APACHE AIRFLOW

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Date: 9th October, 2020

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# Introduction to Airflow

An platform to programmatically author, schedule and monitor workflows.

Features:

1. It is a job scheduler that executes a job based on their dependencies.
2. In Airflow, airflow is written as code in form of DAGs (Directed Acyclic Graphs).
3. Interactive UI Interface

# Basic Terminologies Used in Airflow

## Dag

A DAG (Directed Acyclic Graph) is unidirectional, acyclic graph connecting edges, in which each node refer to a task and edges define dependencies between these tasks.

## Operator

Operator determines what actually needds to be done when a DAG runs.

## Task

When an operator is instantiated, it is called task.

## Workflow

Workflow is sequence of task arranged in a control dependency.

# Airflow Installation

The easiest way to install airflow according to documentation is:

**pip install apache-airflow**

Once airflow is installed, airflow.cfg and dags folder will be created in location where airflow has been installed.

**In server 8:**

/root/airflow/dags

/root/airflow/airflow.cfg

To initialize database

Airflow initdb

sudo yum install python3-devel mysql-devel

sudo yum install python3-devel mariadb-devel

pip install mysqlclient

To create user

Airflow create-user –r \*\*\* -f \*\*\* -l \*\*\*\* -p \*\*\* -email \*\*\*\*

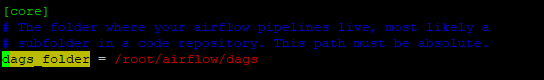
## Configuring airflow.cfg

In the airflow home directory, there is a file named airflow.cfg.

This config file is used to change various airflow settings.

### Configuring locations

First we have to set base locations for logs and DAGS. Find the section [core] and you can set the folders where you want your logs and DAGs to be.



[core]

dags\_folder = /data/airflow/dags

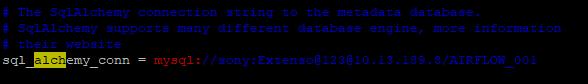
base\_log\_folder = /data/airflow/logs

### Setting up database connection

In the section [core], edit sql\_alchemy\_conn in the following format:

By default, airflow uses SQLite. Follow this document to set MYSQL as the database backend. This database is used as metadata for airflow.

NOTE: Make sure you have installed sqlalchemy and mysqlclient (if you are using mysql as backend) in the same python environment where you have airflow installed.



[core]

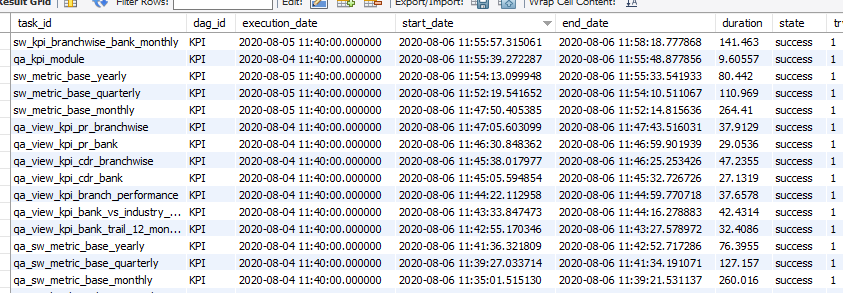
sql\_alchemy\_conn = <driver>://<user>:<password>@<host>/<airflow\_db>

#example

#sql\_alchemy\_conn = mysql://siddhi:9865@localhost/airflow

**Note:**

Once this connection is provided and database is initialized, airflow\_db is created and all information about state of tasks is available in task\_instance table of airflow\_db.



### Configuring Mail

You will have to find a section [smtp], and edit them according to the smtp server used.

The following configuration is used to setup a gmail smtp.



[smtp]

smtp\_host = smtp.gmail.com

smtp\_starttls = True

smtp\_ssl = False

smtp\_user = noreply.extenso@gmail.com

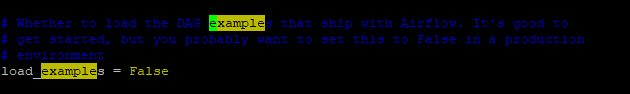
smtp\_password = extenso@123

smtp\_port = 587

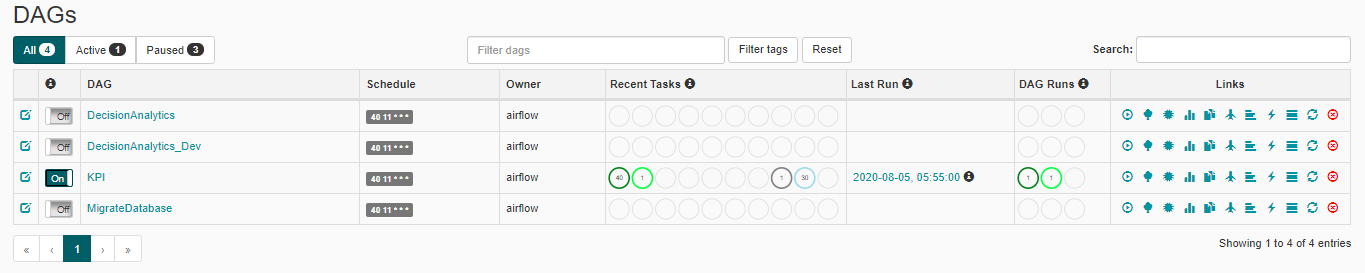
smtp\_mail\_from = noreply.extenso@gmail.com

### Load Example DAG

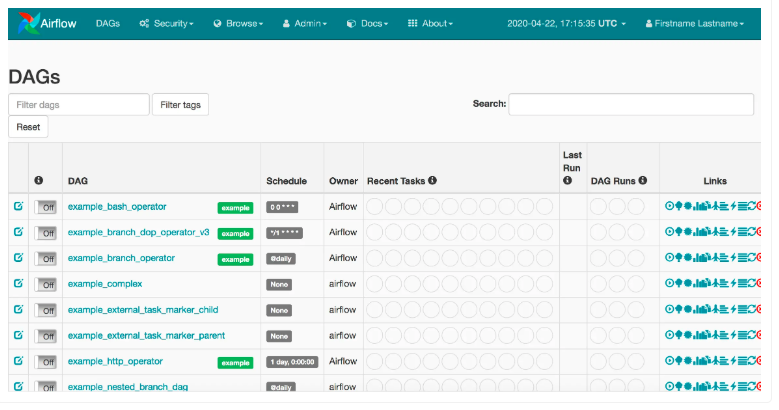
We can choose to whether load sample examples or not by changing following setting in airflow.cfg.



Following is state when load\_examples=False

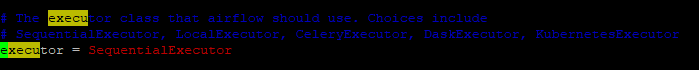


Following is state when load\_examples = True

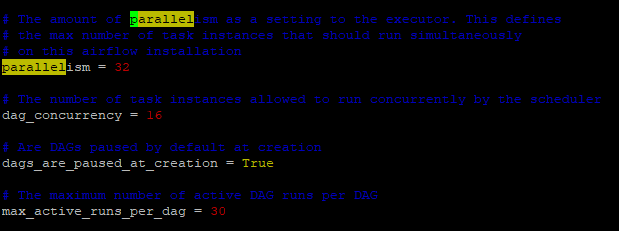


### Executor

We can decide whether tasks in airflow will be executed sequentially or parallel by changing executor in airflow.cfg file.



### Other configs

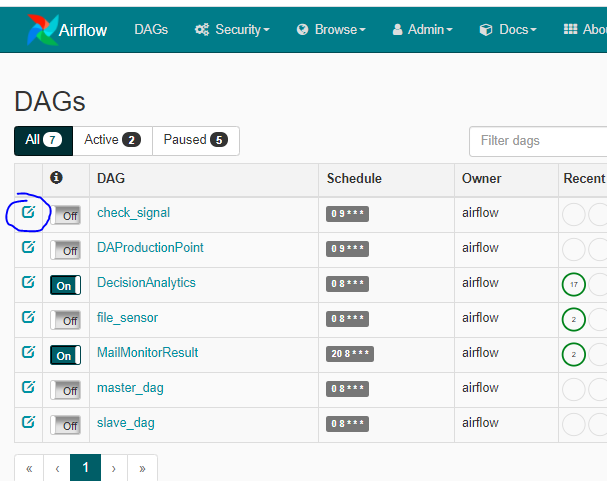


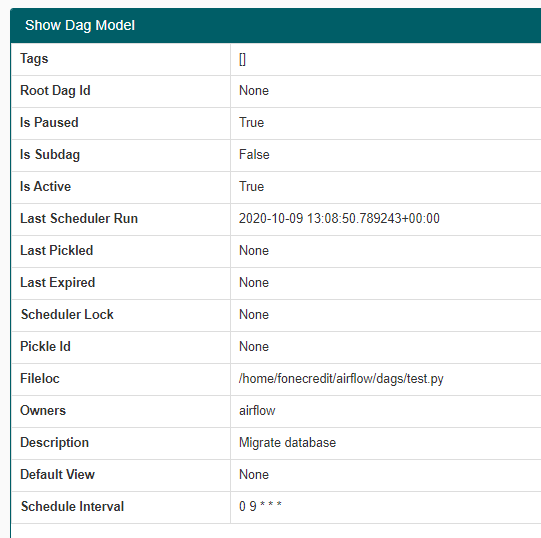
# Airflow UI

## DAGs page

1. Info

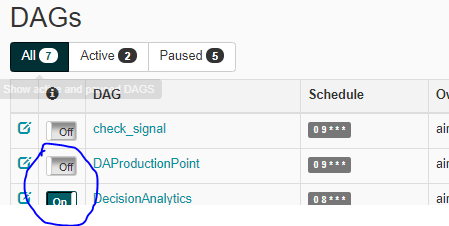
It provides information about dag.





1. Toggle button

It is used to enable or disable dag.



1. Dag Name

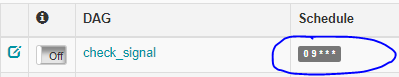
It displays dag id.

On clicking on this dag id, we will be redirected to different views of corresponding dag.

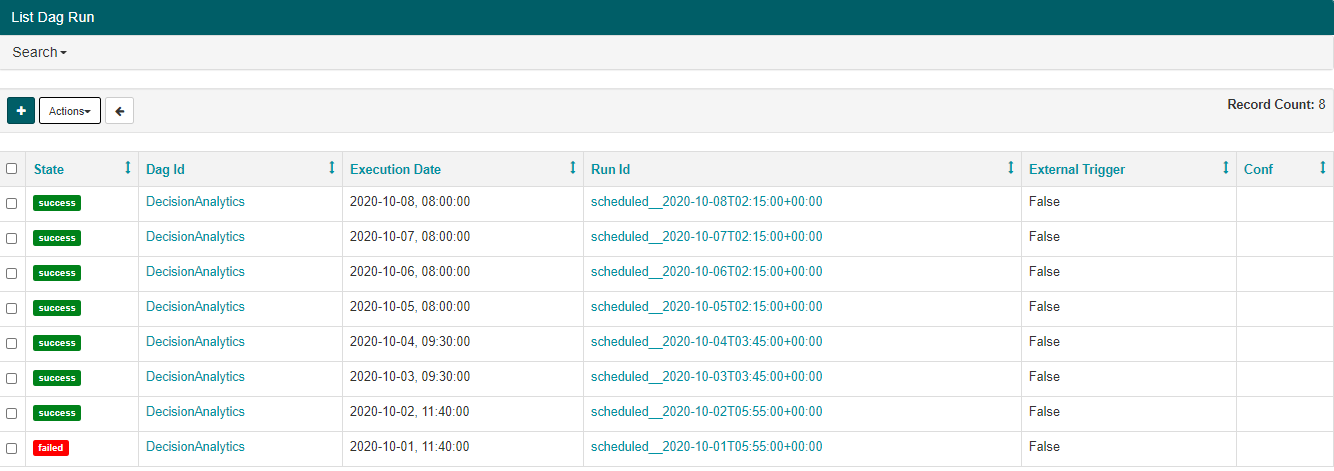


1. Schedule

It stated interval of time after which dag will be triggered.



On clicking on this schedule, we will get list of dag runs.





This provides state of dag run, time when dag was executed.

If run\_id starts with manual, dag was executed by triggering while if it starts with scheduled it means dag was run in scheduled time.

1. Owner

This shows owner of dag

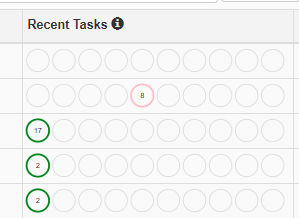
1. Recent tasks

It shows summary of task that were present in latest dag run.

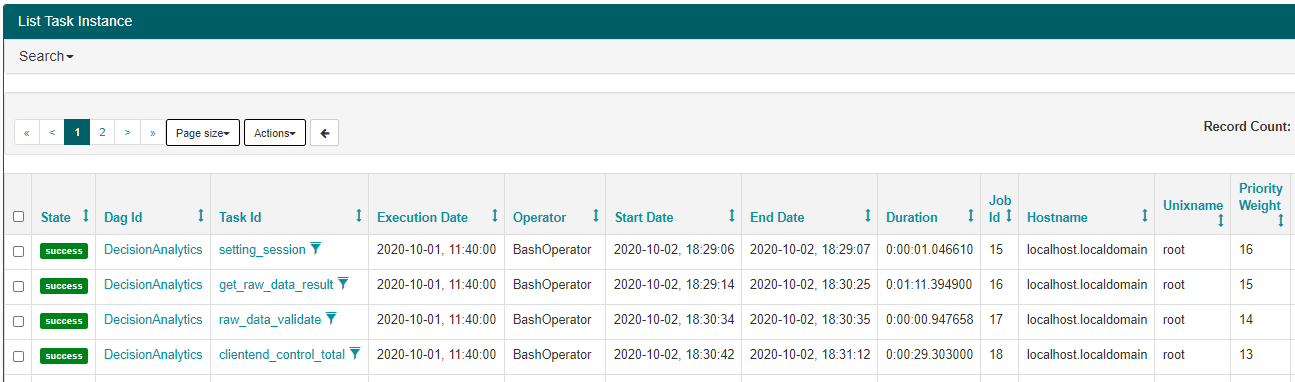
If a dag is currently running, then it will show its live task status.

If a dag is not currently running, then it will show status from most recent dag run.

Each circle represnts different status of task run.

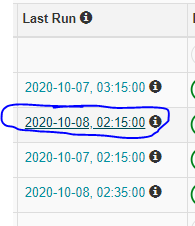


Clicking on each circle will show task instance details.



1. Last Run

It shows date and time when corresponing dag was run last time.



1. DAG Run

It provides status of complete dag/ whole pipeline.

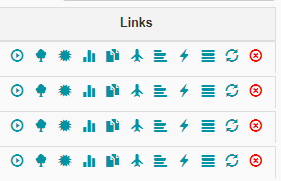
It has three little circle, each for success, running and failed.

It show status of dag as a whole, not just of last dag run.



1. Links

Clicking on any button on click section, will render us to particular view of corresponding dag.



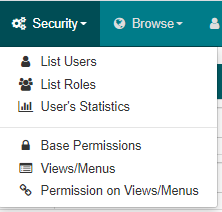
* Trigger dag

It is used to trigger dag or run dag before scheduled time.

Details of other icons in link will be provided in section Views in UI.

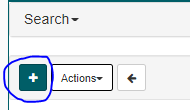
## Security Page

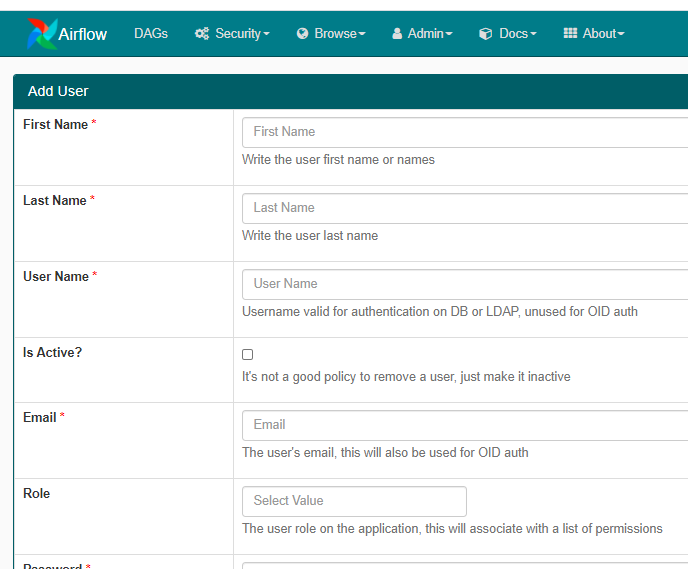
From this page, we can list users, add users, list role, add roles.



To add users

Click on List Users Option, click +icon then fill all details of user.

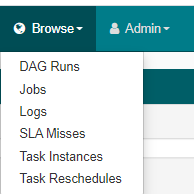




Similary we can also add role, by clicking on List Roles Option, click +icon then fill all details of user.

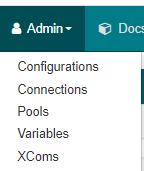
## Browse Page

We can browse details about dag runs, task runs by clicking on Browse button and respective button as per requirement.

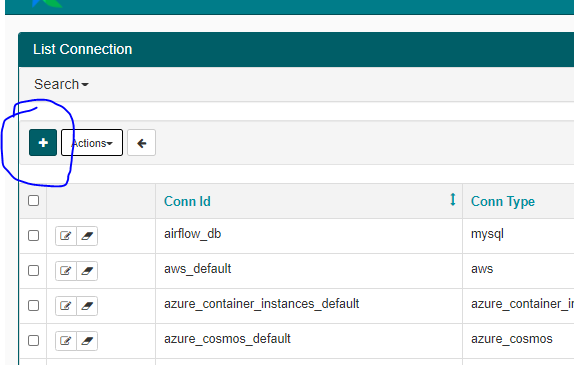


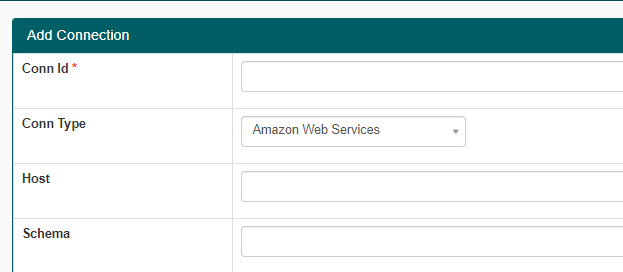
## Admin Page

We can add connection, pool and variable by clicking on admin page and respective button as per requirement.



Adding connection



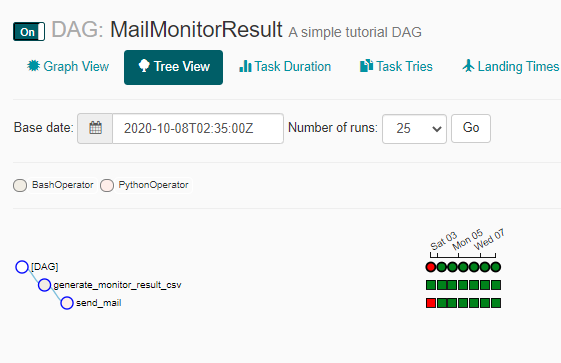


# Views in UI

* Tree view

It is used to view tree representation of dag.

In this view, we can see details of multiple dag run in a place.



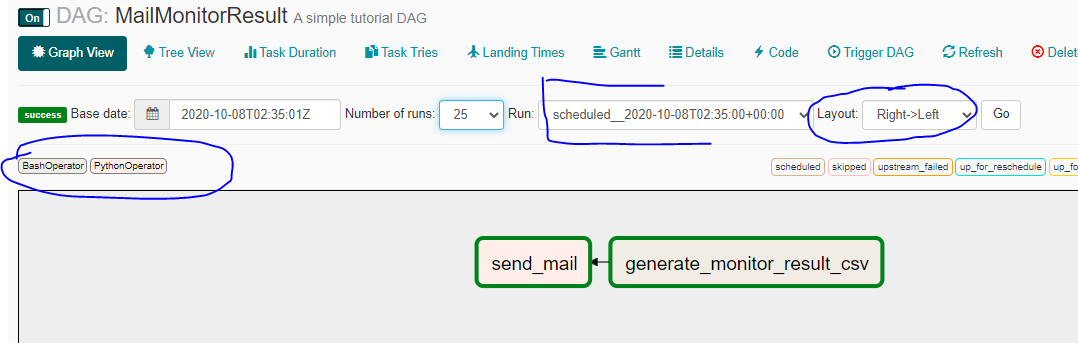
* Graph view

It is used to view graphical representation of dag.

It also displays Operator being used.

We can change layout o view as well.

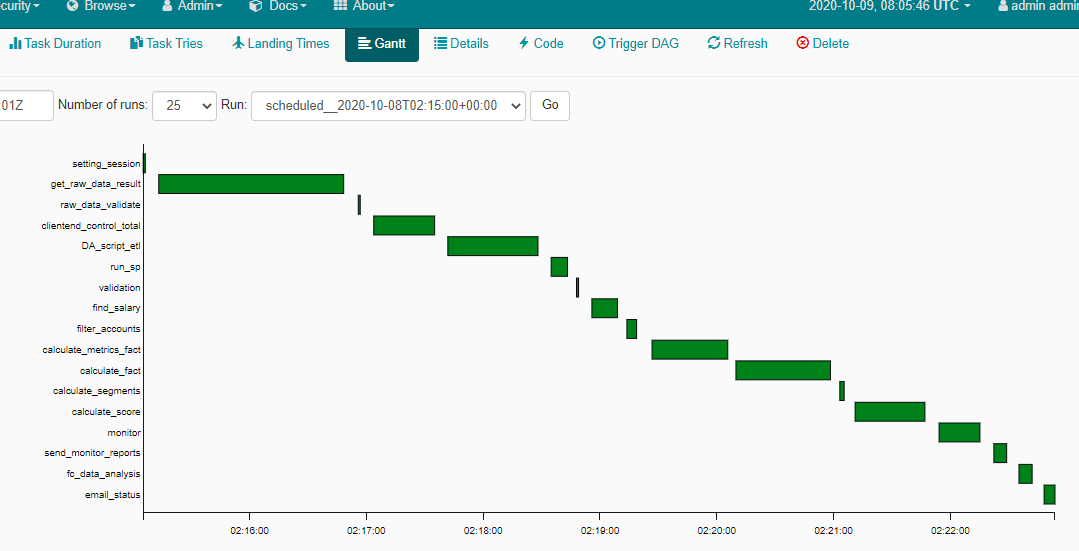
Hovering over task will show brief detail about task.



* Gantt Chart

It show which task took how much time for its execution.

It show which task is taking long time to execute, which tasks are executing parallely and so on.

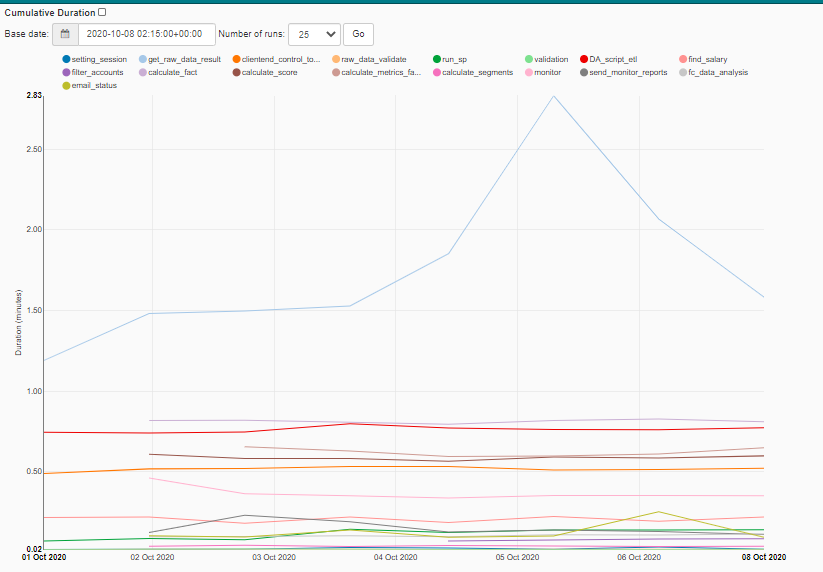


* Task duration

It tells time taken by each task to run on each dag run.

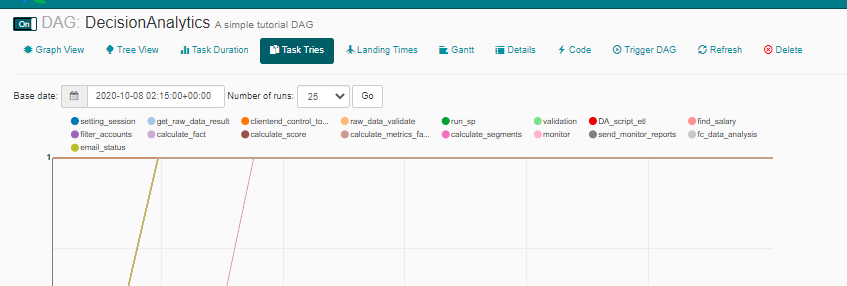
x-axis- date

y-axis- time taken by task to run



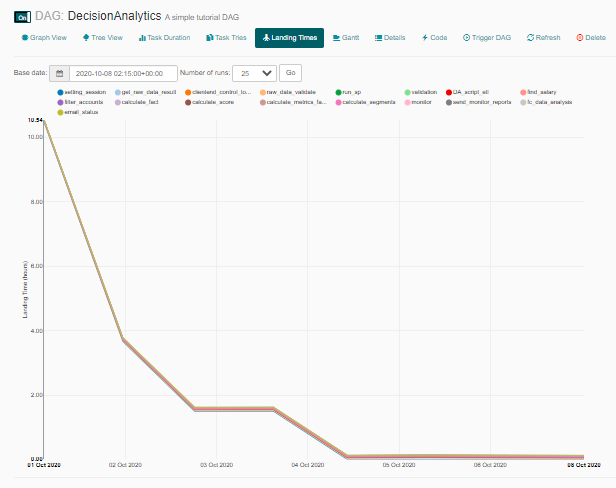
* Task tries

It shows number of tries for a task.



* Landing times

It shows how dags have performed over time.



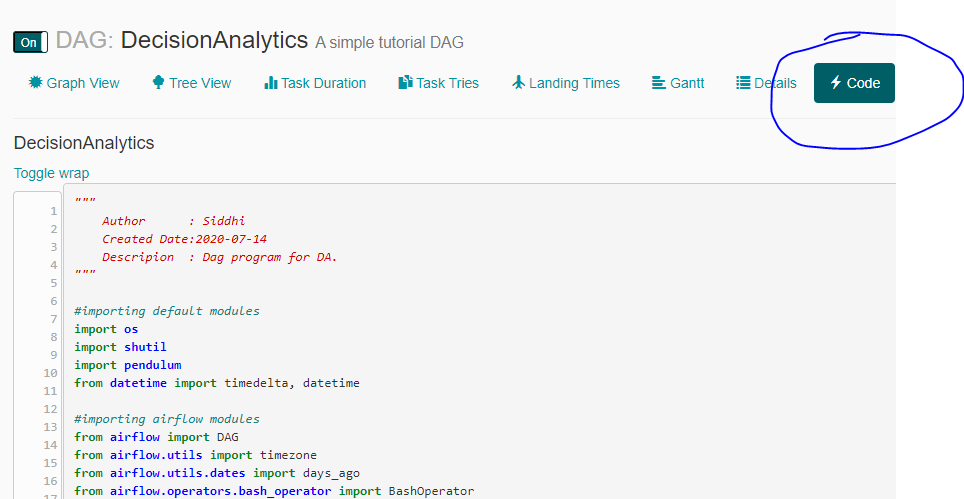
* Details

It provides short detail about dag code.



* Code

It is used to view dag code.



* Refresh: Suppose, we have made some changes in our dag progra, it will take some time to get reflected in UI. If we wish to view does changes instantly, we can make use of refresh button.
* Delete: It is used to delete selected dag, its run details, meta data except log (logs won’t get deleted’)

# Airflow CLI Comands

## Create user

airflow create\_user -u admin123 -r admin -e sony.shrestha@extensodata.com -f sony -l shrestha -p admin123

## Reset Database

airflow resetdb

Note:

After we reset database, we must create user because created user will be removed from our database.

## Initialize database

Initialize the database.

**airflow initdb**

## Run Airflow

1. Start the scheduler

**airflow scheduler**

1. Start the webserver

**airflow webserver -p 8080**

## Print list of active dags

airflow list\_dags

## Test Single Task

**airflow test airflow\_name task\_name date**

airflow test MigrateDatabase create\_database\_bkp 2020-07-28

## Print list of tasks of certain DAG

airflow list\_tasks KPI

## Print the hierarchy of tasks

airflow list\_tasks KPI –tree

## Create Connection

airflow connections --add --conn\_id 'server\_8' --conn\_uri 'mysql://sony:Extenso@123@10.13.189.8'

## List all Connections

airflow conections –l

## Delete Connection

airflow connections -d --conn\_id myqsl\_server

## Get dag runs

airflow list\_dag\_runs DecisionAnalytics

## Trigger dag

airflow trigger\_dag dag\_name

## Pause/ Unpause dag

airflow pause dag\_name

airflow unpause dag\_name

## View next excution time of dag

airflow next\_execution dag\_name

## Delete all records for Airflow metadata database

airflow delete\_dag dag\_name

# Start Airflow as background process

In CLI,

Run

cd /etc/systemd/system

Create two files

vi airflow\_web.service

vi airflow\_scheduler.service

In airflow\_web.service

[Unit]

Description=Airflow webserver.

[Service]

Environment="PATH=/data/airflow/airflow\_venv/bin/"

Type=simple

ExecStart=/data/airflow/airflow\_venv/bin/airflow webserver -p 8081

[Install]

WantedBy=multi-user.target

In airflow\_scheduler.service

[Unit]

Description=Airflow webserver.

[Service]

Environment="PATH=/data/airflow/airflow\_venv/bin/:$PATH:/usr/local/bin:/bin:/usr/bin:/usr/local/sbin:/usr/sbin"

Type=simple

ExecStart=/data/airflow/airflow\_venv/bin/airflow scheduler

[Install]

WantedBy=multi-user.target

Note: to get airflow path do **which airflow**

Run

sudo systemctl daemon-reload

To start and enable service

Sudo systemctl start airflow\_web

Sudo systemctl start airflow\_scheduler

Sudo systemctl enable airflow\_web

Sudo systemctl enable airflow\_scheduler

To stop service

Sudo systemctl stop airflow\_web

Sudo systemctl stop airflow\_scheduler

# Airflow State

There are two main categories for state in airflow:

1. Dagrun
2. Task

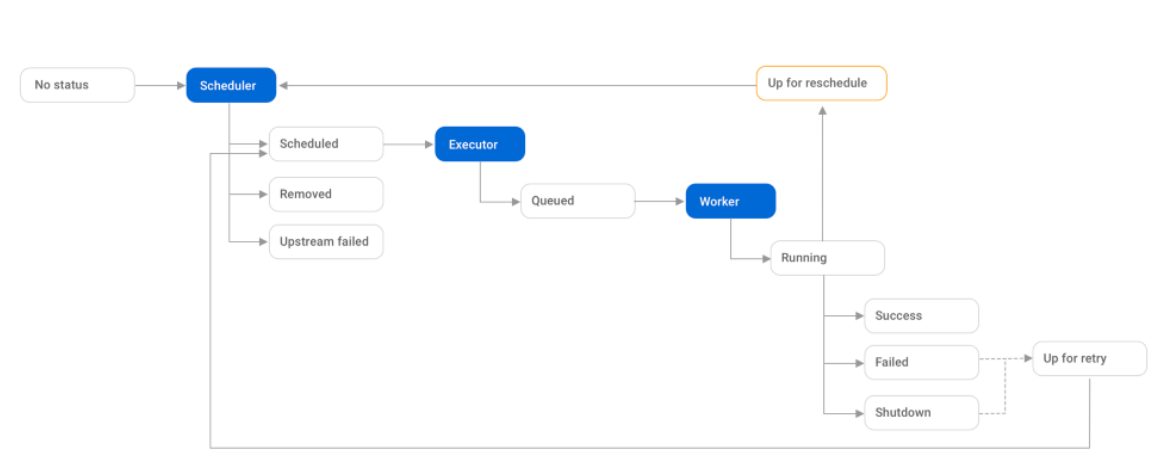
## Dagrun

States included in Dagrun are:

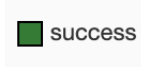
1. Success
2. Running
3. Failed

## Task

### LifeCycle of Airflow Task State



1. Success

This is a state when task runs successfully without any error.

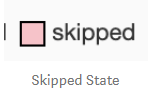
1. Running

This is a state when airflow scheduler has already assigned task to executor.

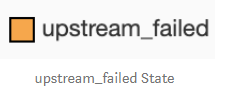
1. Failed

This is a state when there is some error in task.

1. Skipped

This is a state when execution of certain task is skipped like in case of Branch Operator, based on branch condition, task on one end of branch is executed and task in other end of branch is skipped.

1. Upstream\_failed

This state of task refers that t2 was not executed because t1 failed and dependency between t1 and t2 was sent such a way that t2 needs to be executed only when t1 executes successfully.

1. Up\_for\_retry
2. Up\_for\_reschedule
3. Queued

This state states that task is waiting for a slot in an executor.

1. None

This stste states that current state of task is not known.

1. Scheduled

This state states that task has been scheuled by scheduler to sen to executor

# Writing DAG Program

There are only 5 steps you need to remember to write an Airflow DAG or workflow:

* Step 1: Importing modules
* Step 2: Default Arguments
* Step 3: Instantiate a DAG
* Step 4: Tasks
* Step 5: Setting up Dependencies

## Import module

#importing default modules

import os

import shutil

import pendulum

from datetime import timedelta, datetime

#importing airflow modules

from airflow import DAG

from airflow.utils import timezone

from airflow.utils.dates import days\_ago

from airflow.operators.bash\_operator import BashOperator

from airflow.operators.sensors import SqlSensor

#importing custom modules

from utilities.utilities import \*

from utilities.variables import \*

local\_tz = pendulum.timezone('Asia/Kathmandu')

start\_date = datetime(\*\*START\_DATE, tzinfo=local\_tz)

## Default arguments

default\_args = {

'owner': 'airflow',

'depends\_on\_past': False,

'start\_date': start\_date,

'email': EMAIL\_LIST,

'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),

# 'wait\_for\_downstream': False,

# 'dag': dag,

# 'sla': timedelta(hours=2),

# 'execution\_timeout': timedelta(seconds=300),

# 'on\_failure\_callback': some\_function,

# 'on\_success\_callback': some\_other\_function,

# 'on\_retry\_callback': another\_function,

# 'sla\_miss\_callback': yet\_another\_function,

# 'trigger\_rule': 'all\_success'

}

## Instantiate a dag

dag = DAG(

'DAProductionPoint',

default\_args=default\_args,

description='Migrate database',

schedule\_interval=CRON\_EXPRESSION\_DA\_Production\_Point,

template\_searchpath=[SQL\_SCRIPT\_LOCATION],

catchup=False

)

## Tasks

Note:

task\_id

dag =dag is must

**Example:**

slave\_task2 = BashOperator(

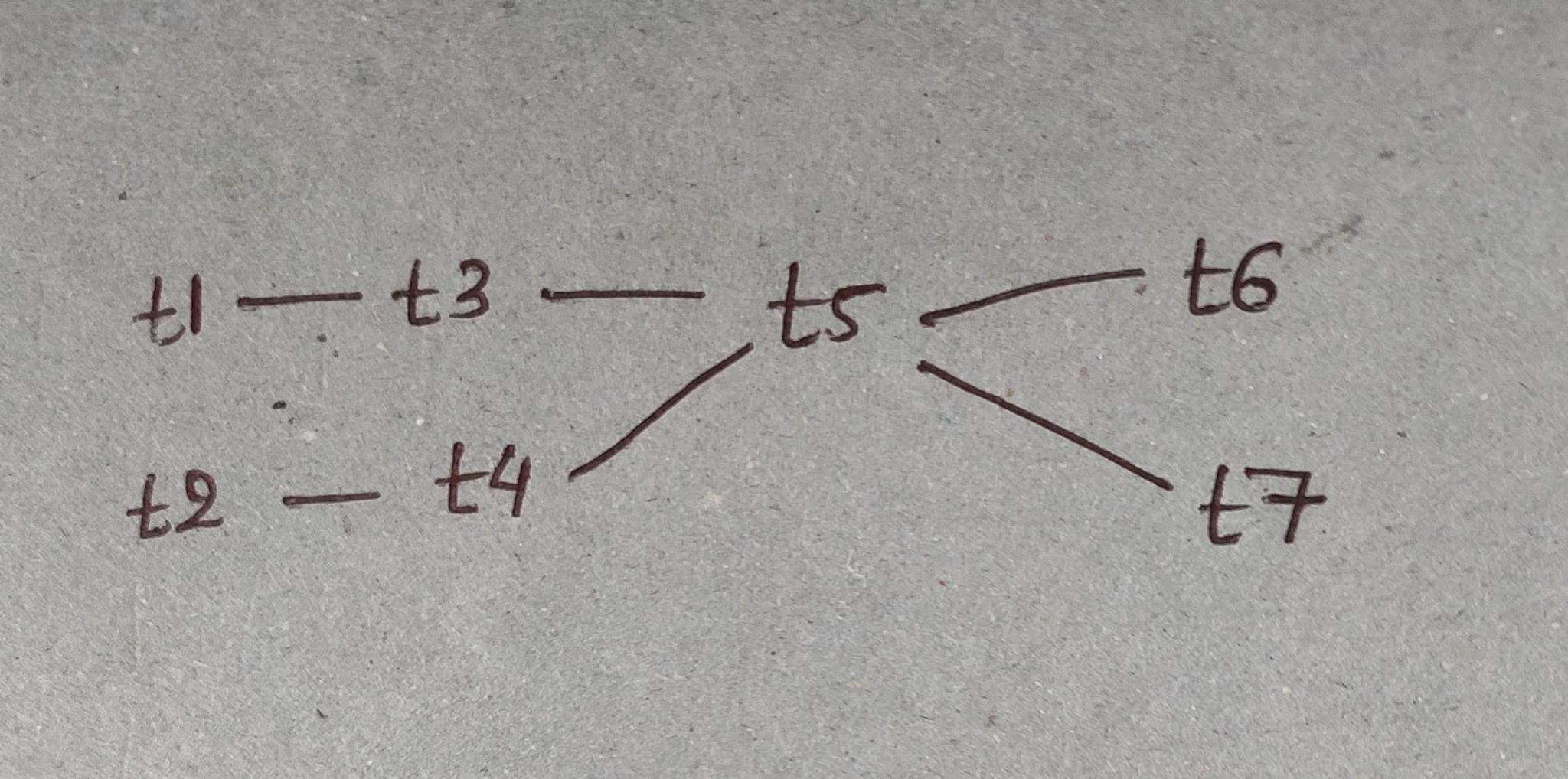
task\_id='slave\_task2',

bash\_command='echo slavetask2 ',

dag=dag

)

## Setting up Dependencies



t1 >> t3

t2 >> t4

[t3, t4] >> t5

T5 >> [t6, t7]

## Making config driven

Importing Custom Modules

Besides this,

We can also import custom module

*#importing custom modules*

**from** **kpi.utilities.utilities** **import** \*

**from** **kpi.utilities.variables** **import** \*

This can be helpful to make variables used in dag program config driven

Suppose, config file is:



In utilities/ variables.py

import os

from sqlalchemy import create\_engine

from utilities.db\_con import \*

file\_path = os.path.dirname(os.path.dirname(os.path.realpath(\_\_file\_\_)))

def initialize\_json\_config():

import json

global PYTHON\_LOCATION

with open(os.path.abspath(file\_path + '/config/config.json'), 'r') as js:

js\_conf = json.load(js)

CLIENT=js\_conf['CLIENT']

mysql\_url=get\_con\_url(\*\*js\_conf["mysql\_config"])

oracle\_url=get\_oracle\_con\_url(\*\*js\_conf["oracle\_config"])

def get\_con\_url(\*\*conf):

return conf["driver"]+"://"+conf["username"]+":"+conf["password"]+"@"+conf["host"]

def get\_oracle\_con\_url(\*\*client\_con):

client\_con\_url = ("{driver}://{username}:{password}@(DESCRIPTION = "

"(LOAD\_BALANCE=on) (FAILOVER=ON) "

"(ADDRESS = (PROTOCOL = TCP)(HOST = {host})(PORT = {port})) "

"(CONNECT\_DATA = (SERVER = DEDICATED) (SERVICE\_NAME = {sid})))")

return client\_con\_url.format(username=client\_con['username'],

password=client\_con['password'],

host=client\_con['host'],

sid=client\_con['sid\_name'],

port=client\_con['port'],

driver=client\_con['driver'])

initialize\_json\_config()

In db\_con.py

from sqlalchemy.orm import sessionmaker

from sqlalchemy import create\_engine

def create\_session(connection\_url):

global session

en\_flag = 0

ses\_flag = 0

try:

if type(connection\_url) is str:

engine = create\_engine(connection\_url)

en\_flag = 1

else:

engine = connection\_url

Session = sessionmaker(bind=engine)

session = Session()

ses\_flag = 1

except Exception as e:

if en\_flag == 1:

engine.dispose()

if ses\_flag == 1:

session.close()

raise e

return session

# Operators

An operator describes a single task in a workflow.

Operator determines what actually needs to be done when a DAG runs.

## Properties of Operators:

Operators are atomic (but not always)

Once an operator is instantiated, it is refered to a task.

Every operator is derived from Airflow’s BaseOperator.

Two operators can communicate with each other using feature called Xcom.

## Different types of Operator

1. Action Operator
   1. Action operators are used to perform an action.
   2. Example: PythonOperator, BashOperator
2. Sensor Operator
   1. Sensor Operator keeps executing at certain time interval.
   2. They succeed when a criteria is met and fail when timeout occurs.
   3. Example: FileSensor, SqlSensor
3. Transfer Operator
   1. Transfer Operator moves/ transfers data from one location to another location.
   2. Example: MySqlToHiveTransfer

## Importing Operators

# importing operator in airflow

from airflow.operators.bash\_operator import BashOperator

from airflow.operators.python\_operator import PythonOperator

from airflow.operators.mysql\_operator import MySqlOperator

from airflow.operators.email\_operator import EmailOperator

from airflow.operators.dummy\_operator import DummyOperator

from airflow.operators.python\_operator import BranchPythonOperator

from airflow.operators.latest\_only\_operator import LatestOnlyOperator

## Operatorwise Explanation

### BashOperator

Bash operator is used to perform certain bash commands.

**Example:**

t1 = BashOperator(

task\_id='BashOperatorExample',

bash\_command='echo "Hello World"',

dag=dag,

)

### Python Operator

Python Operator is used to call python function.

**Example:**

t2 = PythonOperator(

task\_id='PythonOperatorExample',

python\_callable=python\_function,

dag=dag,

)

Note:

This python callable function can be within current dag file or we can import python function from other location:

# import python functions

from Airflow\_Tutorial.python\_files.main import \*

### MySqlOperator

It is used to execute Mysql commands.

**Example:**

t3 = MySqlOperator(

task\_id='MySqlOperatorExample',

mysql\_conn\_id="server\_8",

sql="create\_table.sql", # sql= “ update……”

dag=dag

)

Note:

It is possible to run single mysql command or commands from a sql file.

For this:

While creating dag object following line should be included:

dag=DAG(

'AirflowTutorial',

default\_args=default\_args,

description='Understanding DAG Program',

schedule\_interval='@daily',

template\_searchpath=['/root/airflow/dags/Airflow\_Tutorial/sql\_files'],

catchup=False )

This line specifies that sql file is present inside this template location.

**Connection needs to be created as follows:**

airflow connections --add --conn\_id 'server\_8' --conn\_uri 'mysql://sony:Extenso@123@10.13.189.8'

### Email Operator

It is used to send mail.

**Example:**

t4 = EmailOperator(

task\_id='EmailOperatorExample',

subject='Test: Email Operator',

cc='sony.sth8@gmail.com',

bcc='pop.son4p@gmail.com',

to='sony.shrestha@extensodata.com',

html\_content=""" <h1> Email Operator Passed </h1> <br> <br> Email sent successfully <br> """,

files=['/root/airflow/dags/Airflow\_Tutorial/sql\_files/create\_table.sql'],

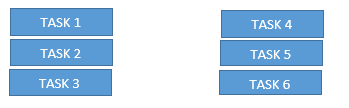
dag=dag

)

### Dummy Operator

It does nothing.

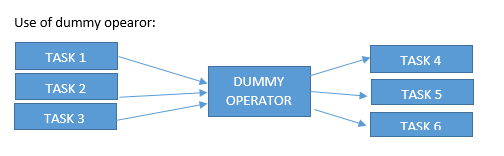
**Use of dummy opearor:**



Suppose TASK 4,5,6 needs to be executed only after TASK1,2,3 are executed successfully.

It is ddifficult estalish link without using Dumy Operator.

Now, using dummy Operator:



**Example:**

t5 = DummyOperator(

task\_id='DummyOperatorExample',

dag=dag

)

### Branch Python Operator

It is used to peform branching operation.

**Example:**

def decide\_branch():

if sth:

return "t7"

else:

return "t8"

t6=BranchPythonOperator(

task\_id='BranchPythonOperatorExample',

python\_callable=decide\_branch,

dag=dag

)

t7=BashOperator(

task\_id='on\_success',

bash\_command='echo "SUCCESS"',

dag=dag

)

t8=BashOperator(

task\_id='on\_failure',

bash\_command='echo "FAILURE"',

dag=dag

)

# Sensor

## Definition

Sensor execute certain task in certain interval of time.

They succeed when a condition is met an fails when timeout occurs.

## Importing sensor

# importing airflow sensors

from airflow.contrib.sensors.file\_sensor import FileSensor

from airflow.operators.sensors import ExternalTaskSensor

from airflow.operators.sensors import SqlSensor

## Terms associated with Sensor

1. **poke\_interval:** time in seconds that the given job should wait in between each tries
2. **timeout:** time in second before task fails or timeout occurs
3. **soft\_fail:** If it is set to True, it will mark tas as SKIPPED on failure

## Explanation of Different Sensor

### File Sensor

It will check for existence of certain file until timeout occurs.

Example:

file\_sensor = FileSensor(

task\_id='file\_sensor',

filepath='/home/fonecredit/airflow/dags/test.txt',

dag=dag

)

### Sql Sensor

It will execute a sql statement until a condition is met.

It will keep trying until success or failure criteria are met of if the first cell is not in (0, ‘0’ , ‘’ , None).

An allow\_null parameter will exclude None/Null results from failure criteria.

**Example:**

check\_signal = SqlSensor(

task\_id='check\_signal',

conn\_id='mysql\_server',

sql='SELECT flag FROM '+master\_db\_name+'.md\_check\_signal e"',

dag=dag,

timeout=300,

poke\_interval=10,

soft\_fail=True

)

### External Task Sensor

It will wait until task in another dag succeeds.

Suppose, there is master dag with dag\_id=master\_dag and last task id as master\_task

Then, to run slave dag only if master ag succeeds, we can use External Task Sensor.

**Example:**

sensor\_task = ExternalTaskSensor(

task\_id = 'sensor',

external\_dag\_id='master\_dag',

external\_task\_id='master\_task',

dag=dag

)

slave\_task1 = BashOperator(

task\_id='slave\_task1',

bash\_command='echo slavetask1 ',

dag=dag,

trigger\_rule = 'all\_success'

)

slave\_task2 = BashOperator(

task\_id='slave\_task2',

bash\_command='echo slavetask2 ',

dag=dag,

trigger\_rule = 'all\_success'

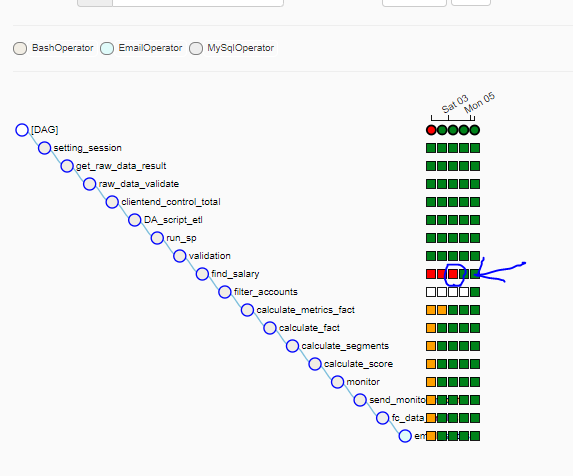
)

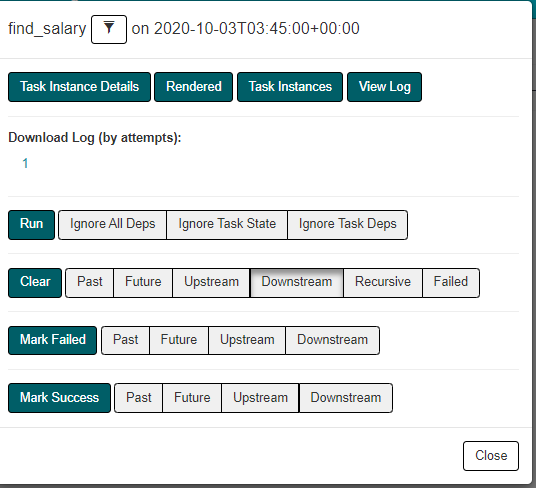
sensor\_task >> slave\_task1 >> slave\_task2

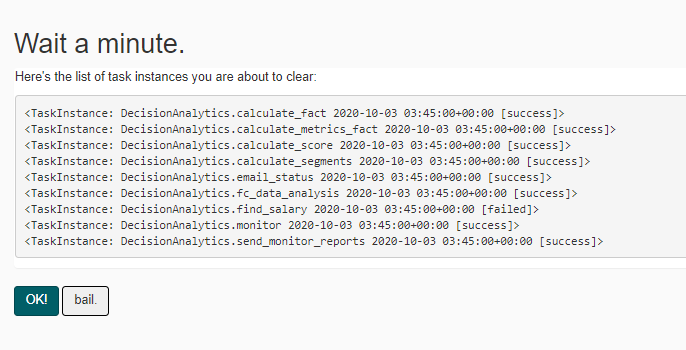
# Additional Details

## Run DAG from failed task onwards

1. Click on failed task instance in tree view.
2. Click on Clear with Downstream
3. Click on OK.







## With context manager

In dag, we need to instantiate each task by including dag=dag in each task.

We can avoid writing this piece of code in each task by using with context manager.

**Example:**

with DAG() as dag:

T1=BashOperator(

task\_id= ‘test\_dag’,

bash\_command= ‘echo hello’

)

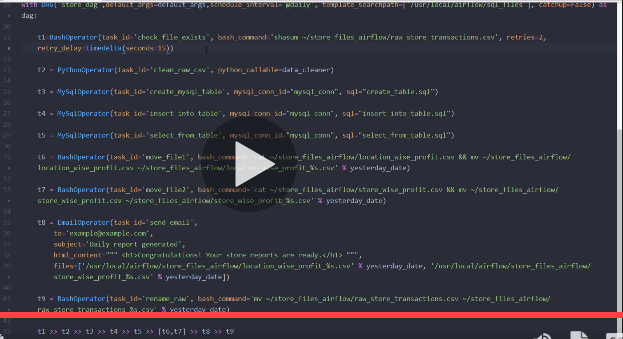
T2=BashOperator(

task\_id= ‘test1\_dag’,

bash\_command= ‘echo hi’

)

T1 >> T2



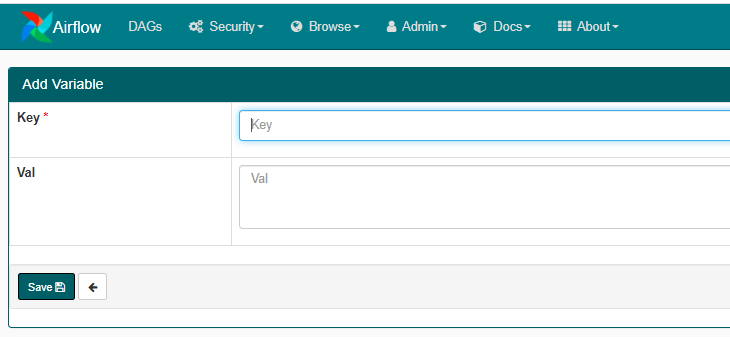
## Variables in airflow

### Add variable

There are two ways to create variable in airflow.

Way 1:

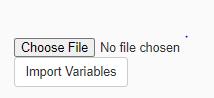
* In UI, Go to Admin
* Click on Admin
* Click on Variables
* Click on + icon



* Click on Save button

Way 2:

* In UI, Go to Admin
* Click on Admin
* Click on Variables
* Click on choose file
* Add json file from browser
* Click on Import Variables



### Use varible in dag file

Created variable can be used in dag file by incluing following line in dag code:

{{ var.value.key\_name }}

## Backfill and Catchup

When a dag program is run, dag is executed for all time starting from start date.

To stop dag from getting executed for all past runs,

We should add catchup=False when instantiating a dag.

dag = DAG(

'DAProductionPoint',

default\_args=default\_args,

description='Migrate database',

schedule\_interval=CRON\_EXPRESSION\_DA\_Production\_Point,

template\_searchpath=[SQL\_SCRIPT\_LOCATION],

catchup=False

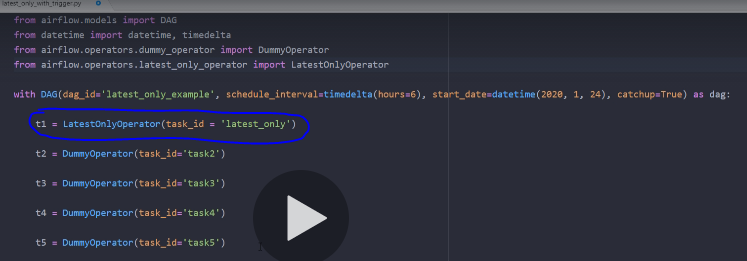
)

Note:

catchup=False will stop execution for past runs in dag level i.e. whole dag will not get executed for past run. We cannot stop execution of dag for past run in task level by using this option. This can be performed by using LatestOnly Operator.

## LatestOnly Operator

It is used to stop execution of task for past runs.



## .airflowignore file

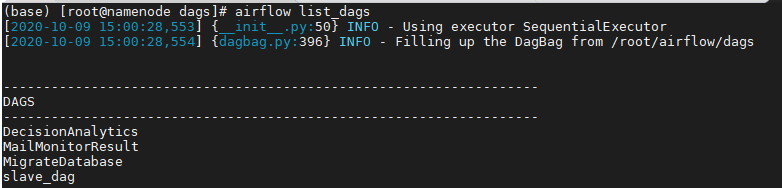
This file specifies list of files or directories in dag folder that airflow shoul ignore

Suppose, there are three dags: test1, test2, test3

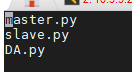
To ignore test3, Create .airflowignore file and enter test3 in it.

On running scheduler, this dag file will be ignored by airflow.

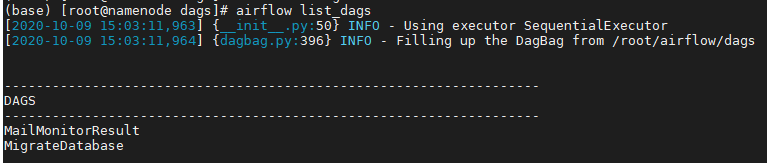
Before introducing .airflowignore file



In .airflowignore file



After introducing .airflowignore file



# Sending Custom mails with attachment

# importing default modules

import os

import shutil

# importing airflow modules

from airflow.utils.email import send\_email

# import email template

from html\_template.email\_template import \*

from utilities.variables import \*

# get log file

def get\_log\_location(contextDict):

log\_folder = contextDict['ti'].log\_filepath.split('.')[0]

if os.path.exists(log\_folder):

shutil.make\_archive(log\_folder, 'zip', log\_folder)

return log\_folder+'.zip'

else:

return contextDict['ti'].log\_filepath

# mail on success

def notify\_email\_success(contextDict, \*\*kwargs):

if 'file' in (contextDict['params']):

files = (contextDict['params']['file'])

else:

files = []

files.append(get\_log\_location(contextDict))

email\_list = (contextDict['params']['email\_list'])

title = "{} DA: {} {}".format(CLIENT,contextDict['task'].task\_id,success\_title)

body="{}<br>{}<br><br>{}<br><br>{}".format(

salutation,success\_body,contextDict['params']['task\_success\_msg'],regards)

files = [f for f in files if os.path.exists(f)]

if len(files) == 0:

send\_email(email\_list, title, body)

else:

send\_email(email\_list, title, body, files)

# mail on failure

def notify\_email\_failure(contextDict, \*\*kwargs):

if 'file' in (contextDict['params']):

files = (contextDict['params']['file'])

else:

files = []

files.append(get\_log\_location(contextDict))

email\_list = (contextDict['params']['email\_list'])

# email title.

title = "{} DA: {} {}".format(CLIENT,contextDict['task'].task\_id,failure\_title)

# email contents

body="{}<br>{}<br><br>{}<br><br>{}".format(

salutation,failure\_body,contextDict['params']['task\_failure\_msg'],regards)

files = [f for f in files if os.path.exists(f)]

if len(files) == 0:

send\_email(email\_list, title, body)

else:

send\_email(email\_list, title, body, files)

html\_template.py

global salutation

global success\_title

global success\_body

global failure\_title

global failure\_body

global regards

salutation="""Respected Sir/Madam,

"""

success\_title="""passed"""

success\_body="""Above task has been successfully executed.

"""

failure\_title="""failed"""

failure\_body="""Above task failed to execute. Find attached log file to debug error for respective task.

"""

regards="""With regards,

<br>

Airflow Automated Mail

"""

# Installation of Oracle Client in Linux

Steps:

1. Download the desired Instant Client ZIP files. All installations require a Basic or Basic Light package.
2. Unzip the packages into a single directory such as /opt/oracle/instantclient\_19\_3 that is accessible to your application. For example:
   1. cd /opt/oracle
   2. unzip instantclient-basic-linux.x64-19.3.0.0.0dbru.zip
3. Prior to version 18.3, create the appropriate links for the version of Instant Client. For example:
   1. cd /opt/oracle/instantclient\_12\_2
   2. ln -s libclntsh.so.12.1 libclntsh.so
   3. ln -s libocci.so.12.1 libocci.so
4. Install the operating system libaio package. This is called libaio1 on some Linux distributions. For example, on Oracle Linux, run:
   1. sudo yum install libaio
5. If Instant Client is the only Oracle Software installed on this system then update the runtime link path, for example:
   1. sudo sh -c "echo /opt/oracle/instantclient\_19\_3 > \ /etc/ld.so.conf.d/oracle-instantclient.conf"
   2. sudo ldconfig
6. Alternatively, set the LD\_LIBRARY\_PATH environment variable prior to running applications. For example:
   1. export LD\_LIBRARY\_PATH=/opt/oracle/instantclient\_19\_3:$LD\_LIBRARY\_PATH

# Installation of Oracle Client in Windows

Go to the link:

<https://www.oracle.com/database/technologies/oracle12c-windows-downloads.html>

Download:

Oracle Database 12c Release 2 Client (12.2.0.1.0) for Microsoft Windows (x64)