Hands-On with Apache Airflow

Session 2

SESSION OVERVIEW

01 Airflow setup/installation on EC2 instance

02 Main motivations behind various operators in Airflow

03 Airflow CLI and UI walkthrough

04 Airflow operators and their demonstrations

INSTALL AIRFLOW ON EC2 INSTANCE

1. Login to your ec2 instance
2. In the ec2-user (not the root user) run the following commands:
3. wget https://airflow-installation.s3.amazonaws.com/Install-airflow.sh
4. chmod 777 Install-airflow.sh
5. bash -x Install-airflow.sh
6. source airflow/bin/activate (your are in the airflow venv with most services already running)
7. airflow -h (to check the airflow is installed properly)
8. (to start/stop or check status of certain airflow services use this command and follow the instructions in the file)wget https://airflow-installation.s3.amazonaws.com/Running+Airflow+UI

IMPORTANT CONFIGRATIONS

- When you first setup airflow, it creates a file called airflow.cfg
- This file contains Airflow's configurations which can be easily edited to better suit ones requirements
- You can see these configurations from the CLI using:
  - **airflow config** command

IMPORTANT CONFIGRATIONS

Config Name	Description	Sample Values
dags_folder	• The folder where your airflow pipelines live • This path must be absolute	/home/ubuntu/airflow/dags
executor	• The type of executor that airflow should use. • Choices include SequentialExecutor, LocalExecutor, CeleryExecutor	CeleryExecutor
sql_alchemy_conn	• The SqlAlchemy connection string to the metadata database	postgresql+psycopg2://airflow:airflow@localhost/airflow
parallelism	• The amount of parallelism as a setting to the executor • This defines the max number of task instances that should run simultaneously for the airflow installation	32
dag_concurrency	• The number of task instances allowed to run concurrently by the scheduler	16
max_active_runs_per_dag	• The maximum number of active DAG runs per DAG	16
base_url	• The base URL of your website as airflow cannot guess what domain or cname you are using.	http://localhost:8080
broker_url	• The Celery broker URL. Celery supports RabbitMQ, Redis and experimentally a sqlalchemy database.	redis://127.0.0.1:6379/1

OPERATORS IN AIRFLOW

- Operators **determine what actually gets done** by a task.
- Operators describe **a single task in a workflow** which can be a shell script, a Hive query, a Python function etc.
- The DAG ensures that operators run in the correct order
- They may run on two completely different machines.
- Airflow has a feature of **operator cross communication** known as **Xcom**, which allows two operators to combine or share resources or files
- Operators are only loaded by Airflow if they are assigned to a DAG.

OPERATOR DEFINITION

```
# Import modules related to DAG and operators
from airflow import DAG
from airflow.operators.python_operator import PythonOperator
from airflow.operators.hive_operator import HiveOperator

# Create a DAG object with necessary configs
ml_dag = DAG('sample', description='Python ML',
          schedule_interval='0 12 * * *',
          start_date=datetime(2017, 3, 20))

# Create task objects with desired task operators
hive_task = HiveOperator(task_id='load_hive_tables', dag=ml_dag, ...)
python_task = PythonOperator(task_id='get_query_result', dag=ml_dag, ...)

# Create task dependencies
hive_task >> python_task
```

BASH OPERATOR

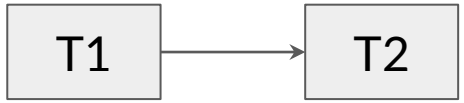
- The **BashOperator** is used for running any Shell command or script with your DAG.
- It is one of the most versatile and widely used operators in Airflow
- Arguments:
  - **task_id :** The ID for the task
  - **bash_command :** The shell command/script to be executed
  - **dag :** The DAG to which this task belongs

PYTHON OPERATOR

- The **PythonOperator** is used to execute Python callables.
- Arguments:
  - **python_callable :** the function name to be called
  - **op_args/op_kwargs :** to pass additional arguments to the Python callable

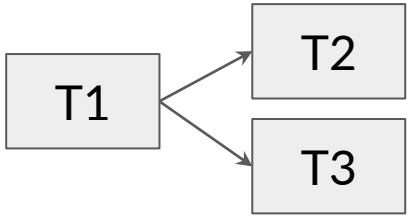
TASK DEPENDENCIES

- If task T1 should finish before T2 starts, you can do this using:
  - T1.set_downstream(T2)
  - T1 >> T2
  - T2.set_upstream(T1)
  - T2 << T1



- You can also define a chain of dependencies at once:
  - T1 >> T2 >> T3 instead of T1 >> T2 and T2 >> T3

- You can set multiple dependencies at once:
  - T1 >> [T2, T3]



PYTHON OPERATOR DAG

SQOOP OPERATOR

- The **SqoopOperator** is used to execute a Sqoop job
- It is usually used to transfer data between RDBMS and HDFS
- Arguments :
  - **conn_id :** connection ID
  - **table :** MySQL table name
  - **cmd_type :** Command type
  - **target_dir :** Target directory for HDFS

HIVE OPERATOR

- The **HiveOperator** is used to connect to Hive using hive_conn_id and execute Hive queries
- Arguments:
  - **hql :** Hive query to be executed
  - **hive_cli_conn_id :** Hive connection

SPARK OPERATOR

- The Spark operators are used to schedule spark jobs using Airflow
- **SparkSubmitOperator** launches Spark using the spark-submit CLI on the airflow machine
- It supports all the configurations and arguments needed by spark-submit
- To run Spark SQL, we can make use of **SparkSqlOperator**
- Arguments for SparkSubmitOperator :
  - **application :** The application to be submitted as a job, either jar or py file
  - **conn_id :** Connection ID
  - **application_args:** Arguments for the application being submitted

EMAIL OPERATOR

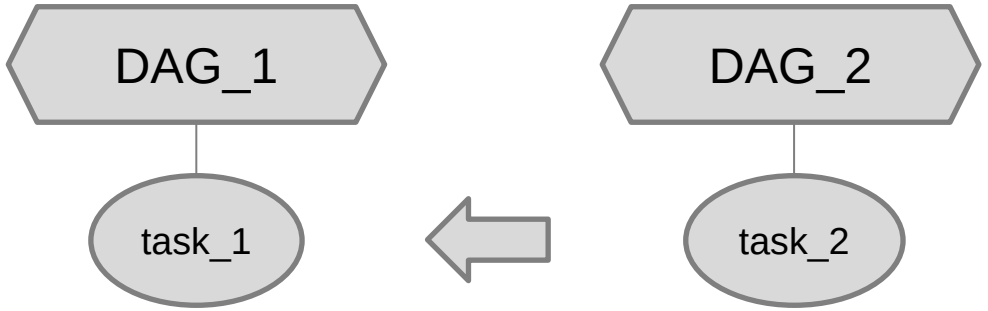
- The **EmailOperator** is used for alerting task events like task completion, task failure, task retry, task fail on retry
- It is also used to send attachments along with emails with error messages or logs
- Arguments :
  - **to :** list of receiver emails
  - **subject :** subject for the email
  - **html_content :** content of the email, html markup is used
  - **files :** files to attach in the email

BASE OPERATOR

- The **BaseOperator** is the abstract base class for all operators, so data members and methods declared in this class available to all the operators
- It contains methods such as set_downstream() and set_upstream()
- You can create a custom operator by extending the **airflow.models.baseoperator.BaseOperator** and then overriding the execute() method
- Some important arguments received by the BaseOperator include :
  - task_id, owner, email, email_on_retry, retries, depends_on_past, dag, params, default_args, queue, sla, execution_timeout, on_failure_callback, on_success_callback, on_retry_callback, trigger_rule, run_as_user, task_concurrency, do_xcom_push

SENSOR OPERATOR

- Sensors are useful to check for a certain condition before we run a task.
- Eg: we have a task in a DAG depending on a task in another DAG or we have a task which should run only after a file has arrived in HDFS
- Sensor tasks continue to execute at a time interval and succeed when a criteria is met or fail when they timeout
- Arguments:
  - **soft_fail :** if True marks the task as SKIPPED on failure
  - **poke_interval**: interval between each try (> 1 minute recommended)
  - **timeout :** time before the sensor fails



SENSOR OPERATOR EXAMPLES

- **WebHdfsSensor**
  - Waits for a file or folder to land in HDFS
- **ExternalTaskSensor**
  - Waits for a different DAG or a task in a different DAG to complete for a specific execution_date
- **TimeDeltaSensor**
  - Waits for a timedelta after the task's execution_date +schedule_interval
- **TimeSensor**
  - Waits until the specified time of the day

SESSION SUMMARY

01 Airflow Setup

02 Airflow Configurations

03 UI Walkthrough

04 Operators in Airflow with individual demonstrations

THANK YOU