relic to list of companies
- [AIRFLOW-1289] Removes restriction on number of scheduler threads
- [AIRFLOW-1024] Ignore celery executor errors (#49)
- [AIRFLOW-1265] Fix exception while loading celery configurations
- [AIRFLOW-1290] set docs author to 'Apache Airflow'
- [AIRFLOW-1242] Allowing project_id to have a colon in it.
- [AIRFLOW-1282] Fix known event column sorting
- [AIRFLOW-1166] Speed up _change_state_for_tis_without_dagrun
- [AIRFLOW-1208] Speed-up cli tests
- [AIRFLOW-1192] Some enhancements to qubole_operator
- [AIRFLOW-1281] Sort variables by key field by default
- [AIRFLOW-1277] Forbid KE creation with empty fields
- [AIRFLOW-1276] Forbid event creation with end_data earlier than start_date
- [AIRFLOW-1263] Dynamic height for charts
- [AIRFLOW-1266] Increase width of gantt y axis
- [AIRFLOW-1244] Forbid creation of a pool with empty name
- [AIRFLOW-1274][HTTPSENSOR] Rename parameter params to data
- [AIRFLOW-654] Add SSL Config Option for CeleryExecutor w/ RabbitMQ - Add BROKER_USE_SSL config to give option to send AMQP messages over SSL - Can be set using usual airflow options (e.g. airflow.cfg, env vars, etc.)
- [AIRFLOW-1256] Add United Airlines to readme
- [AIRFLOW-1251] Add eRevalue to Airflow users
- [AIRFLOW-908] Print hostname at the start of cli run
- [AIRFLOW-1237] Fix IN-predicate sqlalchemy warning
- [AIRFLOW-1243] DAGs table has no default entries to show
- [AIRFLOW-1245] Fix random failure in test_trigger_dag_for_date
- [AIRFLOW-1248] Fix wrong conf name for worker timeout
- [AIRFLOW-1197] : SparkSubmitHook on_kill error
- [AIRFLOW-1191] : SparkSubmitHook custom cmd
- [AIRFLOW-1234] Cover utils.operator_helpers with UTs
- [AIRFLOW-1217] Enable Sqoop logging

- [AIRFLOW-645] Support HTTPS connections in HttpHook
- [AIRFLOW-1231] Use flask_wtf.CSRFProtect
- [AIRFLOW-1232] Remove deprecated readfp warning
- [AIRFLOW-1233] Cover utils.json with unit tests
- [AIRFLOW-1227] Remove empty column on the Logs view
- [AIRFLOW-1226] Remove empty column on the Jobs view
- [AIRFLOW-1221] Fix templating bug with DatabricksSubmitRunOperator
- [AIRFLOW-1210] Enable DbApiHook unit tests
- [AIRFLOW-1199] Fix create modal
- [AIRFLOW-1200] Forbid creation of a variable with an empty key
- [AIRFLOW-1207] Enable utils.helpers unit tests
- [AIRFLOW-1213] Add hcatalog parameters to sqoop
- [AIRFLOW-1201] Update deprecated 'nose-parameterized'
- [AIRFLOW-1186] Sort dag.get_task_instances by execution_date
- [AIRFLOW-1203] Pin Google API client version to fix OAuth issue
- [AIRFLOW-1145] Fix closest_date_partition function with before set to True If we're looking for the closest date before, we should take the latest date in the list of date before.
- [AIRFLOW-1180] Fix flask-wtf version for test_csrf_rejection
- [AIRFLOW-993] Update date inference logic
- [AIRFLOW-1170] DbApiHook insert_rows inserts parameters separately
- [AIRFLOW-1041] Do not shadow xcom_push method[]
- [AIRFLOW-860][AIRFLOW-935] Fix plugin executor import cycle and executor selection
- [AIRFLOW-1189] Fix get a DataFrame using BigQueryHook failing
- [AIRFLOW-1184] SparkSubmitHook does not split args
- [AIRFLOW-1182] SparkSubmitOperator template field
- [AIRFLOW-823] Allow specifying execution date in task_info API
- [AIRFLOW-1175] Add Pronto Tools to Airflow user list
- [AIRFLOW-1150] Fix scripts execution in sparksql hook[]
- [AIRFLOW-1141] remove crawl_for_tasks
- [AIRFLOW-1193] Add Checkr to company using Airflow
- [AIRFLOW-1168] Add closing() to all connections and cursors
- [AIRFLOW-1188] Add max_bad_records param to GoogleCloudStorageToBigQueryOperator
- [AIRFLOW-1187][AIRFLOW-1185] Fix PyPi package names in documents
- [AIRFLOW-1185] Fix PyPi URL in templates
- [AIRFLOW-XXX] Updating CHANGELOG, README, and UPDATING after 1.8.1 release
- [AIRFLOW-1181] Add delete and list functionality to gcs_hook

- [AIRFLOW-1179] Fix Pandas 0.2x breaking Google BigQuery change
- [AIRFLOW-1167] Support microseconds in FTPHook modification time
- [AIRFLOW-1173] Add Robinhood to who uses Airflow
- [AIRFLOW-945][AIRFLOW-941] Remove psycopg2 connection workaround
- [AIRFLOW-1140] DatabricksSubmitRunOperator should template the "json" field.
- [AIRFLOW-1160] Update Spark parameters for Mesos
- [AIRFLOW 1149][AIRFLOW-1149] Allow for custom filters in Jinja2 templates
- [AIRFLOW-1036] Randomize exponential backoff
- [AIRFLOW-1155] Add Tails.com to community
- [AIRFLOW-1142] Do not reset orphaned state for backfills
- [AIRFLOW-492] Make sure stat updates cannot fail a task
- [AIRFLOW-1119] Fix unload query so headers are on first row[]
- [AIRFLOW-1089] Add Spark application arguments
- [AIRFLOW-1125] Document encrypted connections
- [AIRFLOW-1122] Increase stroke width in UI
- [AIRFLOW-1138] Add missing licenses to files in scripts directory
- (AIRFLOW-11-38) [AIRFLOW-1136] Capture invalid arguments for Sqoop
- [AIRFLOW-1127] Move license notices to LICENSE
- [AIRFLOW-1118] Add evo.company to Airflow users
- [AIRFLOW-1121][AIRFLOW-1004] Fix *airflow webserver –pid* to write out pid file
- [AIRFLOW-1124] Do not set all tasks to scheduled in backfill
- [AIRFLOW-1120] Update version view to include Apache prefix
- [AIRFLOW-1091] Add script that can compare jira target against merges
- [AIRFLOW-1107] Add support for ftps non-default port
- [AIRFLOW-1000] Rebrand distribution to Apache Airflow
- [AIRFLOW-1094] Run unit tests under contrib in Travis
- [AIRFLOW-1112] Log which pool when pool is full in scheduler
- [AIRFLOW-1106] Add Groupalia/Letsbonus to the ReadMe
- [AIRFLOW-1109] Use kill signal to kill processes and log results
- [AIRFLOW-1074] Don't count queued tasks for concurrency limits
- [AIRFLOW-1095] Make ldap_auth memberOf come from configuration
- [AIRFLOW-1090] Add HBO
- [AIRFLOW-1035] Use binary exponential backoff
- [AIRFLOW-1081] Improve performance of duration chart
- [AIRFLOW-1078] Fix latest_runs endpoint for old flask versions
- [AIRFLOW-1085] Enhance the SparkSubmitOperator

- [AIRFLOW-1050] Do not count up_for_retry as not ready
- [AIRFLOW-1028] Databricks Operator for Airflow
- [AIRFLOW-1075] Security docs cleanup
- [AIRFLOW-1033][AIFRLOW-1033] Fix ti_deps for no schedule dags
- [AIRFLOW-1016] Allow HTTP HEAD request method on HTTPSensor
- [AIRFLOW-970] Load latest_runs on homepage async
- [AIRFLOW-111] Include queued tasks in scheduler concurrency check
- [AIRFLOW-1001] Fix landing times if there is no following schedule
- [AIRFLOW-1065] Add functionality for Azure Blob Storage over wasb://
- [AIRFLOW-947] Improve exceptions for unavailable Presto cluster
- [AIRFLOW-1067] use example.com in examples
- [AIRFLOW-1064] Change default sort to job_id for TaskInstanceModelView
- [AIRFLOW-1030][AIRFLOW-1] Fix hook import for HttpSensor
- [AIRFLOW-1051] Add a test for resetdb to CliTests
- [AIRFLOW-1004][AIRFLOW-276] Fix *airflow webserver -D* to run in background
- [AIRFLOW-1062] Fix DagRun#find to return correct result
- [AIRFLOW-1011] Fix bug in BackfillJob._execute() for SubDAGs
- [AIRFLOW-1038] Specify celery serialization options explicitly
- [AIRFLOW-1054] Fix broken import in test_dag
- [AIRFLOW-1007] Use Jinja sandbox for chart_data endpoint
- [AIRFLOW-719] Fix race condition in ShortCircuit, Branch and LatestOnly
- [AIRFLOW-1043] Fix doc strings of operators
- [AIRFLOW-840] Make ticket renewer python3 compatible
- [AIRFLOW-985] Extend the sqoop operator and hook
- [AIRFLOW-1034] Make it possible to connect to S3 in sigv4 regions
- [AIRFLOW-1045] Make log level configurable via airflow.cfg
- [AIRFLOW-1047] Sanitize strings passed to Markup
- [AIRFLOW-1040] Fix some small typos in comments and docstrings
- [AIRFLOW-1017] get_task_instance shouldn't throw exception when no TI
- [AIRFLOW-1006] Add config_templates to MANIFEST
- [AIRFLOW-999] Add support for Redis database
- [AIRFLOW-1009] Remove SQLOperator from Concepts page
- [AIRFLOW-1006] Move config templates to separate files
- [AIRFLOW-1005] Improve Airflow startup time
- [AIRFLOW-1010] Add convenience script for signing releases
- [AIRFLOW-995] Remove reference to actual Airflow issue

- [AIRFLOW-681] homepage doc link should pointing to apache repo not airbnb repo
- [AIRFLOW-705][AIRFLOW-706] Fix run_command bugs
- [AIRFLOW-990] Fix Py27 unicode logging in DockerOperator
- [AIRFLOW-963] Fix non-rendered code examples
- [AIRFLOW-969] Catch bad python_callable argument
- [AIRFLOW-984] Enable subclassing of SubDagOperator
- [AIRFLOW-997] Update setup.cfg to point to Apache
- [AIRFLOW-994] Add MiNODES to the official airflow user list
- [AIRFLOW-995][AIRFLOW-1] Update GitHub PR Template
- [AIRFLOW-989] Do not mark dag run successful if unfinished tasks
- [AIRFLOW-903] New configuration setting for the default dag view
- [AIRFLOW-979] Add GovTech GDS
- [AIRFLOW-933] Replace eval with literal_eval to prevent RCE
- [AIRFLOW-974] Fix mkdirs race condition
- [AIRFLOW-917] Fix formatting of error message
- [AIRFLOW-770] Refactor BaseHook so env vars are always read
- [AIRFLOW-900] Double trigger should not kill original task instance
- [AIRFLOW-900] Fixes bugs in LocalTaskJob for double run protection
- [AIRFLOW-932][AIRFLOW-932][AIRFLOW-921][AIRFLOW-910] Do not mark tasks removed when backfilling[
- [AIRFLOW-961] run onkill when SIGTERMed
- [AIRFLOW-910] Use parallel task execution for backfills
- [AIRFLOW-967] Wrap strings in native for py2 ldap compatibility
- [AIRFLOW-958] Improve tooltip readability
- AIRFLOW-959 Cleanup and reorganize .gitignore
- AIRFLOW-960 Add .editorconfig file
- [AIRFLOW-931] Do not set QUEUED in TaskInstances
- [AIRFLOW-956] Get docs working on readthedocs.org
- [AIRFLOW-954] Fix configparser ImportError
- [AIRFLOW-941] Use defined parameters for psycopg2
- [AIRFLOW-943] Update Digital First Media in users list
- [AIRFLOW-942] Add mytaxi to Airflow users
- [AIRFLOW-939] add .swp to gitginore
- [AIRFLOW-719] Prevent DAGs from ending prematurely
- [AIRFLOW-938] Use test for True in task_stats queries
- [AIRFLOW-937] Improve performance of task_stats

- [AIRFLOW-933] use ast.literal_eval rather eval because ast.literal_eval does not execute input.
- [AIRFLOW-925] Revert airflow.hooks change that cherry-pick picked
- [AIRFLOW-919] Running tasks with no start date shouldn't break a DAGs UI
- [AIRFLOW-802][AIRFLOW-1] Add spark-submit operator/hook
- [AIRFLOW-725] Use keyring to store credentials for JIRA
- [AIRFLOW-916] Remove deprecated readfp function
- [AIRFLOW-911] Add coloring and timing to tests
- [AIRFLOW-906] Update Code icon from lightning bolt to file
- [AIRFLOW-897] Prevent dagruns from failing with unfinished tasks
- [AIRFLOW-896] Remove unicode to 8-bit conversion in BigQueryOperator
- [AIRFLOW-899] Tasks in SCHEDULED state should be white in the UI instead of black
- [AIRFLOW-895] Address Apache release incompliancies
- [AIRFLOW-893][AIRFLOW-510] Fix crashing webservers when a dagrun has no start date
- [AIRFLOW-880] Make webserver serve logs in a sane way for remote logs
- [AIRFLOW-889] Fix minor error in the docstrings for BaseOperator
- [AIRFLOW-809][AIRFLOW-1] Use __eq__ ColumnOperator When Testing Booleans
- [AIRFLOW-875] Add template to HttpSensor params
- [AIRFLOW-866] Add FTPSensor
- [AIRFLOW-881] Check if SubDagOperator is in DAG context manager
- [AIRFLOW-885] Add change.org to the users list
- [AIRFLOW-836] Use POST and CSRF for state changing endpoints
- [AIRFLOW-862] Fix Unit Tests for DaskExecutor
- [AIRFLOW-887] Support future v0.16
- [AIRFLOW-886] Pass result to post_execute() hook
- [AIRFLOW-871] change logging.warn() into warning()
- [AIRFLOW-882] Remove unnecessary dag>>op assignment in docs
- [AIRFLOW-861] make pickle_info endpoint be login_required
- [AIRFLOW-869] Refactor mark success functionality
- [AIRFLOW-877] Remove .sql template extension from GCS download operator
- [AIRFLOW-826] Add Zendesk hook
- [AIRFLOW-842] do not query the DB with an empty IN clause
- [AIRFLOW-834] change raise StopIteration into return
- [AIRFLOW-832] Let debug server run without SSL
- [AIRFLOW-862] Add DaskExecutor
- [AIRFLOW-858] Configurable database name for DB operators
- [AIRFLOW-863] Example DAGs should have recent start dates

- [AIRFLOW-853] use utf8 encoding for stdout line decode
- [AIRFLOW-857] Use library assert statements instead of conditionals
- [AIRFLOW-856] Make sure execution date is set for local client
- [AIRFLOW-854] Add OKI as Airflow user
- [AIRFLOW-830][AIRFLOW-829][AIRFLOW-88] Reduce Travis log verbosity
- [AIRFLOW-814] Fix Presto*CheckOperator.__init__
- [AIRFLOW-793] Enable compressed loading in S3ToHiveTransfer
- [AIRFLOW-844] Fix cgroups directory creation
- [AIRFLOW-831] Restore import to fix broken tests
- [AIRFLOW-794] Access DAGS_FOLDER and SQL_ALCHEMY_CONN exclusively from settings
- [AIRFLOW-694] Fix config behaviour for empty envvar
- [AIRFLOW-365] Set dag.fileloc explicitly and use for Code view
- [AIRFLOW-781] Allow DataFlowOperators to accept jobs stored in GCS

3.20.5 Airflow 1.8.2, 2017-09-04

- [AIRFLOW-809][AIRFLOW-1] Use __eq__ ColumnOperator When Testing Booleans
- [AIRFLOW-1296] Propagate SKIPPED to all downstream tasks
- Re-enable caching for hadoop components
- Pin Hive and Hadoop to a specific version and create writable warehouse dir
- [AIRFLOW-1308] Disable nanny usage for Dask
- Updating CHANGELOG for 1.8.2rc1
- [AIRFLOW-1294] Backfills can loose tasks to execute
- [AIRFLOW-1291] Update NOTICE and LICENSE files to match ASF requirements
- [AIRFLOW-XXX] Set version to 1.8.2rc1
- [AIRFLOW-1160] Update Spark parameters for Mesos
- [AIRFLOW 1149][AIRFLOW-1149] Allow for custom filters in Jinja2 templates
- [AIRFLOW-1119] Fix unload query so headers are on first row[]
- [AIRFLOW-1089] Add Spark application arguments
- [AIRFLOW-1078] Fix latest_runs endpoint for old flask versions
- [AIRFLOW-1074] Don't count queued tasks for concurrency limits
- [AIRFLOW-1064] Change default sort to job_id for TaskInstanceModelView
- [AIRFLOW-1038] Specify celery serialization options explicitly
- [AIRFLOW-1036] Randomize exponential backoff
- [AIRFLOW-993] Update date inference logic
- [AIRFLOW-1167] Support microseconds in FTPHook modification time
- [AIRFLOW-1179] Fix Pandas 0.2x breaking Google BigQuery change

- [AIRFLOW-1263] Dynamic height for charts
- [AIRFLOW-1266] Increase width of gantt y axis
- [AIRFLOW-1290] set docs author to 'Apache Airflow'
- [AIRFLOW-1282] Fix known event column sorting
- [AIRFLOW-1166] Speed up _change_state_for_tis_without_dagrun
- [AIRFLOW-1192] Some enhancements to qubole_operator
- [AIRFLOW-1281] Sort variables by key field by default
- [AIRFLOW-1244] Forbid creation of a pool with empty name
- [AIRFLOW-1243] DAGs table has no default entries to show
- [AIRFLOW-1227] Remove empty column on the Logs view
- [AIRFLOW-1226] Remove empty column on the Jobs view
- [AIRFLOW-1199] Fix create modal
- [AIRFLOW-1200] Forbid creation of a variable with an empty key
- [AIRFLOW-1186] Sort dag.get_task_instances by execution_date
- [AIRFLOW-1145] Fix closest_date_partition function with before set to True If we're looking for the closest date before, we should take the latest date in the list of date before.
- [AIRFLOW-1180] Fix flask-wtf version for test_csrf_rejection
- [AIRFLOW-1170] DbApiHook insert_rows inserts parameters separately
- [AIRFLOW-1150] Fix scripts execution in sparksql hook[]
- [AIRFLOW-1168] Add closing() to all connections and cursors
- [AIRFLOW-XXX] Updating CHANGELOG, README, and UPDATING after 1.8.1 release

3.20.6 Airflow 1.8.1, 2017-05-09

- [AIRFLOW-1142] SubDAG Tasks Not Executed Even Though All Dependencies Met
- [AIRFLOW-1138] Add licenses to files in scripts directory
- [AIRFLOW-1127] Move license notices to LICENSE instead of NOTICE
- [AIRFLOW-1124] Do not set all task instances to scheduled on backfill
- [AIRFLOW-1120] Update version view to include Apache prefix
- [AIRFLOW-1062] DagRun#find returns wrong result if external_trigger=False is specified
- [AIRFLOW-1054] Fix broken import on test_dag
- [AIRFLOW-1050] Retries ignored - regression
- [AIRFLOW-1033] TypeError: can't compare datetime.datetime to None
- [AIRFLOW-1017] get_task_instance should return None instead of throw an exception for non-existent TIs
- [AIRFLOW-1011] Fix bug in BackfillJob._execute() for SubDAGs
- [AIRFLOW-1004] *airflow webserver -D* runs in foreground
- [AIRFLOW-1001] Landing Time shows "unsupported operand type(s) for -: 'datetime.datetime' and 'NoneType'" on example_subdag_operator

- [AIRFLOW-1000] Rebrand to Apache Airflow instead of Airflow
- [AIRFLOW-989] Clear Task Regression
- [AIRFLOW-974] airflow.util.file mkdir has a race condition
- [AIRFLOW-906] Update Code icon from lightning bolt to file
- [AIRFLOW-858] Configurable database name for DB operators
- [AIRFLOW-853] ssh_execute_operator.py stdout decode default to ASCII
- [AIRFLOW-832] Fix debug server
- [AIRFLOW-817] Trigger dag fails when using CLI + API
- [AIRFLOW-816] Make sure to pull nvd3 from local resources
- [AIRFLOW-815] Add previous/next execution dates to available default variables.
- [AIRFLOW-813] Fix unterminated unit tests in tests.job (tests/job.py)
- [AIRFLOW-812] Scheduler job terminates when there is no dag file
- [AIRFLOW-806] UI should properly ignore DAG doc when it is None
- [AIRFLOW-794] Consistent access to DAGS_FOLDER and SQL_ALCHEMY_CONN
- [AIRFLOW-785] ImportError if cgroupspy is not installed
- [AIRFLOW-784] Cannot install with funcsigs > 1.0.0
- [AIRFLOW-780] The UI no longer shows broken DAGs
- [AIRFLOW-777] dag_is_running is initlialized to True instead of False
- [AIRFLOW-719] Skipped operations make DAG finish prematurely
- [AIRFLOW-694] Empty env vars do not overwrite non-empty config values
- [AIRFLOW-492] Insert into dag_stats table results into failed task while task itself succeeded
- [AIRFLOW-139] Executing VACUUM with PostgresOperator
- [AIRFLOW-111] DAG concurrency is not honored
- [AIRFLOW-88] Improve clarity Travis CI reports

3.20.7 Airflow 1.8.0, 2017-03-12

- [AIRFLOW-900] Double trigger should not kill original task instance
- [AIRFLOW-900] Fixes bugs in LocalTaskJob for double run protection
- [AIRFLOW-932] Do not mark tasks removed when backfilling
- [AIRFLOW-961] run onkill when SIGTERMed
- [AIRFLOW-910] Use parallel task execution for backfills
- [AIRFLOW-967] Wrap strings in native for py2 ldap compatibility
- [AIRFLOW-941] Use defined parameters for psycopg2
- [AIRFLOW-719] Prevent DAGs from ending prematurely
- [AIRFLOW-938] Use test for True in task_stats queries
- [AIRFLOW-937] Improve performance of task_stats

- [AIRFLOW-933] use ast.literal_eval rather eval because ast.literal_eval does not execute input.
- [AIRFLOW-925] Revert airflow.hooks change that cherry-pick picked
- [AIRFLOW-919] Running tasks with no start date shouldn't break a DAGs UI
- [AIRFLOW-802] Add spark-submit operator/hook
- [AIRFLOW-897] Prevent dagruns from failing with unfinished tasks
- [AIRFLOW-861] make pickle_info endpoint be login_required
- [AIRFLOW-853] use utf8 encoding for stdout line decode
- [AIRFLOW-856] Make sure execution date is set for local client
- [AIRFLOW-830][AIRFLOW-829][AIRFLOW-88] Reduce Travis log verbosity
- [AIRFLOW-831] Restore import to fix broken tests
- [AIRFLOW-794] Access DAGS_FOLDER and SQL_ALCHEMY_CONN exclusively from settings
- [AIRFLOW-694] Fix config behaviour for empty envvar
- [AIRFLOW-365] Set dag.fileloc explicitly and use for Code view
- [AIRFLOW-931] Do not set QUEUED in TaskInstances
- [AIRFLOW-899] Tasks in SCHEDULED state should be white in the UI instead of black
- [AIRFLOW-895] Address Apache release incompliancies
- [AIRFLOW-893][AIRFLOW-510] Fix crashing webservers when a dagrun has no start date
- [AIRFLOW-793] Enable compressed loading in S3ToHiveTransfer
- [AIRFLOW-863] Example DAGs should have recent start dates
- [AIRFLOW-869] Refactor mark success functionality
- [AIRFLOW-856] Make sure execution date is set for local client
- [AIRFLOW-814] Fix Presto*CheckOperator.__init__
- [AIRFLOW-844] Fix cgroups directory creation
- [AIRFLOW-816] Use static nvd3 and d3
- [AIRFLOW-821] Fix py3 compatibility
- [AIRFLOW-817] Check for None value of execution_date in endpoint
- [AIRFLOW-822] Close db before exception
- [AIRFLOW-815] Add prev/next execution dates to template variables
- [AIRFLOW-813] Fix unterminated unit tests in SchedulerJobTest
- [AIRFLOW-813] Fix unterminated scheduler unit tests
- [AIRFLOW-806] UI should properly ignore DAG doc when it is None
- [AIRFLOW-812] Fix the scheduler termination bug.
- [AIRFLOW-780] Fix dag import errors no longer working
- [AIRFLOW-783] Fix py3 incompatibility in BaseTaskRunner
- [AIRFLOW-810] Correct down_revision dag_id/state index creation
- [AIRFLOW-807] Improve scheduler performance for large DAGs

- [AIRFLOW-798] Check return_code before forcing termination
- [AIRFLOW-139] Let psycopg2 handle autocommit for PostgresHook
- [AIRFLOW-776] Add missing cgroups devel dependency
- [AIRFLOW-777] Fix expression to check if a DagRun is in running state
- [AIRFLOW-785] Don't import CgroupTaskRunner at global scope
- [AIRFLOW-784] Pin funcsigs to 1.0.0
- [AIRFLOW-624] Fix setup.py to not import airflow.version as version
- [AIRFLOW-779] Task should fail with specific message when deleted
- [AIRFLOW-778] Fix completey broken MetastorePartitionSensor
- [AIRFLOW-739] Set pickle_info log to debug
- [AIRFLOW-771] Make S3 logs append instead of clobber
- [AIRFLOW-773] Fix flaky datetime addition in api test
- [AIRFLOW-219][AIRFLOW-398] Cgroups + impersonation
- [AIRFLOW-683] Add jira hook, operator and sensor
- [AIRFLOW-762] Add Google DataProc delete operator
- [AIRFLOW-760] Update systemd config
- [AIRFLOW-759] Use previous dag_run to verify depend_on_past
- [AIRFLOW-757] Set child_process_log_directory default more sensible
- [AIRFLOW-692] Open XCom page to super-admins only
- [AIRFLOW-737] Fix HDFS Sensor directory.
- [AIRFLOW-747] Fix retry_delay not honoured
- [AIRFLOW-558] Add Support for dag.catchup=(True|False) Option
- [AIRFLOW-489] Allow specifying execution date in trigger_dag API
- [AIRFLOW-738] Commit deleted xcom items before insert
- [AIRFLOW-729] Add Google Cloud Dataproc cluster creation operator
- [AIRFLOW-728] Add Google BigQuery table sensor
- [AIRFLOW-741] Log to debug instead of info for app.py
- [AIRFLOW-731] Fix period bug for NamedHivePartitionSensor
- [AIRFLOW-740] Pin jinja2 to < 2.9.0
- [AIRFLOW-663] Improve time units for task performance charts
- [AIRFLOW-665] Fix email attachments
- [AIRFLOW-734] Fix SMTP auth regression when not using user/pass
- [AIRFLOW-702] Fix LDAP Regex Bug
- [AIRFLOW-717] Add Cloud Storage updated sensor
- [AIRFLOW-695] Retries do not execute because dagrun is in FAILED state
- [AIRFLOW-673] Add operational metrics test for SchedulerJob

- [AIRFLOW-727] try_number is not increased
- [AIRFLOW-715] A more efficient HDFS Sensor:
- [AIRFLOW-716] Allow AVRO BigQuery load-job without schema
- [AIRFLOW-718] Allow the query URI for DataProc Pig
- Log needs to be part of try/catch block
- [AIRFLOW-721] Descendant process can disappear before termination
- [AIRFLOW-403] Bash operator's kill method leaves underlying processes running
- [AIRFLOW-657] Add AutoCommit Parameter for MSSQL
- [AIRFLOW-641] Improve pull request instructions
- [AIRFLOW-685] Add test for MySqlHook.bulk_load()
- [AIRFLOW-686] Match auth backend config section
- [AIRFLOW-691] Add SSH KeepAlive option to SSH_hook
- [AIRFLOW-709] Use same engine for migrations and reflection
- [AIRFLOW-700] Update to reference to web authentication documentation
- [AIRFLOW-649] Support non-sched DAGs in LatestOnlyOp
- [AIRFLOW-712] Fix AIRFLOW-667 to use proper HTTP error properties
- [AIRFLOW-710] Add OneFineStay as official user
- [AIRFLOW-703][AIRFLOW-1] Stop Xcom being cleared too early
- [AIRFLOW-679] Stop concurrent task instances from running
- [AIRFLOW-704][AIRFLOW-1] Fix invalid syntax in BQ hook
- [AIRFLOW-667] Handle BigQuery 503 error
- [AIRFLOW-680] Disable connection pool for commands
- [AIRFLOW-678] Prevent scheduler from double triggering TIs
- [AIRFLOW-677] Kill task if it fails to heartbeat
- [AIRFLOW-674] Ability to add descriptions for DAGs
- [AIRFLOW-682] Bump MAX_PERIODS to make mark_success work for large DAGs
- Use jdk selector to set required jdk
- [AIRFLOW-647] Restore dag.get_active_runs
- [AIRFLOW-662] Change seasons to months in project description
- [AIRFLOW-656] Add dag/task/date index to xcom table
- [AIRFLOW-658] Improve schema_update_options in GCP
- [AIRFLOW-41] Fix pool oversubscription
- [AIRFLOW-489] Add API Framework
- [AIRFLOW-653] Add some missing endpoint tests
- [AIRFLOW-652] Remove obsolete endpoint
- [AIRFLOW-345] Add contrib ECSOperator

- [AIRFLOW-650] Adding Celect to user list
- [AIRFLOW-510] Filter Paused Dags, show Last Run & Trigger Dag
- [AIRFLOW-643] Improve date handling for sf_hook
- [AIRFLOW-638] Add schema_update_options to GCP ops
- [AIRFLOW-640] Install and enable nose-ignore-docstring
- [AIRFLOW-639]AIRFLOW-639] Alphasort package names
- [AIRFLOW-375] Fix pylint errors
- [AIRFLOW-347] Show empty DAG runs in tree view
- [AIRFLOW-628] Adding SalesforceHook to contrib/hooks
- [AIRFLOW-514] hive hook loads data from pandas DataFrame into hive and infers types
- [AIRFLOW-565] Fixes DockerOperator on Python3.x
- [AIRFLOW-635] Encryption option for S3 hook
- [AIRFLOW-137] Fix max_active_runs on clearing tasks
- [AIRFLOW-343] Fix schema plumbing in HiveServer2Hook
- [AIRFLOW-130] Fix ssh operator macosx
- [AIRFLOW-633] Show TI attributes in TI view
- [AIRFLOW-626][AIRFLOW-1] HTML Content does not show up when sending email with attachment
- [AIRFLOW-533] Set autocommit via set_autocommit
- [AIRFLOW-629] stop pinning lxml
- [AIRFLOW-464] Add setdefault method to Variable
- [AIRFLOW-626][AIRFLOW-1] HTML Content does not show up when sending email with attachment
- [AIRFLOW-591] Add datadog hook & sensor
- [AIRFLOW-561] Add RedshiftToS3Transfer operator
- [AIRFLOW-570] Pass root to date form on gantt
- [AIRFLOW-504] Store fractional seconds in MySQL tables
- [AIRFLOW-623] LDAP attributes not always a list
- [AIRFLOW-611] source_format in BigQueryBaseCursor
- [AIRFLOW-619] Fix exception in Gannt chart
- [AIRFLOW-618] Cast DateTimes to avoid sqllite errors
- [AIRFLOW-422] Add JSON endpoint for task info
- [AIRFLOW-616][AIRFLOW-617] Minor fixes to PR tool UX
- [AIRFLOW-179] Fix DbApiHook with non-ASCII chars
- [AIRFLOW-566] Add timeout while fetching logs
- [AIRFLOW-615] Set graph glyphicon first
- [AIRFLOW-609] Add application_name to PostgresHook
- [AIRFLOW-604] Revert .first() to .one()

- [AIRFLOW-370] Create AirflowConfigException in exceptions.py
- [AIRFLOW-582] Fixes TI.get_dagrun filter (removes start_date)
- [AIRFLOW-568] Fix double task_stats count if a DagRun is active
- [AIRFLOW-585] Fix race condition in backfill execution loop
- [AIRFLOW-580] Prevent landscape warning on .format
- [AIRFLOW-597] Check if content is None, not false-equivalent
- [AIRFLOW-586] test_dag_v1 fails from 0 to 3 a.m.
- [AIRFLOW-453] Add XCom Admin Page
- [AIRFLOW-588] Add Google Cloud Storage Object sensor[]
- [AIRFLOW-592] example_xcom import Error
- [AIRFLOW-587] Fix incorrect scope for Google Auth[]
- [AIRFLOW-589] Add templatable job_name[]
- [AIRFLOW-227] Show running config in config view
- [AIRFLOW-319]AIRFLOW-319] xcom push response in HTTP Operator
- [AIRFLOW-385] Add symlink to latest scheduler log directory
- [AIRFLOW-583] Fix decode error in gcs_to_bq
- [AIRFLOW-96] s3_conn_id using environment variable
- [AIRFLOW-575] Clarify tutorial and FAQ about *schedule_interval* always inheriting from DAG object
- [AIRFLOW-577] Output BigQuery job for improved debugging
- [AIRFLOW-560] Get URI & SQLA engine from Connection
- [AIRFLOW-518] Require DataProfilingMixin for Variables CRUD
- [AIRFLOW-553] Fix load path for filters.js
- [AIRFLOW-554] Add Jinja support to Spark-sql
- [AIRFLOW-550] Make ssl config check empty string safe
- [AIRFLOW-500] Use id for github allowed teams
- [AIRFLOW-556] Add UI PR guidelines
- [AIRFLOW-358][AIRFLOW-430] Add *connections* cli
- [AIRFLOW-548] Load DAGs immediately & continually
- [AIRFLOW-539] Updated BQ hook and BQ operator to support Standard SQL.
- [AIRFLOW-378] Add string casting to params of spark-sql operator
- [AIRFLOW-544] Add Pause/Resume toggle button
- [AIRFLOW-333][AIRFLOW-258] Fix non-module plugin components
- [AIRFLOW-542] Add tooltip to DAGs links icons
- [AIRFLOW-530] Update docs to reflect connection environment var has to be in uppercase
- [AIRFLOW-525] Update template_fields in Qubole Op
- [AIRFLOW-480] Support binary file download from GCS

- [AIRFLOW-198] Implement latest_only_operator
- [AIRFLOW-91] Add SSL config option for the webserver
- [AIRFLOW-191] Fix connection leak with PostgreSQL backend
- [AIRFLOW-512] Fix 'bellow' typo in docs & comments
- [AIRFLOW-509][AIRFLOW-1] Create operator to delete tables in BigQuery
- [AIRFLOW-498] Remove hard-coded gcp project id
- [AIRFLOW-505] Support unicode characters in authors' names
- [AIRFLOW-494] Add per-operator success/failure metrics
- [AIRFLOW-488] Fix test_simple fail
- [AIRFLOW-468] Update Panda requirement to 0.17.1
- [AIRFLOW-159] Add cloud integration section + GCP documentation
- [AIRFLOW-477][AIRFLOW-478] Restructure security section for clarity
- [AIRFLOW-467] Allow defining of project_id in BigQueryHook
- [AIRFLOW-483] Change print to logging statement
- [AIRFLOW-475] make the segment granularity in Druid hook configurable

3.20.8 Airflow 1.7.2

- [AIRFLOW-463] Link Airflow icon to landing page
- [AIRFLOW-149] Task Dependency Engine + Why Isn't My Task Running View
- [AIRFLOW-361] Add default failure handler for the Qubole Operator
- [AIRFLOW-353] Fix dag run status update failure
- [AIRFLOW-447] Store source URIs in Python 3 compatible list
- [AIRFLOW-443] Make module names unique when importing
- [AIRFLOW-444] Add Google authentication backend
- [AIRFLOW-446][AIRFLOW-445] Adds missing dataproc submit options
- [AIRFLOW-431] Add CLI for CRUD operations on pools
- [AIRFLOW-329] Update Dag Overview Page with Better Status Columns
- [AIRFLOW-360] Fix style warnings in models.py
- [AIRFLOW-425] Add white fill for null state tasks in tree view.
- [AIRFLOW-69] Use dag runs in backfill jobs
- [AIRFLOW-415] Make dag_id not found error clearer
- [AIRFLOW-416] Use ordinals in README's company list
- [AIRFLOW-369] Allow setting default DAG orientation
- [AIRFLOW-410] Add 2 Q/A to the FAQ in the docs
- [AIRFLOW-407] Add different colors for some sensors
- [AIRFLOW-414] Improve error message for missing FERNET_KEY

- [AIRFLOW-406] Sphinx/rst fixes
- [AIRFLOW-412] Fix lxml dependency
- [AIRFLOW-413] Fix unset path bug when backfilling via pickle
- [AIRFLOW-78] Airflow clear leaves dag_runs
- [AIRFLOW-402] Remove NamedHivePartitionSensor static check, add docs
- [AIRFLOW-394] Add an option to the Task Duration graph to show cumulative times
- [AIRFLOW-404] Retry download if unpacking fails for hive
- [AIRFLOW-276] Gunicorn rolling restart
- [AIRFLOW-399] Remove dags/testdruid.py
- [AIRFLOW-400] models.py/DAG.set_dag_runs_state() does not correctly set state
- [AIRFLOW-395] Fix colon/equal signs typo for resources in default config
- [AIRFLOW-397] Documentation: Fix typo "instatiating" to "instantiating"
- [AIRFLOW-395] Remove trailing commas from resources in config
- [AIRFLOW-388] Add a new chart for Task_Tries for each DAG
- [AIRFLOW-322] Fix typo in FAQ section
- [AIRFLOW-375] Pylint fixes
- limit scope to user email only AIRFLOW-386
- [AIRFLOW-383] Cleanup example qubole operator dag
- [AIRFLOW-160] Parse DAG files through child processes
- [AIRFLOW-381] Manual UI Dag Run creation: require dag_id field
- [AIRFLOW-373] Enhance CLI variables functionality
- [AIRFLOW-379] Enhance Variables page functionality: import/export variables
- [AIRFLOW-331] modify the LDAP authentication config lines in 'Security' sample codes
- [AIRFLOW-356][AIRFLOW-355][AIRFLOW-354] Replace nobr, enable DAG only exists locally message, change edit DAG icon
- [AIRFLOW-362] Import __future__ division
- [AIRFLOW-359] Pin flask-login to 0.2.11
- [AIRFLOW-261] Add bcc and cc fields to EmailOperator
- [AIRFLOW-348] Fix code style warnings
- [AIRFLOW-349] Add metric for number of zombies killed
- [AIRFLOW-340] Remove unused dependency on Babel
- [AIRFLOW-339]: Ability to pass a flower conf file
- [AIRFLOW-341][operators] Add resource requirement attributes to operators
- [AIRFLOW-335] Fix simple style errors/warnings
- [AIRFLOW-337] Add __repr__ to VariableAccessor and VariableJsonAccessor
- [AIRFLOW-334] Fix using undefined variable

- [AIRFLOW-315] Fix blank lines code style warnings
- [AIRFLOW-306] Add Spark-sql Hook and Operator
- [AIRFLOW-327] Add rename method to the FTPHook
- [AIRFLOW-321] Fix a wrong code example about tests/dags
- [AIRFLOW-316] Always check DB state for Backfill Job execution
- [AIRFLOW-264] Adding workload management for Hive
- [AIRFLOW-297] support exponential backoff option for retry delay
- [AIRFLOW-31][AIRFLOW-200] Add note to updating.md
- [AIRFLOW-307] There is no __neq__ python magic method.
- [AIRFLOW-309] Add requirements of develop dependencies to docs
- [AIRFLOW-307] Rename __neq__ to __ne__ python magic method.
- [AIRFLOW-313] Fix code style for sqoop_hook.py
- [AIRFLOW-311] Fix wrong path in CONTRIBUTING.md
- [AIRFLOW-24] DataFlow Java Operator
- [AIRFLOW-308] Add link to refresh DAG within DAG view header
- [AIRFLOW-314] Fix BigQuery cursor run_table_upsert method
- [AIRFLOW-298] fix incubator diclaimer in docs
- [AIRFLOW-284] HiveServer2Hook fix for cursor scope for get_results
- [AIRFLOW-260] More graceful exit when issues can't be closed
- [AIRFLOW-260] Handle case when no version is found
- [AIRFLOW-228] Handle empty version list in PR tool
- [AIRFLOW-302] Improve default squash commit message
- [AIRFLOW-187] Improve prompt styling
- [AIRFLOW-187] Fix typo in argument name
- [AIRFLOW-187] Move "Close XXX" message to end of squash commit
- [AIRFLOW-247] Add EMR hook, operators and sensors. Add AWS base hook
- [AIRFLOW-301] Fix broken unit test
- [AIRFLOW-100] Add execution_date_fn to ExternalTaskSensor
- [AIRFLOW-282] Remove PR Tool logic that depends on version formatting
- [AIRFLOW-291] Add index for state in TI table
- [AIRFLOW-269] Add some unit tests for PostgreSQL
- [AIRFLOW-296] template_ext is being treated as a string rather than a tuple in qubole operator
- [AIRFLOW-286] Improve FTPHook to implement context manager interface
- [AIRFLOW-243] Create NamedHivePartitionSensor
- [AIRFLOW-246] Improve dag_stats endpoint query
- [AIRFLOW-189] Highlighting of Parent/Child nodes in Graphs

- [ARFLOW-255] Check dagrun timeout when comparing active runs
- [AIRFLOW-281] Add port to mssql_hook
- [AIRFLOW-285] Use Airflow 2.0 style imports for all remaining hooks/operators
- [AIRFLOW-40] Add LDAP group filtering feature.
- [AIRFLOW-277] Multiple deletions does not work in Task Instances view if using SQLite backend
- [AIRFLOW-200] Make hook/operator imports lazy, and print proper exceptions
- [AIRFLOW-283] Make store_to_xcom_key a templated field in GoogleCloudStorageDownloadOperator
- [AIRFLOW-278] Support utf-8 ecoding for SQL
- [AIRFLOW-280] clean up tmp druid table no matter if an ingestion job succeeds or not
- [AIRFLOW-274] Add XCom functionality to GoogleCloudStorageDownloadOperator
- [AIRFLOW-273] Create an svg version of the airflow logo.
- [AIRFLOW-275] Update contributing guidelines
- [AIRFLOW-244] Modify hive operator to inject analysis data
- [AIRFLOW-162] Allow variable to be accessible into templates
- [AIRFLOW-248] Add Apache license header to all files
- [AIRFLOW-263] Remove temp backtick file
- [AIRFLOW-252] Raise Sqlite exceptions when deleting tasks instance in WebUI
- [AIRFLOW-180] Fix timeout behavior for sensors
- [AIRFLOW-262] Simplify commands in MANIFEST.in
- [AIRFLOW-31] Add zope dependency
- [AIRFLOW-6] Remove dependency on Highcharts
- [AIRFLOW-234] make task that aren't *running* self-terminate
- [AIRFLOW-256] Fix test_scheduler_reschedule heartrate
- Add Python 3 compatibility fix
- [AIRFLOW-31] Use standard imports for hooks/operators
- [AIRFLOW-173] Initial implementation of FileSensor
- [AIRFLOW-224] Collect orphaned tasks and reschedule them
- [AIRFLOW-239] Fix tests indentation
- [AIRFLOW-225] Better units for task duration graph
- [AIRFLOW-241] Add testing done section to PR template
- [AIRFLOW-222] Show duration of task instances in ui
- [AIRFLOW-231] Do not eval user input in PrestoHook
- [AIRFLOW-216] Add Sqoop Hook and Operator
- [AIRFLOW-171] Add upgrade notes on email and S3 to 1.7.1.2
- [AIRFLOW-238] Make compatible with flask-admin 1.4.1
- [AIRFLOW-230] [HiveServer2Hook] adding multi statements support

- [AIRFLOW-142] setup_env.sh doesn't download hive tarball if hdp is specified as distro
- [AIRFLOW-223] Make parametrable the IP on which Flower binds to
- [AIRFLOW-218] Added option to enable webserver gunicorn access/err logs
- [AIRFLOW-213] Add "Closes #X" phrase to commit messages
- [AIRFLOW-68] Align start_date with the schedule_interval
- [AIRFLOW-9] Improving docs to meet Apache's standards
- [AIRFLOW-131] Make XCom.clear more selective
- [AIRFLOW-214] Fix occasion of detached taskinstance
- [AIRFLOW-206] Add commit to close PR
- [AIRFLOW-206] Always load local log files if they exist
- [AIRFLOW-211] Fix JIRA "resolve" vs "close" behavior
- [AIRFLOW-64] Add note about relative DAGS_FOLDER
- [AIRFLOW-114] Sort plugins dropdown
- [AIRFLOW-209] Add scheduler tests and improve lineage handling
- [AIRFLOW-207] Improve JIRA auth workflow
- [AIRFLOW-187] Improve PR tool UX
- [AIRFLOW-155] Documentation of Qubole Operator
- Optimize and refactor process_dag
- [AIRFLOW-185] Handle empty versions list
- [AIRFLOW-201] Fix for HiveMetastoreHook + kerberos
- [AIRFLOW-202]: Fixes stray print line
- [AIRFLOW-196] Fix bug that exception is not handled in HttpSensor
- [AIRFLOW-195] : Add toggle support to subdag clearing in the CLI
- [AIRFLOW-23] Support for Google Cloud DataProc
- [AIRFLOW-25] Configuration for Celery always required
- [AIRFLOW-190] Add codecov and remove download count
- [AIRFLOW-168] Correct evaluation of @once schedule
- [AIRFLOW-183] Fetch log from remote when worker returns 4xx/5xx response
- [AIRFLOW-181] Fix failing unpacking of hadoop by redownloading
- [AIRFLOW-176] remove unused formatting key
- [AIRFLOW-167]: Add dag_state option in cli
- [AIRFLOW-178] Fix bug so that zip file is detected in DAG folder
- [AIRFLOW-176] Improve PR Tool JIRA workflow
- AIRFLOW-45: Support Hidden Airflow Variables
- [AIRFLOW-175] Run git-reset before checkout in PR tool
- [AIRFLOW-157] Make PR tool Py3-compat; add JIRA command

- [AIRFLOW-170] Add missing @apply_defaults

3.20.9 Airflow 1.7.1, 2016-05-19

- Fix : Don't treat premature tasks as could_not_run tasks
- AIRFLOW-92 Avoid unneeded upstream_failed session closes apache/airflow#1485
- Add logic to lock DB and avoid race condition
- Handle queued tasks from multiple jobs/executors
- AIRFLOW-52 Warn about overwriting tasks in a DAG
- Fix corner case with joining processes/queues (#1473)
- [AIRFLOW-52] Fix bottlenecks when working with many tasks
- Add columns to toggle extra detail in the connection list view.
- Log the number of errors when importing DAGs
- Log dagbag metrics dupplicate messages in queue into Statsd (#1406)
- Clean up issue template (#1419)
- correct missed arg.foreground to arg.daemon in cli
- Reinstate imports for github enterprise auth
- Use os.execvp instead of subprocess.Popen for the webserver
- Revert from using "–foreground" to "–daemon"
- Implement a Cloudant hook
- Add missing args to *airflow clear*
- Fixed a bug in the scheduler: num_runs used where runs intended
- Add multiprocessing support to the scheduler
- Partial fix to make sure next_run_date cannot be None
- Support list/get/set variables in the CLI
- Properly handle BigQuery booleans in BigQuery hook.
- Added the ability to view XCom variables in webserver
- Change DAG.tasks from a list to a dict
- Add support for zipped dags
- Stop creating hook on instantiating of S3 operator
- User subquery in views to find running DAGs
- Prevent DAGs from being reloaded on every scheduler iteration
- Add a missing word to docs
- Document the parameters of *DbApiHook*
- added oracle operator with existing oracle hook
- Add PyOpenSSL to Google cloud gcp_api.
- Remove executor error unit test

- Add DAG inference, deferral, and context manager
- Don't return error when writing files to Google cloud storage.
- Fix GCS logging for gcp_api.
- Ensure attr is in scope for error message
- Fixing misnamed PULL_REQUEST_TEMPLATE
- Extract non_pooled_task_slot_count into a configuration param
- Update plugins.rst for clarity on the example (#1309)
- Fix s3 logging issue
- Add twitter feed example dag
- Github ISSUE_TEMPLATE & PR_TEMPLATE cleanup
- Reduce logger verbosity
- Adding a PR Template
- Add Lucid to list of users
- Fix usage of asciiart
- Use session instead of outdated main_session for are_dependencies_met
- Fix celery flower port allocation
- Fix for missing edit actions due to flask-admin upgrade
- Fix typo in comment in prioritize_queued method
- Add HipchatOperator
- Include all example dags in backfill unit test
- Make sure skipped jobs are actually skipped
- Fixing a broken example dag, example_skip_dag.py
- Add consistent and thorough signal handling and logging
- Allow Operators to specify SKIPPED status internally
- Update docstring for executor trap unit test
- Doc: explain the usage of Jinja templating for templated params
- Don't schedule runs before the DAG's start_date
- Fix infinite retries with pools, with test
- Fix handling of deadlocked jobs
- Show only Airflow's deprecation warnings
- Set DAG_FOLDER for unit tests
- Missing comma in setup.py
- Deprecate *args and **kwargs in BaseOperator
- Raise deep scheduler exceptions to force a process restart.
- Change inconsistent example DAG owners
- Fix module path of send_email_smtp in configuration

- added Gentner Lab to list of users
- Increase timeout time for unit test
- Fix reading strings from conf
- CHORE - Remove Trailing Spaces
- Fix SSHExecuteOperator crash when using a custom ssh port
- Add note about airflow components to template
- Rewrite BackfillJob logic for clarity
- Add unit tests
- Fix miscellaneous bugs and clean up code
- Fix logic for determining DagRun states
- Make SchedulerJob not run EVERY queued task
- Improve BackfillJob handling of queued/deadlocked tasks
- Introduce ignore_depends_on_past parameters
- Use Popen with CeleryExecutor
- Rename user table to users to avoid conflict with postgres
- Beware of negative pool slots.
- Add support for calling_format from boto to S3_Hook
- Add pypi meta data and sync version number
- Set dags_are_paused_at_creation's default value to True
- Resurface S3Log class eaten by rebase/push -f
- Add missing session.commit() at end of initdb
- Validate that subdag tasks have pool slots available, and test
- Use urlparse for remote GCS logs, and add unit tests
- Make webserver worker timeout configurable
- Fixed scheduling for @once interval
- Use psycopg2's API for serializing postgres cell values
- Make the provide_session decorator more robust
- update link to Lyft's website
- use num_shards instead of partitions to be consistent with batch ingestion
- Add documentation links to README
- Update docs with separate configuration section
- Fix airflow.utils deprecation warning code being Python 3 incompatible
- Extract dbapi cell serialization into its own method
- Set Postgres autocommit as supported only if server version is < 7.4
- Use refactored utils module in unit test imports
- Add changelog for 1.7.0

- Use LocalExecutor on Travis if possible
- remove unused logging,errno, MiniHiveCluster imports
- remove extra import of logging lib
- Fix required gcloud version
- Refactoring utils into smaller submodules
- Properly measure number of task retry attempts
- Add function to get configuration as dict, plus unit tests
- Merge branch 'master' into hivemeta_sasl
- Add wiki link to README.md
- [hotfix] make email.Utils > email.utils for py3
- Add the missing "Date" header to the warning e-mails
- Add the missing "Date" header to the warning e-mails
- Check name of SubDag class instead of class itself
- [hotfix] removing repo_token from .coveralls.yml
- Set the service_name in coverals.yml
- Fixes #1223
- Update Airflow docs for remote logging
- Add unit tests for trapping Executor errors
- Make sure Executors properly trap errors
- Fix HttpOpSensorTest to use fake resquest session
- Linting
- Add an example on pool usage in the documentation
- Add two methods to bigquery hook's base cursor: run_table_upsert, which adds a table or updates an existing table; and run_grant_dataset_view_access, which grants view access to a given dataset for a given table.
- Tasks references upstream and downstream tasks using strings instead of references
- Fix typos in models.py
- Fix broken links in documentation
- [hotfix] fixing the Scheduler CLI to make dag_id optional
- Update link to Common Pitfalls wiki page in README
- Allow disabling periodic committing when inserting rows with DbApiHook
- added Glassdoor to "who uses airflow"
- Fix typo preventing from launching webserver
- Documentation badge
- Fixing ISSUE_TEMPLATE name to include .md suffix
- Adding an ISSUE_TEMPLATE to ensure that issues are adequately defined
- Linting & debugging

- Refactoring the CLI to be data-driven
- Updating the Bug Reporting protocol in the Contributing.md file
- Fixing the docs
- clean up references to old session
- remove session reference
- resolve conflict
- clear xcom data when task instance starts
- replace main_session with @provide_session
- Add extras to installation.rst
- Changes to Contributing to reflect more closely the current state of development.
- Modifying README to link to the wiki committer list
- docs: fixes a spelling mistake in default config
- Set killMode to 'control-group' for webservice.service
- Set KillMode to 'control-group' for worker.service
- Linting
- Fix WebHdfsSensor
- Adding more licenses to pass checks
- fixing landscape's config
- [hotfix] typo that made it in master
- [hotfix] fixing landscape requirement detection
- Make testing on hive conditional
- Merge remote-tracking branch 'upstream/master' into minicluster
- Update README.md
- Throwing in a few license to pass the build
- Adding a reqs.txt for landscape.io
- Pointing to a reqs file
- Some linting
- Adding a .landscape.yml file
- badge for pypi version
- Add license and ignore for sql and csv
- Use correct connection id
- Use correct table name
- Provide data for ci tests
- new badge for showing staleness of reqs
- removing requirements.txt as it is uni-dimensional
- Make it work on py3

- Remove decode for logging
- Also keep py2 compatible
- More py3 fixes
- Convert to bytes for py3 compat
- Make sure to be py3 compatible
- Use unicodecsv to make it py3 compatible
- Replace tab with spaces Remove unused import
- Merge remote-tracking branch 'upstream/master'
- Support decimal types in MySQL to GCS
- Make sure to write binary as string can be unicode
- Ignore metastore
- More impyla fixes
- Test HivemetaStore if python 2
- Allow users to set hdfs_namenode_principal in HDFSHook config
- Add tests for Hiveserver2 and fix some issues from impyla
- Merge branch 'impyla' into minicluster
- This patch allows for testing of hive operators and hooks. Sasl is used (NoSasl in connection string is not possible). Tests have been adjusted.
- Treat SKIPPED and SUCCESS the same way when evaluating depends_on_past=True
- fix bigquery hook
- version cap for gcp_api
- Fix typo when returning VerticaHook
- Adding fernet key to use it as part of stdout commands
- Adding support for ssl parameters. (picking up from jthomas123)
- more detail in error message.
- make sure paths don't conflict bc of trailing /
- change gcs_hook to self.hook
- refactor remote log read/write and add GCS support
- Only use multipart upload in S3Hook if file is large enough
- Merge branch 'airbnb/master'
- Add GSSAPI SASL to HiveMetaStoreHook.
- Add warning for deprecated setting
- Use kerberos_service_name = 'hive' as standard instead of 'impala'.
- Use GSSAPI instead of KERBEROS and provide backwards compatibility
- ISSUE-1123 Use impyla instead of pyhs2
- set celery_executor to use queue name as exchange

3.21 FAQ

3.21.1 Why isn't my task getting scheduled?

There are very many reasons why your task might not be getting scheduled. Here are some of the common causes:

- Does your script "compile", can the Airflow engine parse it and find your DAG object. To test this, you can run `airflow list_dags` and confirm that your DAG shows up in the list. You can also run `airflow list_tasks foo_dag_id --tree` and confirm that your task shows up in the list as expected. If you use the CeleryExecutor, you may want to confirm that this works both where the scheduler runs as well as where the worker runs.
- Does the file containing your DAG contain the string "airflow" and "DAG" somewhere in the contents? When searching the DAG directory, Airflow ignores files not containing "airflow" and "DAG" in order to prevent the DagBag parsing from importing all python files collocated with user's DAGs.
- Is your `start_date` set properly? The Airflow scheduler triggers the task soon after the `start_date + scheduler_interval` is passed.
- Is your `schedule_interval` set properly? The default `schedule_interval` is one day (`datetime.timedelta(1)`). You must specify a different `schedule_interval` directly to the DAG object you instantiate, not as a `default_param`, as task instances do not override their parent DAG's `schedule_interval`.
- Is your `start_date` beyond where you can see it in the UI? If you set your `start_date` to some time say 3 months ago, you won't be able to see it in the main view in the UI, but you should be able to see it in the `Menu -> Browse ->Task Instances`.
- Are the dependencies for the task met. The task instances directly upstream from the task need to be in a `success` state. Also, if you have set `depends_on_past=True`, the previous task instance needs to have succeeded (except if it is the first run for that task). Also, if `wait_for_downstream=True`, make sure you understand what it means. You can view how these properties are set from the `Task Instance Details` page for your task.
- Are the DagRuns you need created and active? A DagRun represents a specific execution of an entire DAG and has a state (running, success, failed, . . .). The scheduler creates new DagRun as it moves forward, but never goes back in time to create new ones. The scheduler only evaluates `running` DagRuns to see what task instances it can trigger. Note that clearing tasks instances (from the UI or CLI) does set the state of a DagRun back to running. You can bulk view the list of DagRuns and alter states by clicking on the schedule tag for a DAG.
- Is the `concurrency` parameter of your DAG reached? `concurrency` defines how many `running` task instances a DAG is allowed to have, beyond which point things get queued.
- Is the `max_active_runs` parameter of your DAG reached? `max_active_runs` defines how many `running` concurrent instances of a DAG there are allowed to be.

You may also want to read the Scheduler section of the docs and make sure you fully understand how it proceeds.

3.21.2 How do I trigger tasks based on another task's failure?

Check out the `Trigger Rule` section in the Concepts section of the documentation

3.21.3 Why are connection passwords still not encrypted in the metadata db after I installed airflow[crypto]?

Check out the `Connections` section in the Configuration section of the documentation

3.21.4 What's the deal with `start_date`?

`start_date` is partly legacy from the pre-DagRun era, but it is still relevant in many ways. When creating a new DAG, you probably want to set a global `start_date` for your tasks using `default_args`. The first DagRun to be created will be based on the `min(start_date)` for all your task. From that point on, the scheduler creates new DagRuns based on your `schedule_interval` and the corresponding task instances run as your dependencies are met. When introducing new tasks to your DAG, you need to pay special attention to `start_date`, and may want to reactivate inactive DagRuns to get the new task onboarded properly.

We recommend against using dynamic values as `start_date`, especially `datetime.now()` as it can be quite confusing. The task is triggered once the period closes, and in theory an `@hourly` DAG would never get to an hour after now as `now()` moves along.

Previously we also recommended using rounded `start_date` in relation to your `schedule_interval`. This meant an `@hourly` would be at `00:00` minutes:seconds, a `@daily` job at midnight, a `@monthly` job on the first of the month. This is no longer required. Airflow will now auto align the `start_date` and the `schedule_interval`, by using the `start_date` as the moment to start looking.

You can use any sensor or a `TimeDeltaSensor` to delay the execution of tasks within the schedule interval. While `schedule_interval` does allow specifying a `datetime.timedelta` object, we recommend using the macros or cron expressions instead, as it enforces this idea of rounded schedules.

When using `depends_on_past=True` it's important to pay special attention to `start_date` as the past dependency is not enforced only on the specific schedule of the `start_date` specified for the task. It's also important to watch DagRun activity status in time when introducing new `depends_on_past=True`, unless you are planning on running a backfill for the new task(s).

Also important to note is that the tasks `start_date`, in the context of a backfill CLI command, get overridden by the backfill's command `start_date`. This allows for a backfill on tasks that have `depends_on_past=True` to actually start, if that wasn't the case, the backfill just wouldn't start.

3.21.5 How can I create DAGs dynamically?

Airflow looks in your `DAGS_FOLDER` for modules that contain `DAG` objects in their global namespace, and adds the objects it finds in the `DagBag`. Knowing this all we need is a way to dynamically assign variable in the global namespace, which is easily done in python using the `globals()` function for the standard library which behaves like a simple dictionary.

```
for i in range(10):
    dag_id = 'foo_{}'.format(i)
    globals()[dag_id] = DAG(dag_id)
    # or better, call a function that returns a DAG object!
```

3.21.6 What are all the `airflow run` commands in my process list?

There are many layers of `airflow run` commands, meaning it can call itself.

- Basic `airflow run`: fires up an executor, and tell it to run an `airflow run --local` command. if using Celery, this means it puts a command in the queue for it to run remote, on the worker. If using LocalExecutor, that translates into running it in a subprocess pool.
- Local `airflow run --local`: starts an `airflow run --raw` command (described below) as a subprocess and is in charge of emitting heartbeats, listening for external kill signals and ensures some cleanup takes place if the subprocess fails
- Raw `airflow run --raw` runs the actual operator's execute method and performs the actual work

3.21.7 How can my airflow dag run faster?

There are three variables we could control to improve airflow dag performance:

- `parallelism`: This variable controls the number of task instances that the airflow worker can run simultaneously. User could increase the parallelism variable in the `airflow.cfg`.
- `concurrency`: The Airflow scheduler will run no more than `$concurrency` task instances for your DAG at any given time. Concurrency is defined in your Airflow DAG. If you do not set the concurrency on your DAG, the scheduler will use the default value from the `dag_concurrency` entry in your `airflow.cfg`.
- `max_active_runs`: the Airflow scheduler will run no more than `max_active_runs` DagRuns of your DAG at a given time. If you do not set the `max_active_runs` in your DAG, the scheduler will use the default value from the `max_active_runs_per_dag` entry in your `airflow.cfg`.

3.21.8 How can we reduce the airflow UI page load time?

If your dag takes long time to load, you could reduce the value of `default_dag_run_display_number` configuration in `airflow.cfg` to a smaller value. This configurable controls the number of dag run to show in UI with default value 25.

3.21.9 How to fix Exception: Global variable explicit_defaults_for_timestamp needs to be on (1)?

This means `explicit_defaults_for_timestamp` is disabled in your mysql server and you need to enable it by:

1. Set `explicit_defaults_for_timestamp = 1` under the mysqld section in your my.cnf file.
2. Restart the Mysql server.

3.21.10 How to reduce airflow dag scheduling latency in production?

- `max_threads`: Scheduler will spawn multiple threads in parallel to schedule dags. This is controlled by `max_threads` with default value of 2. User should increase this value to a larger value(e.g numbers of cpus where scheduler runs - 1) in production.
- `scheduler_heartbeat_sec`: User should consider to increase `scheduler_heartbeat_sec` config to a higher value(e.g 60 secs) which controls how frequent the airflow scheduler gets the heartbeat and updates the job's entry in database.

3.22 API Reference

3.22.1 Operators

Operators allow for generation of certain types of tasks that become nodes in the DAG when instantiated. All operators derive from `BaseOperator` and inherit many attributes and methods that way. Refer to the *BaseOperator* documentation for more details.

There are 3 main types of operators:

- Operators that performs an **action**, or tell another system to perform an action
- **Transfer** operators move data from one system to another

- **Sensors** are a certain type of operator that will keep running until a certain criterion is met. Examples include a specific file landing in HDFS or S3, a partition appearing in Hive, or a specific time of the day. Sensors are derived from `BaseSensorOperator` and run a poke method at a specified `poke_interval` until it returns `True`.

3.22.1.1 BaseOperator

All operators are derived from `BaseOperator` and acquire much functionality through inheritance. Since this is the core of the engine, it's worth taking the time to understand the parameters of `BaseOperator` to understand the primitive features that can be leveraged in your DAGs.

class airflow.models.**BaseOperator**(***kwargs*)

Bases: `airflow.utils.log.logging_mixin.LoggingMixin`

Abstract base class for all operators. Since operators create objects that become nodes in the dag, BaseOperator contains many recursive methods for dag crawling behavior. To derive this class, you are expected to override the constructor as well as the 'execute' method.

Operators derived from this class should perform or trigger certain tasks synchronously (wait for completion). Example of operators could be an operator that runs a Pig job (PigOperator), a sensor operator that waits for a partition to land in Hive (HiveSensorOperator), or one that moves data from Hive to MySQL (Hive2MySqlOperator). Instances of these operators (tasks) target specific operations, running specific scripts, functions or data transfers.

This class is abstract and shouldn't be instantiated. Instantiating a class derived from this one results in the creation of a task object, which ultimately becomes a node in DAG objects. Task dependencies should be set by using the set_upstream and/or set_downstream methods.

Parameters

- **task_id** (*string*) – a unique, meaningful id for the task
- **owner** (*string*) – the owner of the task, using the unix username is recommended
- **retries** (*int*) – the number of retries that should be performed before failing the task
- **retry_delay** (*timedelta*) – delay between retries
- **retry_exponential_backoff** (*bool*) – allow progressive longer waits between retries by using exponential backoff algorithm on retry delay (delay will be converted into seconds)
- **max_retry_delay** (*timedelta*) – maximum delay interval between retries
- **start_date** (*datetime*) – The `start_date` for the task, determines the `execution_date` for the first task instance. The best practice is to have the start_date rounded to your DAG's `schedule_interval`. Daily jobs have their start_date some day at 00:00:00, hourly jobs have their start_date at 00:00 of a specific hour. Note that Airflow simply looks at the latest `execution_date` and adds the `schedule_interval` to determine the next `execution_date`. It is also very important to note that different tasks' dependencies need to line up in time. If task A depends on task B and their start_date are offset in a way that their execution_date don't line up, A's dependencies will never be met. If you are looking to delay a task, for example running a daily task at 2AM, look into the `TimeSensor` and `TimeDeltaSensor`. We advise against using dynamic `start_date` and recommend using fixed ones. Read the FAQ entry about start_date for more information.
- **end_date** (*datetime*) – if specified, the scheduler won't go beyond this date

- **depends_on_past** (*bool*) – when set to true, task instances will run sequentially while relying on the previous task's schedule to succeed. The task instance for the start_date is allowed to run.
- **wait_for_downstream** (*bool*) – when set to true, an instance of task X will wait for tasks immediately downstream of the previous instance of task X to finish successfully before it runs. This is useful if the different instances of a task X alter the same asset, and this asset is used by tasks downstream of task X. Note that depends_on_past is forced to True wherever wait_for_downstream is used.
- **queue** (*str*) – which queue to target when running this job. Not all executors implement queue management, the CeleryExecutor does support targeting specific queues.
- **dag** (`DAG`) – a reference to the dag the task is attached to (if any)
- **priority_weight** (*int*) – priority weight of this task against other task. This allows the executor to trigger higher priority tasks before others when things get backed up.
- **weight_rule** (*str*) – weighting method used for the effective total priority weight of the task. Options are: `{ downstream | upstream | absolute }` default is `downstream` When set to `downstream` the effective weight of the task is the aggregate sum of all downstream descendants. As a result, upstream tasks will have higher weight and will be scheduled more aggressively when using positive weight values. This is useful when you have multiple dag run instances and desire to have all upstream tasks to complete for all runs before each dag can continue processing downstream tasks. When set to `upstream` the effective weight is the aggregate sum of all upstream ancestors. This is the opposite where downtream tasks have higher weight and will be scheduled more aggressively when using positive weight values. This is useful when you have multiple dag run instances and prefer to have each dag complete before starting upstream tasks of other dags. When set to `absolute`, the effective weight is the exact `priority_weight` specified without additional weighting. You may want to do this when you know exactly what priority weight each task should have. Additionally, when set to `absolute`, there is bonus effect of significantly speeding up the task creation process as for very large DAGS. Options can be set as string or using the constants defined in the static class `airflow.utils.WeightRule`
- **pool** (*str*) – the slot pool this task should run in, slot pools are a way to limit concurrency for certain tasks
- **sla** (*datetime.timedelta*) – time by which the job is expected to succeed. Note that this represents the `timedelta` after the period is closed. For example if you set an SLA of 1 hour, the scheduler would send an email soon after 1:00AM on the `2016-01-02` if the `2016-01-01` instance has not succeeded yet. The scheduler pays special attention for jobs with an SLA and sends alert emails for sla misses. SLA misses are also recorded in the database for future reference. All tasks that share the same SLA time get bundled in a single email, sent soon after that time. SLA notification are sent once and only once for each task instance.
- **execution_timeout** (*datetime.timedelta*) – max time allowed for the execution of this task instance, if it goes beyond it will raise and fail.
- **on_failure_callback** (*callable*) – a function to be called when a task instance of this task fails. a context dictionary is passed as a single parameter to this function. Context contains references to related objects to the task instance and is documented under the macros section of the API.
- **on_retry_callback** (*callable*) – much like the `on_failure_callback` except that it is executed when retries occur.

- **on_success_callback** (*callable*) – much like the `on_failure_callback` except that it is executed when the task succeeds.
- **trigger_rule** (*str*) – defines the rule by which dependencies are applied for the task to get triggered. Options are: `{ all_success | all_failed | all_done | one_success | one_failed | none_failed | dummy}` default is `all_success`. Options can be set as string or using the constants defined in the static class `airflow.utils.TriggerRule`
- **resources** (*dict*) – A map of resource parameter names (the argument names of the Resources constructor) to their values.
- **run_as_user** (*str*) – unix username to impersonate while running the task
- **task_concurrency** (*int*) – When set, a task will be able to limit the concurrent runs across execution_dates
- **executor_config** (*dict*) – Additional task-level configuration parameters that are interpreted by a specific executor. Parameters are namespaced by the name of executor.

  Example: to run this task in a specific docker container through the KubernetesExecutor

  ```
  MyOperator(...,
      executor_config={
      "KubernetesExecutor":
          {"image": "myCustomDockerImage"}
          }
  )
  ```

clear(***kwargs*)
Clears the state of task instances associated with the task, following the parameters specified.

dag
Returns the Operator's DAG if set, otherwise raises an error

deps
Returns the list of dependencies for the operator. These differ from execution context dependencies in that they are specific to tasks and can be extended/overridden by subclasses.

downstream_list
@property: list of tasks directly downstream

execute(*context*)
This is the main method to derive when creating an operator. Context is the same dictionary used as when rendering jinja templates.

Refer to get_template_context for more context.

get_direct_relative_ids(*upstream=False*)
Get the direct relative ids to the current task, upstream or downstream.

get_direct_relatives(*upstream=False*)
Get the direct relatives to the current task, upstream or downstream.

get_flat_relative_ids(*upstream=False*, *found_descendants=None*)
Get a flat list of relatives' ids, either upstream or downstream.

get_flat_relatives(*upstream=False*)
Get a flat list of relatives, either upstream or downstream.

get_task_instances(*session*, *start_date=None*, *end_date=None*)
Get a set of task instance related to this task for a specific date range.

has_dag()
Returns True if the Operator has been assigned to a DAG.

on_kill()
Override this method to cleanup subprocesses when a task instance gets killed. Any use of the threading, subprocess or multiprocessing module within an operator needs to be cleaned up or it will leave ghost processes behind.

post_execute(*context*, **args*, ***kwargs*)
This hook is triggered right after self.execute() is called. It is passed the execution context and any results returned by the operator.

pre_execute(*context*, **args*, ***kwargs*)
This hook is triggered right before self.execute() is called.

prepare_template()
Hook that is triggered after the templated fields get replaced by their content. If you need your operator to alter the content of the file before the template is rendered, it should override this method to do so.

render_template(*attr*, *content*, *context*)
Renders a template either from a file or directly in a field, and returns the rendered result.

render_template_from_field(*attr*, *content*, *context*, *jinja_env*)
Renders a template from a field. If the field is a string, it will simply render the string and return the result. If it is a collection or nested set of collections, it will traverse the structure and render all strings in it.

run(*start_date=None*, *end_date=None*, *ignore_first_depends_on_past=False*, *ignore_ti_state=False*, *mark_success=False*)
Run a set of task instances for a date range.

schedule_interval
The schedule interval of the DAG always wins over individual tasks so that tasks within a DAG always line up. The task still needs a schedule_interval as it may not be attached to a DAG.

set_downstream(*task_or_task_list*)
Set a task or a task list to be directly downstream from the current task.

set_upstream(*task_or_task_list*)
Set a task or a task list to be directly upstream from the current task.

upstream_list
@property: list of tasks directly upstream

xcom_pull(*context*, *task_ids=None*, *dag_id=None*, *key=u'return_value'*, *include_prior_dates=None*)
See TaskInstance.xcom_pull()

xcom_push(*context*, *key*, *value*, *execution_date=None*)
See TaskInstance.xcom_push()

3.22.1.2 BaseSensorOperator

All sensors are derived from `BaseSensorOperator`. All sensors inherit the `timeout` and `poke_interval` on top of the `BaseOperator` attributes.

class airflow.sensors.base_sensor_operator.**BaseSensorOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*, airflow.models.SkipMixin

Sensor operators are derived from this class and inherit these attributes.

Sensor operators keep executing at a time interval and succeed when a criteria is met and fail if and when they time out.

Parameters

- **soft_fail** (*bool*) – Set to true to mark the task as SKIPPED on failure
- **poke_interval** (*int*) – Time in seconds that the job should wait in between each tries
- **timeout** (*int*) – Time, in seconds before the task times out and fails.
- **mode** (*str*) – How the sensor operates. Options are: `{ poke | reschedule }`, default is `poke`. When set to `poke` the sensor is taking up a worker slot for its whole execution time and sleeps between pokes. Use this mode if the expected runtime of the sensor is short or if a short poke interval is requried. When set to `reschedule` the sensor task frees the worker slot when the criteria is not yet met and it's rescheduled at a later time. Use this mode if the expected time until the criteria is met is. The poke inteval should be more than one minute to prevent too much load on the scheduler.

deps
Adds one additional dependency for all sensor operators that checks if a sensor task instance can be rescheduled.

poke (*context*)
Function that the sensors defined while deriving this class should override.

3.22.1.3 Core Operators

Operators

class airflow.operators.bash_operator.**BashOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Execute a Bash script, command or set of commands.

Parameters

- **bash_command** (*string*) – The command, set of commands or reference to a bash script (must be '.sh') to be executed. (templated)
- **xcom_push** (*bool*) – If xcom_push is True, the last line written to stdout will also be pushed to an XCom when the bash command completes.
- **env** (*dict*) – If env is not None, it must be a mapping that defines the environment variables for the new process; these are used instead of inheriting the current process environment, which is the default behavior. (templated)
- **output_encoding** (*str*) – Output encoding of bash command

execute (*context*)
Execute the bash command in a temporary directory which will be cleaned afterwards

class airflow.operators.python_operator.**BranchPythonOperator**(***kwargs*)
Bases: *airflow.operators.python_operator.PythonOperator*, airflow.models.SkipMixin

Allows a workflow to "branch" or follow a single path following the execution of this task.

It derives the PythonOperator and expects a Python function that returns the task_id to follow. The task_id returned should point to a task directly downstream from {self}. All other "branches" or directly downstream tasks are marked with a state of `skipped` so that these paths can't move forward. The `skipped` states are propageted downstream to allow for the DAG state to fill up and the DAG run's state to be inferred.

Note that using tasks with `depends_on_past=True` downstream from `BranchPythonOperator` is logically unsound as `skipped` status will invariably lead to block tasks that depend on their past successes. `skipped` states propagates where all directly upstream tasks are `skipped`.

class `airflow.operators.check_operator.`**`CheckOperator`**`(`***kwargs*`)`
Bases: *`airflow.models.BaseOperator`*

Performs checks against a db. The `CheckOperator` expects a sql query that will return a single row. Each value on that first row is evaluated using python `bool` casting. If any of the values return `False` the check is failed and errors out.

Note that Python bool casting evals the following as `False`:

- `False`
- `0`
- Empty string (`""`)
- Empty list (`[]`)
- Empty dictionary or set (`{}`)

Given a query like `SELECT COUNT(*) FROM foo`, it will fail only if the count `== 0`. You can craft much more complex query that could, for instance, check that the table has the same number of rows as the source table upstream, or that the count of today's partition is greater than yesterday's partition, or that a set of metrics are less than 3 standard deviation for the 7 day average.

This operator can be used as a data quality check in your pipeline, and depending on where you put it in your DAG, you have the choice to stop the critical path, preventing from publishing dubious data, or on the side and receive email alerts without stopping the progress of the DAG.

Note that this is an abstract class and get_db_hook needs to be defined. Whereas a get_db_hook is hook that gets a single record from an external source.

Parameters **`sql`** (*`string`*) – the sql to be executed. (templated)

class `airflow.operators.docker_operator.`**`DockerOperator`**`(`***kwargs*`)`
Bases: *`airflow.models.BaseOperator`*

Execute a command inside a docker container.

A temporary directory is created on the host and mounted into a container to allow storing files that together exceed the default disk size of 10GB in a container. The path to the mounted directory can be accessed via the environment variable `AIRFLOW_TMP_DIR`.

If a login to a private registry is required prior to pulling the image, a Docker connection needs to be configured in Airflow and the connection ID be provided with the parameter `docker_conn_id`.

Parameters

- **`image`** (*`str`*) – Docker image from which to create the container. If image tag is omitted, "latest" will be used.
- **`api_version`** (*`str`*) – Remote API version. Set to `auto` to automatically detect the server's version.
- **`auto_remove`** (*`bool`*) – Auto-removal of the container on daemon side when the container's process exits. The default is False.
- **`command`** (*`str or list`*) – Command to be run in the container. (templated)
- **`cpus`** (*`float`*) – Number of CPUs to assign to the container. This value gets multiplied with 1024. See https://docs.docker.com/engine/reference/run/#cpu-share-constraint

- **dns** (*list of strings*) – Docker custom DNS servers
- **dns_search** (*list of strings*) – Docker custom DNS search domain
- **docker_url** (*str*) – URL of the host running the docker daemon. Default is unix://var/run/docker.sock
- **environment** (*dict*) – Environment variables to set in the container. (templated)
- **force_pull** (*bool*) – Pull the docker image on every run. Default is False.
- **mem_limit** (*float or str*) – Maximum amount of memory the container can use. Either a float value, which represents the limit in bytes, or a string like `128m` or `1g`.
- **network_mode** (*str*) – Network mode for the container.
- **tls_ca_cert** (*str*) – Path to a PEM-encoded certificate authority to secure the docker connection.
- **tls_client_cert** (*str*) – Path to the PEM-encoded certificate used to authenticate docker client.
- **tls_client_key** (*str*) – Path to the PEM-encoded key used to authenticate docker client.
- **tls_hostname** (*str or bool*) – Hostname to match against the docker server certificate or False to disable the check.
- **tls_ssl_version** (*str*) – Version of SSL to use when communicating with docker daemon.
- **tmp_dir** (*str*) – Mount point inside the container to a temporary directory created on the host by the operator. The path is also made available via the environment variable `AIRFLOW_TMP_DIR` inside the container.
- **user** (*int or str*) – Default user inside the docker container.
- **volumes** – List of volumes to mount into the container, e.g. `['/host/path:/container/path', '/host/path2:/container/path2:ro']`.
- **working_dir** (*str*) – Working directory to set on the container (equivalent to the -w switch the docker client)
- **xcom_push** (*bool*) – Does the stdout will be pushed to the next step using XCom. The default is False.
- **xcom_all** (*bool*) – Push all the stdout or just the last line. The default is False (last line).
- **docker_conn_id** (*str*) – ID of the Airflow connection to use
- **shm_size** (*int*) – Size of `/dev/shm` in bytes. The size must be greater than 0. If omitted uses system default.

class `airflow.operators.dummy_operator.`**`DummyOperator`**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Operator that does literally nothing. It can be used to group tasks in a DAG.

class `airflow.operators.email_operator.`**`EmailOperator`**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Sends an email.

Parameters

- **to** (*list or string (comma or semicolon delimited)*) – list of emails to send the email to. (templated)
- **subject** (*string*) – subject line for the email. (templated)
- **html_content** (*string*) – content of the email, html markup is allowed. (templated)
- **files** (*list*) – file names to attach in email
- **cc** (*list or string (comma or semicolon delimited)*) – list of recipients to be added in CC field
- **bcc** (*list or string (comma or semicolon delimited)*) – list of recipients to be added in BCC field
- **mime_subtype** (*string*) – MIME sub content type
- **mime_charset** (*string*) – character set parameter added to the Content-Type header.

class airflow.operators.generic_transfer.**GenericTransfer**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Moves data from a connection to another, assuming that they both provide the required methods in their respective hooks. The source hook needs to expose a *get_records* method, and the destination a *insert_rows* method.

This is meant to be used on small-ish datasets that fit in memory.

Parameters

- **sql** (*str*) – SQL query to execute against the source database. (templated)
- **destination_table** (*str*) – target table. (templated)
- **source_conn_id** (*str*) – source connection
- **destination_conn_id** (*str*) – source connection
- **preoperator** (*str or list of str*) – sql statement or list of statements to be executed prior to loading the data. (templated)

class airflow.operators.hive_operator.**HiveOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Executes hql code or hive script in a specific Hive database.

Parameters

- **hql** (*string*) – the hql to be executed. Note that you may also use a relative path from the dag file of a (template) hive script. (templated)
- **hive_cli_conn_id** (*string*) – reference to the Hive database. (templated)
- **hiveconfs** (*dict*) – if defined, these key value pairs will be passed to hive as `-hiveconf "key"="value"`
- **hiveconf_jinja_translate** (*boolean*) – when True, hiveconf-type templating ${var} gets translated into jinja-type templating {{ var }} and ${hiveconf:var} gets translated into jinja-type templating {{ var }}. Note that you may want to use this along with the `DAG(user_defined_macros=myargs)` parameter. View the DAG object documentation for more details.
- **script_begin_tag** (*str*) – If defined, the operator will get rid of the part of the script before the first occurrence of *script_begin_tag*
- **mapred_queue** (*string*) – queue used by the Hadoop CapacityScheduler. (templated)

- **mapred_queue_priority** (*string*) – priority within CapacityScheduler queue. Possible settings include: VERY_HIGH, HIGH, NORMAL, LOW, VERY_LOW
- **mapred_job_name** (*string*) – This name will appear in the jobtracker. This can make monitoring easier.

class airflow.operators.check_operator.**IntervalCheckOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Checks that the values of metrics given as SQL expressions are within a certain tolerance of the ones from days_back before.

Note that this is an abstract class and get_db_hook needs to be defined. Whereas a get_db_hook is hook that gets a single record from an external source.

Parameters

- **table** (*str*) – the table name
- **days_back** (*int*) – number of days between ds and the ds we want to check against. Defaults to 7 days
- **metrics_threshold** (*dict*) – a dictionary of ratios indexed by metrics

class airflow.operators.latest_only_operator.**LatestOnlyOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*, airflow.models.SkipMixin

Allows a workflow to skip tasks that are not running during the most recent schedule interval.

If the task is run outside of the latest schedule interval, all directly downstream tasks will be skipped.

class airflow.operators.mssql_operator.**MsSqlOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Executes sql code in a specific Microsoft SQL database

Parameters

- **mssql_conn_id** (*string*) – reference to a specific mssql database
- **sql** (*string or string pointing to a template file with .sql extension. (templated)*) – the sql code to be executed
- **database** (*string*) – name of database which overwrite defined one in connection

class airflow.operators.mssql_to_hive.**MsSqlToHiveTransfer**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Moves data from Microsoft SQL Server to Hive. The operator runs your query against Microsoft SQL Server, stores the file locally before loading it into a Hive table. If the `create` or `recreate` arguments are set to `True`, a `CREATE TABLE` and `DROP TABLE` statements are generated. Hive data types are inferred from the cursor's metadata. Note that the table generated in Hive uses `STORED AS textfile` which isn't the most efficient serialization format. If a large amount of data is loaded and/or if the table gets queried considerably, you may want to use this operator only to stage the data into a temporary table before loading it into its final destination using a `HiveOperator`.

Parameters

- **sql** (*str*) – SQL query to execute against the Microsoft SQL Server database. (templated)
- **hive_table** (*str*) – target Hive table, use dot notation to target a specific database. (templated)
- **create** (*bool*) – whether to create the table if it doesn't exist
- **recreate** (*bool*) – whether to drop and recreate the table at every execution

- **partition** (*dict*) – target partition as a dict of partition columns and values. (templated)
- **delimiter** (*str*) – field delimiter in the file
- **mssql_conn_id** (*str*) – source Microsoft SQL Server connection
- **hive_conn_id** (*str*) – destination hive connection
- **tblproperties** (*dict*) – TBLPROPERTIES of the hive table being created

class airflow.operators.pig_operator.**PigOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Executes pig script.

Parameters

- **pig** (*string*) – the pig latin script to be executed. (templated)
- **pig_cli_conn_id** (*string*) – reference to the Hive database
- **pigparams_jinja_translate** (*boolean*) – when True, pig params-type templating ${var} gets translated into jinja-type templating {{ var }}. Note that you may want to use this along with the `DAG(user_defined_macros=myargs)` parameter. View the DAG object documentation for more details.

class airflow.operators.python_operator.**PythonOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Executes a Python callable

Parameters

- **python_callable** (*python callable*) – A reference to an object that is callable
- **op_kwargs** (*dict*) – a dictionary of keyword arguments that will get unpacked in your function
- **op_args** (*list*) – a list of positional arguments that will get unpacked when calling your callable
- **provide_context** (*bool*) – if set to true, Airflow will pass a set of keyword arguments that can be used in your function. This set of kwargs correspond exactly to what you can use in your jinja templates. For this to work, you need to define ***kwargs* in your function header.
- **templates_dict** (*dict of str*) – a dictionary where the values are templates that will get templated by the Airflow engine sometime between `__init__` and `execute` takes place and are made available in your callable's context after the template has been applied. (templated)
- **templates_exts** (*list(str)*) – a list of file extensions to resolve while processing templated fields, for examples `['.sql', '.hql']`

class airflow.operators.python_operator.**PythonVirtualenvOperator**(***kwargs*)
Bases: *airflow.operators.python_operator.PythonOperator*

Allows one to run a function in a virtualenv that is created and destroyed automatically (with certain caveats).

The function must be defined using def, and not be part of a class. All imports must happen inside the function and no variables outside of the scope may be referenced. A global scope variable named virtualenv_string_args will be available (populated by string_args). In addition, one can pass stuff through op_args and op_kwargs, and one can use a return value. Note that if your virtualenv runs in a different Python major version than Airflow, you cannot use return values, op_args, or op_kwargs. You can use string_args though. :param python_callable: A python function with no references to outside variables, defined with def, which will be run in a virtualenv

Parameters

- **requirements** (*list(str)*) – A list of requirements as specified in a pip install command
- **python_version** (*str*) – The Python version to run the virtualenv with. Note that both 2 and 2.7 are acceptable forms.
- **use_dill** (*bool*) – Whether to use dill to serialize the args and result (pickle is default). This allow more complex types but requires you to include dill in your requirements.
- **system_site_packages** (*bool*) – Whether to include system_site_packages in your virtualenv. See virtualenv documentation for more information.
- **op_args** – A list of positional arguments to pass to python_callable.
- **op_kwargs** (*dict*) – A dict of keyword arguments to pass to python_callable.
- **string_args** (*list(str)*) – Strings that are present in the global var virtualenv_string_args, available to python_callable at runtime as a list(str). Note that args are split by newline.
- **templates_dict** (*dict of str*) – a dictionary where the values are templates that will get templated by the Airflow engine sometime between `__init__` and `execute` takes place and are made available in your callable's context after the template has been applied
- **templates_exts** (*list(str)*) – a list of file extensions to resolve while processing templated fields, for examples `['.sql', '.hql']`

class `airflow.operators.s3_file_transform_operator.`**S3FileTransformOperator**(***kwargs*)

Bases: `airflow.models.BaseOperator`

Copies data from a source S3 location to a temporary location on the local filesystem. Runs a transformation on this file as specified by the transformation script and uploads the output to a destination S3 location.

The locations of the source and the destination files in the local filesystem is provided as an first and second arguments to the transformation script. The transformation script is expected to read the data from source, transform it and write the output to the local destination file. The operator then takes over control and uploads the local destination file to S3.

S3 Select is also available to filter the source contents. Users can omit the transformation script if S3 Select expression is specified.

Parameters

- **source_s3_key** (*str*) – The key to be retrieved from S3. (templated)
- **source_aws_conn_id** (*str*) – source s3 connection
- **source_verify** (*bool or str*) – Whether or not to verify SSL certificates for S3 connetion. By default SSL certificates are verified. You can provide the following values:
  - **False: do not validate SSL certificates. SSL will still be used** (unless use_ssl is False), but SSL certificates will not be verified.
  - **path/to/cert/bundle.pem: A filename of the CA cert bundle to uses.** You can specify this argument if you want to use a different CA cert bundle than the one used by botocore.

  This is also applicable to `dest_verify`.

- **dest_s3_key** (*str*) – The key to be written from S3. (templated)
- **dest_aws_conn_id** (*str*) – destination s3 connection
- **replace** (*bool*) – Replace dest S3 key if it already exists
- **transform_script** (*str*) – location of the executable transformation script
- **select_expression** (*str*) – S3 Select expression

class airflow.operators.s3_to_hive_operator.**S3ToHiveTransfer**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Moves data from S3 to Hive. The operator downloads a file from S3, stores the file locally before loading it into a Hive table. If the `create` or `recreate` arguments are set to `True`, a `CREATE TABLE` and `DROP TABLE` statements are generated. Hive data types are inferred from the cursor's metadata from.

Note that the table generated in Hive uses `STORED AS textfile` which isn't the most efficient serialization format. If a large amount of data is loaded and/or if the tables gets queried considerably, you may want to use this operator only to stage the data into a temporary table before loading it into its final destination using a `HiveOperator`.

Parameters

- **s3_key** (*str*) – The key to be retrieved from S3. (templated)
- **field_dict** (*dict*) – A dictionary of the fields name in the file as keys and their Hive types as values
- **hive_table** (*str*) – target Hive table, use dot notation to target a specific database. (templated)
- **create** (*bool*) – whether to create the table if it doesn't exist
- **recreate** (*bool*) – whether to drop and recreate the table at every execution
- **partition** (*dict*) – target partition as a dict of partition columns and values. (templated)
- **headers** (*bool*) – whether the file contains column names on the first line
- **check_headers** (*bool*) – whether the column names on the first line should be checked against the keys of field_dict
- **wildcard_match** (*bool*) – whether the s3_key should be interpreted as a Unix wildcard pattern
- **delimiter** (*str*) – field delimiter in the file
- **aws_conn_id** (*str*) – source s3 connection
- **hive_cli_conn_id** (*str*) – destination hive connection
- **input_compressed** (*bool*) – Boolean to determine if file decompression is required to process headers
- **tblproperties** (*dict*) – TBLPROPERTIES of the hive table being created
- **select_expression** (*str*) – S3 Select expression

Parame verify Whether or not to verify SSL certificates for S3 connection. By default SSL certificates are verified. You can provide the following values: - False: do not validate SSL certificates. SSL will still be used

(unless use_ssl is False), but SSL certificates will not be verified.

- **path/to/cert/bundle.pem: A filename of the CA cert bundle to uses.** You can specify this argument if you want to use a different CA cert bundle than the one used by botocore.

class airflow.operators.python_operator.**ShortCircuitOperator**(***kwargs*)

Bases: *airflow.operators.python_operator.PythonOperator*, airflow.models.SkipMixin

Allows a workflow to continue only if a condition is met. Otherwise, the workflow "short-circuits" and downstream tasks are skipped.

The ShortCircuitOperator is derived from the PythonOperator. It evaluates a condition and short-circuits the workflow if the condition is False. Any downstream tasks are marked with a state of "skipped". If the condition is True, downstream tasks proceed as normal.

The condition is determined by the result of *python_callable*.

class airflow.operators.http_operator.**SimpleHttpOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Calls an endpoint on an HTTP system to execute an action

Parameters

- **http_conn_id** (*string*) – The connection to run the sensor against
- **endpoint** (*string*) – The relative part of the full url. (templated)
- **method** (*string*) – The HTTP method to use, default = "POST"
- **data** (*For POST/PUT, depends on the content-type parameter, for GET a dictionary of key/value string pairs*) – The data to pass. POST-data in POST/PUT and params in the URL for a GET request. (templated)
- **headers** (*a dictionary of string key/value pairs*) – The HTTP headers to be added to the GET request
- **response_check** (*A lambda or defined function.*) – A check against the 'requests' response object. Returns True for 'pass' and False otherwise.
- **extra_options** (*A dictionary of options, where key is string and value depends on the option that's being modified.*) – Extra options for the 'requests' library, see the 'requests' documentation (options to modify timeout, ssl, etc.)
- **xcom_push** (*bool*) – Push the response to Xcom (default: False)
- **log_response** (*bool*) – Log the response (default: False)

class airflow.operators.sqlite_operator.**SqliteOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Executes sql code in a specific Sqlite database

Parameters

- **sqlite_conn_id** (*string*) – reference to a specific sqlite database
- **sql** (*string or string pointing to a template file. File must have a '.sql' extensions.*) – the sql code to be executed. (templated)

class airflow.operators.subdag_operator.**SubDagOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

class airflow.operators.dagrun_operator.**TriggerDagRunOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Triggers a DAG run for a specified `dag_id`

Parameters

- **trigger_dag_id** (*str*) – the dag_id to trigger (templated)
- **python_callable** (*python callable*) – a reference to a python function that will be called while passing it the `context` object and a placeholder object `obj` for your callable to fill and return if you want a DagRun created. This `obj` object contains a `run_id` and `payload` attribute that you can modify in your function. The `run_id` should be a unique identifier for that DAG run, and the payload has to be a picklable object that will be made available to your tasks while executing that DAG run. Your function header should look like `def foo(context, dag_run_obj):`
- **execution_date** (*str or datetime.datetime*) – Execution date for the dag (templated)

class airflow.operators.check_operator.**ValueCheckOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Performs a simple value check using sql code.

Note that this is an abstract class and get_db_hook needs to be defined. Whereas a get_db_hook is hook that gets a single record from an external source.

Parameters **sql** (*string*) – the sql to be executed. (templated)

Sensors

class airflow.sensors.external_task_sensor.**ExternalTaskSensor**(***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Waits for a task to complete in a different DAG

Parameters

- **external_dag_id** (*string*) – The dag_id that contains the task you want to wait for
- **external_task_id** (*string*) – The task_id that contains the task you want to wait for
- **allowed_states** (*list*) – list of allowed states, default is `['success']`
- **execution_delta** (*datetime.timedelta*) – time difference with the previous execution to look at, the default is the same execution_date as the current task. For yesterday, use [positive!] datetime.timedelta(days=1). Either execution_delta or execution_date_fn can be passed to ExternalTaskSensor, but not both.
- **execution_date_fn** (*callable*) – function that receives the current execution date and returns the desired execution dates to query. Either execution_delta or execution_date_fn can be passed to ExternalTaskSensor, but not both.

poke(***kwargs*)
Function that the sensors defined while deriving this class should override.

class airflow.sensors.hive_partition_sensor.**HivePartitionSensor**(***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Waits for a partition to show up in Hive.

Note: Because `partition` supports general logical operators, it can be inefficient. Consider using NamedHivePartitionSensor instead if you don't need the full flexibility of HivePartitionSensor.

Parameters

- **`table`** (*`string`*) – The name of the table to wait for, supports the dot notation (my_database.my_table)
- **`partition`** (*`string`*) – The partition clause to wait for. This is passed as is to the metastore Thrift client `get_partitions_by_filter` method, and apparently supports SQL like notation as in `ds='2015-01-01' AND type='value'` and comparison operators as in `"ds>=2015-01-01"`
- **`metastore_conn_id`** (*`str`*) – reference to the metastore thrift service connection id

`poke`(*context*)
Function that the sensors defined while deriving this class should override.

`class` `airflow.sensors.http_sensor.`**`HttpSensor`**(***kwargs*)
Bases: *`airflow.sensors.base_sensor_operator.BaseSensorOperator`*

Executes a HTTP get statement and returns False on failure: 404 not found or response_check function returned False

Parameters

- **`http_conn_id`** (*`string`*) – The connection to run the sensor against
- **`method`** (*`string`*) – The HTTP request method to use
- **`endpoint`** (*`string`*) – The relative part of the full url
- **`request_params`** (*`a dictionary of string key/value pairs`*) – The parameters to be added to the GET url
- **`headers`** (*`a dictionary of string key/value pairs`*) – The HTTP headers to be added to the GET request
- **`response_check`** (*`A lambda or defined function.`*) – A check against the 'requests' response object. Returns True for 'pass' and False otherwise.
- **`extra_options`** (*`A dictionary of options, where key is string and value depends on the option that's being modified.`*) – Extra options for the 'requests' library, see the 'requests' documentation (options to modify timeout, ssl, etc.)

`poke`(*context*)
Function that the sensors defined while deriving this class should override.

`class` `airflow.sensors.metastore_partition_sensor.`**`MetastorePartitionSensor`**(***kwargs*)
Bases: *`airflow.sensors.sql_sensor.SqlSensor`*

An alternative to the HivePartitionSensor that talk directly to the MySQL db. This was created as a result of observing sub optimal queries generated by the Metastore thrift service when hitting subpartitioned tables. The Thrift service's queries were written in a way that wouldn't leverage the indexes.

Parameters

- **`schema`** (*`str`*) – the schema
- **`table`** (*`str`*) – the table

- **partition_name** (*str*) – the partition name, as defined in the PARTITIONS table of the Metastore. Order of the fields does matter. Examples: `ds=2016-01-01` or `ds=2016-01-01/sub=foo` for a sub partitioned table
- **mysql_conn_id** (*str*) – a reference to the MySQL conn_id for the metastore

poke (*context*)
Function that the sensors defined while deriving this class should override.

class airflow.sensors.named_hive_partition_sensor.**NamedHivePartitionSensor**(***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Waits for a set of partitions to show up in Hive.

Parameters

- **partition_names** (*list of strings*) – List of fully qualified names of the partitions to wait for. A fully qualified name is of the form `schema.table/pk1=pv1/pk2=pv2`, for example, default.users/ds=2016-01-01. This is passed as is to the metastore Thrift client `get_partitions_by_name` method. Note that you cannot use logical or comparison operators as in HivePartitionSensor.
- **metastore_conn_id** (*str*) – reference to the metastore thrift service connection id

poke (*context*)
Function that the sensors defined while deriving this class should override.

class airflow.sensors.s3_key_sensor.**S3KeySensor**(***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Waits for a key (a file-like instance on S3) to be present in a S3 bucket. S3 being a key/value it does not support folders. The path is just a key a resource.

Parameters

- **bucket_key** (*str*) – The key being waited on. Supports full s3:// style url or relative path from root level.
- **bucket_name** (*str*) – Name of the S3 bucket
- **wildcard_match** (*bool*) – whether the bucket_key should be interpreted as a Unix wildcard pattern
- **aws_conn_id** (*str*) – a reference to the s3 connection
- **verify** (*bool or str*) – Whether or not to verify SSL certificates for S3 connection. By default SSL certificates are verified. You can provide the following values: - False: do not validate SSL certificates. SSL will still be used

  (unless use_ssl is False), but SSL certificates will not be verified.

  - **path/to/cert/bundle.pem: A filename of the CA cert bundle to uses.** You can specify this argument if you want to use a different CA cert bundle than the one used by botocore.

poke (*context*)
Function that the sensors defined while deriving this class should override.

class airflow.sensors.s3_prefix_sensor.**S3PrefixSensor**(***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Waits for a prefix to exist. A prefix is the first part of a key, thus enabling checking of constructs similar to glob airfl* or SQL LIKE 'airfl%'. There is the possibility to precise a delimiter to indicate the hierarchy or keys, meaning that the match will stop at that delimiter. Current code accepts sane delimiters, i.e. characters that are NOT special characters in the Python regex engine.

Parameters

- **bucket_name** (*str*) – Name of the S3 bucket
- **prefix** (*str*) – The prefix being waited on. Relative path from bucket root level.
- **delimiter** (*str*) – The delimiter intended to show hierarchy. Defaults to '/'.
- **aws_conn_id** (*str*) – a reference to the s3 connection
- **verify** (*bool or str*) – Whether or not to verify SSL certificates for S3 connection. By default SSL certificates are verified. You can provide the following values: - False: do not validate SSL certificates. SSL will still be used

  (unless use_ssl is False), but SSL certificates will not be verified.

  – **path/to/cert/bundle.pem: A filename of the CA cert bundle to uses.** You can specify this argument if you want to use a different CA cert bundle than the one used by botocore.

poke(*context*)
Function that the sensors defined while deriving this class should override.

class airflow.sensors.sql_sensor.**SqlSensor**(***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Runs a sql statement until a criteria is met. It will keep trying while sql returns no row, or if the first cell in (0, '0', '').

Parameters

- **conn_id** (*string*) – The connection to run the sensor against
- **sql** – The sql to run. To pass, it needs to return at least one cell that contains a non-zero / empty string value.

poke(*context*)
Function that the sensors defined while deriving this class should override.

class airflow.sensors.time_sensor.**TimeSensor**(***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Waits until the specified time of the day.

Parameters **target_time** (*datetime.time*) – time after which the job succeeds

poke(*context*)
Function that the sensors defined while deriving this class should override.

class airflow.sensors.time_delta_sensor.**TimeDeltaSensor**(***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Waits for a timedelta after the task's execution_date + schedule_interval. In Airflow, the daily task stamped with `execution_date` 2016-01-01 can only start running on 2016-01-02. The timedelta here represents the time after the execution period has closed.

Parameters **delta** (*datetime.timedelta*) – time length to wait after execution_date before succeeding

poke(*context*)
Function that the sensors defined while deriving this class should override.

class airflow.sensors.web_hdfs_sensor.**WebHdfsSensor**(***kwargs*)

Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Waits for a file or folder to land in HDFS

poke(*context*)

Function that the sensors defined while deriving this class should override.

3.22.1.4 Community-contributed Operators

Operators

class airflow.contrib.operators.aws_athena_operator.**AWSAthenaOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

An operator that submit presto query to athena.

Parameters

- **query** (*str*) – Presto to be run on athena. (templated)
- **database** (*str*) – Database to select. (templated)
- **output_location** (*str*) – s3 path to write the query results into. (templated)
- **aws_conn_id** (*str*) – aws connection to use
- **sleep_time** (*int*) – Time to wait between two consecutive call to check query status on athena

execute(*context*)

Run Presto Query on Athena

on_kill()

Cancel the submitted athena query

class airflow.contrib.operators.awsbatch_operator.**AWSBatchOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Execute a job on AWS Batch Service

Parameters

- **job_name** (*str*) – the name for the job that will run on AWS Batch
- **job_definition** (*str*) – the job definition name on AWS Batch
- **job_queue** (*str*) – the queue name on AWS Batch
- **overrides** (*dict*) – the same parameter that boto3 will receive on containerOverrides (templated): http://boto3.readthedocs.io/en/latest/reference/services/batch.html#submit_job
- **max_retries** (*int*) – exponential backoff retries while waiter is not merged, 4200 = 48 hours
- **aws_conn_id** (*str*) – connection id of AWS credentials / region name. If None, credential boto3 strategy will be used (http://boto3.readthedocs.io/en/latest/guide/configuration.html).
- **region_name** (*str*) – region name to use in AWS Hook. Override the region_name in connection (if provided)

class airflow.contrib.operators.bigquery_check_operator.**BigQueryCheckOperator**(***kwargs*)
Bases: *airflow.operators.check_operator.CheckOperator*

Performs checks against BigQuery. The `BigQueryCheckOperator` expects a sql query that will return a single row. Each value on that first row is evaluated using python `bool` casting. If any of the values return `False` the check is failed and errors out.

Note that Python bool casting evals the following as `False`:

- `False`
- `0`
- Empty string (`""`)
- Empty list (`[]`)
- Empty dictionary or set (`{}`)

Given a query like `SELECT COUNT(*) FROM foo`, it will fail only if the count `== 0`. You can craft much more complex query that could, for instance, check that the table has the same number of rows as the source table upstream, or that the count of today's partition is greater than yesterday's partition, or that a set of metrics are less than 3 standard deviation for the 7 day average.

This operator can be used as a data quality check in your pipeline, and depending on where you put it in your DAG, you have the choice to stop the critical path, preventing from publishing dubious data, or on the side and receive email alterts without stopping the progress of the DAG.

Parameters

- **sql** (*string*) – the sql to be executed
- **bigquery_conn_id** (*string*) – reference to the BigQuery database
- **use_legacy_sql** (*boolean*) – Whether to use legacy SQL (true) or standard SQL (false).

class airflow.contrib.operators.bigquery_check_operator.**BigQueryValueCheckOperator**(***kwargs*)
Bases: *airflow.operators.check_operator.ValueCheckOperator*

Performs a simple value check using sql code.

Parameters

- **sql** (*string*) – the sql to be executed
- **use_legacy_sql** (*boolean*) – Whether to use legacy SQL (true) or standard SQL (false).

class airflow.contrib.operators.bigquery_check_operator.**BigQueryIntervalCheckOperator**(***kwa
Bases: *airflow.operators.check_operator.IntervalCheckOperator*

Checks that the values of metrics given as SQL expressions are within a certain tolerance of the ones from days_back before.

This method constructs a query like so

```
SELECT {metrics_threshold_dict_key} FROM {table}
WHERE {date_filter_column}=<date>
```

Parameters

- **table** (*str*) – the table name

- **days_back** (*int*) – number of days between ds and the ds we want to check against. Defaults to 7 days
- **metrics_threshold** (*dict*) – a dictionary of ratios indexed by metrics, for example 'COUNT(*)': 1.5 would require a 50 percent or less difference between the current day, and the prior days_back.
- **use_legacy_sql** (*boolean*) – Whether to use legacy SQL (true) or standard SQL (false).

class airflow.contrib.operators.bigquery_get_data.**BigQueryGetDataOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Fetches the data from a BigQuery table (alternatively fetch data for selected columns) and returns data in a python list. The number of elements in the returned list will be equal to the number of rows fetched. Each element in the list will again be a list where element would represent the columns values for that row.

Example Result: `[['Tony', '10'], ['Mike', '20'], ['Steve', '15']]`

Note: If you pass fields to `selected_fields` which are in different order than the order of columns already in BQ table, the data will still be in the order of BQ table. For example if the BQ table has 3 columns as `[A,B,C]` and you pass 'B,A' in the `selected_fields` the data would still be of the form `'A,B'`.

Example:

```
get_data = BigQueryGetDataOperator(
    task_id='get_data_from_bq',
    dataset_id='test_dataset',
    table_id='Transaction_partitions',
    max_results='100',
    selected_fields='DATE',
    bigquery_conn_id='airflow-service-account'
)
```

Parameters

- **dataset_id** (*string*) – The dataset ID of the requested table. (templated)
- **table_id** (*string*) – The table ID of the requested table. (templated)
- **max_results** (*string*) – The maximum number of records (rows) to be fetched from the table. (templated)
- **selected_fields** (*string*) – List of fields to return (comma-separated). If unspecified, all fields are returned.
- **bigquery_conn_id** (*string*) – reference to a specific BigQuery hook.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

class airflow.contrib.operators.bigquery_operator.**BigQueryCreateEmptyTableOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Creates a new, empty table in the specified BigQuery dataset, optionally with schema.

The schema to be used for the BigQuery table may be specified in one of two ways. You may either directly pass the schema fields in, or you may point the operator to a Google cloud storage object name. The object in Google cloud storage must be a JSON file with the schema fields in it. You can also create a table without schema.

Parameters

- **project_id** (*string*) – The project to create the table into. (templated)
- **dataset_id** (*string*) – The dataset to create the table into. (templated)
- **table_id** (*string*) – The Name of the table to be created. (templated)
- **schema_fields** (*list*) – If set, the schema field list as defined here: https://cloud.google.com/bigquery/docs/reference/rest/v2/jobs#configuration.load.schema

  Example:

```
schema_fields=[{"name": "emp_name", "type": "STRING", "mode":
↪"REQUIRED"},
               {"name": "salary", "type": "INTEGER", "mode":
↪"NULLABLE"}]
```

- **gcs_schema_object** (*string*) – Full path to the JSON file containing schema (templated). For example: `gs://test-bucket/dir1/dir2/employee_schema.json`
- **time_partitioning** (*dict*) – configure optional time partitioning fields i.e. partition by field, type and expiration as per API specifications.

  See also:

  https://cloud.google.com/bigquery/docs/reference/rest/v2/tables#timePartitioning
- **bigquery_conn_id** (*string*) – Reference to a specific BigQuery hook.
- **google_cloud_storage_conn_id** (*string*) – Reference to a specific Google cloud storage hook.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **labels** (*dict*) – a dictionary containing labels for the table, passed to BigQuery

  Example (with schema JSON in GCS):

```
CreateTable = BigQueryCreateEmptyTableOperator(
    task_id='BigQueryCreateEmptyTableOperator_task',
    dataset_id='ODS',
    table_id='Employees',
    project_id='internal-gcp-project',
    gcs_schema_object='gs://schema-bucket/employee_schema.json',
    bigquery_conn_id='airflow-service-account',
    google_cloud_storage_conn_id='airflow-service-account'
)
```

  Corresponding Schema file (`employee_schema.json`):

```
[
  {
    "mode": "NULLABLE",
    "name": "emp_name",
    "type": "STRING"
  },
  {
    "mode": "REQUIRED",
    "name": "salary",
```

(continues on next page)

(continued from previous page)

```
    "type": "INTEGER"
  }
]
```

Example (with schema in the DAG):

```
CreateTable = BigQueryCreateEmptyTableOperator(
    task_id='BigQueryCreateEmptyTableOperator_task',
    dataset_id='ODS',
    table_id='Employees',
    project_id='internal-gcp-project',
    schema_fields=[{"name": "emp_name", "type": "STRING", "mode":
↪"REQUIRED"},
                   {"name": "salary", "type": "INTEGER", "mode":
↪"NULLABLE"}],
    bigquery_conn_id='airflow-service-account',
    google_cloud_storage_conn_id='airflow-service-account'
)
```

class airflow.contrib.operators.bigquery_operator.**BigQueryCreateExternalTableOperator**(***kwa*

Bases: *airflow.models.BaseOperator*

Creates a new external table in the dataset with the data in Google Cloud Storage.

The schema to be used for the BigQuery table may be specified in one of two ways. You may either directly pass the schema fields in, or you may point the operator to a Google cloud storage object name. The object in Google cloud storage must be a JSON file with the schema fields in it.

Parameters

- **bucket** (*string*) – The bucket to point the external table to. (templated)
- **source_objects** (*list*) – List of Google cloud storage URIs to point table to. (templated) If source_format is 'DATASTORE_BACKUP', the list must only contain a single URI.
- **destination_project_dataset_table** (*string*) – The dotted (<project>.)<dataset>.<table> BigQuery table to load data into (templated). If <project> is not included, project will be the project defined in the connection json.
- **schema_fields** (*list*) – If set, the schema field list as defined here: https://cloud.google.com/bigquery/docs/reference/rest/v2/jobs#configuration.load.schema

  Example:

  ```
  schema_fields=[{"name": "emp_name", "type": "STRING", "mode":
  ↪"REQUIRED"},
                 {"name": "salary", "type": "INTEGER", "mode":
  ↪"NULLABLE"}]
  ```

  Should not be set when source_format is 'DATASTORE_BACKUP'.
- **schema_object** (*string*) – If set, a GCS object path pointing to a .json file that contains the schema for the table. (templated)
- **source_format** (*string*) – File format of the data.
- **compression** (*string*) – [Optional] The compression type of the data source. Possible values include GZIP and NONE. The default value is NONE. This setting is ignored for Google Cloud Bigtable, Google Cloud Datastore backups and Avro formats.

- **skip_leading_rows** (*int*) – Number of rows to skip when loading from a CSV.
- **field_delimiter** (*string*) – The delimiter to use for the CSV.
- **max_bad_records** (*int*) – The maximum number of bad records that BigQuery can ignore when running the job.
- **quote_character** (*string*) – The value that is used to quote data sections in a CSV file.
- **allow_quoted_newlines** (*boolean*) – Whether to allow quoted newlines (true) or not (false).
- **allow_jagged_rows** (*bool*) – Accept rows that are missing trailing optional columns. The missing values are treated as nulls. If false, records with missing trailing columns are treated as bad records, and if there are too many bad records, an invalid error is returned in the job result. Only applicable to CSV, ignored for other formats.
- **bigquery_conn_id** (*string*) – Reference to a specific BigQuery hook.
- **google_cloud_storage_conn_id** (*string*) – Reference to a specific Google cloud storage hook.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **src_fmt_configs** (*dict*) – configure optional fields specific to the source format

:param labels a dictionary containing labels for the table, passed to BigQuery :type labels: dict

class airflow.contrib.operators.bigquery_operator.**BigQueryDeleteDatasetOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

” This operator deletes an existing dataset from your Project in Big query. https://cloud.google.com/bigquery/docs/reference/rest/v2/datasets/delete :param project_id: The project id of the dataset. :type project_id: string :param dataset_id: The dataset to be deleted. :type dataset_id: string

Example:

```
delete_temp_data = BigQueryDeleteDatasetOperator(dataset_id = 'temp-dataset',
                                                 project_id = 'temp-project',
                                                 bigquery_conn_id='_my_gcp_conn_',
                                                 task_id='Deletetemp',
                                                 dag=dag)
```

class airflow.contrib.operators.bigquery_operator.**BigQueryCreateEmptyDatasetOperator**(***kwarg*

Bases: *airflow.models.BaseOperator*

” This operator is used to create new dataset for your Project in Big query. https://cloud.google.com/bigquery/docs/reference/rest/v2/datasets#resource

Parameters

- **project_id** (*str*) – The name of the project where we want to create the dataset. Don’t need to provide, if projectId in dataset_reference.
- **dataset_id** (*str*) – The id of dataset. Don’t need to provide, if datasetId in dataset_reference.
- **dataset_reference** – Dataset reference that could be provided with request body. More info: https://cloud.google.com/bigquery/docs/reference/rest/v2/datasets#resource

class airflow.contrib.operators.bigquery_operator.**BigQueryOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Executes BigQuery SQL queries in a specific BigQuery database

Parameters

- **bql** (*Can receive a str representing a sql statement, a list of str (sql statements), or reference to a template file. Template reference are recognized by str ending in '.sql'.*) – (Deprecated. Use *sql* parameter instead) the sql code to be executed (templated)
- **sql** (*Can receive a str representing a sql statement, a list of str (sql statements), or reference to a template file. Template reference are recognized by str ending in '.sql'.*) – the sql code to be executed (templated)
- **destination_dataset_table** (*string*) – A dotted (<project>.|<project>:)<dataset>.<table> that, if set, will store the results of the query. (templated)
- **write_disposition** (*string*) – Specifies the action that occurs if the destination table already exists. (default: 'WRITE_EMPTY')
- **create_disposition** (*string*) – Specifies whether the job is allowed to create new tables. (default: 'CREATE_IF_NEEDED')
- **allow_large_results** (*boolean*) – Whether to allow large results.
- **flatten_results** (*boolean*) – If true and query uses legacy SQL dialect, flattens all nested and repeated fields in the query results. `allow_large_results` must be `true` if this is set to `false`. For standard SQL queries, this flag is ignored and results are never flattened.
- **bigquery_conn_id** (*string*) – reference to a specific BigQuery hook.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **udf_config** (*list*) – The User Defined Function configuration for the query. See https://cloud.google.com/bigquery/user-defined-functions for details.
- **use_legacy_sql** (*boolean*) – Whether to use legacy SQL (true) or standard SQL (false).
- **maximum_billing_tier** (*integer*) – Positive integer that serves as a multiplier of the basic price. Defaults to None, in which case it uses the value set in the project.
- **maximum_bytes_billed** (*float*) – Limits the bytes billed for this job. Queries that will have bytes billed beyond this limit will fail (without incurring a charge). If unspecified, this will be set to your project default.
- **api_resource_configs** (*dict*) – a dictionary that contain params 'configuration' applied for Google BigQuery Jobs API: https://cloud.google.com/bigquery/docs/reference/rest/v2/jobs for example, {'query': {'useQueryCache': False}}. You could use it if you need to provide some params that are not supported by BigQueryOperator like args.
- **schema_update_options** (*tuple*) – Allows the schema of the destination table to be updated as a side effect of the load job.
- **query_params** (*dict*) – a dictionary containing query parameter types and values, passed to BigQuery.
- **labels** (*dict*) – a dictionary containing labels for the job/query, passed to BigQuery

- **priority** (*string*) – Specifies a priority for the query. Possible values include INTERACTIVE and BATCH. The default value is INTERACTIVE.
- **time_partitioning** (*dict*) – configure optional time partitioning fields i.e. partition by field, type and expiration as per API specifications.
- **cluster_fields** (*list of str*) – Request that the result of this query be stored sorted by one or more columns. This is only available in conjunction with time_partitioning. The order of columns given determines the sort order.
- **location** (*str*) – The geographic location of the job. Required except for US and EU. See details at https://cloud.google.com/bigquery/docs/locations#specifying_your_location

class airflow.contrib.operators.bigquery_table_delete_operator.**BigQueryTableDeleteOperator**

Bases: *airflow.models.BaseOperator*

Deletes BigQuery tables

Parameters

- **deletion_dataset_table** (*string*) – A dotted (<project>.|<project>:)<dataset>.<table> that indicates which table will be deleted. (templated)
- **bigquery_conn_id** (*string*) – reference to a specific BigQuery hook.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **ignore_if_missing** (*boolean*) – if True, then return success even if the requested table does not exist.

class airflow.contrib.operators.bigquery_to_bigquery.**BigQueryToBigQueryOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Copies data from one BigQuery table to another.

See also:

For more details about these parameters: https://cloud.google.com/bigquery/docs/reference/v2/jobs#configuration.copy

Parameters

- **source_project_dataset_tables** (*list|string*) – One or more dotted (project:|project.)<dataset>.<table> BigQuery tables to use as the source data. If <project> is not included, project will be the project defined in the connection json. Use a list if there are multiple source tables. (templated)
- **destination_project_dataset_table** (*string*) – The destination BigQuery table. Format is: (project:|project.)<dataset>.<table> (templated)
- **write_disposition** (*string*) – The write disposition if the table already exists.
- **create_disposition** (*string*) – The create disposition if the table doesn't exist.
- **bigquery_conn_id** (*string*) – reference to a specific BigQuery hook.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **labels** (*dict*) – a dictionary containing labels for the job/query, passed to BigQuery

class airflow.contrib.operators.bigquery_to_gcs.**BigQueryToCloudStorageOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Transfers a BigQuery table to a Google Cloud Storage bucket.

See also:

For more details about these parameters: https://cloud.google.com/bigquery/docs/reference/v2/jobs

Parameters

- **source_project_dataset_table** (*string*) – The dotted (<project>.|<project>:)<dataset>.<table> BigQuery table to use as the source data. If <project> is not included, project will be the project defined in the connection json. (templated)
- **destination_cloud_storage_uris** (*list*) – The destination Google Cloud Storage URI (e.g. gs://some-bucket/some-file.txt). (templated) Follows convention defined here: https://cloud.google.com/bigquery/exporting-data-from-bigquery#exportingmultiple
- **compression** (*string*) – Type of compression to use.
- **export_format** (*string*) – File format to export.
- **field_delimiter** (*string*) – The delimiter to use when extracting to a CSV.
- **print_header** (*boolean*) – Whether to print a header for a CSV file extract.
- **bigquery_conn_id** (*string*) – reference to a specific BigQuery hook.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **labels** (*dict*) – a dictionary containing labels for the job/query, passed to BigQuery

class airflow.contrib.operators.databricks_operator.**DatabricksSubmitRunOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Submits a Spark job run to Databricks using the api/2.0/jobs/runs/submit API endpoint.

There are two ways to instantiate this operator.

In the first way, you can take the JSON payload that you typically use to call the `api/2.0/jobs/runs/submit` endpoint and pass it directly to our `DatabricksSubmitRunOperator` through the `json` parameter. For example

```
json = {
  'new_cluster': {
    'spark_version': '2.1.0-db3-scala2.11',
    'num_workers': 2
  },
  'notebook_task': {
    'notebook_path': '/Users/airflow@example.com/PrepareData',
  },
}
notebook_run = DatabricksSubmitRunOperator(task_id='notebook_run', json=json)
```

Another way to accomplish the same thing is to use the named parameters of the `DatabricksSubmitRunOperator` directly. Note that there is exactly one named parameter for each top level parameter in the `runs/submit` endpoint. In this method, your code would look like this:

```
new_cluster = {
  'spark_version': '2.1.0-db3-scala2.11',
  'num_workers': 2
}
notebook_task = {
  'notebook_path': '/Users/airflow@example.com/PrepareData',
}
notebook_run = DatabricksSubmitRunOperator(
    task_id='notebook_run',
    new_cluster=new_cluster,
    notebook_task=notebook_task)
```

In the case where both the json parameter **AND** the named parameters are provided, they will be merged together. If there are conflicts during the merge, the named parameters will take precedence and override the top level `json` keys.

Currently the named parameters that `DatabricksSubmitRunOperator` supports are

- `spark_jar_task`
- `notebook_task`
- `new_cluster`
- `existing_cluster_id`
- `libraries`
- `run_name`
- `timeout_seconds`

Parameters

- **`json`** (*`dict`*) – A JSON object containing API parameters which will be passed directly to the `api/2.0/jobs/runs/submit` endpoint. The other named parameters (i.e. `spark_jar_task`, `notebook_task`..) to this operator will be merged with this json dictionary if they are provided. If there are conflicts during the merge, the named parameters will take precedence and override the top level json keys. (templated)

  See also:

  For more information about templating see *Jinja Templating*. https://docs.databricks.com/api/latest/jobs.html#runs-submit

- **`spark_jar_task`** (*`dict`*) – The main class and parameters for the JAR task. Note that the actual JAR is specified in the `libraries`. *EITHER* `spark_jar_task` *OR* `notebook_task` should be specified. This field will be templated.

  See also:

  https://docs.databricks.com/api/latest/jobs.html#jobssparkjartask

- **`notebook_task`** (*`dict`*) – The notebook path and parameters for the notebook task. *EITHER* `spark_jar_task` *OR* `notebook_task` should be specified. This field will be templated.

  See also:

  https://docs.databricks.com/api/latest/jobs.html#jobsnotebooktask

- **new_cluster** (*dict*) – Specs for a new cluster on which this task will be run. *EITHER* `new_cluster` *OR* `existing_cluster_id` should be specified. This field will be templated.

  See also:

  https://docs.databricks.com/api/latest/jobs.html#jobsclusterspecnewcluster

- **existing_cluster_id** (*string*) – ID for existing cluster on which to run this task. *EITHER* `new_cluster` *OR* `existing_cluster_id` should be specified. This field will be templated.
- **libraries** (*list of dicts*) – Libraries which this run will use. This field will be templated.

  See also:

  https://docs.databricks.com/api/latest/libraries.html#managedlibrarieslibrary

- **run_name** (*string*) – The run name used for this task. By default this will be set to the Airflow `task_id`. This `task_id` is a required parameter of the superclass `BaseOperator`. This field will be templated.
- **timeout_seconds** (*int32*) – The timeout for this run. By default a value of 0 is used which means to have no timeout. This field will be templated.
- **databricks_conn_id** (*string*) – The name of the Airflow connection to use. By default and in the common case this will be `databricks_default`. To use token based authentication, provide the key `token` in the extra field for the connection.
- **polling_period_seconds** (*int*) – Controls the rate which we poll for the result of this run. By default the operator will poll every 30 seconds.
- **databricks_retry_limit** (*int*) – Amount of times retry if the Databricks backend is unreachable. Its value must be greater than or equal to 1.
- **databricks_retry_delay** (*float*) – Number of seconds to wait between retries (it might be a floating point number).
- **do_xcom_push** (*boolean*) – Whether we should push run_id and run_page_url to xcom.

class airflow.contrib.operators.dataflow_operator.**DataFlowJavaOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Start a Java Cloud DataFlow batch job. The parameters of the operation will be passed to the job.

See also:

For more detail on job submission have a look at the reference: https://cloud.google.com/dataflow/pipelines/specifying-exec-params

Parameters

- **jar** (*string*) – The reference to a self executing DataFlow jar.
- **dataflow_default_options** (*dict*) – Map of default job options.
- **options** (*dict*) – Map of job specific options.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

- **poll_sleep** (*int*) – The time in seconds to sleep between polling Google Cloud Platform for the dataflow job status while the job is in the JOB_STATE_RUNNING state.
- **job_class** (*string*) – The name of the dataflow job class to be executued, it is often not the main class configured in the dataflow jar file.

Both `jar` and `options` are templated so you can use variables in them.

Note that both `dataflow_default_options` and `options` will be merged to specify pipeline execution parameter, and `dataflow_default_options` is expected to save high-level options, for instances, project and zone information, which apply to all dataflow operators in the DAG.

It's a good practice to define dataflow_* parameters in the default_args of the dag like the project, zone and staging location.

```
default_args = {
    'dataflow_default_options': {
        'project': 'my-gcp-project',
        'zone': 'europe-west1-d',
        'stagingLocation': 'gs://my-staging-bucket/staging/'
    }
}
```

You need to pass the path to your dataflow as a file reference with the `jar` parameter, the jar needs to be a self executing jar (see documentation here: https://beam.apache.org/documentation/runners/dataflow/#self-executing-jar). Use `options` to pass on options to your job.

```
t1 = DataFlowJavaOperator(
    task_id='datapflow_example',
    jar='{{var.value.gcp_dataflow_base}}pipeline/build/libs/pipeline-example-1.0.
↪jar',
    options={
        'autoscalingAlgorithm': 'BASIC',
        'maxNumWorkers': '50',
        'start': '{{ds}}',
        'partitionType': 'DAY',
        'labels': {'foo' : 'bar'}
    },
    gcp_conn_id='gcp-airflow-service-account',
    dag=my-dag)
```

class `airflow.contrib.operators.dataflow_operator.`**`DataflowTemplateOperator`**(***kwargs*)

Bases: `airflow.models.BaseOperator`

Start a Templated Cloud DataFlow batch job. The parameters of the operation will be passed to the job.

Parameters

- **template** (*string*) – The reference to the DataFlow template.
- **dataflow_default_options** (*dict*) – Map of default job environment options.
- **parameters** (*dict*) – Map of job specific parameters for the template.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **poll_sleep** (*int*) – The time in seconds to sleep between polling Google Cloud Platform for the dataflow job status while the job is in the JOB_STATE_RUNNING state.

It's a good practice to define dataflow_* parameters in the default_args of the dag like the project, zone and staging location.

See also:

https://cloud.google.com/dataflow/docs/reference/rest/v1b3/LaunchTemplateParameters https://cloud.google.com/dataflow/docs/reference/rest/v1b3/RuntimeEnvironment

```
default_args = {
    'dataflow_default_options': {
        'project': 'my-gcp-project'
        'zone': 'europe-west1-d',
        'tempLocation': 'gs://my-staging-bucket/staging/'
        }
    }
}
```

You need to pass the path to your dataflow template as a file reference with the `template` parameter. Use `parameters` to pass on parameters to your job. Use `environment` to pass on runtime environment variables to your job.

```
t1 = DataflowTemplateOperator(
    task_id='datapflow_example',
    template='{{var.value.gcp_dataflow_base}}',
    parameters={
        'inputFile': "gs://bucket/input/my_input.txt",
        'outputFile': "gs://bucket/output/my_output.txt"
    },
    gcp_conn_id='gcp-airflow-service-account',
    dag=my-dag)
```

`template`, `dataflow_default_options` and `parameters` are templated so you can use variables in them.

Note that `dataflow_default_options` is expected to save high-level options for project information, which apply to all dataflow operators in the DAG.

See also:

https://cloud.google.com/dataflow/docs/reference/rest/v1b3 /LaunchTemplateParameters https://cloud.google.com/dataflow/docs/reference/rest/v1b3/RuntimeEnvironment For more detail on job template execution have a look at the reference: https://cloud.google.com/dataflow/docs/templates/executing-templates

class `airflow.contrib.operators.dataflow_operator.`**`DataFlowPythonOperator`**(***kwargs*)

Bases: *`airflow.models.BaseOperator`*

Launching Cloud Dataflow jobs written in python. Note that both dataflow_default_options and options will be merged to specify pipeline execution parameter, and dataflow_default_options is expected to save high-level options, for instances, project and zone information, which apply to all dataflow operators in the DAG.

See also:

For more detail on job submission have a look at the reference: https://cloud.google.com/dataflow/pipelines/specifying-exec-params

Parameters

- **py_file** (*string*) – Reference to the python dataflow pipleline file.py, e.g., /some/local/file/path/to/your/python/pipeline/file.

- **py_options** – Additional python options.
- **dataflow_default_options** (*dict*) – Map of default job options.
- **options** (*dict*) – Map of job specific options.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **poll_sleep** (*int*) – The time in seconds to sleep between polling Google Cloud Platform for the dataflow job status while the job is in the JOB_STATE_RUNNING state.

execute (*context*)
Execute the python dataflow job.

class airflow.contrib.operators.dataproc_operator.**DataprocClusterCreateOperator** (***kwargs*)
Bases: *airflow.models.BaseOperator*

Create a new cluster on Google Cloud Dataproc. The operator will wait until the creation is successful or an error occurs in the creation process.

The parameters allow to configure the cluster. Please refer to

https://cloud.google.com/dataproc/docs/reference/rest/v1/projects.regions.clusters

for a detailed explanation on the different parameters. Most of the configuration parameters detailed in the link are available as a parameter to this operator.

Parameters

- **cluster_name** (*string*) – The name of the DataProc cluster to create. (templated)
- **project_id** (*str*) – The ID of the google cloud project in which to create the cluster. (templated)
- **num_workers** (*int*) – The # of workers to spin up. If set to zero will spin up cluster in a single node mode
- **storage_bucket** (*string*) – The storage bucket to use, setting to None lets dataproc generate a custom one for you
- **init_actions_uris** (*list[string]*) – List of GCS uri's containing dataproc initialization scripts
- **init_action_timeout** (*string*) – Amount of time executable scripts in init_actions_uris has to complete
- **metadata** (*dict*) – dict of key-value google compute engine metadata entries to add to all instances
- **image_version** (*string*) – the version of software inside the Dataproc cluster
- **custom_image** – custom Dataproc image for more info see https://cloud.google.com/dataproc/docs/guides/dataproc-images
- **properties** (*dict*) – dict of properties to set on config files (e.g. spark-defaults.conf), see https://cloud.google.com/dataproc/docs/reference/rest/v1/projects.regions.clusters#SoftwareConfig
- **master_machine_type** (*string*) – Compute engine machine type to use for the master node

- **master_disk_type** (*string*) – Type of the boot disk for the master node (default is `pd-standard`). Valid values: `pd-ssd` (Persistent Disk Solid State Drive) or `pd-standard` (Persistent Disk Hard Disk Drive).
- **master_disk_size** (*int*) – Disk size for the master node
- **worker_machine_type** (*string*) – Compute engine machine type to use for the worker nodes
- **worker_disk_type** (*string*) – Type of the boot disk for the worker node (default is `pd-standard`). Valid values: `pd-ssd` (Persistent Disk Solid State Drive) or `pd-standard` (Persistent Disk Hard Disk Drive).
- **worker_disk_size** (*int*) – Disk size for the worker nodes
- **num_preemptible_workers** (*int*) – The # of preemptible worker nodes to spin up
- **labels** (*dict*) – dict of labels to add to the cluster
- **zone** (*string*) – The zone where the cluster will be located. (templated)
- **network_uri** (*string*) – The network uri to be used for machine communication, cannot be specified with subnetwork_uri
- **subnetwork_uri** (*string*) – The subnetwork uri to be used for machine communication, cannot be specified with network_uri
- **internal_ip_only** (*bool*) – If true, all instances in the cluster will only have internal IP addresses. This can only be enabled for subnetwork enabled networks
- **tags** (*list[string]*) – The GCE tags to add to all instances
- **region** – leave as 'global', might become relevant in the future. (templated)
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **service_account** (*string*) – The service account of the dataproc instances.
- **service_account_scopes** (*list[string]*) – The URIs of service account scopes to be included.
- **idle_delete_ttl** (*int*) – The longest duration that cluster would keep alive while staying idle. Passing this threshold will cause cluster to be auto-deleted. A duration in seconds.
- **auto_delete_time** (*datetime.datetime*) – The time when cluster will be auto-deleted.
- **auto_delete_ttl** (*int*) – The life duration of cluster, the cluster will be auto-deleted at the end of this duration. A duration in seconds. (If auto_delete_time is set this parameter will be ignored)

Type custom_image: string

class `airflow.contrib.operators.dataproc_operator.`**`DataprocClusterScaleOperator`**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Scale, up or down, a cluster on Google Cloud Dataproc. The operator will wait until the cluster is re-scaled.

Example:

```
t1 = DataprocClusterScaleOperator(
        task_id='dataproc_scale',
        project_id='my-project',
        cluster_name='cluster-1',
        num_workers=10,
        num_preemptible_workers=10,
        graceful_decommission_timeout='1h',
        dag=dag)
```

See also:

For more detail on about scaling clusters have a look at the reference: https://cloud.google.com/dataproc/docs/concepts/configuring-clusters/scaling-clusters

Parameters

- **cluster_name** (*string*) – The name of the cluster to scale. (templated)
- **project_id** (*string*) – The ID of the google cloud project in which the cluster runs. (templated)
- **region** (*string*) – The region for the dataproc cluster. (templated)
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **num_workers** (*int*) – The new number of workers
- **num_preemptible_workers** (*int*) – The new number of preemptible workers
- **graceful_decommission_timeout** (*string*) – Timeout for graceful YARN decomissioning. Maximum value is 1d
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

class airflow.contrib.operators.dataproc_operator.**DataprocClusterDeleteOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Delete a cluster on Google Cloud Dataproc. The operator will wait until the cluster is destroyed.

Parameters

- **cluster_name** (*string*) – The name of the cluster to create. (templated)
- **project_id** (*string*) – The ID of the google cloud project in which the cluster runs. (templated)
- **region** (*string*) – leave as 'global', might become relevant in the future. (templated)
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

class airflow.contrib.operators.dataproc_operator.**DataProcPigOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Start a Pig query Job on a Cloud DataProc cluster. The parameters of the operation will be passed to the cluster.

It's a good practice to define dataproc_* parameters in the default_args of the dag like the cluster name and UDFs.

```
default_args = {
    'cluster_name': 'cluster-1',
    'dataproc_pig_jars': [
        'gs://example/udf/jar/datafu/1.2.0/datafu.jar',
        'gs://example/udf/jar/gpig/1.2/gpig.jar'
    ]
}
```

You can pass a pig script as string or file reference. Use variables to pass on variables for the pig script to be resolved on the cluster or use the parameters to be resolved in the script as template parameters.

Example:

```
t1 = DataProcPigOperator(
        task_id='dataproc_pig',
        query='a_pig_script.pig',
        variables={'out': 'gs://example/output/{{ds}}'},
        dag=dag)
```

See also:

For more detail on about job submission have a look at the reference: https://cloud.google.com/dataproc/reference/rest/v1/projects.regions.jobs

Parameters

- **`query`** (*string*) – The query or reference to the query file (pg or pig extension). (templated)
- **`query_uri`** (*string*) – The uri of a pig script on Cloud Storage.
- **`variables`** (*dict*) – Map of named parameters for the query. (templated)
- **`job_name`** (*string*) – The job name used in the DataProc cluster. This name by default is the task_id appended with the execution data, but can be templated. The name will always be appended with a random number to avoid name clashes. (templated)
- **`cluster_name`** (*string*) – The name of the DataProc cluster. (templated)
- **`dataproc_pig_properties`** (*dict*) – Map for the Pig properties. Ideal to put in default arguments
- **`dataproc_pig_jars`** (*list*) – URIs to jars provisioned in Cloud Storage (example: for UDFs and libs) and are ideal to put in default arguments.
- **`gcp_conn_id`** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **`delegate_to`** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **`region`** (*str*) – The specified region where the dataproc cluster is created.
- **`job_error_states`** (*list*) – Job states that should be considered error states. Any states in this list will result in an error being raised and failure of the task. Eg, if the `CANCELLED` state should also be considered a task failure, pass in `['ERROR', 'CANCELLED']`. Possible values are currently only `'ERROR'` and `'CANCELLED'`, but could change in the future. Defaults to `['ERROR']`.

Variables **`dataproc_job_id`** (*string*) – The actual "jobId" as submitted to the Dataproc API. This is useful for identifying or linking to the job in the Google Cloud Console Dataproc UI, as the actual "jobId" submitted to the Dataproc API is appended with an 8 character random string.

class airflow.contrib.operators.dataproc_operator.**DataProcHiveOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Start a Hive query Job on a Cloud DataProc cluster.

Parameters

- **query** (*string*) – The query or reference to the query file (q extension).
- **query_uri** (*string*) – The uri of a hive script on Cloud Storage.
- **variables** (*dict*) – Map of named parameters for the query.
- **job_name** (*string*) – The job name used in the DataProc cluster. This name by default is the task_id appended with the execution data, but can be templated. The name will always be appended with a random number to avoid name clashes.
- **cluster_name** (*string*) – The name of the DataProc cluster.
- **dataproc_hive_properties** (*dict*) – Map for the Pig properties. Ideal to put in default arguments
- **dataproc_hive_jars** (*list*) – URIs to jars provisioned in Cloud Storage (example: for UDFs and libs) and are ideal to put in default arguments.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **region** (*str*) – The specified region where the dataproc cluster is created.
- **job_error_states** (*list*) – Job states that should be considered error states. Any states in this list will result in an error being raised and failure of the task. Eg, if the `CANCELLED` state should also be considered a task failure, pass in `['ERROR', 'CANCELLED']`. Possible values are currently only `'ERROR'` and `'CANCELLED'`, but could change in the future. Defaults to `['ERROR']`.

Variables **dataproc_job_id** (*string*) – The actual "jobId" as submitted to the Dataproc API. This is useful for identifying or linking to the job in the Google Cloud Console Dataproc UI, as the actual "jobId" submitted to the Dataproc API is appended with an 8 character random string.

class airflow.contrib.operators.dataproc_operator.**DataProcSparkSqlOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Start a Spark SQL query Job on a Cloud DataProc cluster.

Parameters

- **query** (*string*) – The query or reference to the query file (q extension). (templated)
- **query_uri** (*string*) – The uri of a spark sql script on Cloud Storage.
- **variables** (*dict*) – Map of named parameters for the query. (templated)
- **job_name** (*string*) – The job name used in the DataProc cluster. This name by default is the task_id appended with the execution data, but can be templated. The name will always be appended with a random number to avoid name clashes. (templated)
- **cluster_name** (*string*) – The name of the DataProc cluster. (templated)
- **dataproc_spark_properties** (*dict*) – Map for the Pig properties. Ideal to put in default arguments

- **dataproc_spark_jars** (*list*) – URIs to jars provisioned in Cloud Storage (example: for UDFs and libs) and are ideal to put in default arguments.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **region** (*str*) – The specified region where the dataproc cluster is created.
- **job_error_states** (*list*) – Job states that should be considered error states. Any states in this list will result in an error being raised and failure of the task. Eg, if the `CANCELLED` state should also be considered a task failure, pass in `['ERROR', 'CANCELLED']`. Possible values are currently only `'ERROR'` and `'CANCELLED'`, but could change in the future. Defaults to `['ERROR']`.

Variables **dataproc_job_id** (*string*) – The actual "jobId" as submitted to the Dataproc API. This is useful for identifying or linking to the job in the Google Cloud Console Dataproc UI, as the actual "jobId" submitted to the Dataproc API is appended with an 8 character random string.

class `airflow.contrib.operators.dataproc_operator.`**DataProcSparkOperator**(***kwargs*)

Bases: `airflow.models.BaseOperator`

Start a Spark Job on a Cloud DataProc cluster.

Parameters

- **main_jar** (*string*) – URI of the job jar provisioned on Cloud Storage. (use this or the main_class, not both together).
- **main_class** (*string*) – Name of the job class. (use this or the main_jar, not both together).
- **arguments** (*list*) – Arguments for the job. (templated)
- **archives** (*list*) – List of archived files that will be unpacked in the work directory. Should be stored in Cloud Storage.
- **files** (*list*) – List of files to be copied to the working directory
- **job_name** (*string*) – The job name used in the DataProc cluster. This name by default is the task_id appended with the execution data, but can be templated. The name will always be appended with a random number to avoid name clashes. (templated)
- **cluster_name** (*string*) – The name of the DataProc cluster. (templated)
- **dataproc_spark_properties** (*dict*) – Map for the Pig properties. Ideal to put in default arguments
- **dataproc_spark_jars** (*list*) – URIs to jars provisioned in Cloud Storage (example: for UDFs and libs) and are ideal to put in default arguments.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **region** (*str*) – The specified region where the dataproc cluster is created.
- **job_error_states** (*list*) – Job states that should be considered error states. Any states in this list will result in an error being raised and failure of the task. Eg, if the `CANCELLED` state should also be considered a task failure, pass in `['ERROR',`

'CANCELLED']. Possible values are currently only 'ERROR' and 'CANCELLED', but could change in the future. Defaults to ['ERROR'].

Variables **dataproc_job_id** (*string*) – The actual "jobId" as submitted to the Dataproc API. This is useful for identifying or linking to the job in the Google Cloud Console Dataproc UI, as the actual "jobId" submitted to the Dataproc API is appended with an 8 character random string.

class airflow.contrib.operators.dataproc_operator.**DataProcHadoopOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Start a Hadoop Job on a Cloud DataProc cluster.

Parameters

- **main_jar** (*string*) – URI of the job jar provisioned on Cloud Storage. (use this or the main_class, not both together).
- **main_class** (*string*) – Name of the job class. (use this or the main_jar, not both together).
- **arguments** (*list*) – Arguments for the job. (templated)
- **archives** (*list*) – List of archived files that will be unpacked in the work directory. Should be stored in Cloud Storage.
- **files** (*list*) – List of files to be copied to the working directory
- **job_name** (*string*) – The job name used in the DataProc cluster. This name by default is the task_id appended with the execution data, but can be templated. The name will always be appended with a random number to avoid name clashes. (templated)
- **cluster_name** (*string*) – The name of the DataProc cluster. (templated)
- **dataproc_hadoop_properties** (*dict*) – Map for the Pig properties. Ideal to put in default arguments
- **dataproc_hadoop_jars** (*list*) – URIs to jars provisioned in Cloud Storage (example: for UDFs and libs) and are ideal to put in default arguments.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **region** (*str*) – The specified region where the dataproc cluster is created.
- **job_error_states** (*list*) – Job states that should be considered error states. Any states in this list will result in an error being raised and failure of the task. Eg, if the CANCELLED state should also be considered a task failure, pass in ['ERROR', 'CANCELLED']. Possible values are currently only 'ERROR' and 'CANCELLED', but could change in the future. Defaults to ['ERROR'].

Variables **dataproc_job_id** (*string*) – The actual "jobId" as submitted to the Dataproc API. This is useful for identifying or linking to the job in the Google Cloud Console Dataproc UI, as the actual "jobId" submitted to the Dataproc API is appended with an 8 character random string.

class airflow.contrib.operators.dataproc_operator.**DataProcPySparkOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Start a PySpark Job on a Cloud DataProc cluster.

Parameters

- **main** (*string*) – [Required] The Hadoop Compatible Filesystem (HCFS) URI of the main Python file to use as the driver. Must be a .py file.
- **arguments** (*list*) – Arguments for the job. (templated)
- **archives** (*list*) – List of archived files that will be unpacked in the work directory. Should be stored in Cloud Storage.
- **files** (*list*) – List of files to be copied to the working directory
- **pyfiles** (*list*) – List of Python files to pass to the PySpark framework. Supported file types: .py, .egg, and .zip
- **job_name** (*string*) – The job name used in the DataProc cluster. This name by default is the task_id appended with the execution data, but can be templated. The name will always be appended with a random number to avoid name clashes. (templated)
- **cluster_name** (*string*) – The name of the DataProc cluster.
- **dataproc_pyspark_properties** (*dict*) – Map for the Pig properties. Ideal to put in default arguments
- **dataproc_pyspark_jars** (*list*) – URIs to jars provisioned in Cloud Storage (example: for UDFs and libs) and are ideal to put in default arguments.
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **region** (*str*) – The specified region where the dataproc cluster is created.
- **job_error_states** (*list*) – Job states that should be considered error states. Any states in this list will result in an error being raised and failure of the task. Eg, if the `CANCELLED` state should also be considered a task failure, pass in `['ERROR', 'CANCELLED']`. Possible values are currently only `'ERROR'` and `'CANCELLED'`, but could change in the future. Defaults to `['ERROR']`.

Variables **dataproc_job_id** (*string*) – The actual "jobId" as submitted to the Dataproc API. This is useful for identifying or linking to the job in the Google Cloud Console Dataproc UI, as the actual "jobId" submitted to the Dataproc API is appended with an 8 character random string.

class airflow.contrib.operators.dataproc_operator.**DataprocWorkflowTemplateBaseOperator**(***kw

Bases: *airflow.models.BaseOperator*

class airflow.contrib.operators.dataproc_operator.**DataprocWorkflowTemplateInstantiateOperat

Bases: *airflow.contrib.operators.dataproc_operator.DataprocWorkflowTemplateBaseOperator*

Instantiate a WorkflowTemplate on Google Cloud Dataproc. The operator will wait until the WorkflowTemplate is finished executing.

See also:

Please refer to: https://cloud.google.com/dataproc/docs/reference/rest/v1beta2/projects.regions.workflowTemplates/instantiate

Parameters

- **template_id** (*string*) – The id of the template. (templated)
- **project_id** (*string*) – The ID of the google cloud project in which the template runs
- **region** (*string*) – leave as 'global', might become relevant in the future

- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

class airflow.contrib.operators.dataproc_operator.**DataprocWorkflowTemplateInstantiateInline**

Bases: *airflow.contrib.operators.dataproc_operator.DataprocWorkflowTemplateBaseOperator*

Instantiate a WorkflowTemplate Inline on Google Cloud Dataproc. The operator will wait until the WorkflowTemplate is finished executing.

See also:

Please refer to: https://cloud.google.com/dataproc/docs/reference/rest/v1beta2/projects.regions.workflowTemplates/instantiateInline

Parameters

- **template** (*map*) – The template contents. (templated)
- **project_id** (*string*) – The ID of the google cloud project in which the template runs
- **region** (*string*) – leave as 'global', might become relevant in the future
- **gcp_conn_id** (*string*) – The connection ID to use connecting to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

class airflow.contrib.operators.datastore_export_operator.**DatastoreExportOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Export entities from Google Cloud Datastore to Cloud Storage

Parameters

- **bucket** (*string*) – name of the cloud storage bucket to backup data
- **namespace** (*str*) – optional namespace path in the specified Cloud Storage bucket to backup data. If this namespace does not exist in GCS, it will be created.
- **datastore_conn_id** (*string*) – the name of the Datastore connection id to use
- **cloud_storage_conn_id** (*string*) – the name of the cloud storage connection id to force-write backup
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **entity_filter** (*dict*) – description of what data from the project is included in the export, refer to https://cloud.google.com/datastore/docs/reference/rest/Shared.Types/EntityFilter
- **labels** (*dict*) – client-assigned labels for cloud storage
- **polling_interval_in_seconds** (*int*) – number of seconds to wait before polling for execution status again
- **overwrite_existing** (*bool*) – if the storage bucket + namespace is not empty, it will be emptied prior to exports. This enables overwriting existing backups.
- **xcom_push** (*bool*) – push operation name to xcom for reference

class airflow.contrib.operators.datastore_import_operator.**DatastoreImportOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Import entities from Cloud Storage to Google Cloud Datastore

Parameters

- **bucket** (*string*) – container in Cloud Storage to store data
- **file** (*string*) – path of the backup metadata file in the specified Cloud Storage bucket. It should have the extension .overall_export_metadata
- **namespace** (*str*) – optional namespace of the backup metadata file in the specified Cloud Storage bucket.
- **entity_filter** (*dict*) – description of what data from the project is included in the export, refer to https://cloud.google.com/datastore/docs/reference/rest/Shared.Types/EntityFilter
- **labels** (*dict*) – client-assigned labels for cloud storage
- **datastore_conn_id** (*string*) – the name of the connection id to use
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **polling_interval_in_seconds** (*int*) – number of seconds to wait before polling for execution status again
- **xcom_push** (*bool*) – push operation name to xcom for reference

class airflow.contrib.operators.discord_webhook_operator.**DiscordWebhookOperator**(***kwargs*)
Bases: *airflow.operators.http_operator.SimpleHttpOperator*

This operator allows you to post messages to Discord using incoming webhooks. Takes a Discord connection ID with a default relative webhook endpoint. The default endpoint can be overridden using the webhook_endpoint parameter (https://discordapp.com/developers/docs/resources/webhook).

Each Discord webhook can be pre-configured to use a specific username and avatar_url. You can override these defaults in this operator.

Parameters

- **http_conn_id** (*str*) – Http connection ID with host as "https://discord.com/api/" and default webhook endpoint in the extra field in the form of {"webhook_endpoint": "webhooks/{webhook.id}/{webhook.token}"}
- **webhook_endpoint** (*str*) – Discord webhook endpoint in the form of "webhooks/{webhook.id}/{webhook.token}"
- **message** (*str*) – The message you want to send to your Discord channel (max 2000 characters). (templated)
- **username** (*str*) – Override the default username of the webhook. (templated)
- **avatar_url** (*str*) – Override the default avatar of the webhook
- **tts** (*bool*) – Is a text-to-speech message
- **proxy** (*str*) – Proxy to use to make the Discord webhook call

execute(*context*)
Call the DiscordWebhookHook to post message

class airflow.contrib.operators.ecs_operator.**ECSOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Execute a task on AWS EC2 Container Service

Parameters

- **task_definition** (*str*) – the task definition name on EC2 Container Service
- **cluster** (*str*) – the cluster name on EC2 Container Service
- **overrides** (*dict*) – the same parameter that boto3 will receive (templated): http://boto3.readthedocs.org/en/latest/reference/services/ecs.html#ECS.Client.run_task
- **aws_conn_id** (*str*) – connection id of AWS credentials / region name. If None, credential boto3 strategy will be used (http://boto3.readthedocs.io/en/latest/guide/configuration.html).
- **region_name** (*str*) – region name to use in AWS Hook. Override the region_name in connection (if provided)
- **launch_type** (*str*) – the launch type on which to run your task ('EC2' or 'FARGATE')

class airflow.contrib.operators.emr_add_steps_operator.**EmrAddStepsOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

An operator that adds steps to an existing EMR job_flow.

Parameters

- **job_flow_id** (*str*) – id of the JobFlow to add steps to. (templated)
- **aws_conn_id** (*str*) – aws connection to uses
- **steps** (*list*) – boto3 style steps to be added to the jobflow. (templated)

class airflow.contrib.operators.emr_create_job_flow_operator.**EmrCreateJobFlowOperator**(***kwa*
Bases: *airflow.models.BaseOperator*

Creates an EMR JobFlow, reading the config from the EMR connection. A dictionary of JobFlow overrides can be passed that override the config from the connection.

Parameters

- **aws_conn_id** (*str*) – aws connection to uses
- **emr_conn_id** (*str*) – emr connection to use
- **job_flow_overrides** (*dict*) – boto3 style arguments to override emr_connection extra. (templated)

class airflow.contrib.operators.emr_terminate_job_flow_operator.**EmrTerminateJobFlowOperato**
Bases: *airflow.models.BaseOperator*

Operator to terminate EMR JobFlows.

Parameters

- **job_flow_id** (*str*) – id of the JobFlow to terminate. (templated)
- **aws_conn_id** (*str*) – aws connection to uses

class airflow.contrib.operators.file_to_gcs.**FileToGoogleCloudStorageOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Uploads a file to Google Cloud Storage. Optionally can compress the file for upload.

Parameters

- **src** (*string*) – Path to the local file. (templated)
- **dst** (*string*) – Destination path within the specified bucket. (templated)
- **bucket** (*string*) – The bucket to upload to. (templated)
- **google_cloud_storage_conn_id** (*string*) – The Airflow connection ID to upload with
- **mime_type** (*string*) – The mime-type string
- **delegate_to** (*str*) – The account to impersonate, if any
- **gzip** (*bool*) – Allows for file to be compressed and uploaded as gzip

execute (*context*)
Uploads the file to Google cloud storage

class airflow.contrib.operators.gcs_download_operator.**GoogleCloudStorageDownloadOperator**(**
Bases: *airflow.models.BaseOperator*

Downloads a file from Google Cloud Storage.

Parameters

- **bucket** (*string*) – The Google cloud storage bucket where the object is. (templated)
- **object** (*string*) – The name of the object to download in the Google cloud storage bucket. (templated)
- **filename** (*string*) – The file path on the local file system (where the operator is being executed) that the file should be downloaded to. (templated) If no filename passed, the downloaded data will not be stored on the local file system.
- **store_to_xcom_key** (*string*) – If this param is set, the operator will push the contents of the downloaded file to XCom with the key set in this parameter. If not set, the downloaded data will not be pushed to XCom. (templated)
- **google_cloud_storage_conn_id** (*string*) – The connection ID to use when connecting to Google cloud storage.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

class airflow.contrib.operators.gcs_list_operator.**GoogleCloudStorageListOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

List all objects from the bucket with the give string prefix and delimiter in name.

This operator returns a python list with the name of objects which can be used by *xcom* in the downstream task.

Parameters

- **bucket** (*string*) – The Google cloud storage bucket to find the objects. (templated)
- **prefix** (*string*) – Prefix string which filters objects whose name begin with this prefix. (templated)
- **delimiter** (*string*) – The delimiter by which you want to filter the objects. (templated) For e.g to lists the CSV files from in a directory in GCS you would use delimiter='.csv'.
- **google_cloud_storage_conn_id** (*string*) – The connection ID to use when connecting to Google cloud storage.

- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

Example: The following Operator would list all the Avro files from `sales/sales-2017` folder in `data` bucket.

```
GCS_Files = GoogleCloudStorageListOperator(
    task_id='GCS_Files',
    bucket='data',
    prefix='sales/sales-2017/',
    delimiter='.avro',
    google_cloud_storage_conn_id=google_cloud_conn_id
)
```

class `airflow.contrib.operators.gcs_operator.`**`GoogleCloudStorageCreateBucketOperator`**(***kwargs*

Bases: *airflow.models.BaseOperator*

Creates a new bucket. Google Cloud Storage uses a flat namespace, so you can't create a bucket with a name that is already in use.

See also:

For more information, see Bucket Naming Guidelines: https://cloud.google.com/storage/docs/bucketnaming.html#requirements

Parameters

- **bucket_name** (*string*) – The name of the bucket. (templated)
- **storage_class** (*string*) – This defines how objects in the bucket are stored and determines the SLA and the cost of storage (templated). Values include
  - `MULTI_REGIONAL`
  - `REGIONAL`
  - `STANDARD`
  - `NEARLINE`
  - `COLDLINE`.

  If this value is not specified when the bucket is created, it will default to STANDARD.
- **location** (*string*) – The location of the bucket. (templated) Object data for objects in the bucket resides in physical storage within this region. Defaults to US.

  See also:

  https://developers.google.com/storage/docs/bucket-locations
- **project_id** (*string*) – The ID of the GCP Project. (templated)
- **labels** (*dict*) – User-provided labels, in key/value pairs.
- **google_cloud_storage_conn_id** (*string*) – The connection ID to use when connecting to Google cloud storage.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

Example: The following Operator would create a new bucket `test-bucket` with `MULTI_REGIONAL` storage class in `EU` region

```
CreateBucket = GoogleCloudStorageCreateBucketOperator(
    task_id='CreateNewBucket',
    bucket_name='test-bucket',
    storage_class='MULTI_REGIONAL',
    location='EU',
    labels={'env': 'dev', 'team': 'airflow'},
    google_cloud_storage_conn_id='airflow-service-account'
)
```

class airflow.contrib.operators.gcs_to_bq.**GoogleCloudStorageToBigQueryOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Loads files from Google cloud storage into BigQuery.

The schema to be used for the BigQuery table may be specified in one of two ways. You may either directly pass the schema fields in, or you may point the operator to a Google cloud storage object name. The object in Google cloud storage must be a JSON file with the schema fields in it.

Parameters

- **bucket** (*string*) – The bucket to load from. (templated)
- **source_objects** (*list of str*) – List of Google cloud storage URIs to load from. (templated) If source_format is 'DATASTORE_BACKUP', the list must only contain a single URI.
- **destination_project_dataset_table** (*string*) – The dotted (<project>.)<dataset>.<table> BigQuery table to load data into. If <project> is not included, project will be the project defined in the connection json. (templated)
- **schema_fields** (*list*) – If set, the schema field list as defined here: https://cloud.google.com/bigquery/docs/reference/v2/jobs#configuration.load Should not be set when source_format is 'DATASTORE_BACKUP'.
- **schema_object** (*string*) – If set, a GCS object path pointing to a .json file that contains the schema for the table. (templated)
- **source_format** (*string*) – File format to export.
- **compression** (*string*) – [Optional] The compression type of the data source. Possible values include GZIP and NONE. The default value is NONE. This setting is ignored for Google Cloud Bigtable, Google Cloud Datastore backups and Avro formats.
- **create_disposition** (*string*) – The create disposition if the table doesn't exist.
- **skip_leading_rows** (*int*) – Number of rows to skip when loading from a CSV.
- **write_disposition** (*string*) – The write disposition if the table already exists.
- **field_delimiter** (*string*) – The delimiter to use when loading from a CSV.
- **max_bad_records** (*int*) – The maximum number of bad records that BigQuery can ignore when running the job.
- **quote_character** (*string*) – The value that is used to quote data sections in a CSV file.
- **ignore_unknown_values** (*bool*) – [Optional] Indicates if BigQuery should allow extra values that are not represented in the table schema. If true, the extra values are ignored. If false, records with extra columns are treated as bad records, and if there are too many bad records, an invalid error is returned in the job result.

- **allow_quoted_newlines** (*bool*) – Whether to allow quoted newlines (true) or not (false).
- **allow_jagged_rows** (*bool*) – Accept rows that are missing trailing optional columns. The missing values are treated as nulls. If false, records with missing trailing columns are treated as bad records, and if there are too many bad records, an invalid error is returned in the job result. Only applicable to CSV, ignored for other formats.
- **max_id_key** (*string*) – If set, the name of a column in the BigQuery table that's to be loaded. This will be used to select the MAX value from BigQuery after the load occurs. The results will be returned by the execute() command, which in turn gets stored in XCom for future operators to use. This can be helpful with incremental loads–during future executions, you can pick up from the max ID.
- **bigquery_conn_id** (*string*) – Reference to a specific BigQuery hook.
- **google_cloud_storage_conn_id** (*string*) – Reference to a specific Google cloud storage hook.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **schema_update_options** (*list*) – Allows the schema of the destination table to be updated as a side effect of the load job.
- **src_fmt_configs** (*dict*) – configure optional fields specific to the source format
- **external_table** (*bool*) – Flag to specify if the destination table should be a BigQuery external table. Default Value is False.
- **time_partitioning** (*dict*) – configure optional time partitioning fields i.e. partition by field, type and expiration as per API specifications. Note that 'field' is not available in concurrency with dataset.table$partition.
- **cluster_fields** (*list of str*) – Request that the result of this load be stored sorted by one or more columns. This is only available in conjunction with time_partitioning. The order of columns given determines the sort order. Not applicable for external tables.

class airflow.contrib.operators.gcs_to_gcs.**GoogleCloudStorageToGoogleCloudStorageOperator**(

Bases: *airflow.models.BaseOperator*

Copies objects from a bucket to another, with renaming if requested.

Parameters

- **source_bucket** (*string*) – The source Google cloud storage bucket where the object is. (templated)
- **source_object** (*string*) – The source name of the object to copy in the Google cloud storage bucket. (templated) If wildcards are used in this argument:

  You can use only one wildcard for objects (filenames) within your bucket. The wildcard can appear inside the object name or at the end of the object name. Appending a wildcard to the bucket name is unsupported.

- **destination_bucket** (*string*) – The destination Google cloud storage bucket where the object should be. (templated)
- **destination_object** (*string*) – The destination name of the object in the destination Google cloud storage bucket. (templated) If a wildcard is supplied in the source_object argument, this is the prefix that will be prepended to the final destination objects' paths. Note that the source path's part before the wildcard will be removed; if it needs to be retained it should be appended to destination_object. For example, with prefix `foo/*` and

destination_object `blah/`, the file `foo/baz` will be copied to `blah/baz`; to retain the prefix write the destination_object as e.g. `blah/foo`, in which case the copied file will be named `blah/foo/baz`.

- **move_object** (*bool*) – When move object is True, the object is moved instead of copied to the new location. This is the equivalent of a mv command as opposed to a cp command.
- **google_cloud_storage_conn_id** (*string*) – The connection ID to use when connecting to Google cloud storage.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

Examples: The following Operator would copy a single file named `sales/sales-2017/january.avro` in the `data` bucket to the file named `copied_sales/2017/january-backup.avro` in the ``data_backup`` bucket

```
copy_single_file = GoogleCloudStorageToGoogleCloudStorageOperator(
    task_id='copy_single_file',
    source_bucket='data',
    source_object='sales/sales-2017/january.avro',
    destination_bucket='data_backup',
    destination_object='copied_sales/2017/january-backup.avro',
    google_cloud_storage_conn_id=google_cloud_conn_id
)
```

The following Operator would copy all the Avro files from `sales/sales-2017` folder (i.e. with names starting with that prefix) in `data` bucket to the `copied_sales/2017` folder in the `data_backup` bucket.

```
copy_files = GoogleCloudStorageToGoogleCloudStorageOperator(
    task_id='copy_files',
    source_bucket='data',
    source_object='sales/sales-2017/*.avro',
    destination_bucket='data_backup',
    destination_object='copied_sales/2017/',
    google_cloud_storage_conn_id=google_cloud_conn_id
)
```

The following Operator would move all the Avro files from `sales/sales-2017` folder (i.e. with names starting with that prefix) in `data` bucket to the same folder in the `data_backup` bucket, deleting the original files in the process.

```
move_files = GoogleCloudStorageToGoogleCloudStorageOperator(
    task_id='move_files',
    source_bucket='data',
    source_object='sales/sales-2017/*.avro',
    destination_bucket='data_backup',
    move_object=True,
    google_cloud_storage_conn_id=google_cloud_conn_id
)
```

class `airflow.contrib.operators.gcs_to_gcs_transfer_operator.`**`GoogleCloudStorageToGoogleClo`**

Bases: *`airflow.models.BaseOperator`*

Copies objects from a bucket to another using the GCP Storage Transfer Service.

Parameters

- **source_bucket** (*str*) – The source Google cloud storage bucket where the object is. (templated)
- **destination_bucket** (*str*) – The destination Google cloud storage bucket where the object should be. (templated)
- **project_id** (*str*) – The ID of the Google Cloud Platform Console project that owns the job
- **gcp_conn_id** (*str*) – Optional connection ID to use when connecting to Google Cloud Storage.
- **delegate_to** (*str*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **description** (*str*) – Optional transfer service job description
- **schedule** (*dict*) – Optional transfer service schedule; see https://cloud.google.com/storage-transfer/docs/reference/rest/v1/transferJobs. If not set, run transfer job once as soon as the operator runs
- **object_conditions** (*dict*) – Optional transfer service object conditions; see https://cloud.google.com/storage-transfer/docs/reference/rest/v1/TransferSpec#ObjectConditions
- **transfer_options** (*dict*) – Optional transfer service transfer options; see https://cloud.google.com/storage-transfer/docs/reference/rest/v1/TransferSpec#TransferOptions
- **wait** (*bool*) – Wait for transfer to finish; defaults to *True*

Example:

```
gcs_to_gcs_transfer_op = GoogleCloudStorageToGoogleCloudStorageTransferOperator(
     task_id='gcs_to_gcs_transfer_example',
     source_bucket='my-source-bucket',
     destination_bucket='my-destination-bucket',
     project_id='my-gcp-project',
     dag=my_dag)
```

class airflow.contrib.operators.gcs_to_s3.**GoogleCloudStorageToS3Operator**(***kwargs*)

Bases: *airflow.contrib.operators.gcs_list_operator.GoogleCloudStorageListOperator*

Synchronizes a Google Cloud Storage bucket with an S3 bucket.

Parameters

- **bucket** (*string*) – The Google Cloud Storage bucket to find the objects. (templated)
- **prefix** (*string*) – Prefix string which filters objects whose name begin with this prefix. (templated)
- **delimiter** (*string*) – The delimiter by which you want to filter the objects. (templated) For e.g to lists the CSV files from in a directory in GCS you would use delimiter='.csv'.
- **google_cloud_storage_conn_id** (*string*) – The connection ID to use when connecting to Google Cloud Storage.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **dest_aws_conn_id** (*str*) – The destination S3 connection
- **dest_s3_key** (*str*) – The base S3 key to be used to store the files. (templated)

Parame dest_verify Whether or not to verify SSL certificates for S3 connection. By default SSL certificates are verified. You can provide the following values: - False: do not validate SSL certificates. SSL will still be used

(unless use_ssl is False), but SSL certificates will not be verified.

- **path/to/cert/bundle.pem: A filename of the CA cert bundle to uses.** You can specify this argument if you want to use a different CA cert bundle than the one used by botocore.

class `airflow.contrib.operators.hipchat_operator.`**`HipChatAPIOperator`**(***kwargs*)

Bases: *`airflow.models.BaseOperator`*

Base HipChat Operator. All derived HipChat operators reference from HipChat's official REST API documentation at https://www.hipchat.com/docs/apiv2. Before using any HipChat API operators you need to get an authentication token at https://www.hipchat.com/docs/apiv2/auth. In the future additional HipChat operators will be derived from this class as well.

Parameters

- **`token`** (*str*) – HipChat REST API authentication token
- **`base_url`** (*str*) – HipChat REST API base url.

`prepare_request`()

Used by the execute function. Set the request method, url, and body of HipChat's REST API call. Override in child class. Each HipChatAPI child operator is responsible for having a prepare_request method call which sets self.method, self.url, and self.body.

class `airflow.contrib.operators.hipchat_operator.`**`HipChatAPISendRoomNotificationOperator`**(***k

Bases: *`airflow.contrib.operators.hipchat_operator.HipChatAPIOperator`*

Send notification to a specific HipChat room. More info: https://www.hipchat.com/docs/apiv2/method/send_room_notification

Parameters

- **`room_id`** (*str*) – Room in which to send notification on HipChat. (templated)
- **`message`** (*str*) – The message body. (templated)
- **`frm`** (*str*) – Label to be shown in addition to sender's name
- **`message_format`** (*str*) – How the notification is rendered: html or text
- **`color`** (*str*) – Background color of the msg: yellow, green, red, purple, gray, or random
- **`attach_to`** (*str*) – The message id to attach this notification to
- **`notify`** (*bool*) – Whether this message should trigger a user notification
- **`card`** (*dict*) – HipChat-defined card object

`prepare_request`()

Used by the execute function. Set the request method, url, and body of HipChat's REST API call. Override in child class. Each HipChatAPI child operator is responsible for having a prepare_request method call which sets self.method, self.url, and self.body.

class `airflow.contrib.operators.hive_to_dynamodb.`**`HiveToDynamoDBTransferOperator`**(***kwargs*)

Bases: *`airflow.models.BaseOperator`*

Moves data from Hive to DynamoDB, note that for now the data is loaded into memory before being pushed to DynamoDB, so this operator should be used for smallish amount of data.

Parameters

- **sql** (*str*) – SQL query to execute against the hive database. (templated)
- **table_name** (*str*) – target DynamoDB table
- **table_keys** (*list*) – partition key and sort key
- **pre_process** (*function*) – implement pre-processing of source data
- **pre_process_args** (*list*) – list of pre_process function arguments
- **pre_process_kwargs** (*dict*) – dict of pre_process function arguments
- **region_name** (*str*) – aws region name (example: us-east-1)
- **schema** (*str*) – hive database schema
- **hiveserver2_conn_id** (*str*) – source hive connection
- **aws_conn_id** (*str*) – aws connection

class airflow.contrib.operators.mlengine_operator.**MLEngineBatchPredictionOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Start a Google Cloud ML Engine prediction job.

NOTE: For model origin, users should consider exactly one from the three options below: 1. Populate 'uri' field only, which should be a GCS location that points to a tensorflow savedModel directory. 2. Populate 'model_name' field only, which refers to an existing model, and the default version of the model will be used. 3. Populate both 'model_name' and 'version_name' fields, which refers to a specific version of a specific model.

In options 2 and 3, both model and version name should contain the minimal identifier. For instance, call

```
MLEngineBatchPredictionOperator(
    ...,
    model_name='my_model',
    version_name='my_version',
    ...)
```

if the desired model version is "projects/my_project/models/my_model/versions/my_version".

See https://cloud.google.com/ml-engine/reference/rest/v1/projects.jobs for further documentation on the parameters.

Parameters

- **project_id** (*string*) – The Google Cloud project name where the prediction job is submitted. (templated)
- **job_id** (*string*) – A unique id for the prediction job on Google Cloud ML Engine. (templated)
- **data_format** (*string*) – The format of the input data. It will default to 'DATA_FORMAT_UNSPECIFIED' if is not provided or is not one of ["TEXT", "TF_RECORD", "TF_RECORD_GZIP"].
- **input_paths** (*list of string*) – A list of GCS paths of input data for batch prediction. Accepting wildcard operator *, but only at the end. (templated)
- **output_path** (*string*) – The GCS path where the prediction results are written to. (templated)
- **region** (*string*) – The Google Compute Engine region to run the prediction job in. (templated)

- **model_name** (*string*) – The Google Cloud ML Engine model to use for prediction. If version_name is not provided, the default version of this model will be used. Should not be None if version_name is provided. Should be None if uri is provided. (templated)
- **version_name** (*string*) – The Google Cloud ML Engine model version to use for prediction. Should be None if uri is provided. (templated)
- **uri** (*string*) – The GCS path of the saved model to use for prediction. Should be None if model_name is provided. It should be a GCS path pointing to a tensorflow SavedModel. (templated)
- **max_worker_count** (*int*) – The maximum number of workers to be used for parallel processing. Defaults to 10 if not specified.
- **runtime_version** (*string*) – The Google Cloud ML Engine runtime version to use for batch prediction.
- **gcp_conn_id** (*string*) – The connection ID used for connection to Google Cloud Platform.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have doamin-wide delegation enabled.

Raises: `ValueError`: if a unique model/version origin cannot be determined.

class airflow.contrib.operators.mlengine_operator.**MLEngineModelOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Operator for managing a Google Cloud ML Engine model.

Parameters

- **project_id** (*string*) – The Google Cloud project name to which MLEngine model belongs. (templated)
- **model** (*dict*) – A dictionary containing the information about the model. If the *operation* is *create*, then the *model* parameter should contain all the information about this model such as *name*.

  If the *operation* is *get*, the *model* parameter should contain the *name* of the model.
- **operation** (*string*) – The operation to perform. Available operations are:
  - `create`: Creates a new model as provided by the *model* parameter.
  - `get`: Gets a particular model where the name is specified in *model*.
- **gcp_conn_id** (*string*) – The connection ID to use when fetching connection info.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

class airflow.contrib.operators.mlengine_operator.**MLEngineVersionOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Operator for managing a Google Cloud ML Engine version.

Parameters

- **project_id** (*string*) – The Google Cloud project name to which MLEngine model belongs.
- **model_name** (*string*) – The name of the Google Cloud ML Engine model that the version belongs to. (templated)

- **version_name** (*string*) – A name to use for the version being operated upon. If not None and the *version* argument is None or does not have a value for the *name* key, then this will be populated in the payload for the *name* key. (templated)
- **version** (*dict*) – A dictionary containing the information about the version. If the *operation* is *create*, *version* should contain all the information about this version such as name, and deploymentUrl. If the *operation* is *get* or *delete*, the *version* parameter should contain the *name* of the version. If it is None, the only *operation* possible would be *list*. (templated)
- **operation** (*string*) – The operation to perform. Available operations are:
  - `create`: Creates a new version in the model specified by *model_name*, in which case the *version* parameter should contain all the information to create that version (e.g. *name*, *deploymentUrl*).
  - `get`: Gets full information of a particular version in the model specified by *model_name*. The name of the version should be specified in the *version* parameter.
  - `list`: Lists all available versions of the model specified by *model_name*.
  - `delete`: Deletes the version specified in *version* parameter from the model specified by *model_name*). The name of the version should be specified in the *version* parameter.
- **gcp_conn_id** (*string*) – The connection ID to use when fetching connection info.
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

class airflow.contrib.operators.mlengine_operator.**MLEngineTrainingOperator**(***kwargs*)
Bases: `airflow.models.BaseOperator`

Operator for launching a MLEngine training job.

Parameters

- **project_id** (*string*) – The Google Cloud project name within which MLEngine training job should run (templated).
- **job_id** (*string*) – A unique templated id for the submitted Google MLEngine training job. (templated)
- **package_uris** (*string*) – A list of package locations for MLEngine training job, which should include the main training program + any additional dependencies. (templated)
- **training_python_module** (*string*) – The Python module name to run within MLEngine training job after installing 'package_uris' packages. (templated)
- **training_args** (*string*) – A list of templated command line arguments to pass to the MLEngine training program. (templated)
- **region** (*string*) – The Google Compute Engine region to run the MLEngine training job in (templated).
- **scale_tier** (*string*) – Resource tier for MLEngine training job. (templated)
- **runtime_version** (*string*) – The Google Cloud ML runtime version to use for training. (templated)
- **python_version** (*string*) – The version of Python used in training. (templated)
- **job_dir** (*string*) – A Google Cloud Storage path in which to store training outputs and other data needed for training. (templated)
- **gcp_conn_id** (*string*) – The connection ID to use when fetching connection info.

- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **mode** (*string*) – Can be one of 'DRY_RUN'/'CLOUD'. In 'DRY_RUN' mode, no real training job will be launched, but the MLEngine training job request will be printed out. In 'CLOUD' mode, a real MLEngine training job creation request will be issued.

class airflow.contrib.operators.pubsub_operator.**PubSubTopicCreateOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Create a PubSub topic.

By default, if the topic already exists, this operator will not cause the DAG to fail.

```
with DAG('successful DAG') as dag:
    (
        dag
        >> PubSubTopicCreateOperator(project='my-project',
                                     topic='my_new_topic')
        >> PubSubTopicCreateOperator(project='my-project',
                                     topic='my_new_topic')
    )
```

The operator can be configured to fail if the topic already exists.

```
with DAG('failing DAG') as dag:
    (
        dag
        >> PubSubTopicCreateOperator(project='my-project',
                                     topic='my_new_topic')
        >> PubSubTopicCreateOperator(project='my-project',
                                     topic='my_new_topic',
                                     fail_if_exists=True)
    )
```

Both `project` and `topic` are templated so you can use variables in them.

class airflow.contrib.operators.pubsub_operator.**PubSubTopicDeleteOperator**(***kwargs*)

Bases: *airflow.models.BaseOperator*

Delete a PubSub topic.

By default, if the topic does not exist, this operator will not cause the DAG to fail.

```
with DAG('successful DAG') as dag:
    (
        dag
        >> PubSubTopicDeleteOperator(project='my-project',
                                     topic='non_existing_topic')
    )
```

The operator can be configured to fail if the topic does not exist.

```
with DAG('failing DAG') as dag:
    (
        dag
        >> PubSubTopicCreateOperator(project='my-project',
                                     topic='non_existing_topic',
                                     fail_if_not_exists=True)
    )
```

Both `project` and `topic` are templated so you can use variables in them.

class `airflow.contrib.operators.pubsub_operator.`**`PubSubSubscriptionCreateOperator`**(***kwargs*)

Bases: *`airflow.models.BaseOperator`*

Create a PubSub subscription.

By default, the subscription will be created in `topic_project`. If `subscription_project` is specified and the GCP credentials allow, the Subscription can be created in a different project from its topic.

By default, if the subscription already exists, this operator will not cause the DAG to fail. However, the topic must exist in the project.

```
with DAG('successful DAG') as dag:
    (
        dag
        >> PubSubSubscriptionCreateOperator(
            topic_project='my-project', topic='my-topic',
            subscription='my-subscription')
        >> PubSubSubscriptionCreateOperator(
            topic_project='my-project', topic='my-topic',
            subscription='my-subscription')
    )
```

The operator can be configured to fail if the subscription already exists.

```
with DAG('failing DAG') as dag:
    (
        dag
        >> PubSubSubscriptionCreateOperator(
            topic_project='my-project', topic='my-topic',
            subscription='my-subscription')
        >> PubSubSubscriptionCreateOperator(
            topic_project='my-project', topic='my-topic',
            subscription='my-subscription', fail_if_exists=True)
    )
```

Finally, subscription is not required. If not passed, the operator will generated a universally unique identifier for the subscription's name.

```
with DAG('DAG') as dag:
    (
        dag >> PubSubSubscriptionCreateOperator(
            topic_project='my-project', topic='my-topic')
    )
```

`topic_project`, `topic`, `subscription`, and `subscription` are templated so you can use variables in them.

class `airflow.contrib.operators.pubsub_operator.`**`PubSubSubscriptionDeleteOperator`**(***kwargs*)

Bases: *`airflow.models.BaseOperator`*

Delete a PubSub subscription.

By default, if the subscription does not exist, this operator will not cause the DAG to fail.

```
with DAG('successful DAG') as dag:
    (
        dag
        >> PubSubSubscriptionDeleteOperator(project='my-project',
```

(continues on next page)

(continued from previous page)

```
                                                   subscription='non-existing')
    )
```

The operator can be configured to fail if the subscription already exists.

```
with DAG('failing DAG') as dag:
    (
        dag
        >> PubSubSubscriptionDeleteOperator(
             project='my-project', subscription='non-existing',
             fail_if_not_exists=True)
    )
```

`project`, and `subscription` are templated so you can use variables in them.

class `airflow.contrib.operators.pubsub_operator.`**`PubSubPublishOperator`**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Publish messages to a PubSub topic.

Each Task publishes all provided messages to the same topic in a single GCP project. If the topic does not exist, this task will fail.

```
   from base64 import b64encode as b64e

   m1 = {'data': b64e('Hello, World!'),
         'attributes': {'type': 'greeting'}
        }
   m2 = {'data': b64e('Knock, knock')}
   m3 = {'attributes': {'foo': ''}}

   t1 = PubSubPublishOperator(
       project='my-project',topic='my_topic',
       messages=[m1, m2, m3],
       create_topic=True,
       dag=dag)

``project`` , ``topic``, and ``messages`` are templated so you can use
```

variables in them.

class `airflow.contrib.operators.s3_list_operator.`**`S3ListOperator`**(***kwargs*)
Bases: *airflow.models.BaseOperator*

List all objects from the bucket with the given string prefix in name.

This operator returns a python list with the name of objects which can be used by *xcom* in the downstream task.

Parameters

- **bucket** (*string*) – The S3 bucket where to find the objects. (templated)
- **prefix** (*string*) – Prefix string to filters the objects whose name begin with such prefix. (templated)
- **delimiter** (*string*) – the delimiter marks key hierarchy. (templated)
- **aws_conn_id** (*string*) – The connection ID to use when connecting to S3 storage.

Parame verify Whether or not to verify SSL certificates for S3 connection. By default SSL certificates are verified. You can provide the following values: - False: do not validate SSL certificates. SSL will still be used

(unless use_ssl is False), but SSL certificates will not be verified.

- **path/to/cert/bundle.pem: A filename of the CA cert bundle to uses.** You can specify this argument if you want to use a different CA cert bundle than the one used by botocore.

Example: The following operator would list all the files (excluding subfolders) from the S3 `customers/2018/04/` key in the `data` bucket.

```
s3_file = S3ListOperator(
    task_id='list_3s_files',
    bucket='data',
    prefix='customers/2018/04/',
    delimiter='/',
    aws_conn_id='aws_customers_conn'
)
```

class airflow.contrib.operators.s3_to_gcs_operator.**S3ToGoogleCloudStorageOperator**(***kwargs*)

Bases: *airflow.contrib.operators.s3_list_operator.S3ListOperator*

Synchronizes an S3 key, possibly a prefix, with a Google Cloud Storage destination path.

Parameters

- **bucket** (*string*) – The S3 bucket where to find the objects. (templated)
- **prefix** (*string*) – Prefix string which filters objects whose name begin with such prefix. (templated)
- **delimiter** (*string*) – the delimiter marks key hierarchy. (templated)
- **aws_conn_id** (*string*) – The source S3 connection
- **dest_gcs_conn_id** (*string*) – The destination connection ID to use when connecting to Google Cloud Storage.
- **dest_gcs** (*string*) – The destination Google Cloud Storage bucket and prefix where you want to store the files. (templated)
- **delegate_to** (*string*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **replace** (*bool*) – Whether you want to replace existing destination files or not.

Parame verify Whether or not to verify SSL certificates for S3 connection. By default SSL certificates are verified. You can provide the following values: - False: do not validate SSL certificates. SSL will still be used

(unless use_ssl is False), but SSL certificates will not be verified.

- **path/to/cert/bundle.pem: A filename of the CA cert bundle to uses.** You can specify this argument if you want to use a different CA cert bundle than the one used by botocore.

Example:

```
s3_to_gcs_op = S3ToGoogleCloudStorageOperator(
     task_id='s3_to_gcs_example',
     bucket='my-s3-bucket',
     prefix='data/customers-201804',
     dest_gcs_conn_id='google_cloud_default',
     dest_gcs='gs://my.gcs.bucket/some/customers/',
     replace=False,
     dag=my-dag)
```

Note that `bucket`, `prefix`, `delimiter` and `dest_gcs` are templated, so you can use variables in them if you wish.

class `airflow.contrib.operators.s3_to_gcs_transfer_operator.`**`S3ToGoogleCloudStorageTransferO`**

Bases: *`airflow.models.BaseOperator`*

Synchronizes an S3 bucket with a Google Cloud Storage bucket using the GCP Storage Transfer Service.

Parameters

- **`s3_bucket`** (*str*) – The S3 bucket where to find the objects. (templated)
- **`gcs_bucket`** (*str*) – The destination Google Cloud Storage bucket where you want to store the files. (templated)
- **`project_id`** (*str*) – Optional ID of the Google Cloud Platform Console project that owns the job
- **`aws_conn_id`** (*str*) – The source S3 connection
- **`gcp_conn_id`** (*str*) – The destination connection ID to use when connecting to Google Cloud Storage.
- **`delegate_to`** (*str*) – The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.
- **`description`** (*str*) – Optional transfer service job description
- **`schedule`** (*dict*) – Optional transfer service schedule; see https://cloud.google.com/storage-transfer/docs/reference/rest/v1/transferJobs. If not set, run transfer job once as soon as the operator runs
- **`object_conditions`** (*dict*) – Optional transfer service object conditions; see https://cloud.google.com/storage-transfer/docs/reference/rest/v1/TransferSpec
- **`transfer_options`** (*dict*) – Optional transfer service transfer options; see https://cloud.google.com/storage-transfer/docs/reference/rest/v1/TransferSpec
- **`wait`** (*bool*) – Wait for transfer to finish

Example:

```
s3_to_gcs_transfer_op = S3ToGoogleCloudStorageTransferOperator(
     task_id='s3_to_gcs_transfer_example',
     s3_bucket='my-s3-bucket',
     project_id='my-gcp-project',
     gcs_bucket='my-gcs-bucket',
     dag=my_dag)
```

class `airflow.contrib.operators.sagemaker_base_operator.`**`SageMakerBaseOperator`**(***kwargs*)

Bases: *`airflow.models.BaseOperator`*

This is the base operator for all SageMaker operators.

Parameters

- **config** (*dict*) – The configuration necessary to start a training job (templated)
- **aws_conn_id** (*str*) – The AWS connection ID to use.

class airflow.contrib.operators.sagemaker_endpoint_operator.**SageMakerEndpointOperator**(***kwa*

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Create a SageMaker endpoint.

This operator returns The ARN of the endpoint created in Amazon SageMaker

Parameters

- **config** (*dict*) – The configuration necessary to create an endpoint.

  If you need to create a SageMaker endpoint based on an existed SageMaker model and an existed SageMaker endpoint config:

  ```
  config = endpoint_configuration;
  ```

  If you need to create all of SageMaker model, SageMaker endpoint-config and SageMaker endpoint:

  ```
  config = {
      'Model': model_configuration,
      'EndpointConfig': endpoint_config_configuration,
      'Endpoint': endpoint_configuration
  }
  ```

  For details of the configuration parameter of model_configuration see `SageMaker.Client.create_model()`

  For details of the configuration parameter of endpoint_config_configuration see `SageMaker.Client.create_endpoint_config()`

  For details of the configuration parameter of endpoint_configuration see `SageMaker.Client.create_endpoint()`

- **aws_conn_id** (*str*) – The AWS connection ID to use.
- **wait_for_completion** (*bool*) – Whether the operator should wait until the endpoint creation finishes.
- **check_interval** (*int*) – If wait is set to True, this is the time interval, in seconds, that this operation waits before polling the status of the endpoint creation.
- **max_ingestion_time** (*int*) – If wait is set to True, this operation fails if the endpoint creation doesn't finish within max_ingestion_time seconds. If you set this parameter to None it never times out.
- **operation** (*str*) – Whether to create an endpoint or update an endpoint. Must be either 'create or 'update'.

class airflow.contrib.operators.sagemaker_endpoint_config_operator.**SageMakerEndpointConfig**

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Create a SageMaker endpoint config.

This operator returns The ARN of the endpoint config created in Amazon SageMaker

Parameters

- **config** (*dict*) – The configuration necessary to create an endpoint config.

  For details of the configuration parameter see `SageMaker.Client.create_endpoint_config()`

- **aws_conn_id** (*str*) – The AWS connection ID to use.

class airflow.contrib.operators.sagemaker_model_operator.**SageMakerModelOperator**(***kwargs*)

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Create a SageMaker model.

This operator returns The ARN of the model created in Amazon SageMaker

Parameters

- **config** (*dict*) – The configuration necessary to create a model.

  For details of the configuration parameter see `SageMaker.Client.create_model()`

- **aws_conn_id** (*str*) – The AWS connection ID to use.

class airflow.contrib.operators.sagemaker_training_operator.**SageMakerTrainingOperator**(***kwa*

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Initiate a SageMaker training job.

This operator returns The ARN of the training job created in Amazon SageMaker.

Parameters

- **config** (*dict*) – The configuration necessary to start a training job (templated).

  For details of the configuration parameter see `SageMaker.Client.create_training_job()`

- **aws_conn_id** (*str*) – The AWS connection ID to use.
- **wait_for_completion** (*bool*) – If wait is set to True, the time interval, in seconds, that the operation waits to check the status of the training job.
- **print_log** (*bool*) – if the operator should print the cloudwatch log during training
- **check_interval** (*int*) – if wait is set to be true, this is the time interval in seconds which the operator will check the status of the training job
- **max_ingestion_time** (*int*) – If wait is set to True, the operation fails if the training job doesn't finish within max_ingestion_time seconds. If you set this parameter to None, the operation does not timeout.

class airflow.contrib.operators.sagemaker_transform_operator.**SageMakerTransformOperator**(***k*

Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Initiate a SageMaker transform job.

This operator returns The ARN of the model created in Amazon SageMaker.

Parameters

- **config** (*dict*) – The configuration necessary to start a transform job (templated).

  If you need to create a SageMaker transform job based on an existed SageMaker model:

  ```
  config = transform_config
  ```

  If you need to create both SageMaker model and SageMaker Transform job:

  ```
  config = {
      'Model': model_config,
      'Transform': transform_config
  }
  ```

  For details of the configuration parameter of transform_config see `SageMaker.Client.create_transform_job()`

  For details of the configuration parameter of model_config, See: `SageMaker.Client.create_model()`
- **aws_conn_id** (*string*) – The AWS connection ID to use.
- **wait_for_completion** (*bool*) – Set to True to wait until the transform job finishes.
- **check_interval** (*int*) – If wait is set to True, the time interval, in seconds, that this operation waits to check the status of the transform job.
- **max_ingestion_time** (*int*) – If wait is set to True, the operation fails if the transform job doesn't finish within max_ingestion_time seconds. If you set this parameter to None, the operation does not timeout.

class airflow.contrib.operators.sagemaker_tuning_operator.**SageMakerTuningOperator**(***kwargs*)
Bases: *airflow.contrib.operators.sagemaker_base_operator.SageMakerBaseOperator*

Initiate a SageMaker hyperparameter tuning job.

This operator returns The ARN of the tuning job created in Amazon SageMaker.

Parameters

- **config** (*dict*) – The configuration necessary to start a tuning job (templated).

  For details of the configuration parameter see `SageMaker.Client.create_hyper_parameter_tuning_job()`
- **aws_conn_id** (*str*) – The AWS connection ID to use.
- **wait_for_completion** (*bool*) – Set to True to wait until the tuning job finishes.
- **check_interval** (*int*) – If wait is set to True, the time interval, in seconds, that this operation waits to check the status of the tuning job.
- **max_ingestion_time** (*int*) – If wait is set to True, the operation fails if the tuning job doesn't finish within max_ingestion_time seconds. If you set this parameter to None, the operation does not timeout.

class airflow.contrib.operators.slack_webhook_operator.**SlackWebhookOperator**(***kwargs*)
Bases: *airflow.operators.http_operator.SimpleHttpOperator*

This operator allows you to post messages to Slack using incoming webhooks. Takes both Slack webhook token directly and connection that has Slack webhook token. If both supplied, Slack webhook token will be used.

Each Slack webhook token can be pre-configured to use a specific channel, username and icon. You can override these defaults in this hook.

Parameters

- **http_conn_id** (*str*) – connection that has Slack webhook token in the extra field
- **webhook_token** (*str*) – Slack webhook token
- **message** (*str*) – The message you want to send on Slack
- **channel** (*str*) – The channel the message should be posted to
- **username** (*str*) – The username to post to slack with
- **icon_emoji** (*str*) – The emoji to use as icon for the user posting to Slack
- **link_names** (*bool*) – Whether or not to find and link channel and usernames in your message
- **proxy** (*str*) – Proxy to use to make the Slack webhook call

execute (*context*)
Call the SlackWebhookHook to post the provided Slack message

class airflow.contrib.operators.spark_jdbc_operator.**SparkJDBCOperator** (***kwargs*)
Bases: *airflow.contrib.operators.spark_submit_operator.SparkSubmitOperator*

This operator extends the SparkSubmitOperator specifically for performing data transfers to/from JDBC-based databases with Apache Spark. As with the SparkSubmitOperator, it assumes that the "spark-submit" binary is available on the PATH.

Parameters

- **spark_app_name** (*str*) – Name of the job (default airflow-spark-jdbc)
- **spark_conn_id** (*str*) – Connection id as configured in Airflow administration
- **spark_conf** (*dict*) – Any additional Spark configuration properties
- **spark_py_files** (*str*) – Additional python files used (.zip, .egg, or .py)
- **spark_files** (*str*) – Additional files to upload to the container running the job
- **spark_jars** (*str*) – Additional jars to upload and add to the driver and executor classpath
- **num_executors** (*int*) – number of executor to run. This should be set so as to manage the number of connections made with the JDBC database
- **executor_cores** (*int*) – Number of cores per executor
- **executor_memory** (*str*) – Memory per executor (e.g. 1000M, 2G)
- **driver_memory** (*str*) – Memory allocated to the driver (e.g. 1000M, 2G)
- **verbose** (*bool*) – Whether to pass the verbose flag to spark-submit for debugging
- **keytab** (*str*) – Full path to the file that contains the keytab
- **principal** (*str*) – The name of the kerberos principal used for keytab
- **cmd_type** (*str*) – Which way the data should flow. 2 possible values: spark_to_jdbc: data written by spark from metastore to jdbc jdbc_to_spark: data written by spark from jdbc to metastore
- **jdbc_table** (*str*) – The name of the JDBC table
- **jdbc_conn_id** – Connection id used for connection to JDBC database

- **jdbc_driver** (*str*) – Name of the JDBC driver to use for the JDBC connection. This driver (usually a jar) should be passed in the 'jars' parameter
- **metastore_table** (*str*) – The name of the metastore table,
- **jdbc_truncate** (*bool*) – (spark_to_jdbc only) Whether or not Spark should truncate or drop and recreate the JDBC table. This only takes effect if 'save_mode' is set to Overwrite. Also, if the schema is different, Spark cannot truncate, and will drop and recreate
- **save_mode** (*str*) – The Spark save-mode to use (e.g. overwrite, append, etc.)
- **save_format** (*str*) – (jdbc_to_spark-only) The Spark save-format to use (e.g. parquet)
- **batch_size** (*int*) – (spark_to_jdbc only) The size of the batch to insert per round trip to the JDBC database. Defaults to 1000
- **fetch_size** (*int*) – (jdbc_to_spark only) The size of the batch to fetch per round trip from the JDBC database. Default depends on the JDBC driver
- **num_partitions** (*int*) – The maximum number of partitions that can be used by Spark simultaneously, both for spark_to_jdbc and jdbc_to_spark operations. This will also cap the number of JDBC connections that can be opened
- **partition_column** (*str*) – (jdbc_to_spark-only) A numeric column to be used to partition the metastore table by. If specified, you must also specify: num_partitions, lower_bound, upper_bound
- **lower_bound** (*int*) – (jdbc_to_spark-only) Lower bound of the range of the numeric partition column to fetch. If specified, you must also specify: num_partitions, partition_column, upper_bound
- **upper_bound** (*int*) – (jdbc_to_spark-only) Upper bound of the range of the numeric partition column to fetch. If specified, you must also specify: num_partitions, partition_column, lower_bound
- **create_table_column_types** – (spark_to_jdbc-only) The database column data types to use instead of the defaults, when creating the table. Data type information should be specified in the same format as CREATE TABLE columns syntax (e.g: "name CHAR(64), comments VARCHAR(1024)"). The specified types should be valid spark sql data types.

Type jdbc_conn_id: str

execute (*context*)
Call the SparkSubmitHook to run the provided spark job

class airflow.contrib.operators.spark_sql_operator.**SparkSqlOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

Execute Spark SQL query

Parameters

- **sql** (*str*) – The SQL query to execute. (templated)
- **conf** (*str (format: PROP=VALUE)*) – arbitrary Spark configuration property
- **conn_id** (*str*) – connection_id string
- **total_executor_cores** (*int*) – (Standalone & Mesos only) Total cores for all executors (Default: all the available cores on the worker)
- **executor_cores** (*int*) – (Standalone & YARN only) Number of cores per executor (Default: 2)
- **executor_memory** (*str*) – Memory per executor (e.g. 1000M, 2G) (Default: 1G)

- **keytab** (*str*) – Full path to the file that contains the keytab
- **master** (*str*) – spark://host:port, mesos://host:port, yarn, or local
- **name** (*str*) – Name of the job
- **num_executors** (*int*) – Number of executors to launch
- **verbose** (*bool*) – Whether to pass the verbose flag to spark-sql
- **yarn_queue** (*str*) – The YARN queue to submit to (Default: "default")

execute (*context*)
Call the SparkSqlHook to run the provided sql query

class airflow.contrib.operators.spark_submit_operator.**SparkSubmitOperator**(***kwargs*)
Bases: *airflow.models.BaseOperator*

This hook is a wrapper around the spark-submit binary to kick off a spark-submit job. It requires that the "spark-submit" binary is in the PATH or the spark-home is set in the extra on the connection.

Parameters

- **application** (*str*) – The application that submitted as a job, either jar or py file. (templated)
- **conf** (*dict*) – Arbitrary Spark configuration properties
- **conn_id** (*str*) – The connection id as configured in Airflow administration. When an invalid connection_id is supplied, it will default to yarn.
- **files** (*str*) – Upload additional files to the executor running the job, separated by a comma. Files will be placed in the working directory of each executor. For example, serialized objects.
- **py_files** (*str*) – Additional python files used by the job, can be .zip, .egg or .py.
- **jars** (*str*) – Submit additional jars to upload and place them in executor classpath.
- **driver_classpath** (*str*) – Additional, driver-specific, classpath settings.
- **java_class** (*str*) – the main class of the Java application
- **packages** (*str*) – Comma-separated list of maven coordinates of jars to include on the driver and executor classpaths. (templated)
- **exclude_packages** (*str*) – Comma-separated list of maven coordinates of jars to exclude while resolving the dependencies provided in 'packages'
- **repositories** (*str*) – Comma-separated list of additional remote repositories to search for the maven coordinates given with 'packages'
- **total_executor_cores** (*int*) – (Standalone & Mesos only) Total cores for all executors (Default: all the available cores on the worker)
- **executor_cores** (*int*) – (Standalone & YARN only) Number of cores per executor (Default: 2)
- **executor_memory** (*str*) – Memory per executor (e.g. 1000M, 2G) (Default: 1G)
- **driver_memory** (*str*) – Memory allocated to the driver (e.g. 1000M, 2G) (Default: 1G)
- **keytab** (*str*) – Full path to the file that contains the keytab
- **principal** (*str*) – The name of the kerberos principal used for keytab
- **name** (*str*) – Name of the job (default airflow-spark). (templated)

- **num_executors** (*int*) – Number of executors to launch
- **application_args** (*list*) – Arguments for the application being submitted
- **env_vars** (*dict*) – Environment variables for spark-submit. It supports yarn and k8s mode too.
- **verbose** (*bool*) – Whether to pass the verbose flag to spark-submit process for debugging

execute (*context*)
Call the SparkSubmitHook to run the provided spark job

class airflow.contrib.operators.sqoop_operator.**SqoopOperator** (***kwargs*)
Bases: *airflow.models.BaseOperator*

Execute a Sqoop job. Documentation for Apache Sqoop can be found here:

https://sqoop.apache.org/docs/1.4.2/SqoopUserGuide.html.

execute (*context*)
Execute sqoop job

class airflow.contrib.operators.vertica_operator.**VerticaOperator** (***kwargs*)
Bases: *airflow.models.BaseOperator*

Executes sql code in a specific Vertica database

Parameters

- **vertica_conn_id** (*string*) – reference to a specific Vertica database
- **sql** (*Can receive a str representing a sql statement, a list of str (sql statements), or reference to a template file. Template reference are recognized by str ending in '.sql'*) – the sql code to be executed. (templated)

class airflow.contrib.operators.vertica_to_hive.**VerticaToHiveTransfer** (***kwargs*)
Bases: *airflow.models.BaseOperator*

Moves data from Vertia to Hive. The operator runs your query against Vertia, stores the file locally before loading it into a Hive table. If the `create` or `recreate` arguments are set to `True`, a `CREATE TABLE` and `DROP TABLE` statements are generated. Hive data types are inferred from the cursor's metadata. Note that the table generated in Hive uses `STORED AS textfile` which isn't the most efficient serialization format. If a large amount of data is loaded and/or if the table gets queried considerably, you may want to use this operator only to stage the data into a temporary table before loading it into its final destination using a `HiveOperator`.

Parameters

- **sql** (*str*) – SQL query to execute against the Vertia database. (templated)
- **hive_table** (*str*) – target Hive table, use dot notation to target a specific database. (templated)
- **create** (*bool*) – whether to create the table if it doesn't exist
- **recreate** (*bool*) – whether to drop and recreate the table at every execution
- **partition** (*dict*) – target partition as a dict of partition columns and values. (templated)
- **delimiter** (*str*) – field delimiter in the file
- **vertica_conn_id** (*str*) – source Vertica connection
- **hive_conn_id** (*str*) – destination hive connection

Sensors

class airflow.contrib.sensors.aws_athena_sensor.**AthenaSensor**(***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Asks for the state of the Query until it reaches a failure state or success state. If it fails, failing the task.

Parameters

- **query_execution_id** (*str*) – query_execution_id to check the state of
- **max_retires** (*int*) – Number of times to poll for query state before returning the current state, defaults to None
- **aws_conn_id** (*str*) – aws connection to use, defaults to 'aws_default'
- **sleep_time** (*int*) – Time to wait between two consecutive call to check query status on athena, defaults to 10

poke(*context*)
Function that the sensors defined while deriving this class should override.

class airflow.contrib.sensors.aws_glue_catalog_partition_sensor.**AwsGlueCatalogPartitionSens**
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Waits for a partition to show up in AWS Glue Catalog.

Parameters

- **table_name** (*str*) – The name of the table to wait for, supports the dot notation (my_database.my_table)
- **expression** (*str*) – The partition clause to wait for. This is passed as is to the AWS Glue Catalog API's get_partitions function, and supports SQL like notation as in `ds='2015-01-01' AND type='value'` and comparison operators as in `"ds>=2015-01-01"`. See https://docs.aws.amazon.com/glue/latest/dg/aws-glue-api-catalog-partitions.html #aws-glue-api-catalog-partitions-GetPartitions
- **aws_conn_id** (*str*) – ID of the Airflow connection where credentials and extra configuration are stored
- **region_name** (*str*) – Optional aws region name (example: us-east-1). Uses region from connection if not specified.
- **database_name** (*str*) – The name of the catalog database where the partitions reside.
- **poke_interval** (*int*) – Time in seconds that the job should wait in between each tries

get_hook()
Gets the AwsGlueCatalogHook

poke(*context*)
Checks for existence of the partition in the AWS Glue Catalog table

class airflow.contrib.sensors.aws_redshift_cluster_sensor.**AwsRedshiftClusterSensor**(***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Waits for a Redshift cluster to reach a specific status.

Parameters

- **cluster_identifier** (*str*) – The identifier for the cluster being pinged.
- **target_status** (*str*) – The cluster status desired.

poke (*context*)
Function that the sensors defined while deriving this class should override.

class airflow.contrib.sensors.bash_sensor.**BashSensor** (***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Executes a bash command/script and returns True if and only if the return code is 0.

Parameters

- **bash_command** (*string*) – The command, set of commands or reference to a bash script (must be '.sh') to be executed.
- **env** (*dict*) – If env is not None, it must be a mapping that defines the environment variables for the new process; these are used instead of inheriting the current process environment, which is the default behavior. (templated)
- **output_encoding** (*string*) – output encoding of bash command.

poke (*context*)
Execute the bash command in a temporary directory which will be cleaned afterwards

class airflow.contrib.sensors.bigquery_sensor.**BigQueryTableSensor** (***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Checks for the existence of a table in Google Bigquery.

param project_id The Google cloud project in which to look for the table. The connection supplied to the hook must provide access to the specified project.

type project_id string

param dataset_id The name of the dataset in which to look for the table. storage bucket.

type dataset_id string

param table_id The name of the table to check the existence of.

type table_id string

param bigquery_conn_id The connection ID to use when connecting to Google BigQuery.

type bigquery_conn_id string

param delegate_to The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

type delegate_to string

poke (*context*)
Function that the sensors defined while deriving this class should override.

class airflow.contrib.sensors.emr_base_sensor.**EmrBaseSensor** (***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Contains general sensor behavior for EMR. Subclasses should implement get_emr_response() and state_from_response() methods. Subclasses should also implement NON_TERMINAL_STATES and FAILED_STATE constants.

poke (*context*)
Function that the sensors defined while deriving this class should override.

class airflow.contrib.sensors.emr_job_flow_sensor.**EmrJobFlowSensor** (***kwargs*)
Bases: *airflow.contrib.sensors.emr_base_sensor.EmrBaseSensor*

Asks for the state of the JobFlow until it reaches a terminal state. If it fails the sensor errors, failing the task.

Parameters **job_flow_id** (*string*) – job_flow_id to check the state of

class airflow.contrib.sensors.emr_step_sensor.**EmrStepSensor**(***kwargs*)

Bases: *airflow.contrib.sensors.emr_base_sensor.EmrBaseSensor*

Asks for the state of the step until it reaches a terminal state. If it fails the sensor errors, failing the task.

Parameters

- **job_flow_id** (*string*) – job_flow_id which contains the step check the state of
- **step_id** (*string*) – step to check the state of

class airflow.contrib.sensors.file_sensor.**FileSensor**(***kwargs*)

Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Waits for a file or folder to land in a filesystem.

If the path given is a directory then this sensor will only return true if any files exist inside it (either directly, or within a subdirectory)

Parameters

- **fs_conn_id** (*string*) – reference to the File (path) connection id
- **filepath** – File or folder name (relative to the base path set within the connection)

poke(*context*)

Function that the sensors defined while deriving this class should override.

class airflow.contrib.sensors.ftp_sensor.**FTPSensor**(***kwargs*)

Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Waits for a file or directory to be present on FTP.

poke(*context*)

Function that the sensors defined while deriving this class should override.

template_fields = ('path',)

Errors that are transient in nature, and where action can be retried

class airflow.contrib.sensors.ftp_sensor.**FTPSSensor**(***kwargs*)

Bases: *airflow.contrib.sensors.ftp_sensor.FTPSensor*

Waits for a file or directory to be present on FTP over SSL.

class airflow.contrib.sensors.gcs_sensor.**GoogleCloudStorageObjectSensor**(***kwargs*)

Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Checks for the existence of a file in Google Cloud Storage. Create a new GoogleCloudStorageObjectSensor.

param bucket The Google cloud storage bucket where the object is.

type bucket string

param object The name of the object to check in the Google cloud storage bucket.

type object string

param google_cloud_storage_conn_id The connection ID to use when connecting to Google cloud storage.

type google_cloud_storage_conn_id string

param delegate_to The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

type delegate_to string

poke (*context*)
Function that the sensors defined while deriving this class should override.

class airflow.contrib.sensors.gcs_sensor.**GoogleCloudStorageObjectUpdatedSensor** (***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Checks if an object is updated in Google Cloud Storage. Create a new GoogleCloudStorageObjectUpdatedSensor.

param bucket The Google cloud storage bucket where the object is.

type bucket string

param object The name of the object to download in the Google cloud storage bucket.

type object string

param ts_func Callback for defining the update condition. The default callback returns execution_date + schedule_interval. The callback takes the context as parameter.

type ts_func function

param google_cloud_storage_conn_id The connection ID to use when connecting to Google cloud storage.

type google_cloud_storage_conn_id string

param delegate_to The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

type delegate_to string

poke (*context*)
Function that the sensors defined while deriving this class should override.

class airflow.contrib.sensors.gcs_sensor.**GoogleCloudStoragePrefixSensor** (***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Checks for the existence of a files at prefix in Google Cloud Storage bucket. Create a new GoogleCloudStorageObjectSensor.

param bucket The Google cloud storage bucket where the object is.

type bucket string

param prefix The name of the prefix to check in the Google cloud storage bucket.

type prefix string

param google_cloud_storage_conn_id The connection ID to use when connecting to Google cloud storage.

type google_cloud_storage_conn_id string

param delegate_to The account to impersonate, if any. For this to work, the service account making the request must have domain-wide delegation enabled.

type delegate_to string

poke (*context*)
Function that the sensors defined while deriving this class should override.

class airflow.contrib.sensors.pubsub_sensor.**PubSubPullSensor** (***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Pulls messages from a PubSub subscription and passes them through XCom.

This sensor operator will pull up to `max_messages` messages from the specified PubSub subscription. When the subscription returns messages, the poke method's criteria will be fulfilled and the messages will be returned from the operator and passed through XCom for downstream tasks.

If `ack_messages` is set to True, messages will be immediately acknowledged before being returned, otherwise, downstream tasks will be responsible for acknowledging them.

`project` and `subscription` are templated so you can use variables in them.

execute (*context*)
Overridden to allow messages to be passed

poke (*context*)
Function that the sensors defined while deriving this class should override.

class airflow.contrib.sensors.python_sensor.**PythonSensor** (***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Waits for a Python callable to return True.

User could put input argument in templates_dict e.g templates_dict = {'start_ds': 1970}

and access the argument by calling *kwargs['templates_dict']['start_ds']* in the the callable

Parameters

- **python_callable** (*python callable*) – A reference to an object that is callable
- **op_kwargs** (*dict*) – a dictionary of keyword arguments that will get unpacked in your function
- **op_args** (*list*) – a list of positional arguments that will get unpacked when calling your callable
- **provide_context** (*bool*) – if set to true, Airflow will pass a set of keyword arguments that can be used in your function. This set of kwargs correspond exactly to what you can use in your jinja templates. For this to work, you need to define ***kwargs* in your function header.
- **templates_dict** (*dict of str*) – a dictionary where the values are templates that will get templated by the Airflow engine sometime between `__init__` and `execute` takes place and are made available in your callable's context after the template has been applied.

poke (*context*)
Function that the sensors defined while deriving this class should override.

class airflow.contrib.sensors.sagemaker_base_sensor.**SageMakerBaseSensor** (***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Contains general sensor behavior for SageMaker. Subclasses should implement get_sagemaker_response() and state_from_response() methods. Subclasses should also implement NON_TERMINAL_STATES and FAILED_STATE methods.

poke (*context*)
Function that the sensors defined while deriving this class should override.

class airflow.contrib.sensors.sagemaker_endpoint_sensor.**SageMakerEndpointSensor** (***kwargs*)
Bases: *airflow.contrib.sensors.sagemaker_base_sensor.SageMakerBaseSensor*

Asks for the state of the endpoint state until it reaches a terminal state. If it fails the sensor errors, the task fails.

Parameters **job_name** (*str*) – job_name of the endpoint instance to check the state of

class airflow.contrib.sensors.sagemaker_training_sensor.**SageMakerTrainingSensor**(***kwargs*)
Bases: *airflow.contrib.sensors.sagemaker_base_sensor.SageMakerBaseSensor*

Asks for the state of the training state until it reaches a terminal state. If it fails the sensor errors, failing the task.

Parameters

- **job_name** (*str*) – name of the SageMaker training job to check the state of
- **print_log** (*bool*) – if the operator should print the cloudwatch log

class airflow.contrib.sensors.sagemaker_transform_sensor.**SageMakerTransformSensor**(***kwargs*)
Bases: *airflow.contrib.sensors.sagemaker_base_sensor.SageMakerBaseSensor*

Asks for the state of the transform state until it reaches a terminal state. The sensor will error if the job errors, throwing a AirflowException containing the failure reason.

Parameters **job_name** (*string*) – job_name of the transform job instance to check the state of

class airflow.contrib.sensors.sagemaker_tuning_sensor.**SageMakerTuningSensor**(***kwargs*)
Bases: *airflow.contrib.sensors.sagemaker_base_sensor.SageMakerBaseSensor*

Asks for the state of the tuning state until it reaches a terminal state. The sensor will error if the job errors, throwing a AirflowException containing the failure reason.

Parameters **job_name** (*str*) – job_name of the tuning instance to check the state of

class airflow.contrib.sensors.weekday_sensor.**DayOfWeekSensor**(***kwargs*)
Bases: *airflow.sensors.base_sensor_operator.BaseSensorOperator*

Waits until the first specified day of the week. For example, if the execution day of the task is '2018-12-22' (Saturday) and you pass 'FRIDAY', the task will wait until next Friday.

Example (with single day):

```
weekend_check = DayOfWeekSensor(
    task_id='weekend_check',
    week_day='Saturday',
    use_task_execution_day=True,
    dag=dag)
```

Example (with multiple day using set):

```
weekend_check = DayOfWeekSensor(
    task_id='weekend_check',
    week_day={'Saturday', 'Sunday'},
    use_task_execution_day=True,
    dag=dag)
```

Example (with `WeekDay` enum):

```
# import WeekDay Enum
from airflow.contrib.utils.weekday import WeekDay

weekend_check = DayOfWeekSensor(
    task_id='weekend_check',
    week_day={WeekDay.SATURDAY, WeekDay.SUNDAY},
    use_task_execution_day=True,
    dag=dag)
```

Parameters

- **week_day** (*set or str or WeekDay*) – Day of the week to check (full name). Optionally, a set of days can also be provided using a set. Example values:
  - `"MONDAY",`
  - `{"Saturday", "Sunday"}`
  - `{WeekDay.TUESDAY}`
  - `{WeekDay.SATURDAY, WeekDay.SUNDAY}`
- **use_task_execution_day** (*bool*) – If `True`, uses task's execution day to compare with week_day. Execution Date is Useful for backfilling. If `False`, uses system's day of the week. Useful when you don't want to run anything on weekdays on the system.

poke (*context*)
Function that the sensors defined while deriving this class should override.

3.22.2 Macros

Here's a list of variables and macros that can be used in templates

3.22.2.1 Default Variables

The Airflow engine passes a few variables by default that are accessible in all templates

Variable	Description
`{{ ds }}`	the execution date as `YYYY-MM-DD`
`{{ ds_nodash }}`	the execution date as `YYYYMMDD`
`{{ prev_ds }}`	the previous execution date as `YYYY-MM-DD` if `{{ ds }}` is `2018-01-08` and `schec`
`{{ prev_ds_nodash }}`	the previous execution date as `YYYYMMDD` if exists, else ‘‘None‘
`{{ next_ds }}`	the next execution date as `YYYY-MM-DD` if `{{ ds }}` is `2018-01-01` and `schedule`
`{{ next_ds_nodash }}`	the next execution date as `YYYYMMDD` if exists, else ‘‘None‘
`{{ yesterday_ds }}`	the day before the execution date as `YYYY-MM-DD`
`{{ yesterday_ds_nodash }}`	the day before the execution date as `YYYYMMDD`
`{{ tomorrow_ds }}`	the day after the execution date as `YYYY-MM-DD`
`{{ tomorrow_ds_nodash }}`	the day after the execution date as `YYYYMMDD`
`{{ ts }}`	same as `execution_date.isoformat()`. Example: `2018-01-01T00:00:00+0`
`{{ ts_nodash }}`	same as `ts` without `-`, `:` and TimeZone info. Example: `20180101T000000`
`{{ ts_nodash_with_tz }}`	same as `ts` without `-` and `:`. Example: `20180101T000000+0000`
`{{ execution_date }}`	the execution_date, (datetime.datetime)
`{{ prev_execution_date }}`	the previous execution date (if available) (datetime.datetime)
`{{ next_execution_date }}`	the next execution date (datetime.datetime)
`{{ dag }}`	the DAG object
`{{ task }}`	the Task object
`{{ macros }}`	a reference to the macros package, described below
`{{ task_instance }}`	the task_instance object
`{{ end_date }}`	same as `{{ ds }}`
`{{ latest_date }}`	same as `{{ ds }}`
`{{ ti }}`	same as `{{ task_instance }}`
`{{ params }}`	a reference to the user-defined params dictionary which can be overridden by the dictionar
`{{ var.value.my_var }}`	global defined variables represented as a dictionary
`{{ var.json.my_var.path }}`	global defined variables represented as a dictionary with deserialized JSON object, append

Table 2 – continued fron

Variable	Description
`{{ task_instance_key_str }}`	a unique, human-readable key to the task instance formatted `{dag_id}_{task_id}_{`
`{{ conf }}`	the full configuration object located at `airflow.configuration.conf` which repre
`{{ run_id }}`	the `run_id` of the current DAG run
`{{ dag_run }}`	a reference to the DagRun object
`{{ test_mode }}`	whether the task instance was called using the CLI's test subcommand

Note that you can access the object's attributes and methods with simple dot notation. Here are some examples of what is possible: `{{ task.owner }}`, `{{ task.task_id }}`, `{{ ti.hostname }}`, ... Refer to the models documentation for more information on the objects' attributes and methods.

The `var` template variable allows you to access variables defined in Airflow's UI. You can access them as either plain-text or JSON. If you use JSON, you are also able to walk nested structures, such as dictionaries like: `{{ var.json.my_dict_var.key1 }}`

3.22.2.2 Macros

Macros are a way to expose objects to your templates and live under the `macros` namespace in your templates.

A few commonly used libraries and methods are made available.

Variable	Description
`macros.datetime`	The standard lib's `datetime.datetime`
`macros.timedelta`	The standard lib's `datetime.timedelta`
`macros.dateutil`	A reference to the `dateutil` package
`macros.time`	The standard lib's `time`
`macros.uuid`	The standard lib's `uuid`
`macros.random`	The standard lib's `random`

Some airflow specific macros are also defined:

`airflow.macros.`**`ds_add`**`(`*ds*, *days*`)`

Add or subtract days from a YYYY-MM-DD

Parameters

- **ds** (*str*) – anchor date in `YYYY-MM-DD` format to add to
- **days** (*int*) – number of days to add to the ds, you can use negative values

```
>>> ds_add('2015-01-01', 5)
'2015-01-06'
>>> ds_add('2015-01-06', -5)
'2015-01-01'
```

`airflow.macros.`**`ds_format`**`(`*ds*, *input_format*, *output_format*`)`

Takes an input string and outputs another string as specified in the output format

Parameters

- **ds** (*str*) – input string which contains a date
- **input_format** (*str*) – input string format. E.g. %Y-%m-%d
- **output_format** (*str*) – output string format E.g. %Y-%m-%d

```
>>> ds_format('2015-01-01', "%Y-%m-%d", "%m-%d-%y")
'01-01-15'
>>> ds_format('1/5/2015', "%m/%d/%Y",  "%Y-%m-%d")
'2015-01-05'
```

`airflow.macros.`**`random`**`()` → x in the interval [0, 1).

`airflow.macros.hive.`**`closest_ds_partition`**`(`*table*, *ds*, *before=True*, *schema='default'*, *metastore_conn_id='metastore_default'*`)`

This function finds the date in a list closest to the target date. An optional parameter can be given to get the closest before or after.

Parameters

- **`table`** (*`str`*) – A hive table name
- **`ds`** (*`datetime.date list`*) – A datestamp `%Y-%m-%d` e.g. `yyyy-mm-dd`
- **`before`** (*`bool or None`*) – closest before (True), after (False) or either side of ds

Returns The closest date

Return type str or None

```
>>> tbl = 'airflow.static_babynames_partitioned'
>>> closest_ds_partition(tbl, '2015-01-02')
'2015-01-01'
```

`airflow.macros.hive.`**`max_partition`**`(`*table*, *schema='default'*, *field=None*, *filter_map=None*, *metastore_conn_id='metastore_default'*`)`

Gets the max partition for a table.

Parameters

- **`schema`** (*`string`*) – The hive schema the table lives in
- **`table`** (*`string`*) – The hive table you are interested in, supports the dot notation as in "my_database.my_table", if a dot is found, the schema param is disregarded
- **`metastore_conn_id`** (*`string`*) – The hive connection you are interested in. If your default is set you don't need to use this parameter.
- **`filter_map`** (*`map`*) – partition_key:partition_value map used for partition filtering, e.g. {'key1': 'value1', 'key2': 'value2'}. Only partitions matching all partition_key:partition_value pairs will be considered as candidates of max partition.
- **`field`** (*`str`*) – the field to get the max value from. If there's only one partition field, this will be inferred

```
>>> max_partition('airflow.static_babynames_partitioned')
'2015-01-01'
```

3.22.3 Models

Models are built on top of the SQLAlchemy ORM Base class, and instances are persisted in the database.

`class` `airflow.models.`**`BaseOperator`**`(`***kwargs*`)`

Bases: `airflow.utils.log.logging_mixin.LoggingMixin`

Abstract base class for all operators. Since operators create objects that become nodes in the dag, BaseOperator contains many recursive methods for dag crawling behavior. To derive this class, you are expected to override the constructor as well as the 'execute' method.

Operators derived from this class should perform or trigger certain tasks synchronously (wait for completion). Example of operators could be an operator that runs a Pig job (PigOperator), a sensor operator that waits for a partition to land in Hive (HiveSensorOperator), or one that moves data from Hive to MySQL (Hive2MySqlOperator). Instances of these operators (tasks) target specific operations, running specific scripts, functions or data transfers.

This class is abstract and shouldn't be instantiated. Instantiating a class derived from this one results in the creation of a task object, which ultimately becomes a node in DAG objects. Task dependencies should be set by using the set_upstream and/or set_downstream methods.

Parameters

- **`task_id`** (*`string`*) – a unique, meaningful id for the task
- **`owner`** (*`string`*) – the owner of the task, using the unix username is recommended
- **`retries`** (*`int`*) – the number of retries that should be performed before failing the task
- **`retry_delay`** (*`timedelta`*) – delay between retries
- **`retry_exponential_backoff`** (*`bool`*) – allow progressive longer waits between retries by using exponential backoff algorithm on retry delay (delay will be converted into seconds)
- **`max_retry_delay`** (*`timedelta`*) – maximum delay interval between retries
- **`start_date`** (*`datetime`*) – The `start_date` for the task, determines the `execution_date` for the first task instance. The best practice is to have the start_date rounded to your DAG's `schedule_interval`. Daily jobs have their start_date some day at 00:00:00, hourly jobs have their start_date at 00:00 of a specific hour. Note that Airflow simply looks at the latest `execution_date` and adds the `schedule_interval` to determine the next `execution_date`. It is also very important to note that different tasks' dependencies need to line up in time. If task A depends on task B and their start_date are offset in a way that their execution_date don't line up, A's dependencies will never be met. If you are looking to delay a task, for example running a daily task at 2AM, look into the `TimeSensor` and `TimeDeltaSensor`. We advise against using dynamic `start_date` and recommend using fixed ones. Read the FAQ entry about start_date for more information.
- **`end_date`** (*`datetime`*) – if specified, the scheduler won't go beyond this date
- **`depends_on_past`** (*`bool`*) – when set to true, task instances will run sequentially while relying on the previous task's schedule to succeed. The task instance for the start_date is allowed to run.
- **`wait_for_downstream`** (*`bool`*) – when set to true, an instance of task X will wait for tasks immediately downstream of the previous instance of task X to finish successfully before it runs. This is useful if the different instances of a task X alter the same asset, and this asset is used by tasks downstream of task X. Note that depends_on_past is forced to True wherever wait_for_downstream is used.
- **`queue`** (*`str`*) – which queue to target when running this job. Not all executors implement queue management, the CeleryExecutor does support targeting specific queues.
- **`dag`** (`DAG`) – a reference to the dag the task is attached to (if any)
- **`priority_weight`** (*`int`*) – priority weight of this task against other task. This allows the executor to trigger higher priority tasks before others when things get backed up.

- **weight_rule** (*str*) – weighting method used for the effective total priority weight of the task. Options are: `{ downstream | upstream | absolute }` default is `downstream` When set to `downstream` the effective weight of the task is the aggregate sum of all downstream descendants. As a result, upstream tasks will have higher weight and will be scheduled more aggressively when using positive weight values. This is useful when you have multiple dag run instances and desire to have all upstream tasks to complete for all runs before each dag can continue processing downstream tasks. When set to `upstream` the effective weight is the aggregate sum of all upstream ancestors. This is the opposite where downtream tasks have higher weight and will be scheduled more aggressively when using positive weight values. This is useful when you have multiple dag run instances and prefer to have each dag complete before starting upstream tasks of other dags. When set to `absolute`, the effective weight is the exact `priority_weight` specified without additional weighting. You may want to do this when you know exactly what priority weight each task should have. Additionally, when set to `absolute`, there is bonus effect of significantly speeding up the task creation process as for very large DAGS. Options can be set as string or using the constants defined in the static class `airflow.utils.WeightRule`
- **pool** (*str*) – the slot pool this task should run in, slot pools are a way to limit concurrency for certain tasks
- **sla** (*datetime.timedelta*) – time by which the job is expected to succeed. Note that this represents the `timedelta` after the period is closed. For example if you set an SLA of 1 hour, the scheduler would send an email soon after 1:00AM on the `2016-01-02` if the `2016-01-01` instance has not succeeded yet. The scheduler pays special attention for jobs with an SLA and sends alert emails for sla misses. SLA misses are also recorded in the database for future reference. All tasks that share the same SLA time get bundled in a single email, sent soon after that time. SLA notification are sent once and only once for each task instance.
- **execution_timeout** (*datetime.timedelta*) – max time allowed for the execution of this task instance, if it goes beyond it will raise and fail.
- **on_failure_callback** (*callable*) – a function to be called when a task instance of this task fails. a context dictionary is passed as a single parameter to this function. Context contains references to related objects to the task instance and is documented under the macros section of the API.
- **on_retry_callback** (*callable*) – much like the `on_failure_callback` except that it is executed when retries occur.
- **on_success_callback** (*callable*) – much like the `on_failure_callback` except that it is executed when the task succeeds.
- **trigger_rule** (*str*) – defines the rule by which dependencies are applied for the task to get triggered. Options are: `{ all_success | all_failed | all_done | one_success | one_failed | none_failed | dummy}` default is `all_success`. Options can be set as string or using the constants defined in the static class `airflow.utils.TriggerRule`
- **resources** (*dict*) – A map of resource parameter names (the argument names of the Resources constructor) to their values.
- **run_as_user** (*str*) – unix username to impersonate while running the task
- **task_concurrency** (*int*) – When set, a task will be able to limit the concurrent runs across execution_dates
- **executor_config** (*dict*) – Additional task-level configuration parameters that are interpreted by a specific executor. Parameters are namespaced by the name of executor.

Example: to run this task in a specific docker container through the KubernetesExecutor

```
MyOperator(...,
    executor_config={
    "KubernetesExecutor":
        {"image": "myCustomDockerImage"}
        }
)
```

clear(***kwargs*)
Clears the state of task instances associated with the task, following the parameters specified.

dag
Returns the Operator's DAG if set, otherwise raises an error

deps
Returns the list of dependencies for the operator. These differ from execution context dependencies in that they are specific to tasks and can be extended/overridden by subclasses.

downstream_list
@property: list of tasks directly downstream

execute(*context*)
This is the main method to derive when creating an operator. Context is the same dictionary used as when rendering jinja templates.

Refer to get_template_context for more context.

get_direct_relative_ids(*upstream=False*)
Get the direct relative ids to the current task, upstream or downstream.

get_direct_relatives(*upstream=False*)
Get the direct relatives to the current task, upstream or downstream.

get_flat_relative_ids(*upstream=False*, *found_descendants=None*)
Get a flat list of relatives' ids, either upstream or downstream.

get_flat_relatives(*upstream=False*)
Get a flat list of relatives, either upstream or downstream.

get_task_instances(*session*, *start_date=None*, *end_date=None*)
Get a set of task instance related to this task for a specific date range.

has_dag()
Returns True if the Operator has been assigned to a DAG.

on_kill()
Override this method to cleanup subprocesses when a task instance gets killed. Any use of the threading, subprocess or multiprocessing module within an operator needs to be cleaned up or it will leave ghost processes behind.

post_execute(*context*, **args*, ***kwargs*)
This hook is triggered right after self.execute() is called. It is passed the execution context and any results returned by the operator.

pre_execute(*context*, **args*, ***kwargs*)
This hook is triggered right before self.execute() is called.

prepare_template()
Hook that is triggered after the templated fields get replaced by their content. If you need your operator to alter the content of the file before the template is rendered, it should override this method to do so.

render_template (*attr*, *content*, *context*)
Renders a template either from a file or directly in a field, and returns the rendered result.

render_template_from_field (*attr*, *content*, *context*, *jinja_env*)
Renders a template from a field. If the field is a string, it will simply render the string and return the result. If it is a collection or nested set of collections, it will traverse the structure and render all strings in it.

run (*start_date=None*, *end_date=None*, *ignore_first_depends_on_past=False*, *ignore_ti_state=False*, *mark_success=False*)
Run a set of task instances for a date range.

schedule_interval
The schedule interval of the DAG always wins over individual tasks so that tasks within a DAG always line up. The task still needs a schedule_interval as it may not be attached to a DAG.

set_downstream (*task_or_task_list*)
Set a task or a task list to be directly downstream from the current task.

set_upstream (*task_or_task_list*)
Set a task or a task list to be directly upstream from the current task.

upstream_list
@property: list of tasks directly upstream

xcom_pull (*context*, *task_ids=None*, *dag_id=None*, *key=u'return_value'*, *include_prior_dates=None*)
See TaskInstance.xcom_pull()

xcom_push (*context*, *key*, *value*, *execution_date=None*)
See TaskInstance.xcom_push()

class `airflow.models.`**Chart** (***kwargs*)
Bases: `sqlalchemy.ext.declarative.api.Base`

class `airflow.models.`**Connection** (*conn_id=None*, *conn_type=None*, *host=None*, *login=None*, *password=None*, *schema=None*, *port=None*, *extra=None*, *uri=None*)
Bases: `sqlalchemy.ext.declarative.api.Base`, `airflow.utils.log.logging_mixin.LoggingMixin`

Placeholder to store information about different database instances connection information. The idea here is that scripts use references to database instances (conn_id) instead of hard coding hostname, logins and passwords when using operators or hooks.

extra_dejson
Returns the extra property by deserializing json.

class `airflow.models.`**DAG** (*dag_id*, *description=u"*, *schedule_interval=datetime.timedelta(1)*, *start_date=None*, *end_date=None*, *full_filepath=None*, *template_searchpath=None*, *user_defined_macros=None*, *user_defined_filters=None*, *default_args=None*, *concurrency=16*, *max_active_runs=16*, *dagrun_timeout=None*, *sla_miss_callback=None*, *default_view=u'tree'*, *orientation='LR'*, *catchup=True*, *on_success_callback=None*, *on_failure_callback=None*, *params=None*)
Bases: `airflow.dag.base_dag.BaseDag`, `airflow.utils.log.logging_mixin.LoggingMixin`

A dag (directed acyclic graph) is a collection of tasks with directional dependencies. A dag also has a schedule, a start end an end date (optional). For each schedule, (say daily or hourly), the DAG needs to run each individual tasks as their dependencies are met. Certain tasks have the property of depending on their own past, meaning that they can't run until their previous schedule (and upstream tasks) are completed.

DAGs essentially act as namespaces for tasks. A task_id can only be added once to a DAG.

Parameters

- **dag_id** (*string*) – The id of the DAG
- **description** (*string*) – The description for the DAG to e.g. be shown on the webserver
- **schedule_interval** (*datetime.timedelta or dateutil.relativedelta.relativedelta or str that acts as a cron expression*) – Defines how often that DAG runs, this timedelta object gets added to your latest task instance's execution_date to figure out the next schedule
- **start_date** (*datetime.datetime*) – The timestamp from which the scheduler will attempt to backfill
- **end_date** (*datetime.datetime*) – A date beyond which your DAG won't run, leave to None for open ended scheduling
- **template_searchpath** (*string or list of stings*) – This list of folders (non relative) defines where jinja will look for your templates. Order matters. Note that jinja/airflow includes the path of your DAG file by default
- **user_defined_macros** (*dict*) – a dictionary of macros that will be exposed in your jinja templates. For example, passing `dict(foo='bar')` to this argument allows you to `{{ foo }}` in all jinja templates related to this DAG. Note that you can pass any type of object here.
- **user_defined_filters** (*dict*) – a dictionary of filters that will be exposed in your jinja templates. For example, passing `dict(hello=lambda name: 'Hello %s' % name)` to this argument allows you to `{{ 'world' | hello }}` in all jinja templates related to this DAG.
- **default_args** (*dict*) – A dictionary of default parameters to be used as constructor keyword parameters when initialising operators. Note that operators have the same hook, and precede those defined here, meaning that if your dict contains *'depends_on_past': True* here and *'depends_on_past': False* in the operator's call *default_args*, the actual value will be *False*.
- **params** (*dict*) – a dictionary of DAG level parameters that are made accessible in templates, namespaced under *params*. These params can be overridden at the task level.
- **concurrency** (*int*) – the number of task instances allowed to run concurrently
- **max_active_runs** (*int*) – maximum number of active DAG runs, beyond this number of DAG runs in a running state, the scheduler won't create new active DAG runs
- **dagrun_timeout** (*datetime.timedelta*) – specify how long a DagRun should be up before timing out / failing, so that new DagRuns can be created
- **sla_miss_callback** (*types.FunctionType*) – specify a function to call when reporting SLA timeouts.
- **default_view** (*string*) – Specify DAG default view (tree, graph, duration, gantt, landing_times)
- **orientation** (*string*) – Specify DAG orientation in graph view (LR, TB, RL, BT)
- **catchup** (*bool*) – Perform scheduler catchup (or only run latest)? Defaults to True
- **on_failure_callback** (*callable*) – A function to be called when a DagRun of this dag fails. A context dictionary is passed as a single parameter to this function.

- **on_success_callback** (*callable*) – Much like the `on_failure_callback` except that it is executed when the dag succeeds.

add_task(*task*)
Add a task to the DAG

Parameters **task** (*task*) – the task you want to add

add_tasks(*tasks*)
Add a list of tasks to the DAG

Parameters **tasks** (*list of tasks*) – a lit of tasks you want to add

clear(***kwargs*)
Clears a set of task instances associated with the current dag for a specified date range.

cli()
Exposes a CLI specific to this DAG

concurrency_reached
Returns a boolean indicating whether the concurrency limit for this DAG has been reached

create_dagrun(***kwargs*)
Creates a dag run from this dag including the tasks associated with this dag. Returns the dag run.

Parameters

- **run_id** (*string*) – defines the the run id for this dag run
- **execution_date** (*datetime*) – the execution date of this dag run
- **state** (*State*) – the state of the dag run
- **start_date** (*datetime*) – the date this dag run should be evaluated
- **external_trigger** (*bool*) – whether this dag run is externally triggered
- **session** (*Session*) – database session

static deactivate_stale_dags(**args*, ***kwargs*)
Deactivate any DAGs that were last touched by the scheduler before the expiration date. These DAGs were likely deleted.

Parameters **expiration_date** (*datetime*) – set inactive DAGs that were touched before this time

Returns None

static deactivate_unknown_dags(**args*, ***kwargs*)
Given a list of known DAGs, deactivate any other DAGs that are marked as active in the ORM

Parameters **active_dag_ids** (*list[unicode]*) – list of DAG IDs that are active

Returns None

filepath
File location of where the dag object is instantiated

folder
Folder location of where the dag object is instantiated

following_schedule(*dttm*)
Calculates the following schedule for this dag in UTC.

Parameters **dttm** – utc datetime

Returns utc datetime

get_active_runs(***kwargs*)
Returns a list of dag run execution dates currently running

Parameters **session** –

Returns List of execution dates

get_dagrun(***kwargs*)
Returns the dag run for a given execution date if it exists, otherwise none.

Parameters

- **execution_date** – The execution date of the DagRun to find.
- **session** –

Returns The DagRun if found, otherwise None.

get_last_dagrun(***kwargs*)
Returns the last dag run for this dag, None if there was none. Last dag run can be any type of run eg. scheduled or backfilled. Overridden DagRuns are ignored

get_num_active_runs(***kwargs*)
Returns the number of active "running" dag runs

Parameters

- **external_trigger** (*bool*) – True for externally triggered active dag runs
- **session** –

Returns number greater than 0 for active dag runs

static get_num_task_instances(**args*, ***kwargs*)
Returns the number of task instances in the given DAG.

Parameters

- **session** – ORM session
- **dag_id** (*unicode*) – ID of the DAG to get the task concurrency of
- **task_ids** (*list[unicode]*) – A list of valid task IDs for the given DAG
- **states** (*list[state]*) – A list of states to filter by if supplied

Returns The number of running tasks

Return type int

get_run_dates(*start_date*, *end_date=None*)
Returns a list of dates between the interval received as parameter using this dag's schedule interval. Returned dates can be used for execution dates.

Parameters

- **start_date** (*datetime*) – the start date of the interval
- **end_date** (*datetime*) – the end date of the interval, defaults to timezone.utcnow()

Returns a list of dates within the interval following the dag's schedule

Return type list

get_template_env()
Returns a jinja2 Environment while taking into account the DAGs template_searchpath, user_defined_macros and user_defined_filters

handle_callback(***kwargs*)
Triggers the appropriate callback depending on the value of success, namely the on_failure_callback or on_success_callback. This method gets the context of a single TaskInstance part of this DagRun and passes that to the callable along with a 'reason', primarily to differentiate DagRun failures. .. note:

```
The logs end up in $AIRFLOW_HOME/logs/scheduler/latest/PROJECT/DAG_FILE.py.log
```

Parameters

- **dagrun** – DagRun object
- **success** – Flag to specify if failure or success callback should be called
- **reason** – Completion reason
- **session** – Database session

is_fixed_time_schedule()
Figures out if the DAG schedule has a fixed time (e.g. 3 AM).

Returns True if the schedule has a fixed time, False if not.

is_paused
Returns a boolean indicating whether this DAG is paused

latest_execution_date
Returns the latest date for which at least one dag run exists

normalize_schedule(*dttm*)
Returns dttm + interval unless dttm is first interval then it returns dttm

previous_schedule(*dttm*)
Calculates the previous schedule for this dag in UTC

Parameters **dttm** – utc datetime

Returns utc datetime

run(*start_date=None*, *end_date=None*, *mark_success=False*, *local=False*, *executor=None*, *donot_pickle=False*, *ignore_task_deps=False*, *ignore_first_depends_on_past=False*, *pool=None*, *delay_on_limit_secs=1.0*, *verbose=False*, *conf=None*, *rerun_failed_tasks=False*)
Runs the DAG.

Parameters

- **start_date** (*datetime*) – the start date of the range to run
- **end_date** (*datetime*) – the end date of the range to run
- **mark_success** (*bool*) – True to mark jobs as succeeded without running them
- **local** (*bool*) – True to run the tasks using the LocalExecutor
- **executor** (*BaseExecutor*) – The executor instance to run the tasks
- **donot_pickle** (*bool*) – True to avoid pickling DAG object and send to workers
- **ignore_task_deps** (*bool*) – True to skip upstream tasks
- **ignore_first_depends_on_past** (*bool*) – True to ignore depends_on_past dependencies for the first set of tasks only
- **pool** (*string*) – Resource pool to use

- **delay_on_limit_secs** (*float*) – Time in seconds to wait before next attempt to run dag run when max_active_runs limit has been reached
- **verbose** (*boolean*) – Make logging output more verbose
- **conf** (*dict*) – user defined dictionary passed from CLI

set_dependency(*upstream_task_id*, *downstream_task_id*)
Simple utility method to set dependency between two tasks that already have been added to the DAG using add_task()

sub_dag(*task_regex*, *include_downstream=False*, *include_upstream=True*)
Returns a subset of the current dag as a deep copy of the current dag based on a regex that should match one or many tasks, and includes upstream and downstream neighbours based on the flag passed.

subdags
Returns a list of the subdag objects associated to this DAG

sync_to_db(***kwargs*)
Save attributes about this DAG to the DB. Note that this method can be called for both DAGs and Sub-DAGs. A SubDag is actually a SubDagOperator.

Parameters

- **dag** (DAG) – the DAG object to save to the DB
- **sync_time** (*datetime*) – The time that the DAG should be marked as sync'ed

Returns None

test_cycle()
Check to see if there are any cycles in the DAG. Returns False if no cycle found, otherwise raises exception.

topological_sort()
Sorts tasks in topographical order, such that a task comes after any of its upstream dependencies.

Heavily inspired by: http://blog.jupo.org/2012/04/06/topological-sorting-acyclic-directed-graphs/

Returns list of tasks in topological order

tree_view()
Shows an ascii tree representation of the DAG

class airflow.models.**DagBag**(*dag_folder=None*, *executor=None*, *include_examples=True*)
Bases: `airflow.dag.base_dag.BaseDagBag`, `airflow.utils.log.logging_mixin.LoggingMixin`

A dagbag is a collection of dags, parsed out of a folder tree and has high level configuration settings, like what database to use as a backend and what executor to use to fire off tasks. This makes it easier to run distinct environments for say production and development, tests, or for different teams or security profiles. What would have been system level settings are now dagbag level so that one system can run multiple, independent settings sets.

Parameters

- **dag_folder** (*unicode*) – the folder to scan to find DAGs
- **executor** – the executor to use when executing task instances in this DagBag
- **include_examples** (*bool*) – whether to include the examples that ship with airflow or not
- **has_logged** – an instance boolean that gets flipped from False to True after a file has been skipped. This is to prevent overloading the user with logging messages about skipped files. Therefore only once per DagBag is a file logged being skipped.

bag_dag(*dag*, *parent_dag*, *root_dag*)
Adds the DAG into the bag, recurses into sub dags. Throws AirflowDagCycleException if a cycle is detected in this dag or its subdags

collect_dags(*dag_folder=None*, *only_if_updated=True*, *include_examples=True*)
Given a file path or a folder, this method looks for python modules, imports them and adds them to the dagbag collection.

Note that if a `.airflowignore` file is found while processing the directory, it will behave much like a `.gitignore`, ignoring files that match any of the regex patterns specified in the file.

Note: The patterns in .airflowignore are treated as un-anchored regexes, not shell-like glob patterns.

dagbag_report()
Prints a report around DagBag loading stats

get_dag(*dag_id*)
Gets the DAG out of the dictionary, and refreshes it if expired

kill_zombies(***kwargs*)
Fail given zombie tasks, which are tasks that haven't had a heartbeat for too long, in the current DagBag.

Parameters

- **zombies** (*SimpleTaskInstance*) – zombie task instances to kill.
- **session** – DB session.

:type Session.

process_file(*filepath*, *only_if_updated=True*, *safe_mode=True*)
Given a path to a python module or zip file, this method imports the module and look for dag objects within it.

size()

Returns the amount of dags contained in this dagbag

class airflow.models.**DagModel**(***kwargs*)
Bases: `sqlalchemy.ext.declarative.api.Base`

class airflow.models.**DagPickle**(*dag*)
Bases: `sqlalchemy.ext.declarative.api.Base`

Dags can originate from different places (user repos, master repo, . . .) and also get executed in different places (different executors). This object represents a version of a DAG and becomes a source of truth for a BackfillJob execution. A pickle is a native python serialized object, and in this case gets stored in the database for the duration of the job.

The executors pick up the DagPickle id and read the dag definition from the database.

class airflow.models.**DagRun**(***kwargs*)
Bases: `sqlalchemy.ext.declarative.api.Base`, `airflow.utils.log.logging_mixin.LoggingMixin`

DagRun describes an instance of a Dag. It can be created by the scheduler (for regular runs) or by an external trigger

static find(**args*, ***kwargs*)
Returns a set of dag runs for the given search criteria.

Parameters

- **dag_id** (*integer, list*) – the dag_id to find dag runs for

- **run_id** (*string*) – defines the the run id for this dag run
- **execution_date** (*datetime*) – the execution date
- **state** (*State*) – the state of the dag run
- **external_trigger** (*bool*) – whether this dag run is externally triggered
- **no_backfills** – return no backfills (True), return all (False).

Defaults to False :type no_backfills: bool :param session: database session :type session: Session

get_dag()
Returns the Dag associated with this DagRun.

Returns DAG

classmethod get_latest_runs(***kwargs*)
Returns the latest DagRun for each DAG.

get_previous_dagrun(***kwargs*)
The previous DagRun, if there is one

get_previous_scheduled_dagrun(***kwargs*)
The previous, SCHEDULED DagRun, if there is one

static get_run(*session*, *dag_id*, *execution_date*)

Parameters

- **dag_id** (*unicode*) – DAG ID
- **execution_date** (*datetime*) – execution date

Returns DagRun corresponding to the given dag_id and execution date

if one exists. None otherwise. :rtype: DagRun

get_task_instance(***kwargs*)
Returns the task instance specified by task_id for this dag run

Parameters **task_id** – the task id

get_task_instances(***kwargs*)
Returns the task instances for this dag run

refresh_from_db(***kwargs*)
Reloads the current dagrun from the database :param session: database session

update_state(***kwargs*)
Determines the overall state of the DagRun based on the state of its TaskInstances.

Returns State

verify_integrity(***kwargs*)
Verifies the DagRun by checking for removed tasks or tasks that are not in the database yet. It will set state to removed or add the task if required.

class airflow.models.**DagStat**(*dag_id*, *state*, *count=0*, *dirty=False*)
Bases: `sqlalchemy.ext.declarative.api.Base`

static create(**args*, ***kwargs*)
Creates the missing states the stats table for the dag specified

Parameters

- **dag_id** – dag id of the dag to create stats for

- **session** – database session

Returns

static set_dirty(**args*, ***kwargs*)

Parameters

- **dag_id** – the dag_id to mark dirty
- **session** – database session

Returns

static update(**args*, ***kwargs*)
Updates the stats for dirty/out-of-sync dags

Parameters

- **dag_ids** (*list*) – dag_ids to be updated
- **dirty_only** (*bool*) – only updated for marked dirty, defaults to True
- **session** (*Session*) – db session to use

class airflow.models.**ImportError**(***kwargs*)
Bases: `sqlalchemy.ext.declarative.api.Base`

exception airflow.models.**InvalidFernetToken**
Bases: `exceptions.Exception`

class airflow.models.**KnownEvent**(***kwargs*)
Bases: `sqlalchemy.ext.declarative.api.Base`

class airflow.models.**KnownEventType**(***kwargs*)
Bases: `sqlalchemy.ext.declarative.api.Base`

class airflow.models.**KubeResourceVersion**(***kwargs*)
Bases: `sqlalchemy.ext.declarative.api.Base`

class airflow.models.**KubeWorkerIdentifier**(***kwargs*)
Bases: `sqlalchemy.ext.declarative.api.Base`

class airflow.models.**Log**(*event*, *task_instance*, *owner=None*, *extra=None*, ***kwargs*)
Bases: `sqlalchemy.ext.declarative.api.Base`

Used to actively log events to the database

class airflow.models.**NullFernet**
Bases: `future.types.newobject.newobject`

A "Null" encryptor class that doesn't encrypt or decrypt but that presents a similar interface to Fernet.

The purpose of this is to make the rest of the code not have to know the difference, and to only display the message once, not 20 times when *airflow initdb* is ran.

class airflow.models.**Pool**(***kwargs*)
Bases: `sqlalchemy.ext.declarative.api.Base`

open_slots(***kwargs*)
Returns the number of slots open at the moment

queued_slots(***kwargs*)
Returns the number of slots used at the moment

used_slots(***kwargs*)
Returns the number of slots used at the moment

class `airflow.models.`**`SlaMiss`**(***kwargs*)

Bases: `sqlalchemy.ext.declarative.api.Base`

Model that stores a history of the SLA that have been missed. It is used to keep track of SLA failures over time and to avoid double triggering alert emails.

class `airflow.models.`**`TaskFail`**(*task*, *execution_date*, *start_date*, *end_date*)

Bases: `sqlalchemy.ext.declarative.api.Base`

TaskFail tracks the failed run durations of each task instance.

class `airflow.models.`**`TaskInstance`**(*task*, *execution_date*, *state=None*)

Bases: `sqlalchemy.ext.declarative.api.Base`, `airflow.utils.log.logging_mixin.LoggingMixin`

Task instances store the state of a task instance. This table is the authority and single source of truth around what tasks have run and the state they are in.

The SqlAlchemy model doesn't have a SqlAlchemy foreign key to the task or dag model deliberately to have more control over transactions.

Database transactions on this table should insure double triggers and any confusion around what task instances are or aren't ready to run even while multiple schedulers may be firing task instances.

`are_dependencies_met`(***kwargs*)

Returns whether or not all the conditions are met for this task instance to be run given the context for the dependencies (e.g. a task instance being force run from the UI will ignore some dependencies).

Parameters

- **`dep_context`** (*`DepContext`*) – The execution context that determines the dependencies that should be evaluated.
- **`session`** (*`Session`*) – database session
- **`verbose`** (*`boolean`*) – whether log details on failed dependencies on info or debug log level

`are_dependents_done`(***kwargs*)

Checks whether the dependents of this task instance have all succeeded. This is meant to be used by wait_for_downstream.

This is useful when you do not want to start processing the next schedule of a task until the dependents are done. For instance, if the task DROPs and recreates a table.

`clear_xcom_data`(***kwargs*)

Clears all XCom data from the database for the task instance

`command`(*mark_success=False*, *ignore_all_deps=False*, *ignore_depends_on_past=False*, *ignore_task_deps=False*, *ignore_ti_state=False*, *local=False*, *pickle_id=None*, *raw=False*, *job_id=None*, *pool=None*, *cfg_path=None*)

Returns a command that can be executed anywhere where airflow is installed. This command is part of the message sent to executors by the orchestrator.

`command_as_list`(*mark_success=False*, *ignore_all_deps=False*, *ignore_task_deps=False*, *ignore_depends_on_past=False*, *ignore_ti_state=False*, *local=False*, *pickle_id=None*, *raw=False*, *job_id=None*, *pool=None*, *cfg_path=None*)

Returns a command that can be executed anywhere where airflow is installed. This command is part of the message sent to executors by the orchestrator.

`current_state`(***kwargs*)

Get the very latest state from the database, if a session is passed, we use and looking up the state becomes part of the session, otherwise a new session is used.

error(***kwargs*)
Forces the task instance's state to FAILED in the database.

static generate_command(*dag_id, task_id, execution_date, mark_success=False, ignore_all_deps=False, ignore_depends_on_past=False, ignore_task_deps=False, ignore_ti_state=False, local=False, pickle_id=None, file_path=None, raw=False, job_id=None, pool=None, cfg_path=None*)
Generates the shell command required to execute this task instance.

Parameters

- **dag_id** (*unicode*) – DAG ID
- **task_id** (*unicode*) – Task ID
- **execution_date** (*datetime*) – Execution date for the task
- **mark_success** (*bool*) – Whether to mark the task as successful
- **ignore_all_deps** (*boolean*) – Ignore all ignorable dependencies. Overrides the other ignore_* parameters.
- **ignore_depends_on_past** (*boolean*) – Ignore depends_on_past parameter of DAGs (e.g. for Backfills)
- **ignore_task_deps** (*boolean*) – Ignore task-specific dependencies such as depends_on_past and trigger rule
- **ignore_ti_state** (*boolean*) – Ignore the task instance's previous failure/success
- **local** (*bool*) – Whether to run the task locally
- **pickle_id** (*unicode*) – If the DAG was serialized to the DB, the ID associated with the pickled DAG
- **file_path** – path to the file containing the DAG definition
- **raw** – raw mode (needs more details)
- **job_id** – job ID (needs more details)
- **pool** (*unicode*) – the Airflow pool that the task should run in
- **cfg_path** (*basestring*) – the Path to the configuration file

Returns shell command that can be used to run the task instance

get_dagrun(***kwargs*)
Returns the DagRun for this TaskInstance

Parameters session –

Returns DagRun

init_on_load()
Initialize the attributes that aren't stored in the DB.

init_run_context(*raw=False*)
Sets the log context.

is_eligible_to_retry()
Is task instance is eligible for retry

is_premature
Returns whether a task is in UP_FOR_RETRY state and its retry interval has elapsed.

key
Returns a tuple that identifies the task instance uniquely

next_retry_datetime()
Get datetime of the next retry if the task instance fails. For exponential backoff, retry_delay is used as base and will be converted to seconds.

pool_full(***kwargs*)
Returns a boolean as to whether the slot pool has room for this task to run

previous_ti
The task instance for the task that ran before this task instance

ready_for_retry()
Checks on whether the task instance is in the right state and timeframe to be retried.

refresh_from_db(***kwargs*)
Refreshes the task instance from the database based on the primary key

Parameters **lock_for_update** – if True, indicates that the database should lock the TaskInstance (issuing a FOR UPDATE clause) until the session is committed.

try_number
Return the try number that this task number will be when it is actually run.

If the TI is currently running, this will match the column in the databse, in all othercases this will be incremenetd

xcom_pull(*task_ids=None*, *dag_id=None*, *key=u'return_value'*, *include_prior_dates=False*)
Pull XComs that optionally meet certain criteria.

The default value for *key* limits the search to XComs that were returned by other tasks (as opposed to those that were pushed manually). To remove this filter, pass key=None (or any desired value).

If a single task_id string is provided, the result is the value of the most recent matching XCom from that task_id. If multiple task_ids are provided, a tuple of matching values is returned. None is returned whenever no matches are found.

Parameters

- **key** (*string*) – A key for the XCom. If provided, only XComs with matching keys will be returned. The default key is 'return_value', also available as a constant XCOM_RETURN_KEY. This key is automatically given to XComs returned by tasks (as opposed to being pushed manually). To remove the filter, pass key=None.
- **task_ids** (*string or iterable of strings (representing task_ids)*) – Only XComs from tasks with matching ids will be pulled. Can pass None to remove the filter.
- **dag_id** (*string*) – If provided, only pulls XComs from this DAG. If None (default), the DAG of the calling task is used.
- **include_prior_dates** (*bool*) – If False, only XComs from the current execution_date are returned. If True, XComs from previous dates are returned as well.

xcom_push(*key*, *value*, *execution_date=None*)
Make an XCom available for tasks to pull.

Parameters

- **key** (*string*) – A key for the XCom
- **value** (*any pickleable object*) – A value for the XCom. The value is pickled and stored in the database.

- **execution_date** (*datetime*) – if provided, the XCom will not be visible until this date. This can be used, for example, to send a message to a task on a future date without it being immediately visible.

class airflow.models.**TaskReschedule**(*task*, *execution_date*, *try_number*, *start_date*, *end_date*, *reschedule_date*)

Bases: sqlalchemy.ext.declarative.api.Base

TaskReschedule tracks rescheduled task instances.

static find_for_task_instance(**args*, ***kwargs*)

Returns all task reschedules for the task instance and try number, in ascending order.

Parameters **task_instance** (TaskInstance) – the task instance to find task reschedules for

class airflow.models.**User**(***kwargs*)

Bases: sqlalchemy.ext.declarative.api.Base

class airflow.models.**Variable**(***kwargs*)

Bases: sqlalchemy.ext.declarative.api.Base, airflow.utils.log.logging_mixin.LoggingMixin

classmethod setdefault(*key*, *default*, *deserialize_json=False*)

Like a Python builtin dict object, setdefault returns the current value for a key, and if it isn't there, stores the default value and returns it.

Parameters

- **key** (*String*) – Dict key for this Variable
- **default** – Default value to set and return if the variable

isn't already in the DB :type default: Mixed :param deserialize_json: Store this as a JSON encoded value in the DB

and un-encode it when retrieving a value

Returns Mixed

class airflow.models.**XCom**(***kwargs*)

Bases: sqlalchemy.ext.declarative.api.Base, airflow.utils.log.logging_mixin.LoggingMixin

Base class for XCom objects.

classmethod get_many(***kwargs*)

Retrieve an XCom value, optionally meeting certain criteria TODO: "pickling" has been deprecated and JSON is preferred.

"pickling" will be removed in Airflow 2.0.

classmethod get_one(***kwargs*)

Retrieve an XCom value, optionally meeting certain criteria. TODO: "pickling" has been deprecated and JSON is preferred.

"pickling" will be removed in Airflow 2.0.

Returns XCom value

classmethod set(***kwargs*)

Store an XCom value. TODO: "pickling" has been deprecated and JSON is preferred.

"pickling" will be removed in Airflow 2.0.

Returns None

`airflow.models.`**`clear_task_instances`**(*tis*, *session*, *activate_dag_runs=True*, *dag=None*)

Clears a set of task instances, but makes sure the running ones get killed.

Parameters

- **`tis`** – a list of task instances
- **`session`** – current session
- **`activate_dag_runs`** – flag to check for active dag run
- **`dag`** – DAG object

`airflow.models.`**`get_fernet`**()

Deferred load of Fernet key.

This function could fail either because Cryptography is not installed or because the Fernet key is invalid.

Returns Fernet object

Raises AirflowException if there's a problem trying to load Fernet

3.22.4 Hooks

Hooks are interfaces to external platforms and databases, implementing a common interface when possible and acting as building blocks for operators.

class `airflow.hooks.dbapi_hook.`**`DbApiHook`**(**args*, ***kwargs*)

Bases: `airflow.hooks.base_hook.BaseHook`

Abstract base class for sql hooks.

`bulk_dump`(*table*, *tmp_file*)

Dumps a database table into a tab-delimited file

Parameters

- **`table`** (*`str`*) – The name of the source table
- **`tmp_file`** (*`str`*) – The path of the target file

`bulk_load`(*table*, *tmp_file*)

Loads a tab-delimited file into a database table

Parameters

- **`table`** (*`str`*) – The name of the target table
- **`tmp_file`** (*`str`*) – The path of the file to load into the table

`get_autocommit`(*conn*)

Get autocommit setting for the provided connection. Return True if conn.autocommit is set to True. Return False if conn.autocommit is not set or set to False or conn does not support autocommit. :param conn: Connection to get autocommit setting from. :type conn: connection object. :return: connection autocommit setting. :rtype bool.

`get_conn`()

Returns a connection object

get_cursor()
Returns a cursor

get_first(*sql*, *parameters=None*)
Executes the sql and returns the first resulting row.

Parameters

- **sql** (*str or list*) – the sql statement to be executed (str) or a list of sql statements to execute
- **parameters** (*mapping or iterable*) – The parameters to render the SQL query with.

get_pandas_df(*sql*, *parameters=None*)
Executes the sql and returns a pandas dataframe

Parameters

- **sql** (*str or list*) – the sql statement to be executed (str) or a list of sql statements to execute
- **parameters** (*mapping or iterable*) – The parameters to render the SQL query with.

get_records(*sql*, *parameters=None*)
Executes the sql and returns a set of records.

Parameters

- **sql** (*str or list*) – the sql statement to be executed (str) or a list of sql statements to execute
- **parameters** (*mapping or iterable*) – The parameters to render the SQL query with.

insert_rows(*table*, *rows*, *target_fields=None*, *commit_every=1000*, *replace=False*)
A generic way to insert a set of tuples into a table, a new transaction is created every commit_every rows

Parameters

- **table** (*str*) – Name of the target table
- **rows** (*iterable of tuples*) – The rows to insert into the table
- **target_fields** (*iterable of strings*) – The names of the columns to fill in the table
- **commit_every** (*int*) – The maximum number of rows to insert in one transaction. Set to 0 to insert all rows in one transaction.
- **replace** (*bool*) – Whether to replace instead of insert

run(*sql*, *autocommit=False*, *parameters=None*)
Runs a command or a list of commands. Pass a list of sql statements to the sql parameter to get them to execute sequentially

Parameters

- **sql** (*str or list*) – the sql statement to be executed (str) or a list of sql statements to execute
- **autocommit** (*bool*) – What to set the connection's autocommit setting to before executing the query.

- **parameters** (*mapping or iterable*) – The parameters to render the SQL query with.

set_autocommit(*conn*, *autocommit*)
Sets the autocommit flag on the connection

class airflow.hooks.docker_hook.**DockerHook**(*docker_conn_id='docker_default'*, *base_url=None*, *version=None*, *tls=None*)
Bases: `airflow.hooks.base_hook.BaseHook`, `airflow.utils.log.logging_mixin.LoggingMixin`

Interact with a private Docker registry.

Parameters **docker_conn_id** (*str*) – ID of the Airflow connection where credentials and extra configuration are stored

class airflow.hooks.hive_hooks.**HiveCliHook**(*hive_cli_conn_id=u'hive_cli_default'*, *run_as=None*, *mapred_queue=None*, *mapred_queue_priority=None*, *mapred_job_name=None*)
Bases: `airflow.hooks.base_hook.BaseHook`

Simple wrapper around the hive CLI.

It also supports the `beeline` a lighter CLI that runs JDBC and is replacing the heavier traditional CLI. To enable `beeline`, set the use_beeline param in the extra field of your connection as in `{ "use_beeline": true }`

Note that you can also set default hive CLI parameters using the `hive_cli_params` to be used in your connection as in `{"hive_cli_params": "-hiveconf mapred.job.tracker=some.jobtracker:444"}` Parameters passed here can be overridden by run_cli's hive_conf param

The extra connection parameter `auth` gets passed as in the `jdbc` connection string as is.

Parameters

- **mapred_queue** (*string*) – queue used by the Hadoop Scheduler (Capacity or Fair)
- **mapred_queue_priority** (*string*) – priority within the job queue. Possible settings include: VERY_HIGH, HIGH, NORMAL, LOW, VERY_LOW
- **mapred_job_name** (*string*) – This name will appear in the jobtracker. This can make monitoring easier.

load_df(*df*, *table*, *field_dict=None*, *delimiter=u'*, *'*, *encoding=u'utf8'*, *pandas_kwargs=None*, ***kwargs*)
Loads a pandas DataFrame into hive.

Hive data types will be inferred if not passed but column names will not be sanitized.

Parameters

- **df** (*DataFrame*) – DataFrame to load into a Hive table
- **table** (*str*) – target Hive table, use dot notation to target a specific database
- **field_dict** (*OrderedDict*) – mapping from column name to hive data type. Note that it must be OrderedDict so as to keep columns' order.
- **delimiter** (*str*) – field delimiter in the file
- **encoding** (*str*) – string encoding to use when writing DataFrame to file
- **pandas_kwargs** (*dict*) – passed to DataFrame.to_csv
- **kwargs** – passed to self.load_file

load_file(*filepath*, *table*, *delimiter=u', '*, *field_dict=None*, *create=True*, *overwrite=True*, *partition=None*, *recreate=False*, *tblproperties=None*)

Loads a local file into Hive

Note that the table generated in Hive uses `STORED AS textfile` which isn't the most efficient serialization format. If a large amount of data is loaded and/or if the tables gets queried considerably, you may want to use this operator only to stage the data into a temporary table before loading it into its final destination using a `HiveOperator`.

Parameters

- **filepath** (*str*) – local filepath of the file to load
- **table** (*str*) – target Hive table, use dot notation to target a specific database
- **delimiter** (*str*) – field delimiter in the file
- **field_dict** (*OrderedDict*) – A dictionary of the fields name in the file as keys and their Hive types as values. Note that it must be OrderedDict so as to keep columns' order.
- **create** (*bool*) – whether to create the table if it doesn't exist
- **overwrite** (*bool*) – whether to overwrite the data in table or partition
- **partition** (*dict*) – target partition as a dict of partition columns and values
- **recreate** (*bool*) – whether to drop and recreate the table at every execution
- **tblproperties** (*dict*) – TBLPROPERTIES of the hive table being created

run_cli(*hql*, *schema=None*, *verbose=True*, *hive_conf=None*)

Run an hql statement using the hive cli. If hive_conf is specified it should be a dict and the entries will be set as key/value pairs in HiveConf

Parameters **hive_conf** (*dict*) – if specified these key value pairs will be passed to hive as `-hiveconf "key"="value"`. Note that they will be passed after the `hive_cli_params` and thus will override whatever values are specified in the database.

```
>>> hh = HiveCliHook()
>>> result = hh.run_cli("USE airflow;")
>>> ("OK" in result)
True
```

test_hql(*hql*)

Test an hql statement using the hive cli and EXPLAIN

class airflow.hooks.hive_hooks.**HiveMetastoreHook**(*metastore_conn_id=u'metastore_default'*)

Bases: `airflow.hooks.base_hook.BaseHook`

Wrapper to interact with the Hive Metastore

check_for_named_partition(*schema*, *table*, *partition_name*)

Checks whether a partition with a given name exists

Parameters

- **schema** (*string*) – Name of hive schema (database) @table belongs to
- **table** – Name of hive table @partition belongs to

Partition Name of the partitions to check for (eg *a=b/c=d*)

Return type boolean

```
>>> hh = HiveMetastoreHook()
>>> t = 'static_babynames_partitioned'
>>> hh.check_for_named_partition('airflow', t, "ds=2015-01-01")
True
>>> hh.check_for_named_partition('airflow', t, "ds=xxx")
False
```

check_for_partition (*schema*, *table*, *partition*)
Checks whether a partition exists

Parameters

- **schema** (*string*) – Name of hive schema (database) @table belongs to
- **table** – Name of hive table @partition belongs to

Partition Expression that matches the partitions to check for (eg *a = 'b' AND c = 'd'*)

Return type boolean

```
>>> hh = HiveMetastoreHook()
>>> t = 'static_babynames_partitioned'
>>> hh.check_for_partition('airflow', t, "ds='2015-01-01'")
True
```

get_databases (*pattern=u'*'*)
Get a metastore table object

get_metastore_client ()
Returns a Hive thrift client.

get_partitions (*schema*, *table_name*, *filter=None*)
Returns a list of all partitions in a table. Works only for tables with less than 32767 (java short max val). For subpartitioned table, the number might easily exceed this.

```
>>> hh = HiveMetastoreHook()
>>> t = 'static_babynames_partitioned'
>>> parts = hh.get_partitions(schema='airflow', table_name=t)
>>> len(parts)
1
>>> parts
[{'ds': '2015-01-01'}]
```

get_table (*table_name*, *db=u'default'*)
Get a metastore table object

```
>>> hh = HiveMetastoreHook()
>>> t = hh.get_table(db='airflow', table_name='static_babynames')
>>> t.tableName
'static_babynames'
>>> [col.name for col in t.sd.cols]
['state', 'year', 'name', 'gender', 'num']
```

get_tables (*db*, *pattern=u'*'*)
Get a metastore table object

max_partition (*schema*, *table_name*, *field=None*, *filter_map=None*)
Returns the maximum value for all partitions with given field in a table. If only one partition key exist in the table, the key will be used as field. filter_map should be a partition_key:partition_value map and will be used to filter out partitions.

Parameters

- **schema** (*string*) – schema name.
- **table_name** (*string*) – table name.
- **field** (*string*) – partition key to get max partition from.
- **filter_map** (*map*) – partition_key:partition_value map used for partition filtering.

```
>>> hh = HiveMetastoreHook()
>>> filter_map = {'ds': '2015-01-01', 'ds': '2014-01-01'}
>>> t = 'static_babynames_partitioned'
>>> hh.max_partition(schema='airflow',        ... table_name=t, field='ds',␣
↪filter_map=filter_map)
'2015-01-01'
```

table_exists (*table_name*, *db=u'default'*)
Check if table exists

```
>>> hh = HiveMetastoreHook()
>>> hh.table_exists(db='airflow', table_name='static_babynames')
True
>>> hh.table_exists(db='airflow', table_name='does_not_exist')
False
```

class airflow.hooks.hive_hooks.**HiveServer2Hook** (*hiveserver2_conn_id=u'hiveserver2_default'*)
Bases: `airflow.hooks.base_hook.BaseHook`

Wrapper around the pyhive library

Note that the default authMechanism is PLAIN, to override it you can specify it in the `extra` of your connection in the UI as in

get_pandas_df (*hql*, *schema=u'default'*)
Get a pandas dataframe from a Hive query

```
>>> hh = HiveServer2Hook()
>>> sql = "SELECT * FROM airflow.static_babynames LIMIT 100"
>>> df = hh.get_pandas_df(sql)
>>> len(df.index)
100
```

get_records (*hql*, *schema=u'default'*)
Get a set of records from a Hive query.

```
>>> hh = HiveServer2Hook()
>>> sql = "SELECT * FROM airflow.static_babynames LIMIT 100"
>>> len(hh.get_records(sql))
100
```

get_results (*hql*, *schema=u'default'*, *fetch_size=None*, *hive_conf=None*)
Get results of the provided hql in target schema. :param hql: hql to be executed. :param schema: target schema, default to 'default'. :param fetch_size max size of result to fetch. :param hive_conf: hive_conf to execute alone with the hql. :return: results of hql execution.

to_csv (*hql*, *csv_filepath*, *schema=u'default'*, *delimiter=u'*, *'*, *lineterminator=u'\r\n'*, *output_header=True*, *fetch_size=1000*, *hive_conf=None*)
Execute hql in target schema and write results to a csv file. :param hql: hql to be executed. :param csv_filepath: filepath of csv to write results into. :param schema: target schema, , default to 'default'. :param delimiter: delimiter of the csv file. :param lineterminator: lineterminator of the csv file. :param

output_header: header of the csv file. :param fetch_size: number of result rows to write into the csv file. :param hive_conf: hive_conf to execute alone with the hql. :return:

`airflow.hooks.hive_hooks.`**`get_context_from_env_var`**`()`

Extract context from env variable, e.g. dag_id, task_id and execution_date, so that they can be used inside BashOperator and PythonOperator. :return: The context of interest.

`class` `airflow.hooks.http_hook.`**`HttpHook`**`(`*method='POST'*, *http_conn_id='http_default'*`)`

Bases: `airflow.hooks.base_hook.BaseHook`

Interact with HTTP servers. :param http_conn_id: connection that has the base API url i.e https://www.google.com/

and optional authentication credentials. Default headers can also be specified in the Extra field in json format.

Parameters **`method`** (*`str`*) – the API method to be called

`check_response``(`*response*`)`

Checks the status code and raise an AirflowException exception on non 2XX or 3XX status codes :param response: A requests response object :type response: requests.response

`get_conn``(`*headers=None*`)`

Returns http session for use with requests :param headers: additional headers to be passed through as a dictionary :type headers: dict

`run``(`*endpoint*, *data=None*, *headers=None*, *extra_options=None*`)`

Performs the request :param endpoint: the endpoint to be called i.e. resource/v1/query? :type endpoint: str :param data: payload to be uploaded or request parameters :type data: dict :param headers: additional headers to be passed through as a dictionary :type headers: dict :param extra_options: additional options to be used when executing the request

i.e. {'check_response': False} to avoid checking raising exceptions on non 2XX or 3XX status codes

`run_and_check``(`*session*, *prepped_request*, *extra_options*`)`

Grabs extra options like timeout and actually runs the request, checking for the result :param session: the session to be used to execute the request :type session: requests.Session :param prepped_request: the prepared request generated in run() :type prepped_request: session.prepare_request :param extra_options: additional options to be used when executing the request

i.e. {'check_response': False} to avoid checking raising exceptions on non 2XX or 3XX status codes

`run_with_advanced_retry``(`*_retry_args*, **args*, ***kwargs*`)`

Runs Hook.run() with a Tenacity decorator attached to it. This is useful for connectors which might be disturbed by intermittent issues and should not instantly fail. :param _retry_args: Arguments which define the retry behaviour.

See Tenacity documentation at https://github.com/jd/tenacity

Example: :: hook = HttpHook(http_conn_id='my_conn',method='GET') retry_args = dict(

wait=tenacity.wait_exponential(), stop=tenacity.stop_after_attempt(10), retry=requests.exceptions.ConnectionError

) hook.run_with_advanced_retry(

endpoint='v1/test', _retry_args=retry_args

)

class airflow.hooks.mssql_hook.**MsSqlHook**(**args*, ***kwargs*)
Bases: *airflow.hooks.dbapi_hook.DbApiHook*

Interact with Microsoft SQL Server.

get_conn()
Returns a mssql connection object

set_autocommit(*conn*, *autocommit*)
Sets the autocommit flag on the connection

class airflow.hooks.pig_hook.**PigCliHook**(*pig_cli_conn_id='pig_cli_default'*)
Bases: airflow.hooks.base_hook.BaseHook

Simple wrapper around the pig CLI.

Note that you can also set default pig CLI properties using the `pig_properties` to be used in your connection as in `{"pig_properties": "-Dpig.tmpfilecompression=true"}`

run_cli(*pig*, *verbose=True*)
Run an pig script using the pig cli

```
>>> ph = PigCliHook()
>>> result = ph.run_cli("ls /;")
>>> ("hdfs://" in result)
True
```

class airflow.hooks.S3_hook.**S3Hook**(*aws_conn_id='aws_default'*, *verify=None*)
Bases: *airflow.contrib.hooks.aws_hook.AwsHook*

Interact with AWS S3, using the boto3 library.

check_for_bucket(*bucket_name*)
Check if bucket_name exists.

Parameters **bucket_name** (*str*) – the name of the bucket

check_for_key(*key*, *bucket_name=None*)
Checks if a key exists in a bucket

Parameters

- **key** (*str*) – S3 key that will point to the file
- **bucket_name** (*str*) – Name of the bucket in which the file is stored

check_for_prefix(*bucket_name*, *prefix*, *delimiter*)
Checks that a prefix exists in a bucket

Parameters

- **bucket_name** (*str*) – the name of the bucket
- **prefix** (*str*) – a key prefix
- **delimiter** (*str*) – the delimiter marks key hierarchy.

check_for_wildcard_key (*wildcard_key*, *bucket_name=None*, *delimiter=''*)
Checks that a key matching a wildcard expression exists in a bucket

Parameters

- **wildcard_key** (*str*) – the path to the key
- **bucket_name** (*str*) – the name of the bucket
- **delimiter** (*str*) – the delimiter marks key hierarchy

copy_object (*source_bucket_key*, *dest_bucket_key*, *source_bucket_name=None*, *dest_bucket_name=None*, *source_version_id=None*)
Creates a copy of an object that is already stored in S3.

Note: the S3 connection used here needs to have access to both source and destination bucket/key.

Parameters

- **source_bucket_key** (*str*) – The key of the source object.

  It can be either full s3:// style url or relative path from root level.

  When it's specified as a full s3:// url, please omit source_bucket_name.
- **dest_bucket_key** (*str*) – The key of the object to copy to.

  The convention to specify *dest_bucket_key* is the same as *source_bucket_key*.
- **source_bucket_name** (*str*) – Name of the S3 bucket where the source object is in.

  It should be omitted when *source_bucket_key* is provided as a full s3:// url.
- **dest_bucket_name** (*str*) – Name of the S3 bucket to where the object is copied.

  It should be omitted when *dest_bucket_key* is provided as a full s3:// url.
- **source_version_id** (*str*) – Version ID of the source object (OPTIONAL)

create_bucket (*bucket_name*, *region_name=None*)
Creates an Amazon S3 bucket.

Parameters

- **bucket_name** (*str*) – The name of the bucket
- **region_name** (*str*) – The name of the aws region in which to create the bucket.

delete_objects (*bucket*, *keys*)

Parameters

- **bucket** (*str*) – Name of the bucket in which you are going to delete object(s)
- **keys** (*str or list*) – The key(s) to delete from S3 bucket.

  When `keys` is a string, it's supposed to be the key name of the single object to delete.

  When `keys` is a list, it's supposed to be the list of the keys to delete.

get_bucket (*bucket_name*)
Returns a boto3.S3.Bucket object

Parameters **bucket_name** (*str*) – the name of the bucket

get_key (*key*, *bucket_name=None*)
Returns a boto3.s3.Object

Parameters

- **key** (*str*) – the path to the key
- **bucket_name** (*str*) – the name of the bucket

get_wildcard_key (*wildcard_key*, *bucket_name=None*, *delimiter="*)
Returns a boto3.s3.Object object matching the wildcard expression

Parameters

- **wildcard_key** (*str*) – the path to the key
- **bucket_name** (*str*) – the name of the bucket
- **delimiter** (*str*) – the delimiter marks key hierarchy

list_keys (*bucket_name*, *prefix="*, *delimiter="*, *page_size=None*, *max_items=None*)
Lists keys in a bucket under prefix and not containing delimiter

Parameters

- **bucket_name** (*str*) – the name of the bucket
- **prefix** (*str*) – a key prefix
- **delimiter** (*str*) – the delimiter marks key hierarchy.
- **page_size** (*int*) – pagination size
- **max_items** (*int*) – maximum items to return

list_prefixes (*bucket_name*, *prefix="*, *delimiter="*, *page_size=None*, *max_items=None*)
Lists prefixes in a bucket under prefix

Parameters

- **bucket_name** (*str*) – the name of the bucket
- **prefix** (*str*) – a key prefix
- **delimiter** (*str*) – the delimiter marks key hierarchy.
- **page_size** (*int*) – pagination size
- **max_items** (*int*) – maximum items to return

load_bytes (*bytes_data*, *key*, *bucket_name=None*, *replace=False*, *encrypt=False*)
Loads bytes to S3

This is provided as a convenience to drop a string in S3. It uses the boto infrastructure to ship a file to s3.

Parameters

- **bytes_data** (*bytes*) – bytes to set as content for the key.
- **key** (*str*) – S3 key that will point to the file
- **bucket_name** (*str*) – Name of the bucket in which to store the file
- **replace** (*bool*) – A flag to decide whether or not to overwrite the key if it already exists
- **encrypt** (*bool*) – If True, the file will be encrypted on the server-side by S3 and will be stored in an encrypted form while at rest in S3.

load_file (*filename*, *key*, *bucket_name=None*, *replace=False*, *encrypt=False*)
Loads a local file to S3

Parameters

- **filename** (*str*) – name of the file to load.

- **key** (*str*) – S3 key that will point to the file
- **bucket_name** (*str*) – Name of the bucket in which to store the file
- **replace** (*bool*) – A flag to decide whether or not to overwrite the key if it already exists. If replace is False and the key exists, an error will be raised.
- **encrypt** (*bool*) – If True, the file will be encrypted on the server-side by S3 and will be stored in an encrypted form while at rest in S3.

load_file_obj (*file_obj*, *key*, *bucket_name=None*, *replace=False*, *encrypt=False*)
Loads a file object to S3

Parameters

- **file_obj** (*file-like object*) – The file-like object to set as the content for the S3 key.
- **key** (*str*) – S3 key that will point to the file
- **bucket_name** (*str*) – Name of the bucket in which to store the file
- **replace** (*bool*) – A flag that indicates whether to overwrite the key if it already exists.
- **encrypt** (*bool*) – If True, S3 encrypts the file on the server, and the file is stored in encrypted form at rest in S3.

load_string (*string_data*, *key*, *bucket_name=None*, *replace=False*, *encrypt=False*, *encoding='utf-8'*)
Loads a string to S3

This is provided as a convenience to drop a string in S3. It uses the boto infrastructure to ship a file to s3.

Parameters

- **string_data** (*str*) – string to set as content for the key.
- **key** (*str*) – S3 key that will point to the file
- **bucket_name** (*str*) – Name of the bucket in which to store the file
- **replace** (*bool*) – A flag to decide whether or not to overwrite the key if it already exists
- **encrypt** (*bool*) – If True, the file will be encrypted on the server-side by S3 and will be stored in an encrypted form while at rest in S3.

read_key (*key*, *bucket_name=None*)
Reads a key from S3

Parameters

- **key** (*str*) – S3 key that will point to the file
- **bucket_name** (*str*) – Name of the bucket in which the file is stored

select_key (*key*, *bucket_name=None*, *expression='SELECT * FROM S3Object'*, *expression_type='SQL'*, *input_serialization=None*, *output_serialization=None*)
Reads a key with S3 Select.

Parameters

- **key** (*str*) – S3 key that will point to the file
- **bucket_name** (*str*) – Name of the bucket in which the file is stored
- **expression** (*str*) – S3 Select expression
- **expression_type** (*str*) – S3 Select expression type

- **input_serialization** (*dict*) – S3 Select input data serialization format
- **output_serialization** (*dict*) – S3 Select output data serialization format

Returns retrieved subset of original data by S3 Select

Return type str

See also:

For more details about S3 Select parameters: http://boto3.readthedocs.io/en/latest/reference/services/s3.html#S3.Client.select_object_content

class airflow.hooks.sqlite_hook.**SqliteHook**(**args*, ***kwargs*)
Bases: *airflow.hooks.dbapi_hook.DbApiHook*

Interact with SQLite.

get_conn()
Returns a sqlite connection object

3.22.4.1 Community contributed hooks

class airflow.contrib.hooks.aws_athena_hook.**AWSAthenaHook**(*aws_conn_id='aws_default'*, *sleep_time=30*, **args*, ***kwargs*)
Bases: *airflow.contrib.hooks.aws_hook.AwsHook*

Interact with AWS Athena to run, poll queries and return query results

Parameters

- **aws_conn_id** (*str*) – aws connection to use.
- **sleep_time** (*int*) – Time to wait between two consecutive call to check query status on athena

check_query_status(*query_execution_id*)
Fetch the status of submitted athena query. Returns None or one of valid query states.

Parameters **query_execution_id** (*str*) – Id of submitted athena query

Returns str

get_conn()
check if aws conn exists already or create one and return it

Returns boto3 session

get_query_results(*query_execution_id*)
Fetch submitted athena query results. returns none if query is in intermediate state or failed/cancelled state else dict of query output

Parameters **query_execution_id** (*str*) – Id of submitted athena query

Returns dict

poll_query_status(*query_execution_id*, *max_tries=None*)
Poll the status of submitted athena query until query state reaches final state. Returns one of the final states

Parameters

- **query_execution_id** (*str*) – Id of submitted athena query
- **max_tries** (*int*) – Number of times to poll for query state before function exits

Returns str

run_query (*query*, *query_context*, *result_configuration*, *client_request_token=None*)
Run Presto query on athena with provided config and return submitted query_execution_id

Parameters

- **query** (*str*) – Presto query to run
- **query_context** (*dict*) – Context in which query need to be run
- **result_configuration** (*dict*) – Dict with path to store results in and config related to encryption
- **client_request_token** (*str*) – Unique token created by user to avoid multiple executions of same query

Returns str

stop_query (*query_execution_id*)
Cancel the submitted athena query

Parameters **query_execution_id** (*str*) – Id of submitted athena query

Returns dict

class airflow.contrib.hooks.aws_dynamodb_hook.**AwsDynamoDBHook** (*table_keys=None*, *table_name=None*, *region_name=None*, **args*, ***kwargs*)

Bases: *airflow.contrib.hooks.aws_hook.AwsHook*

Interact with AWS DynamoDB.

Parameters

- **table_keys** (*list*) – partition key and sort key
- **table_name** (*str*) – target DynamoDB table
- **region_name** (*str*) – aws region name (example: us-east-1)

write_batch_data (*items*)
Write batch items to dynamodb table with provisioned throughout capacity.

class airflow.contrib.hooks.aws_firehose_hook.**AwsFirehoseHook** (*delivery_stream*, *region_name=None*, **args*, ***kwargs*)

Bases: *airflow.contrib.hooks.aws_hook.AwsHook*

Interact with AWS Kinesis Firehose. :param delivery_stream: Name of the delivery stream :type delivery_stream: str :param region_name: AWS region name (example: us-east-1) :type region_name: str

get_conn ()
Returns AwsHook connection object.

put_records (*records*)
Write batch records to Kinesis Firehose

class airflow.contrib.hooks.aws_glue_catalog_hook.**AwsGlueCatalogHook**(*aws_conn_id='aws_default'*, *region_name=None*, **args*, ***kwargs*)

Bases: *airflow.contrib.hooks.aws_hook.AwsHook*

Interact with AWS Glue Catalog

Parameters

- **aws_conn_id** (*str*) – ID of the Airflow connection where credentials and extra configuration are stored
- **region_name** (*str*) – aws region name (example: us-east-1)

check_for_partition(*database_name*, *table_name*, *expression*)

Checks whether a partition exists

Parameters

- **database_name** (*str*) – Name of hive database (schema) @table belongs to
- **table_name** (*str*) – Name of hive table @partition belongs to

Expression Expression that matches the partitions to check for (eg *a = 'b' AND c = 'd'*)

Return type bool

```
>>> hook = AwsGlueCatalogHook()
>>> t = 'static_babynames_partitioned'
>>> hook.check_for_partition('airflow', t, "ds='2015-01-01'")
True
```

get_conn()

Returns glue connection object.

get_partitions(*database_name*, *table_name*, *expression=''*, *page_size=None*, *max_items=None*)

Retrieves the partition values for a table.

Parameters

- **database_name** (*str*) – The name of the catalog database where the partitions reside.
- **table_name** (*str*) – The name of the partitions' table.
- **expression** (*str*) – An expression filtering the partitions to be returned. Please see official AWS documentation for further information. https://docs.aws.amazon.com/glue/latest/dg/aws-glue-api-catalog-partitions.html#aws-glue-api-catalog-partitions-GetPartitions
- **page_size** (*int*) – pagination size
- **max_items** (*int*) – maximum items to return

Returns set of partition values where each value is a tuple since a partition may be composed of multiple columns. For example:

{('2018-01-01','1'), ('2018-01-01','2')}

class airflow.contrib.hooks.aws_hook.**AwsHook**(*aws_conn_id='aws_default'*, *verify=None*)

Bases: airflow.hooks.base_hook.BaseHook

Interact with AWS. This class is a thin wrapper around the boto3 python library.

expand_role(*role*)
If the IAM role is a role name, get the Amazon Resource Name (ARN) for the role. If IAM role is already an IAM role ARN, no change is made.

Parameters **role** – IAM role name or ARN

Returns IAM role ARN

get_credentials(*region_name=None*)
Get the underlying *botocore.Credentials* object.

This contains the following authentication attributes: access_key, secret_key and token.

get_session(*region_name=None*)
Get the underlying boto3.session.

class airflow.contrib.hooks.aws_lambda_hook.**AwsLambdaHook**(*function_name*, *region_name=None*, *log_type='None'*, *qualifier='$LATEST'*, *invocation_type='RequestResponse'*, **args*, ***kwargs*)

Bases: *airflow.contrib.hooks.aws_hook.AwsHook*

Interact with AWS Lambda

Parameters

- **function_name** (*str*) – AWS Lambda Function Name
- **region_name** (*str*) – AWS Region Name (example: us-west-2)
- **log_type** (*str*) – Tail Invocation Request
- **qualifier** (*str*) – AWS Lambda Function Version or Alias Name
- **invocation_type** (*str*) – AWS Lambda Invocation Type (RequestResponse, Event etc)

invoke_lambda(*payload*)
Invoke Lambda Function

class airflow.contrib.hooks.bigquery_hook.**BigQueryHook**(*bigquery_conn_id='bigquery_default'*, *delegate_to=None*, *use_legacy_sql=True*, *location=None*)

Bases: *airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook*, *airflow.hooks.dbapi_hook.DbApiHook*, airflow.utils.log.logging_mixin.LoggingMixin

Interact with BigQuery. This hook uses the Google Cloud Platform connection.

get_conn()
Returns a BigQuery PEP 249 connection object.

get_pandas_df(*sql*, *parameters=None*, *dialect=None*)
Returns a Pandas DataFrame for the results produced by a BigQuery query. The DbApiHook method must be overridden because Pandas doesn't support PEP 249 connections, except for SQLite. See:

https://github.com/pydata/pandas/blob/master/pandas/io/sql.py#L447 https://github.com/pydata/pandas/issues/6900

Parameters

- **sql** (*string*) – The BigQuery SQL to execute.

- **parameters** (*mapping or iterable*) – The parameters to render the SQL query with (not used, leave to override superclass method)
- **dialect** (*string in {'legacy', 'standard'}*) – Dialect of BigQuery SQL – legacy SQL or standard SQL defaults to use *self.use_legacy_sql* if not specified

get_service()
Returns a BigQuery service object.

insert_rows(*table*, *rows*, *target_fields=None*, *commit_every=1000*)
Insertion is currently unsupported. Theoretically, you could use BigQuery's streaming API to insert rows into a table, but this hasn't been implemented.

table_exists(*project_id*, *dataset_id*, *table_id*)
Checks for the existence of a table in Google BigQuery.

Parameters

- **project_id** (*string*) – The Google cloud project in which to look for the table. The connection supplied to the hook must provide access to the specified project.
- **dataset_id** (*string*) – The name of the dataset in which to look for the table.
- **table_id** (*string*) – The name of the table to check the existence of.

class airflow.contrib.hooks.databricks_hook.**DatabricksHook**(*databricks_conn_id='databricks_default'*, *time-out_seconds=180*, *retry_limit=3*, *retry_delay=1.0*)
Bases: `airflow.hooks.base_hook.BaseHook`, `airflow.utils.log.logging_mixin.LoggingMixin`

Interact with Databricks.

run_now(*json*)
Utility function to call the `api/2.0/jobs/run-now` endpoint.

Parameters **json** (*dict*) – The data used in the body of the request to the `run-now` endpoint.

Returns the run_id as a string

Return type string

submit_run(*json*)
Utility function to call the `api/2.0/jobs/runs/submit` endpoint.

Parameters **json** (*dict*) – The data used in the body of the request to the `submit` endpoint.

Returns the run_id as a string

Return type string

class airflow.contrib.hooks.datastore_hook.**DatastoreHook**(*datastore_conn_id='google_cloud_datastore_def*
delegate_to=None)
Bases: `airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook`

Interact with Google Cloud Datastore. This hook uses the Google Cloud Platform connection.

This object is not threads safe. If you want to make multiple requests simultaneously, you will need to create a hook per thread.

allocate_ids(*partialKeys*)
Allocate IDs for incomplete keys. see https://cloud.google.com/datastore/docs/reference/rest/v1/projects/allocateIds

Parameters **`partialKeys`** – a list of partial keys

Returns a list of full keys.

`begin_transaction`()
Get a new transaction handle

See also:

https://cloud.google.com/datastore/docs/reference/rest/v1/projects/beginTransaction

Returns a transaction handle

`commit`(*body*)
Commit a transaction, optionally creating, deleting or modifying some entities.

See also:

https://cloud.google.com/datastore/docs/reference/rest/v1/projects/commit

Parameters **`body`** – the body of the commit request

Returns the response body of the commit request

`delete_operation`(*name*)
Deletes the long-running operation

Parameters **`name`** – the name of the operation resource

`export_to_storage_bucket`(*bucket*, *namespace=None*, *entity_filter=None*, *labels=None*)
Export entities from Cloud Datastore to Cloud Storage for backup

`get_conn`(*version='v1'*)
Returns a Google Cloud Datastore service object.

`get_operation`(*name*)
Gets the latest state of a long-running operation

Parameters **`name`** – the name of the operation resource

`import_from_storage_bucket`(*bucket*, *file*, *namespace=None*, *entity_filter=None*, *labels=None*)
Import a backup from Cloud Storage to Cloud Datastore

`lookup`(*keys*, *read_consistency=None*, *transaction=None*)
Lookup some entities by key

See also:

https://cloud.google.com/datastore/docs/reference/rest/v1/projects/lookup

Parameters

- **`keys`** – the keys to lookup
- **`read_consistency`** – the read consistency to use. default, strong or eventual. Cannot be used with a transaction.
- **`transaction`** – the transaction to use, if any.

Returns the response body of the lookup request.

`poll_operation_until_done`(*name*, *polling_interval_in_seconds*)
Poll backup operation state until it's completed

rollback(*transaction*)

Roll back a transaction

See also:

https://cloud.google.com/datastore/docs/reference/rest/v1/projects/rollback

Parameters **transaction** – the transaction to roll back

run_query(*body*)

Run a query for entities.

See also:

https://cloud.google.com/datastore/docs/reference/rest/v1/projects/runQuery

Parameters **body** – the body of the query request

Returns the batch of query results.

class airflow.contrib.hooks.discord_webhook_hook.**DiscordWebhookHook**(*http_conn_id=None*, *webhook_endpoint=None*, *message=''*, *username=None*, *avatar_url=None*, *tts=False*, *proxy=None*, **args*, ***kwargs*)

Bases: *airflow.hooks.http_hook.HttpHook*

This hook allows you to post messages to Discord using incoming webhooks. Takes a Discord connection ID with a default relative webhook endpoint. The default endpoint can be overridden using the webhook_endpoint parameter (https://discordapp.com/developers/docs/resources/webhook).

Each Discord webhook can be pre-configured to use a specific username and avatar_url. You can override these defaults in this hook.

Parameters

- **http_conn_id** (*str*) – Http connection ID with host as "https://discord.com/api/" and default webhook endpoint in the extra field in the form of {"webhook_endpoint": "webhooks/{webhook.id}/{webhook.token}"}
- **webhook_endpoint** (*str*) – Discord webhook endpoint in the form of "webhooks/{webhook.id}/{webhook.token}"
- **message** (*str*) – The message you want to send to your Discord channel (max 2000 characters)
- **username** (*str*) – Override the default username of the webhook
- **avatar_url** (*str*) – Override the default avatar of the webhook
- **tts** (*bool*) – Is a text-to-speech message
- **proxy** (*str*) – Proxy to use to make the Discord webhook call

execute()
Execute the Discord webhook call

class airflow.contrib.hooks.emr_hook.**EmrHook**(*emr_conn_id=None*, *region_name=None*, **args*, ***kwargs*)
Bases: *airflow.contrib.hooks.aws_hook.AwsHook*

Interact with AWS EMR. emr_conn_id is only necessary for using the create_job_flow method.

create_job_flow(*job_flow_overrides*)
Creates a job flow using the config from the EMR connection. Keys of the json extra hash may have the arguments of the boto3 run_job_flow method. Overrides for this config may be passed as the job_flow_overrides.

class airflow.contrib.hooks.fs_hook.**FSHook**(*conn_id='fs_default'*)
Bases: airflow.hooks.base_hook.BaseHook

Allows for interaction with an file server.

Connection should have a name and a path specified under extra:

example: Conn Id: fs_test Conn Type: File (path) Host, Shchema, Login, Password, Port: empty Extra: {"path": "/tmp"}

class airflow.contrib.hooks.ftp_hook.**FTPHook**(*ftp_conn_id='ftp_default'*)
Bases: airflow.hooks.base_hook.BaseHook, airflow.utils.log.logging_mixin.LoggingMixin

Interact with FTP.

Errors that may occur throughout but should be handled downstream.

close_conn()
Closes the connection. An error will occur if the connection wasn't ever opened.

create_directory(*path*)
Creates a directory on the remote system.

Parameters path (*str*) – full path to the remote directory to create

delete_directory(*path*)
Deletes a directory on the remote system.

Parameters path (*str*) – full path to the remote directory to delete

delete_file(*path*)
Removes a file on the FTP Server.

Parameters path (*str*) – full path to the remote file

describe_directory(*path*)
Returns a dictionary of {filename: {attributes}} for all files on the remote system (where the MLSD command is supported).

Parameters path (*str*) – full path to the remote directory

get_conn()
Returns a FTP connection object

get_mod_time(*path*)
Returns a datetime object representing the last time the file was modified

Parameters path (*string*) – remote file path

get_size(*path*)
Returns the size of a file (in bytes)

Parameters **path** (*string*) – remote file path

list_directory (*path*, *nlst=False*)
Returns a list of files on the remote system.

Parameters **path** (*str*) – full path to the remote directory to list

rename (*from_name*, *to_name*)
Rename a file.

Parameters

- **from_name** – rename file from name
- **to_name** – rename file to name

retrieve_file (*remote_full_path*, *local_full_path_or_buffer*, *callback=None*)
Transfers the remote file to a local location.

If local_full_path_or_buffer is a string path, the file will be put at that location; if it is a file-like buffer, the file will be written to the buffer but not closed.

Parameters

- **remote_full_path** (*str*) – full path to the remote file
- **local_full_path_or_buffer** (*str or file-like buffer*) – full path to the local file or a file-like buffer
- **callback** (*callable*) – callback which is called each time a block of data is read. if you do not use a callback, these blocks will be written to the file or buffer passed in. if you do pass in a callback, note that writing to a file or buffer will need to be handled inside the callback. [default: output_handle.write()]

Example:: hook = FTPHook(ftp_conn_id='my_conn')

remote_path = '/path/to/remote/file' local_path = '/path/to/local/file'

# with a custom callback (in this case displaying progress on each read) def print_progress(percent_progress):

self.log.info('Percent Downloaded: %s%%' % percent_progress)

total_downloaded = 0 total_file_size = hook.get_size(remote_path) output_handle = open(local_path, 'wb') def write_to_file_with_progress(data):

total_downloaded += len(data) output_handle.write(data) percent_progress = (total_downloaded / total_file_size) * 100 print_progress(percent_progress)

hook.retrieve_file(remote_path, None, callback=write_to_file_with_progress)

# without a custom callback data is written to the local_path hook.retrieve_file(remote_path, local_path)

store_file (*remote_full_path*, *local_full_path_or_buffer*)
Transfers a local file to the remote location.

If local_full_path_or_buffer is a string path, the file will be read from that location; if it is a file-like buffer, the file will be read from the buffer but not closed.

Parameters

- **remote_full_path** (*str*) – full path to the remote file

- **local_full_path_or_buffer** (*str or file-like buffer*) – full path to the local file or a file-like buffer

class airflow.contrib.hooks.ftp_hook.**FTPSHook**(*ftp_conn_id='ftp_default'*)

Bases: *airflow.contrib.hooks.ftp_hook.FTPHook*

get_conn()

Returns a FTPS connection object.

class airflow.contrib.hooks.gcp_api_base_hook.**GoogleCloudBaseHook**(*gcp_conn_id='google_cloud_defaul dele-gate_to=None*)

Bases: airflow.hooks.base_hook.BaseHook, airflow.utils.log.logging_mixin.LoggingMixin

A base hook for Google cloud-related hooks. Google cloud has a shared REST API client that is built in the same way no matter which service you use. This class helps construct and authorize the credentials needed to then call googleapiclient.discovery.build() to actually discover and build a client for a Google cloud service.

The class also contains some miscellaneous helper functions.

All hook derived from this base hook use the 'Google Cloud Platform' connection type. Three ways of authentication are supported:

Default credentials: Only the 'Project Id' is required. You'll need to have set up default credentials, such as by the `GOOGLE_APPLICATION_DEFAULT` environment variable or from the metadata server on Google Compute Engine.

JSON key file: Specify 'Project Id', 'Keyfile Path' and 'Scope'.

Legacy P12 key files are not supported.

JSON data provided in the UI: Specify 'Keyfile JSON'.

static fallback_to_default_project_id(*func*)

Decorator that provides fallback for Google Cloud Platform project id. If the project is None it will be replaced with the project_id from the service account the Hook is authenticated with. Project id can be specified either via project_id kwarg or via first parameter in positional args.

Parameters **func** – function to wrap

Returns result of the function call

class airflow.contrib.hooks.gcp_dataflow_hook.**DataFlowHook**(*gcp_conn_id='google_cloud_default', delegate_to=None, poll_sleep=10*)

Bases: *airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook*

get_conn()

Returns a Google Cloud Dataflow service object.

class airflow.contrib.hooks.gcp_dataproc_hook.**DataProcHook**(*gcp_conn_id='google_cloud_default', delegate_to=None, api_version='v1beta2'*)

Bases: *airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook*

Hook for Google Cloud Dataproc APIs.

await(*operation*)

Awaits for Google Cloud Dataproc Operation to complete.

get_conn()

Returns a Google Cloud Dataproc service object.

wait (*operation*)
Awaits for Google Cloud Dataproc Operation to complete.

class airflow.contrib.hooks.gcp_mlengine_hook.**MLEngineHook** (*gcp_conn_id='google_cloud_default', delegate_to=None*)
Bases: *airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook*

create_job (*project_id, job, use_existing_job_fn=None*)
Launches a MLEngine job and wait for it to reach a terminal state.

Parameters

- **project_id** (*string*) – The Google Cloud project id within which MLEngine job will be launched.
- **job** (*dict*) – MLEngine Job object that should be provided to the MLEngine API, such as:

```
{
  'jobId': 'my_job_id',
  'trainingInput': {
    'scaleTier': 'STANDARD_1',
    ...
  }
}
```

- **use_existing_job_fn** (*function*) – In case that a MLEngine job with the same job_id already exist, this method (if provided) will decide whether we should use this existing job, continue waiting for it to finish and returning the job object. It should accepts a MLEngine job object, and returns a boolean value indicating whether it is OK to reuse the existing job. If 'use_existing_job_fn' is not provided, we by default reuse the existing MLEngine job.

Returns The MLEngine job object if the job successfully reach a terminal state (which might be FAILED or CANCELLED state).

Return type dict

create_model (*project_id, model*)
Create a Model. Blocks until finished.

create_version (*project_id, model_name, version_spec*)
Creates the Version on Google Cloud ML Engine.

Returns the operation if the version was created successfully and raises an error otherwise.

delete_version (*project_id, model_name, version_name*)
Deletes the given version of a model. Blocks until finished.

get_conn ()
Returns a Google MLEngine service object.

get_model (*project_id, model_name*)
Gets a Model. Blocks until finished.

list_versions (*project_id, model_name*)
Lists all available versions of a model. Blocks until finished.

set_default_version (*project_id, model_name, version_name*)
Sets a version to be the default. Blocks until finished.

class `airflow.contrib.hooks.gcp_pubsub_hook.`**`PubSubHook`**(*gcp_conn_id='google_cloud_default'*, *delegate_to=None*)

Bases: *`airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook`*

Hook for accessing Google Pub/Sub.

The GCP project against which actions are applied is determined by the project embedded in the Connection referenced by gcp_conn_id.

`acknowledge`(*project*, *subscription*, *ack_ids*)

Pulls up to `max_messages` messages from Pub/Sub subscription.

Parameters

- **`project`** (*`string`*) – the GCP project name or ID in which to create the topic
- **`subscription`** (*`string`*) – the Pub/Sub subscription name to delete; do not include the 'projects/{project}/topics/' prefix.
- **`ack_ids`** (*`list`*) – List of ReceivedMessage ackIds from a previous pull response

`create_subscription`(*topic_project*, *topic*, *subscription=None*, *subscription_project=None*, *ack_deadline_secs=10*, *fail_if_exists=False*)

Creates a Pub/Sub subscription, if it does not already exist.

Parameters

- **`topic_project`** (*`string`*) – the GCP project ID of the topic that the subscription will be bound to.
- **`topic`** (*`string`*) – the Pub/Sub topic name that the subscription will be bound to create; do not include the `projects/{project}/subscriptions/` prefix.
- **`subscription`** (*`string`*) – the Pub/Sub subscription name. If empty, a random name will be generated using the uuid module
- **`subscription_project`** (*`string`*) – the GCP project ID where the subscription will be created. If unspecified, `topic_project` will be used.
- **`ack_deadline_secs`** (*`int`*) – Number of seconds that a subscriber has to acknowledge each message pulled from the subscription
- **`fail_if_exists`** (*`bool`*) – if set, raise an exception if the topic already exists

Returns subscription name which will be the system-generated value if the `subscription` parameter is not supplied

Return type string

`create_topic`(*project*, *topic*, *fail_if_exists=False*)

Creates a Pub/Sub topic, if it does not already exist.

Parameters

- **`project`** (*`string`*) – the GCP project ID in which to create the topic
- **`topic`** (*`string`*) – the Pub/Sub topic name to create; do not include the `projects/{project}/topics/` prefix.
- **`fail_if_exists`** (*`bool`*) – if set, raise an exception if the topic already exists

`delete_subscription`(*project*, *subscription*, *fail_if_not_exists=False*)

Deletes a Pub/Sub subscription, if it exists.

Parameters

- **`project`** (*`string`*) – the GCP project ID where the subscription exists

- **subscription** (*string*) – the Pub/Sub subscription name to delete; do not include the `projects/{project}/subscriptions/` prefix.
- **fail_if_not_exists** (*bool*) – if set, raise an exception if the topic does not exist

delete_topic (*project*, *topic*, *fail_if_not_exists=False*)
Deletes a Pub/Sub topic if it exists.

Parameters

- **project** (*string*) – the GCP project ID in which to delete the topic
- **topic** (*string*) – the Pub/Sub topic name to delete; do not include the `projects/{project}/topics/` prefix.
- **fail_if_not_exists** (*bool*) – if set, raise an exception if the topic does not exist

get_conn()
Returns a Pub/Sub service object.

Return type googleapiclient.discovery.Resource

publish (*project*, *topic*, *messages*)
Publishes messages to a Pub/Sub topic.

Parameters

- **project** (*string*) – the GCP project ID in which to publish
- **topic** (*string*) – the Pub/Sub topic to which to publish; do not include the `projects/{project}/topics/` prefix.
- **messages** (list of PubSub messages; see http://cloud.google.com/pubsub/docs/reference/rest/v1/PubsubMessage) – messages to publish; if the data field in a message is set, it should already be base64 encoded.

pull (*project*, *subscription*, *max_messages*, *return_immediately=False*)
Pulls up to `max_messages` messages from Pub/Sub subscription.

Parameters

- **project** (*string*) – the GCP project ID where the subscription exists
- **subscription** (*string*) – the Pub/Sub subscription name to pull from; do not include the 'projects/{project}/topics/' prefix.
- **max_messages** (*int*) – The maximum number of messages to return from the Pub/Sub API.
- **return_immediately** (*bool*) – If set, the Pub/Sub API will immediately return if no messages are available. Otherwise, the request will block for an undisclosed, but bounded period of time

:return A list of Pub/Sub ReceivedMessage objects each containing an `ackId` property and a `message` property, which includes the base64-encoded message content. See https://cloud.google.com/pubsub/docs/reference/rest/v1/ projects.subscriptions/pull#ReceivedMessage

class airflow.contrib.hooks.gcs_hook.**GoogleCloudStorageHook** (*google_cloud_storage_conn_id='google_clo*
delegate_to=None)
Bases: *airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook*

Interact with Google Cloud Storage. This hook uses the Google Cloud Platform connection.

copy (*source_bucket*, *source_object*, *destination_bucket=None*, *destination_object=None*)
Copies an object from a bucket to another, with renaming if requested.

destination_bucket or destination_object can be omitted, in which case source bucket/object is used, but not both.

Parameters

- **source_bucket** (*string*) – The bucket of the object to copy from.
- **source_object** (*string*) – The object to copy.
- **destination_bucket** (*string*) – The destination of the object to copied to. Can be omitted; then the same bucket is used.
- **destination_object** (*string*) – The (renamed) path of the object if given. Can be omitted; then the same name is used.

create_bucket (*bucket_name*, *storage_class='MULTI_REGIONAL'*, *location='US'*, *project_id=None*, *labels=None*)
Creates a new bucket. Google Cloud Storage uses a flat namespace, so you can't create a bucket with a name that is already in use.

See also:

For more information, see Bucket Naming Guidelines: https://cloud.google.com/storage/docs/bucketnaming.html#requirements

Parameters

- **bucket_name** (*string*) – The name of the bucket.
- **storage_class** (*string*) – This defines how objects in the bucket are stored and determines the SLA and the cost of storage. Values include
  - `MULTI_REGIONAL`
  - `REGIONAL`
  - `STANDARD`
  - `NEARLINE`
  - `COLDLINE`.

  If this value is not specified when the bucket is created, it will default to STANDARD.
- **location** (*string*) – The location of the bucket. Object data for objects in the bucket resides in physical storage within this region. Defaults to US.

  See also:

  https://developers.google.com/storage/docs/bucket-locations
- **project_id** (*string*) – The ID of the GCP Project.
- **labels** (*dict*) – User-provided labels, in key/value pairs.

Returns If successful, it returns the `id` of the bucket.

delete (*bucket*, *object*, *generation=None*)
Delete an object if versioning is not enabled for the bucket, or if generation parameter is used.

Parameters

- **bucket** (*string*) – name of the bucket, where the object resides

- **object** (*string*) – name of the object to delete
- **generation** (*string*) – if present, permanently delete the object of this generation

Returns True if succeeded

download(*bucket*, *object*, *filename=None*)
Get a file from Google Cloud Storage.

Parameters

- **bucket** (*string*) – The bucket to fetch from.
- **object** (*string*) – The object to fetch.
- **filename** (*string*) – If set, a local file path where the file should be written to.

exists(*bucket*, *object*)
Checks for the existence of a file in Google Cloud Storage.

Parameters

- **bucket** (*string*) – The Google cloud storage bucket where the object is.
- **object** (*string*) – The name of the object to check in the Google cloud storage bucket.

get_conn()
Returns a Google Cloud Storage service object.

get_crc32c(*bucket*, *object*)
Gets the CRC32c checksum of an object in Google Cloud Storage.

Parameters

- **bucket** (*string*) – The Google cloud storage bucket where the object is.
- **object** (*string*) – The name of the object to check in the Google cloud storage bucket.

get_md5hash(*bucket*, *object*)
Gets the MD5 hash of an object in Google Cloud Storage.

Parameters

- **bucket** (*string*) – The Google cloud storage bucket where the object is.
- **object** (*string*) – The name of the object to check in the Google cloud storage bucket.

get_size(*bucket*, *object*)
Gets the size of a file in Google Cloud Storage.

Parameters

- **bucket** (*string*) – The Google cloud storage bucket where the object is.
- **object** (*string*) – The name of the object to check in the Google cloud storage bucket.

insert_bucket_acl(*bucket*, *entity*, *role*, *user_project*)
Creates a new ACL entry on the specified bucket. See: https://cloud.google.com/storage/docs/json_api/v1/bucketAccessControls/insert

Parameters

- **bucket** (*str*) – Name of a bucket.
- **entity** (*str*) – The entity holding the permission, in one of the following forms: user-userId, user-email, group-groupId, group-email, domain-domain, project-team-projectId, allUsers, allAuthenticatedUsers. See: https://cloud.google.com/storage/docs/access-control/lists#scopes

- **role** (*str*) – The access permission for the entity. Acceptable values are: "OWNER", "READER", "WRITER".
- **user_project** (*str*) – (Optional) The project to be billed for this request. Required for Requester Pays buckets.

insert_object_acl (*bucket, object_name, entity, role, generation, user_project*)

Creates a new ACL entry on the specified object. See: https://cloud.google.com/storage/docs/json_api/v1/objectAccessControls/insert

Parameters

- **bucket** (*str*) – Name of a bucket.
- **object_name** (*str*) – Name of the object. For information about how to URL encode object names to be path safe, see: https://cloud.google.com/storage/docs/json_api/#encoding
- **entity** (*str*) – The entity holding the permission, in one of the following forms: user-userId, user-email, group-groupId, group-email, domain-domain, project-team-projectId, allUsers, allAuthenticatedUsers See: https://cloud.google.com/storage/docs/access-control/lists#scopes
- **role** (*str*) – The access permission for the entity. Acceptable values are: "OWNER", "READER".
- **generation** (*str*) – (Optional) If present, selects a specific revision of this object (as opposed to the latest version, the default).
- **user_project** (*str*) – (Optional) The project to be billed for this request. Required for Requester Pays buckets.

is_updated_after (*bucket, object, ts*)

Checks if an object is updated in Google Cloud Storage.

Parameters

- **bucket** (*string*) – The Google cloud storage bucket where the object is.
- **object** (*string*) – The name of the object to check in the Google cloud storage bucket.
- **ts** (*datetime*) – The timestamp to check against.

list (*bucket, versions=None, maxResults=None, prefix=None, delimiter=None*)

List all objects from the bucket with the give string prefix in name

Parameters

- **bucket** (*string*) – bucket name
- **versions** (*boolean*) – if true, list all versions of the objects
- **maxResults** (*integer*) – max count of items to return in a single page of responses
- **prefix** (*string*) – prefix string which filters objects whose name begin with this prefix
- **delimiter** (*string*) – filters objects based on the delimiter (for e.g '.csv')

Returns a stream of object names matching the filtering criteria

rewrite (*source_bucket, source_object, destination_bucket, destination_object=None*)

Has the same functionality as copy, except that will work on files over 5 TB, as well as when copying between locations and/or storage classes.

destination_object can be omitted, in which case source_object is used.

Parameters

- **source_bucket** (*string*) – The bucket of the object to copy from.
- **source_object** (*string*) – The object to copy.
- **destination_bucket** (*string*) – The destination of the object to copied to.
- **destination_object** – The (renamed) path of the object if given. Can be omitted; then the same name is used.

upload(*bucket*, *object*, *filename*, *mime_type='application/octet-stream'*, *gzip=False*, *multipart=False*, *num_retries=0*)

Uploads a local file to Google Cloud Storage.

Parameters

- **bucket** (*string*) – The bucket to upload to.
- **object** (*string*) – The object name to set when uploading the local file.
- **filename** (*string*) – The local file path to the file to be uploaded.
- **mime_type** (*str*) – The MIME type to set when uploading the file.
- **gzip** (*bool*) – Option to compress file for upload
- **multipart** (*bool or int*) – If True, the upload will be split into multiple HTTP requests. The default size is 256MiB per request. Pass a number instead of True to specify the request size, which must be a multiple of 262144 (256KiB).
- **num_retries** (*int*) – The number of times to attempt to re-upload the file (or individual chunks, in the case of multipart uploads). Retries are attempted with exponential backoff.

class airflow.contrib.hooks.gcp_transfer_hook.**GCPTransferServiceHook**(*api_version='v1'*, *gcp_conn_id='google_cloud_de*
dele-
gate_to=None)

Bases: *airflow.contrib.hooks.gcp_api_base_hook.GoogleCloudBaseHook*

Hook for GCP Storage Transfer Service.

get_conn()

Retrieves connection to Google Storage Transfer service.

Returns Google Storage Transfer service object

Return type dict

class airflow.contrib.hooks.imap_hook.**ImapHook**(*imap_conn_id='imap_default'*)

Bases: airflow.hooks.base_hook.BaseHook

This hook connects to a mail server by using the imap protocol.

Parameters imap_conn_id (*str*) – The connection id that contains the information used to authenticate the client. The default value is 'imap_default'.

download_mail_attachments(*name*, *local_output_directory*, *mail_folder='INBOX'*, *check_regex=False*, *latest_only=False*)

Downloads mail's attachments in the mail folder by its name to the local directory.

Parameters

- **name** (*str*) – The name of the attachment that will be downloaded.

- **local_output_directory** (*str*) – The output directory on the local machine where the files will be downloaded to.
- **mail_folder** (*str*) – The mail folder where to look at. The default value is 'INBOX'.
- **check_regex** (*bool*) – Checks the name for a regular expression. The default value is False.
- **latest_only** (*bool*) – If set to True it will only download the first matched attachment. The default value is False.

has_mail_attachment (*name*, *mail_folder='INBOX'*, *check_regex=False*)
Checks the mail folder for mails containing attachments with the given name.

Parameters

- **name** (*str*) – The name of the attachment that will be searched for.
- **mail_folder** (*str*) – The mail folder where to look at. The default value is 'INBOX'.
- **check_regex** (*bool*) – Checks the name for a regular expression. The default value is False.

Returns True if there is an attachment with the given name and False if not.

Return type bool

retrieve_mail_attachments (*name*, *mail_folder='INBOX'*, *check_regex=False*, *latest_only=False*)
Retrieves mail's attachments in the mail folder by its name.

Parameters

- **name** (*str*) – The name of the attachment that will be downloaded.
- **mail_folder** (*str*) – The mail folder where to look at. The default value is 'INBOX'.
- **check_regex** (*bool*) – Checks the name for a regular expression. The default value is False.
- **latest_only** (*bool*) – If set to True it will only retrieve the first matched attachment. The default value is False.

Returns a list of tuple each containing the attachment filename and its payload.

Return type a list of tuple

class airflow.contrib.hooks.openfaas_hook.**OpenFaasHook** (*function_name=None*, *conn_id='open_faas_default'*, **args*, ***kwargs*)

Bases: airflow.hooks.base_hook.BaseHook

Interact with Openfaas to query, deploy, invoke and update function

Parameters

- **function_name** – Name of the function, Defaults to None
- **conn_id** (*str*) – openfass connection to use, Defaults to open_faas_default for example host : http://openfaas.faas.com, Conn Type : Http

class airflow.contrib.hooks.redshift_hook.**RedshiftHook** (*aws_conn_id='aws_default'*, *verify=None*)

Bases: *airflow.contrib.hooks.aws_hook.AwsHook*

Interact with AWS Redshift, using the boto3 library

cluster_status (*cluster_identifier*)
Return status of a cluster

Parameters **cluster_identifier** (*str*) – unique identifier of a cluster

create_cluster_snapshot (*snapshot_identifier*, *cluster_identifier*)
Creates a snapshot of a cluster

Parameters

- **snapshot_identifier** (*str*) – unique identifier for a snapshot of a cluster
- **cluster_identifier** (*str*) – unique identifier of a cluster

delete_cluster (*cluster_identifier*, *skip_final_cluster_snapshot=True*, *final_cluster_snapshot_identifier=''*)
Delete a cluster and optionally create a snapshot

Parameters

- **cluster_identifier** (*str*) – unique identifier of a cluster
- **skip_final_cluster_snapshot** (*bool*) – determines cluster snapshot creation
- **final_cluster_snapshot_identifier** (*str*) – name of final cluster snapshot

describe_cluster_snapshots (*cluster_identifier*)
Gets a list of snapshots for a cluster

Parameters **cluster_identifier** (*str*) – unique identifier of a cluster

restore_from_cluster_snapshot (*cluster_identifier*, *snapshot_identifier*)
Restores a cluster from its snapshot

Parameters

- **cluster_identifier** (*str*) – unique identifier of a cluster
- **snapshot_identifier** (*str*) – unique identifier for a snapshot of a cluster

class airflow.contrib.hooks.sagemaker_hook.**SageMakerHook** (**args*, ***kwargs*)
Bases: *airflow.contrib.hooks.aws_hook.AwsHook*

Interact with Amazon SageMaker.

check_s3_url (*s3url*)
Check if an S3 URL exists

Parameters **s3url** (*str*) – S3 url

Return type bool

check_status (*job_name*, *key*, *describe_function*, *check_interval*, *max_ingestion_time*, *non_terminal_states=None*)
Check status of a SageMaker job

Parameters

- **job_name** (*str*) – name of the job to check status
- **key** (*str*) – the key of the response dict that points to the state
- **describe_function** (*python callable*) – the function used to retrieve the status
- **args** – the arguments for the function
- **check_interval** (*int*) – the time interval in seconds which the operator will check the status of any SageMaker job

- **max_ingestion_time** (*int*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.
- **non_terminal_states** (*set*) – the set of nonterminal states

Returns response of describe call after job is done

check_training_config(*training_config*)
Check if a training configuration is valid

Parameters **training_config** (*dict*) – training_config

Returns None

check_training_status_with_log(*job_name*, *non_terminal_states*, *failed_states*, *wait_for_completion*, *check_interval*, *max_ingestion_time*)
Display the logs for a given training job, optionally tailing them until the job is complete.

Parameters

- **job_name** (*str*) – name of the training job to check status and display logs for
- **non_terminal_states** (*set*) – the set of non_terminal states
- **failed_states** (*set*) – the set of failed states
- **wait_for_completion** (*bool*) – Whether to keep looking for new log entries until the job completes
- **check_interval** (*int*) – The interval in seconds between polling for new log entries and job completion
- **max_ingestion_time** (*int*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns None

check_tuning_config(*tuning_config*)
Check if a tuning configuration is valid

Parameters **tuning_config** (*dict*) – tuning_config

Returns None

configure_s3_resources(*config*)
Extract the S3 operations from the configuration and execute them.

Parameters **config** (*dict*) – config of SageMaker operation

Return type dict

create_endpoint(*config*, *wait_for_completion=True*, *check_interval=30*, *max_ingestion_time=None*)
Create an endpoint

Parameters

- **config** (*dict*) – the config for endpoint
- **wait_for_completion** (*bool*) – if the program should keep running until job finishes
- **check_interval** (*int*) – the time interval in seconds which the operator will check the status of any SageMaker job

- **`max_ingestion_time`** (*`int`*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns A response to endpoint creation

`create_endpoint_config`(*config*)
Create an endpoint config

Parameters **`config`** (*`dict`*) – the config for endpoint-config

Returns A response to endpoint config creation

`create_model`(*config*)
Create a model job

Parameters **`config`** (*`dict`*) – the config for model

Returns A response to model creation

`create_training_job`(*config*, *wait_for_completion=True*, *print_log=True*, *check_interval=30*, *max_ingestion_time=None*)
Create a training job

Parameters

- **`config`** (*`dict`*) – the config for training
- **`wait_for_completion`** (*`bool`*) – if the program should keep running until job finishes
- **`check_interval`** (*`int`*) – the time interval in seconds which the operator will check the status of any SageMaker job
- **`max_ingestion_time`** (*`int`*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns A response to training job creation

`create_transform_job`(*config*, *wait_for_completion=True*, *check_interval=30*, *max_ingestion_time=None*)
Create a transform job

Parameters

- **`config`** (*`dict`*) – the config for transform job
- **`wait_for_completion`** (*`bool`*) – if the program should keep running until job finishes
- **`check_interval`** (*`int`*) – the time interval in seconds which the operator will check the status of any SageMaker job
- **`max_ingestion_time`** (*`int`*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns A response to transform job creation

`create_tuning_job`(*config*, *wait_for_completion=True*, *check_interval=30*, *max_ingestion_time=None*)
Create a tuning job

Parameters

- **config** (*dict*) – the config for tuning
- **wait_for_completion** – if the program should keep running until job finishes
- **wait_for_completion** – bool
- **check_interval** (*int*) – the time interval in seconds which the operator will check the status of any SageMaker job
- **max_ingestion_time** (*int*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns A response to tuning job creation

describe_endpoint(*name*)

Parameters **name** (*string*) – the name of the endpoint

Returns A dict contains all the endpoint info

describe_endpoint_config(*name*)
Return the endpoint config info associated with the name

Parameters **name** (*string*) – the name of the endpoint config

Returns A dict contains all the endpoint config info

describe_model(*name*)
Return the SageMaker model info associated with the name

Parameters **name** (*string*) – the name of the SageMaker model

Returns A dict contains all the model info

describe_training_job(*name*)
Return the training job info associated with the name

Parameters **name** (*str*) – the name of the training job

Returns A dict contains all the training job info

describe_training_job_with_log(*job_name*, *positions*, *stream_names*, *instance_count*, *state*, *last_description*, *last_describe_job_call*)
Return the training job info associated with job_name and print CloudWatch logs

describe_transform_job(*name*)
Return the transform job info associated with the name

Parameters **name** (*string*) – the name of the transform job

Returns A dict contains all the transform job info

describe_tuning_job(*name*)
Return the tuning job info associated with the name

Parameters **name** (*string*) – the name of the tuning job

Returns A dict contains all the tuning job info

get_conn()
Establish an AWS connection for SageMaker

Return type SageMaker.Client

get_log_conn()
Establish an AWS connection for retrieving logs during training

Return type `CloudWatchLog.Client`

`log_stream`(*log_group*, *stream_name*, *start_time=0*, *skip=0*)

A generator for log items in a single stream. This will yield all the items that are available at the current moment.

Parameters

- **`log_group`** (*`str`*) – The name of the log group.
- **`stream_name`** (*`str`*) – The name of the specific stream.
- **`start_time`** (*`int`*) – The time stamp value to start reading the logs from (default: 0).
- **`skip`** (*`int`*) – The number of log entries to skip at the start (default: 0). This is for when there are multiple entries at the same timestamp.

Return type dict

Returns

A CloudWatch log event with the following key-value pairs:
'timestamp' (int): The time in milliseconds of the event.
'message' (str): The log event data.
'ingestionTime' (int): The time in milliseconds the event was ingested.

`multi_stream_iter`(*log_group*, *streams*, *positions=None*)

Iterate over the available events coming from a set of log streams in a single log group interleaving the events from each stream so they're yielded in timestamp order.

Parameters

- **`log_group`** (*`str`*) – The name of the log group.
- **`streams`** (*`list`*) – A list of the log stream names. The position of the stream in this list is the stream number.
- **`positions`** (*`list`*) – A list of pairs of (timestamp, skip) which represents the last record read from each stream.

Returns A tuple of (stream number, cloudwatch log event).

`tar_and_s3_upload`(*path*, *key*, *bucket*)

Tar the local file or directory and upload to s3

Parameters

- **`path`** (*`str`*) – local file or directory
- **`key`** (*`str`*) – s3 key
- **`bucket`** (*`str`*) – s3 bucket

Returns None

`update_endpoint`(*config*, *wait_for_completion=True*, *check_interval=30*, *max_ingestion_time=None*)

Update an endpoint

Parameters

- **`config`** (*`dict`*) – the config for endpoint

- **wait_for_completion** (*bool*) – if the program should keep running until job finishes
- **check_interval** (*int*) – the time interval in seconds which the operator will check the status of any SageMaker job
- **max_ingestion_time** (*int*) – the maximum ingestion time in seconds. Any SageMaker jobs that run longer than this will fail. Setting this to None implies no timeout for any SageMaker job.

Returns A response to endpoint update

class airflow.contrib.hooks.slack_webhook_hook.**SlackWebhookHook**(*http_conn_id=None, webhook_token=None, message=", channel=None, username=None, icon_emoji=None, link_names=False, proxy=None, *args, **kwargs*)

Bases: *airflow.hooks.http_hook.HttpHook*

This hook allows you to post messages to Slack using incoming webhooks. Takes both Slack webhook token directly and connection that has Slack webhook token. If both supplied, Slack webhook token will be used.

Each Slack webhook token can be pre-configured to use a specific channel, username and icon. You can override these defaults in this hook.

Parameters

- **http_conn_id** (*str*) – connection that has Slack webhook token in the extra field
- **webhook_token** (*str*) – Slack webhook token
- **message** (*str*) – The message you want to send on Slack
- **channel** (*str*) – The channel the message should be posted to
- **username** (*str*) – The username to post to slack with
- **icon_emoji** (*str*) – The emoji to use as icon for the user posting to Slack
- **link_names** (*bool*) – Whether or not to find and link channel and usernames in your message
- **proxy** (*str*) – Proxy to use to make the Slack webhook call

execute()

Remote Popen (actually execute the slack webhook call)

Parameters

- **cmd** – command to remotely execute
- **kwargs** – extra arguments to Popen (see subprocess.Popen)

class airflow.contrib.hooks.spark_jdbc_hook.**SparkJDBCHook**(*spark_app_name='airflow-spark-jdbc'*, *spark_conn_id='spark-default'*, *spark_conf=None*, *spark_py_files=None*, *spark_files=None*, *spark_jars=None*, *num_executors=None*, *executor_cores=None*, *executor_memory=None*, *driver_memory=None*, *verbose=False*, *principal=None*, *keytab=None*, *cmd_type='spark_to_jdbc'*, *jdbc_table=None*, *jdbc_conn_id='jdbc-default'*, *jdbc_driver=None*, *metastore_table=None*, *jdbc_truncate=False*, *save_mode=None*, *save_format=None*, *batch_size=None*, *fetch_size=None*, *num_partitions=None*, *partition_column=None*, *lower_bound=None*, *upper_bound=None*, *create_table_column_types=None*, **args*, ***kwargs*)

Bases: `airflow.contrib.hooks.spark_submit_hook.SparkSubmitHook`

This hook extends the SparkSubmitHook specifically for performing data transfers to/from JDBC-based databases with Apache Spark.

Parameters

- **spark_app_name** (*str*) – Name of the job (default airflow-spark-jdbc)
- **spark_conn_id** (*str*) – Connection id as configured in Airflow administration
- **spark_conf** (*dict*) – Any additional Spark configuration properties
- **spark_py_files** (*str*) – Additional python files used (.zip, .egg, or .py)
- **spark_files** (*str*) – Additional files to upload to the container running the job
- **spark_jars** (*str*) – Additional jars to upload and add to the driver and executor classpath
- **num_executors** (*int*) – number of executor to run. This should be set so as to manage the number of connections made with the JDBC database
- **executor_cores** (*int*) – Number of cores per executor

- **executor_memory** (*str*) – Memory per executor (e.g. 1000M, 2G)
- **driver_memory** (*str*) – Memory allocated to the driver (e.g. 1000M, 2G)
- **verbose** (*bool*) – Whether to pass the verbose flag to spark-submit for debugging
- **keytab** (*str*) – Full path to the file that contains the keytab
- **principal** (*str*) – The name of the kerberos principal used for keytab
- **cmd_type** (*str*) – Which way the data should flow. 2 possible values: spark_to_jdbc: data written by spark from metastore to jdbc jdbc_to_spark: data written by spark from jdbc to metastore
- **jdbc_table** (*str*) – The name of the JDBC table
- **jdbc_conn_id** – Connection id used for connection to JDBC database
- **jdbc_driver** (*str*) – Name of the JDBC driver to use for the JDBC connection. This driver (usually a jar) should be passed in the 'jars' parameter
- **metastore_table** (*str*) – The name of the metastore table,
- **jdbc_truncate** (*bool*) – (spark_to_jdbc only) Whether or not Spark should truncate or drop and recreate the JDBC table. This only takes effect if 'save_mode' is set to Overwrite. Also, if the schema is different, Spark cannot truncate, and will drop and recreate
- **save_mode** (*str*) – The Spark save-mode to use (e.g. overwrite, append, etc.)
- **save_format** (*str*) – (jdbc_to_spark-only) The Spark save-format to use (e.g. parquet)
- **batch_size** (*int*) – (spark_to_jdbc only) The size of the batch to insert per round trip to the JDBC database. Defaults to 1000
- **fetch_size** (*int*) – (jdbc_to_spark only) The size of the batch to fetch per round trip from the JDBC database. Default depends on the JDBC driver
- **num_partitions** (*int*) – The maximum number of partitions that can be used by Spark simultaneously, both for spark_to_jdbc and jdbc_to_spark operations. This will also cap the number of JDBC connections that can be opened
- **partition_column** (*str*) – (jdbc_to_spark-only) A numeric column to be used to partition the metastore table by. If specified, you must also specify: num_partitions, lower_bound, upper_bound
- **lower_bound** (*int*) – (jdbc_to_spark-only) Lower bound of the range of the numeric partition column to fetch. If specified, you must also specify: num_partitions, partition_column, upper_bound
- **upper_bound** (*int*) – (jdbc_to_spark-only) Upper bound of the range of the numeric partition column to fetch. If specified, you must also specify: num_partitions, partition_column, lower_bound
- **create_table_column_types** – (spark_to_jdbc-only) The database column data types to use instead of the defaults, when creating the table. Data type information should be specified in the same format as CREATE TABLE columns syntax (e.g: "name CHAR(64), comments VARCHAR(1024)"). The specified types should be valid spark sql data types.

Type jdbc_conn_id: str

class `airflow.contrib.hooks.spark_sql_hook.`**`SparkSqlHook`**(*sql*, *conf=None*, *conn_id='spark_sql_default'*, *total_executor_cores=None*, *executor_cores=None*, *executor_memory=None*, *keytab=None*, *principal=None*, *master='yarn'*, *name='default-name'*, *num_executors=None*, *verbose=True*, *yarn_queue='default'*)

Bases: `airflow.hooks.base_hook.BaseHook`

This hook is a wrapper around the spark-sql binary. It requires that the "spark-sql" binary is in the PATH. :param sql: The SQL query to execute :type sql: str :param conf: arbitrary Spark configuration property :type conf: str (format: PROP=VALUE) :param conn_id: connection_id string :type conn_id: str :param total_executor_cores: (Standalone & Mesos only) Total cores for all executors

(Default: all the available cores on the worker)

Parameters

- **executor_cores** (*int*) – (Standalone & YARN only) Number of cores per executor (Default: 2)
- **executor_memory** (*str*) – Memory per executor (e.g. 1000M, 2G) (Default: 1G)
- **keytab** (*str*) – Full path to the file that contains the keytab
- **master** (*str*) – spark://host:port, mesos://host:port, yarn, or local
- **name** (*str*) – Name of the job.
- **num_executors** (*int*) – Number of executors to launch
- **verbose** (*bool*) – Whether to pass the verbose flag to spark-sql
- **yarn_queue** (*str*) – The YARN queue to submit to (Default: "default")

`run_query`(*cmd=''*, ***kwargs*)

Remote Popen (actually execute the Spark-sql query)

Parameters

- **cmd** – command to remotely execute
- **kwargs** – extra arguments to Popen (see subprocess.Popen)

class airflow.contrib.hooks.spark_submit_hook.**SparkSubmitHook**(*conf=None*, *conn_id='spark_default'*, *files=None*, *py_files=None*, *driver_classpath=None*, *jars=None*, *java_class=None*, *packages=None*, *exclude_packages=None*, *repositories=None*, *total_executor_cores=None*, *executor_cores=None*, *executor_memory=None*, *driver_memory=None*, *keytab=None*, *principal=None*, *name='default-name'*, *num_executors=None*, *application_args=None*, *env_vars=None*, *verbose=False*)

Bases: airflow.hooks.base_hook.BaseHook, airflow.utils.log.logging_mixin.LoggingMixin

This hook is a wrapper around the spark-submit binary to kick off a spark-submit job. It requires that the "spark-submit" binary is in the PATH or the spark_home to be supplied. :param conf: Arbitrary Spark configuration properties :type conf: dict :param conn_id: The connection id as configured in Airflow administration. When an

invalid connection_id is supplied, it will default to yarn.

Parameters

- **files** (*str*) – Upload additional files to the executor running the job, separated by a comma. Files will be placed in the working directory of each executor. For example, serialized objects.
- **py_files** (*str*) – Additional python files used by the job, can be .zip, .egg or .py.
- **driver_classpath** (*str*) – Additional, driver-specific, classpath settings.
- **jars** (*str*) – Submit additional jars to upload and place them in executor classpath.
- **java_class** (*str*) – the main class of the Java application
- **packages** – Comma-separated list of maven coordinates of jars to include on the

driver and executor classpaths :type packages: str :param exclude_packages: Comma-separated list of maven coordinates of jars to exclude while resolving the dependencies provided in 'packages' :type exclude_packages: str :param repositories: Comma-separated list of additional remote repositories to search for the maven coordinates given with 'packages' :type repositories: str :param total_executor_cores: (Standalone & Mesos only) Total cores for all executors (Default: all the available cores on the worker) :type total_executor_cores: int

:param executor_cores: (Standalone, YARN and Kubernetes only) Number of cores per executor (Default: 2) :type executor_cores: int :param executor_memory: Memory per executor (e.g. 1000M, 2G) (Default: 1G) :type executor_memory: str :param driver_memory: Memory allocated to the driver (e.g. 1000M, 2G) (Default: 1G) :type driver_memory: str :param keytab: Full path to the file that contains the keytab :type keytab: str :param principal: The name of the kerberos principal used for keytab :type principal: str :param name: Name of the job (default airflow-spark) :type name: str :param num_executors: Number of executors to launch :type num_executors: int :param application_args: Arguments for the application being submitted :type application_args: list :param env_vars: Environment variables for spark-submit. It

supports yarn and k8s mode too.

Parameters **`verbose`** (*`bool`*) – Whether to pass the verbose flag to spark-submit process for debugging

`submit`(*application=''*, ***kwargs*)

Remote Popen to execute the spark-submit job

Parameters

- **`application`** (*`str`*) – Submitted application, jar or py file
- **`kwargs`** – extra arguments to Popen (see subprocess.Popen)

`class` `airflow.contrib.hooks.sqoop_hook.`**`SqoopHook`**(*conn_id='sqoop_default'*, *verbose=False*, *num_mappers=None*, *hcatalog_database=None*, *hcatalog_table=None*, *properties=None*)

Bases: `airflow.hooks.base_hook.BaseHook`, `airflow.utils.log.logging_mixin.LoggingMixin`

This hook is a wrapper around the sqoop 1 binary. To be able to use the hook it is required that "sqoop" is in the PATH.

Additional arguments that can be passed via the 'extra' JSON field of the sqoop connection: * job_tracker: Job tracker local|jobtracker:port. * namenode: Namenode. * lib_jars: Comma separated jar files to include in the classpath. * files: Comma separated files to be copied to the map reduce cluster. * archives: Comma separated archives to be unarchived on the compute

machines.

- password_file: Path to file containing the password.

Parameters

- **`conn_id`** (*`str`*) – Reference to the sqoop connection.
- **`verbose`** (*`bool`*) – Set sqoop to verbose.
- **`num_mappers`** (*`int`*) – Number of map tasks to import in parallel.
- **`properties`** (*`dict`*) – Properties to set via the -D argument

`Popen`(*cmd*, ***kwargs*)

Remote Popen

Parameters

- **`cmd`** – command to remotely execute
- **`kwargs`** – extra arguments to Popen (see subprocess.Popen)

Returns handle to subprocess

export_table(*table*, *export_dir*, *input_null_string*, *input_null_non_string*, *staging_table*, *clear_staging_table*, *enclosed_by*, *escaped_by*, *input_fields_terminated_by*, *input_lines_terminated_by*, *input_optionally_enclosed_by*, *batch*, *relaxed_isolation*, *extra_export_options=None*)

Exports Hive table to remote location. Arguments are copies of direct sqoop command line Arguments :param table: Table remote destination :param export_dir: Hive table to export :param input_null_string: The string to be interpreted as null for

string columns

Parameters

- **input_null_non_string** – The string to be interpreted as null for non-string columns
- **staging_table** – The table in which data will be staged before being inserted into the destination table
- **clear_staging_table** – Indicate that any data present in the staging table can be deleted
- **enclosed_by** – Sets a required field enclosing character
- **escaped_by** – Sets the escape character
- **input_fields_terminated_by** – Sets the field separator character
- **input_lines_terminated_by** – Sets the end-of-line character
- **input_optionally_enclosed_by** – Sets a field enclosing character
- **batch** – Use batch mode for underlying statement execution
- **relaxed_isolation** – Transaction isolation to read uncommitted for the mappers
- **extra_export_options** – Extra export options to pass as dict. If a key doesn't have a value, just pass an empty string to it. Don't include prefix of – for sqoop options.

import_query(*query*, *target_dir*, *append=False*, *file_type='text'*, *split_by=None*, *direct=None*, *driver=None*, *extra_import_options=None*)

Imports a specific query from the rdbms to hdfs :param query: Free format query to run :param target_dir: HDFS destination dir :param append: Append data to an existing dataset in HDFS :param file_type: "avro", "sequence", "text" or "parquet"

Imports data to hdfs into the specified format. Defaults to text.

Parameters

- **split_by** – Column of the table used to split work units
- **direct** – Use direct import fast path
- **driver** – Manually specify JDBC driver class to use
- **extra_import_options** – Extra import options to pass as dict. If a key doesn't have a value, just pass an empty string to it. Don't include prefix of – for sqoop options.

import_table(*table*, *target_dir=None*, *append=False*, *file_type='text'*, *columns=None*, *split_by=None*, *where=None*, *direct=False*, *driver=None*, *extra_import_options=None*)

Imports table from remote location to target dir. Arguments are copies of direct sqoop command line arguments :param table: Table to read :param target_dir: HDFS destination dir :param append: Append data to an existing dataset in HDFS :param file_type: "avro", "sequence", "text" or "parquet".

Imports data to into the specified format. Defaults to text.

Parameters

- **columns** – <col,col,col…> Columns to import from table
- **split_by** – Column of the table used to split work units
- **where** – WHERE clause to use during import
- **direct** – Use direct connector if exists for the database
- **driver** – Manually specify JDBC driver class to use
- **extra_import_options** – Extra import options to pass as dict. If a key doesn't have a value, just pass an empty string to it. Don't include prefix of – for sqoop options.

class airflow.contrib.hooks.vertica_hook.**VerticaHook**(**args*, ***kwargs*)
Bases: *airflow.hooks.dbapi_hook.DbApiHook*

Interact with Vertica.

get_conn()
Returns verticaql connection object

3.22.5 Executors

Executors are the mechanism by which task instances get run.

class airflow.executors.local_executor.**LocalExecutor**(*parallelism=32*)
Bases: airflow.executors.base_executor.BaseExecutor

LocalExecutor executes tasks locally in parallel. It uses the multiprocessing Python library and queues to parallelize the execution of tasks.

end()
This method is called when the caller is done submitting job and is wants to wait synchronously for the job submitted previously to be all done.

execute_async(*key*, *command*, *queue=None*, *executor_config=None*)
This method will execute the command asynchronously.

start()
Executors may need to get things started. For example LocalExecutor starts N workers.

sync()
Sync will get called periodically by the heartbeat method. Executors should override this to perform gather statuses.

class airflow.executors.sequential_executor.**SequentialExecutor**
Bases: airflow.executors.base_executor.BaseExecutor

This executor will only run one task instance at a time, can be used for debugging. It is also the only executor that can be used with sqlite since sqlite doesn't support multiple connections.

Since we want airflow to work out of the box, it defaults to this SequentialExecutor alongside sqlite as you first install it.

end()
This method is called when the caller is done submitting job and is wants to wait synchronously for the job submitted previously to be all done.

execute_async(*key*, *command*, *queue=None*, *executor_config=None*)
This method will execute the command asynchronously.

sync()
Sync will get called periodically by the heartbeat method. Executors should override this to perform gather statuses.

3.22.5.1 Community-contributed executors

class `airflow.contrib.executors.mesos_executor.`**MesosExecutor**(*parallelism=32*)
Bases: `airflow.executors.base_executor.BaseExecutor`, `airflow.www.utils.LoginMixin`

MesosExecutor allows distributing the execution of task instances to multiple mesos workers.

Apache Mesos is a distributed systems kernel which abstracts CPU, memory, storage, and other compute resources away from machines (physical or virtual), enabling fault-tolerant and elastic distributed systems to easily be built and run effectively. See http://mesos.apache.org/

end()
This method is called when the caller is done submitting job and is wants to wait synchronously for the job submitted previously to be all done.

execute_async(*key*, *command*, *queue=None*, *executor_config=None*)
This method will execute the command asynchronously.

start()
Executors may need to get things started. For example LocalExecutor starts N workers.

sync()
Sync will get called periodically by the heartbeat method. Executors should override this to perform gather statuses.

HTTP Routing Table

/api

Python Module Index

Index