HandsOn – **Apache Airflow**

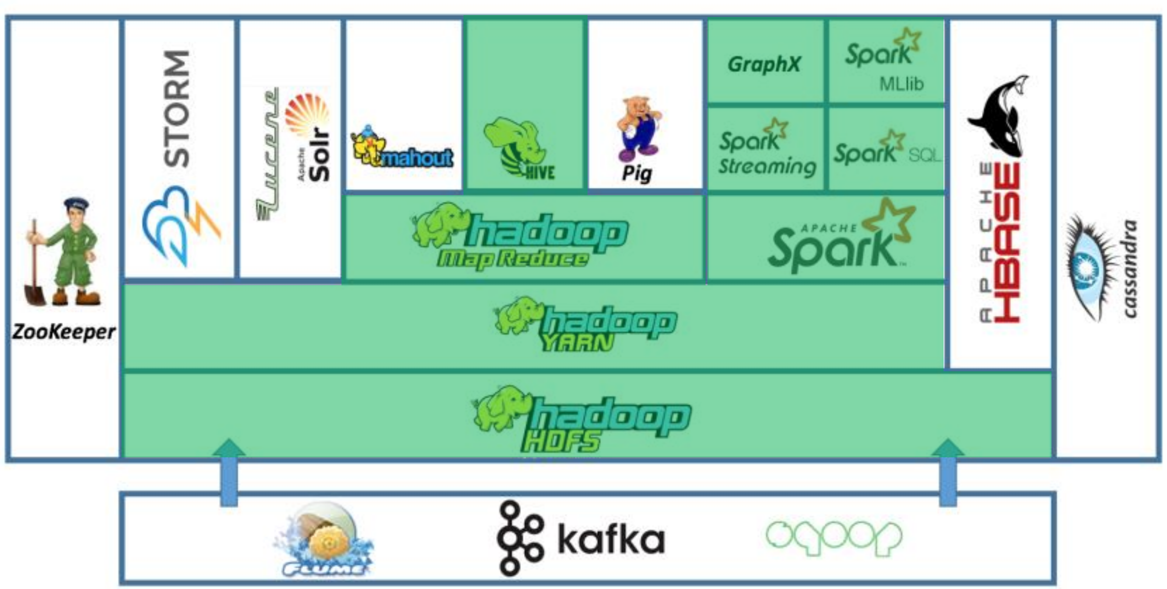
A quick Introduction to ETL Workflow with Apache Airflow

The Hadoop Ecosystem

pentaho

Airflow

Today's (exercise) focus



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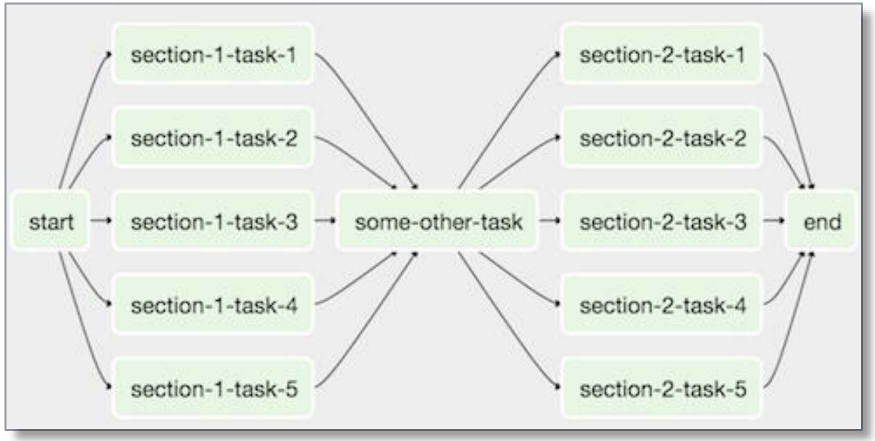
Airflow

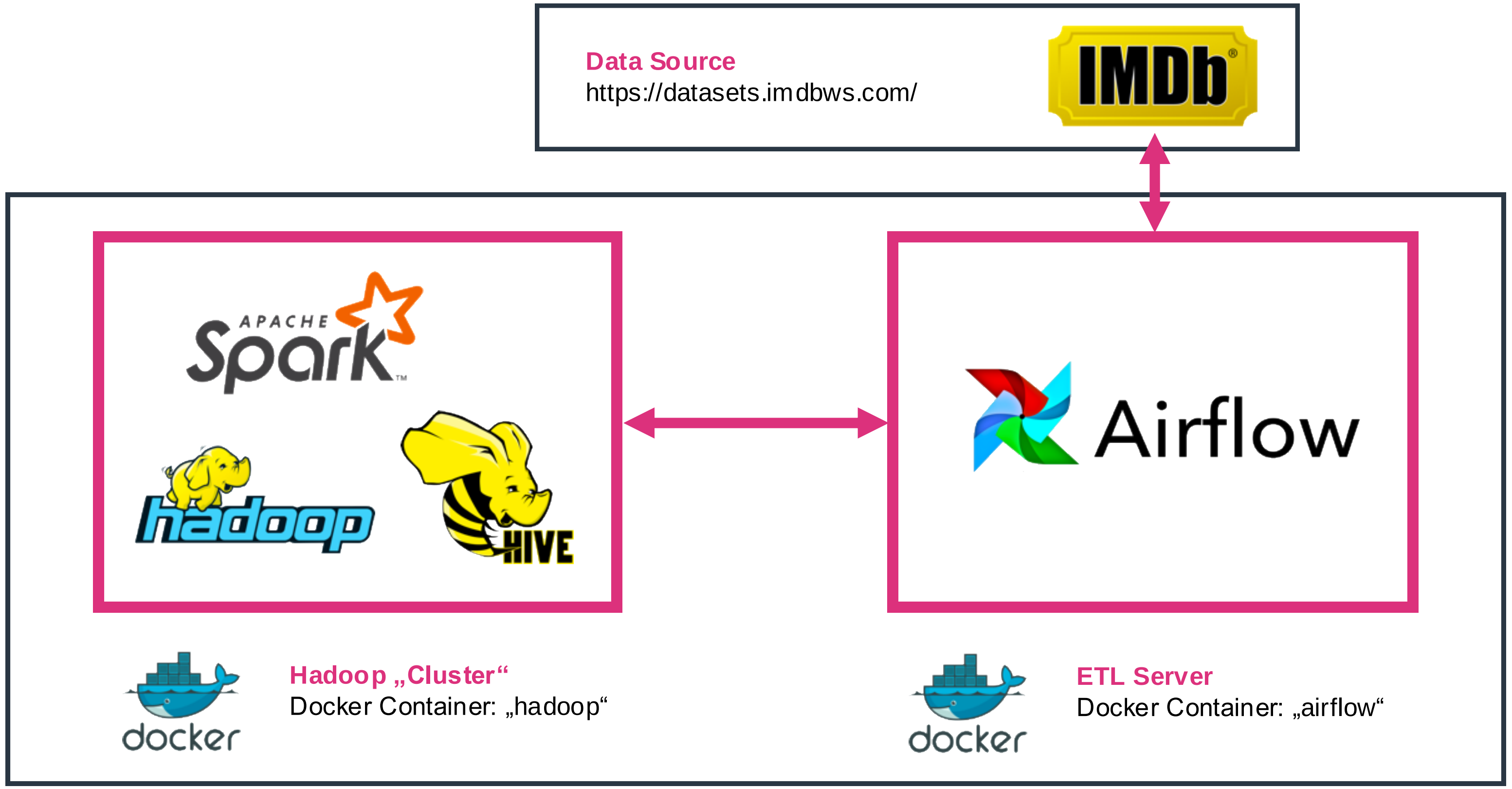
- Apache Open Source Project
- Model Task (e.g. ETL) Workflows
- Python Code Base
- Scheduling, Queues and Pools
- Cluster Ready
- Web UI

- DAG = **Directed Acyclic Graph**



→ a collection of all the tasks you want to run, organized in a way that reflects their relationships and dependencies.

What do we want to do?



Gcloud Server (Connected to via SSH)

Remove Previously created Docker Container

1. Stop and Remove Images:

(This will delete all files you created within previous exercise.
Save them somewhere outside the docker container, if you haven‘t done yet.)

```
docker stop hadoop
docker rm hadoop
```

```
docker stop pentaho
docker rm pentaho
```

Start Hadoop/Hive/Spark Docker Container

1. Pull Docker Image:

```
docker pull marcelmittelstaedt/spark_base:latest
```

2. Start Docker Image:

```
docker run -dit --name hadoop \
          -p 8088:8088 -p 9870:9870 -p 9864:9864 -p 10000:10000 \
          -p 8032:8032 -p 8030:8030 -p 8031:8031 -p 9000:9000 \
          -p 8888:8888 --net bigdatanet \
          marcelmittelstaedt/spark_base:latest
```

3. Wait till first Container Initialization finished:

```
docker logs hadoop

[…]
Stopping nodemanagers
Stopping resourcemanager
Container Startup finished.
```

Start Hadoop/Hive/Spark Docker Container

4. Get into Docker container:

```
docker exec -it hadoop bash
```

5. Switch to hadoop user:

```
sudo su hadoop
```

```
cd
```

6. Start Hadoop Cluster:

```
start-all.sh
```

7. Start HiveServer2:

```
hiveserver2
```

Start Hadoop/Hive/Spark Docker Container

8. Start HiveServer2:

```
hive/bin/hiveserver2

2018-10-02 16:19:08: Starting HiveServer2
SLF4J: Class path contains multiple SLF4J bindings.
SLF4J: Found binding in [jar:file:/home/hadoop/hive/lib/log4j-slf4j-impl-2.10.0.jar!/org/slf4
j/impl/StaticLoggerBinder.class]
SLF4J: Found binding in [jar:file:/home/hadoop/hadoop/share/hadoop/common/lib/slf4j-log4j12-1
.7.25.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: See http://www.slf4j.org/codes.html#multiple_bindings for an explanation.
SLF4J: Actual binding is of type [org.apache.logging.slf4j.Log4jLoggerFactory]
Hive Session ID = b8d1efb3-fc8c-4ec8-bdf0-6a9a41e2ddaa
Hive Session ID = 32503981-a5fd-497e-b887-faf3ec1e686e
Hive Session ID = 00f7eab4-5a29-4ce4-ad97-e90904d9206f
Hive Session ID = 100e54c5-14c6-4acc-b398-040152b08ebf
[…]
```

Start ETL (Airflow) Docker Container

1. Pull Docker Image:

```
docker pull marcelmittelstaedt/airflow:latest
```

2. Start Docker Image:

```
docker run -dit --name airflow \
          -p 8080:8080 \
          --net bigdatanet \
          marcelmittelstaedt/airflow:latest
```

3. Wait till first Container Initialization finished:

```
docker logs airflow

[…]
Successfully added `conn_id`=spark : spark://:@yarn:

Container Startup finished.
```

Start ETL (Airflow) Docker Container

4. Get into Docker container:

```
docker exec -it airflow bash
```

5. Switch to airflow user:

```
sudo su airflow
```

```
cd
```

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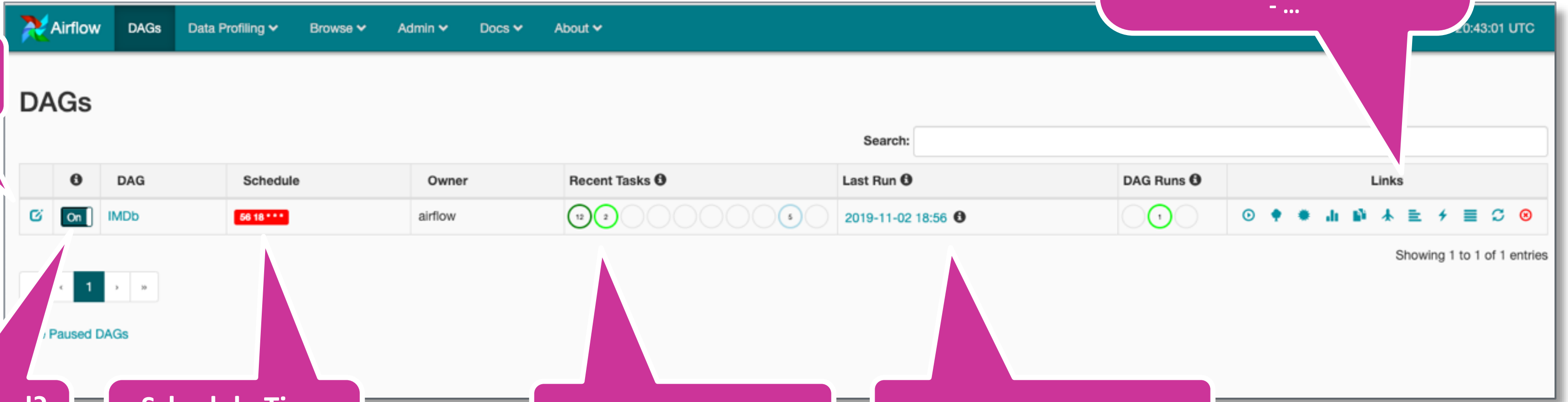
Exercises Preparation II

Airflow First Steps/Dag

Spoon Interface

Airflow Landing Page http://xxx.xxx.xxx.xxx:8080/admin/



DAGs

Search:

		DAG	Schedule	Owner	Recent Tasks	Last Run	DAG Runs	Links
	On	IMDb	56 18 * * *	airflow	12 2 5	2019-11-02 18:56	1	

Showing 1 to 1 of 1 entries

‹ 1 › »

Paused DAGs

DAGs

Quick Links to e.g.:
- Trigger Dag
- View Dag
- View Execution Logs
- View Code
- …

DAG scheduled? (on/off)

Schedule Time (Cron)

Recent Executions

Last Execution of DAG

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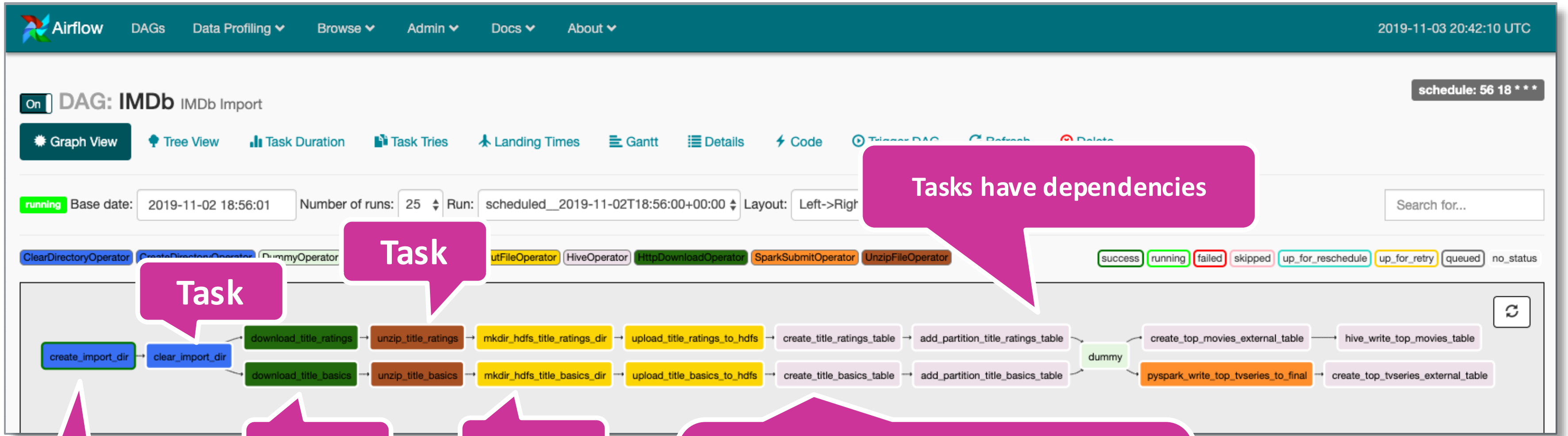
Spoon Interface

Graph View:



running Base date: 2019-11-02 18:56:01 Number of runs: 25 Run: scheduled__2019-11-02T18:56:00+00:00 Layout: Left->Righ

Tasks have dependencies

Task

Task

Task

Task

...

Tasks are e.g.:
- Create (HDFS) Directory
- Execute HiveQuery
- Execute PySpark Job
- ...

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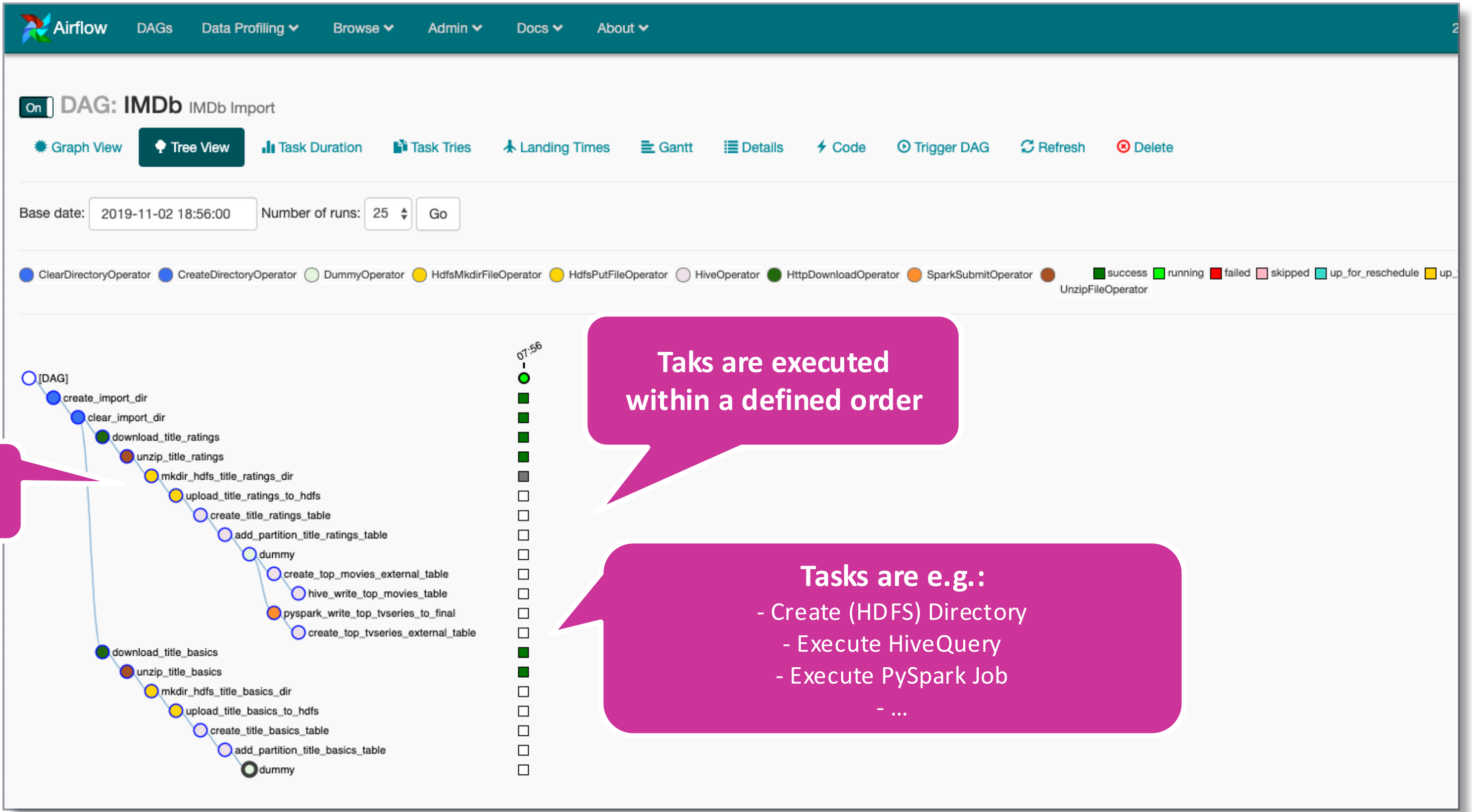
Spoon Interface

Tree View:



On DAG: IMDb IMDb Import

Graph View | Tree View | Task Duration | Task Tries | Landing Times | Gantt | Details | Code | Trigger DAG | Refresh | Delete

Base date: 2019-11-02 18:56:00 Number of runs: 25 Go

● ClearDirectoryOperator ● CreateDirectoryOperator ● DummyOperator ● HdfsMkdirFileOperator ● HdfsPutFileOperator ● HiveOperator ● HttpDownloadOperator ● SparkSubmitOperator ● UnzipFileOperator

🟩 success 🟩 running 🟥 failed ▢ skipped ▢ up_for_reschedule ▢ up_

```
07:56
[DAG]
  create_import_dir
    clear_import_dir
      download_title_ratings
        unzip_title_ratings
          mkdir_hdfs_title_ratings_dir
            upload_title_ratings_to_hdfs
              create_title_ratings_table
                add_partition_title_ratings_table
                  dummy
                    create_top_movies_external_table
                      hive_write_top_movies_table
                    pyspark_write_top_tvseries_to_final
                      create_top_tvseries_external_table
      download_title_basics
        unzip_title_basics
          mkdir_hdfs_title_basics_dir
            upload_title_basics_to_hdfs
              create_title_basics_table
                add_partition_title_basics_table
                  dummy
```

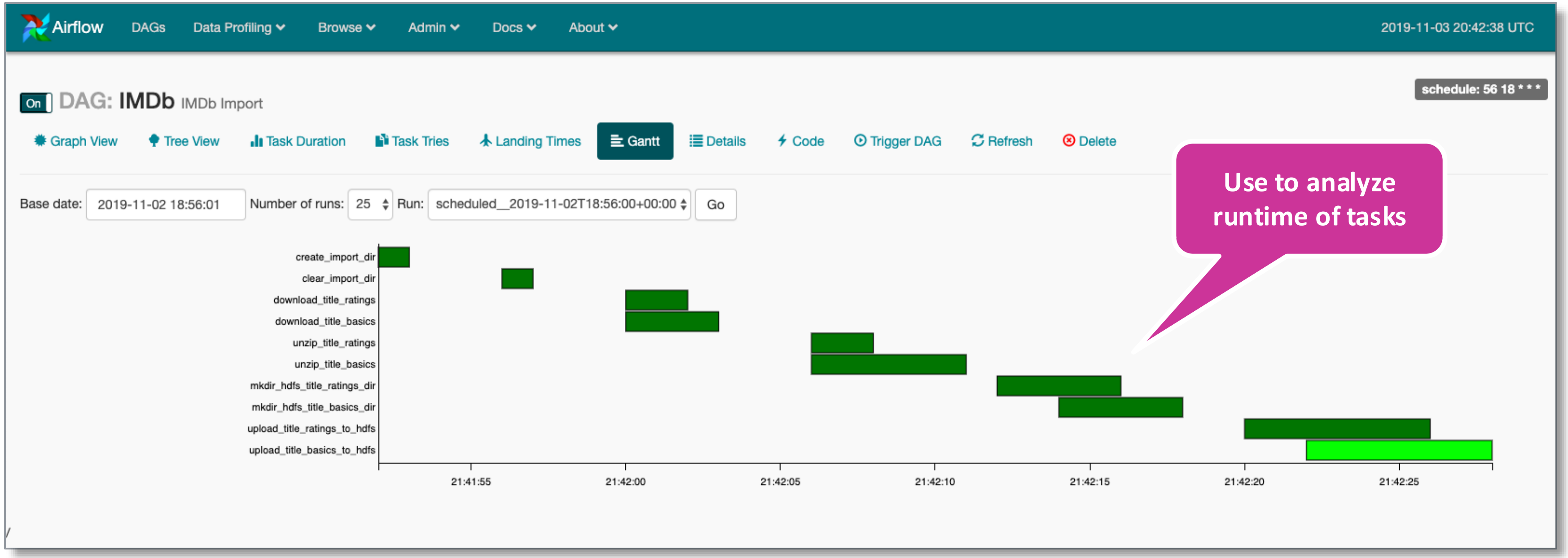
Tasks have dependencies

Taks are executed within a defined order

Tasks are e.g.:
- Create (HDFS) Directory
- Execute HiveQuery
- Execute PySpark Job
- ...

Spoon Interface

Gantt View:

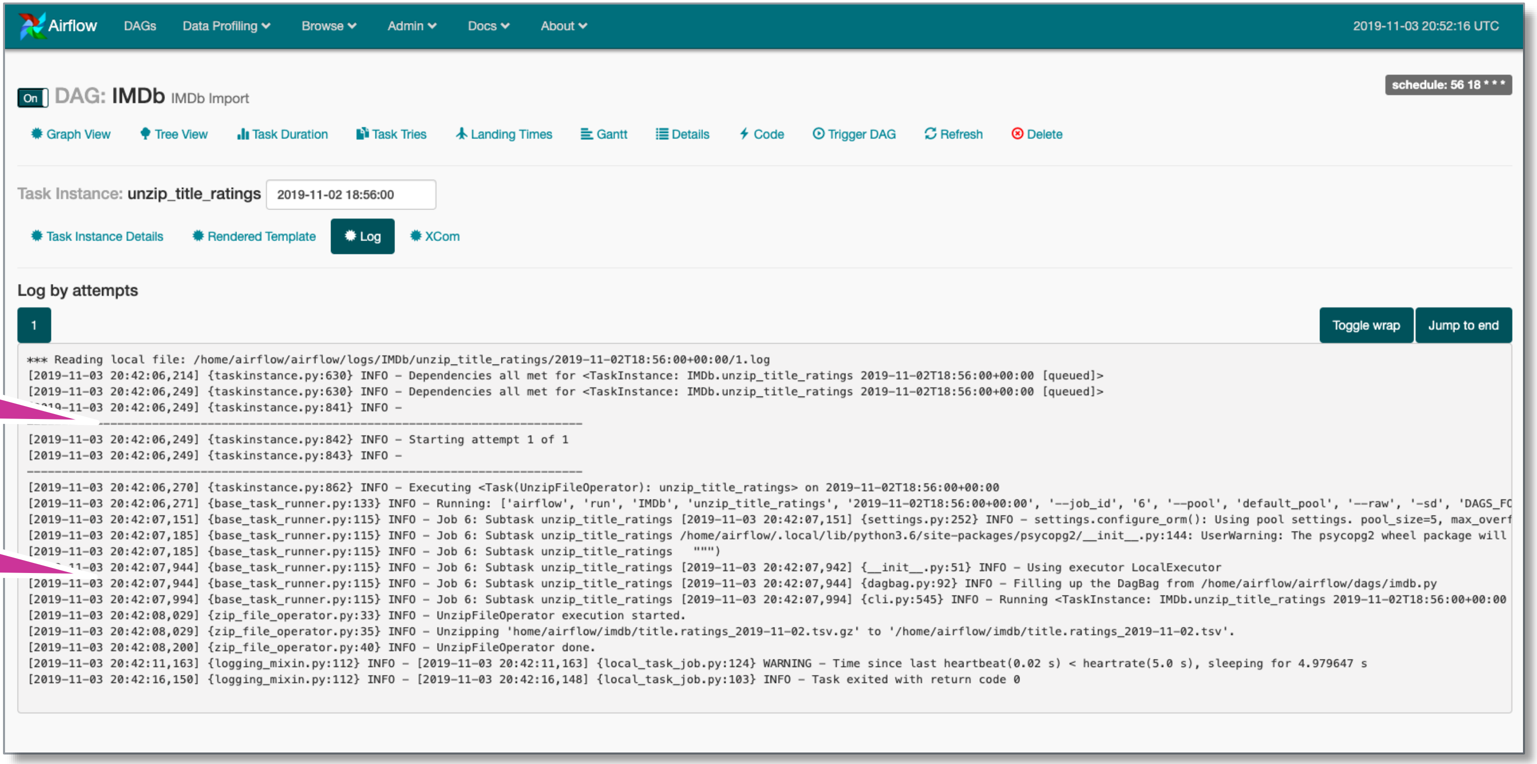


Base date: 2019-11-02 18:56:01 Number of runs: 25 Run: scheduled__2019-11-02T18:56:00+00:00

Use to analyze runtime of tasks

Spoon Interface

Logs View:



```
*** Reading local file: /home/airflow/airflow/logs/IMDb/unzip_title_ratings/2019-11-02T18:56:00+00:00/1.log
[2019-11-03 20:42:06,214] {taskinstance.py:630} INFO - Dependencies all met for <TaskInstance: IMDb.unzip_title_ratings 2019-11-02T18:56:00+00:00 [queued]>
[2019-11-03 20:42:06,249] {taskinstance.py:630} INFO - Dependencies all met for <TaskInstance: IMDb.unzip_title_ratings 2019-11-02T18:56:00+00:00 [queued]>
[2019-11-03 20:42:06,249] {taskinstance.py:841} INFO -
--------------------------------------------------------------------------------
[2019-11-03 20:42:06,249] {taskinstance.py:842} INFO - Starting attempt 1 of 1
[2019-11-03 20:42:06,249] {taskinstance.py:843} INFO -
--------------------------------------------------------------------------------
[2019-11-03 20:42:06,270] {taskinstance.py:862} INFO - Executing <Task(UnzipFileOperator): unzip_title_ratings> on 2019-11-02T18:56:00+00:00
[2019-11-03 20:42:06,271] {base_task_runner.py:133} INFO - Running: ['airflow', 'run', 'IMDb', 'unzip_title_ratings', '2019-11-02T18:56:00+00:00', '--job_id', '6', '--pool', 'default_pool', '--raw', '-sd', 'DAGS_FC
[2019-11-03 20:42:07,151] {base_task_runner.py:115} INFO - Job 6: Subtask unzip_title_ratings [2019-11-03 20:42:07,151] {settings.py:252} INFO - settings.configure_orm(): Using pool settings. pool_size=5, max_overf
[2019-11-03 20:42:07,185] {base_task_runner.py:115} INFO - Job 6: Subtask unzip_title_ratings /home/airflow/.local/lib/python3.6/site-packages/psycopg2/__init__.py:144: UserWarning: The psycopg2 wheel package will
[2019-11-03 20:42:07,185] {base_task_runner.py:115} INFO - Job 6: Subtask unzip_title_ratings   """)
[2019-11-03 20:42:07,944] {base_task_runner.py:115} INFO - Job 6: Subtask unzip_title_ratings [2019-11-03 20:42:07,942] {__init__.py:51} INFO - Using executor LocalExecutor
[2019-11-03 20:42:07,944] {base_task_runner.py:115} INFO - Job 6: Subtask unzip_title_ratings [2019-11-03 20:42:07,944] {dagbag.py:92} INFO - Filling up the DagBag from /home/airflow/airflow/dags/imdb.py
[2019-11-03 20:42:07,994] {base_task_runner.py:115} INFO - Job 6: Subtask unzip_title_ratings [2019-11-03 20:42:07,994] {cli.py:545} INFO - Running <TaskInstance: IMDb.unzip_title_ratings 2019-11-02T18:56:00+00:00
[2019-11-03 20:42:08,029] {zip_file_operator.py:33} INFO - UnzipFileOperator execution started.
[2019-11-03 20:42:08,029] {zip_file_operator.py:35} INFO - Unzipping 'home/airflow/imdb/title.ratings_2019-11-02.tsv.gz' to '/home/airflow/imdb/title.ratings_2019-11-02.tsv'.
[2019-11-03 20:42:08,200] {zip_file_operator.py:40} INFO - UnzipFileOperator done.
[2019-11-03 20:42:11,163] {logging_mixin.py:112} INFO - [2019-11-03 20:42:11,163] {local_task_job.py:124} WARNING - Time since last heartbeat(0.02 s) < heartrate(5.0 s), sleeping for 4.979647 s
[2019-11-03 20:42:16,150] {logging_mixin.py:112} INFO - [2019-11-03 20:42:16,148] {local_task_job.py:103} INFO - Task exited with return code 0
```

Use for Debugging

Each Task has it's own Log

Create Simple Example DAG

1. Open Dag File:

```
vi /home/airflow/airflow/dags/example_dag.py
```

```
from airflow import DAG
from airflow.operators.bash_operator import BashOperator
from datetime import datetime, timedelta

args = {
    'owner': 'airflow'
}

dag = DAG('ExampleDAG', default_args=args, description='Simple Example DAG',
          schedule_interval='56 18 * * *',
          start_date=datetime(2019, 10, 16), catchup=False, max_active_runs=1)

task_1 = BashOperator(
    task_id='print_date',
    bash_command='date',
    dag=dag)

task_2 = BashOperator(
    task_id='sleep',
    bash_command='sleep 5',
    retries=3,
    dag=dag)

task_1 >> task_2
```

DAG Definition, e.g.
- Name
- Schedule Interval (Cron)
- Description
- Start date
- …

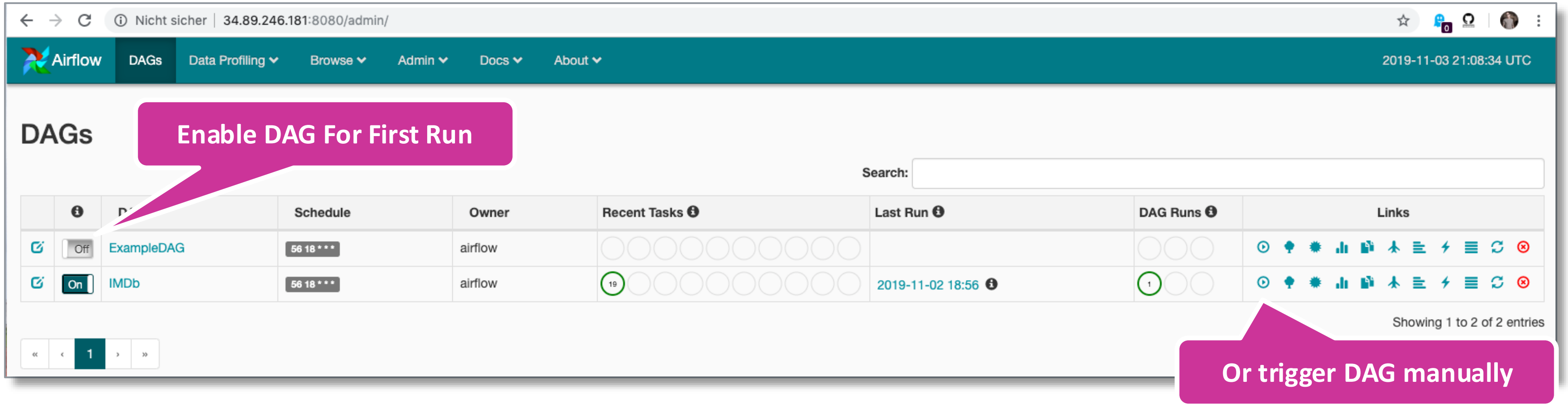
Task 1

Task 2

Task Execution Order
task_2 is dependent on **task_1**

Spoon Interface

Execute DAG:



DAGs

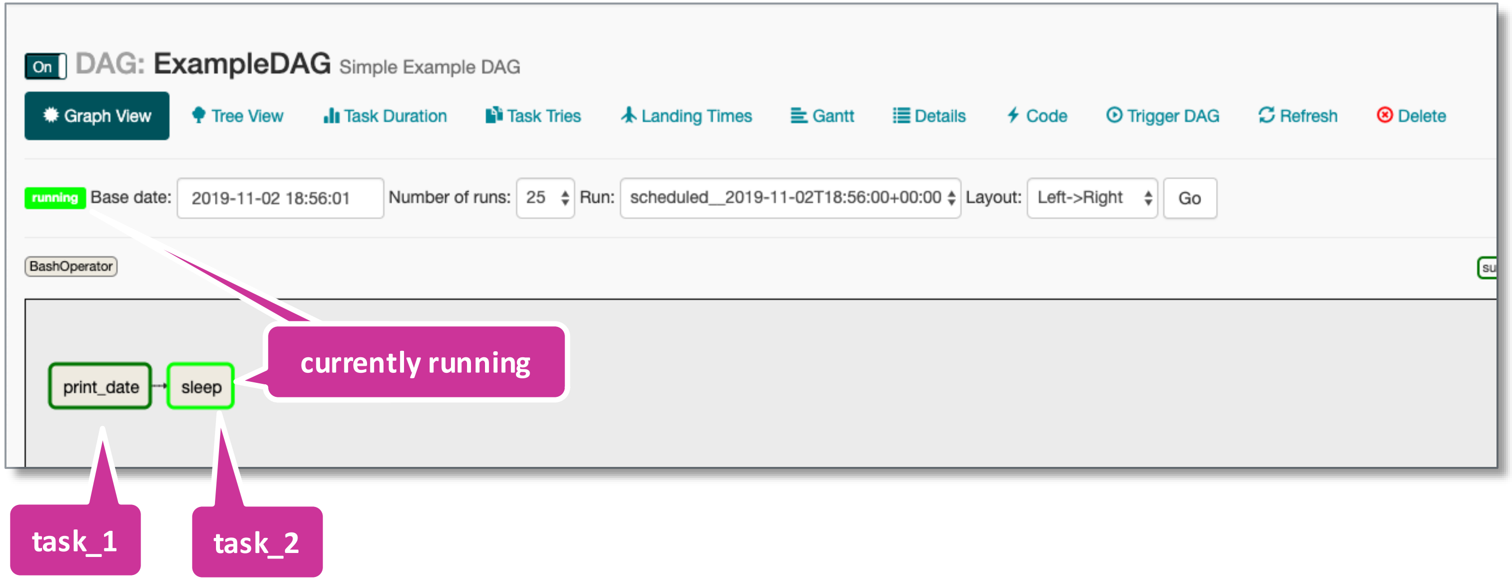
Search:

		DAG	Schedule	Owner	Recent Tasks	Last Run	DAG Runs	Links
	Off	ExampleDAG	56 18 * * *	airflow				
	On	IMDb	56 18 * * *	airflow	19	2019-11-02 18:56	1	

Showing 1 to 2 of 2 entries

Spoon Interface

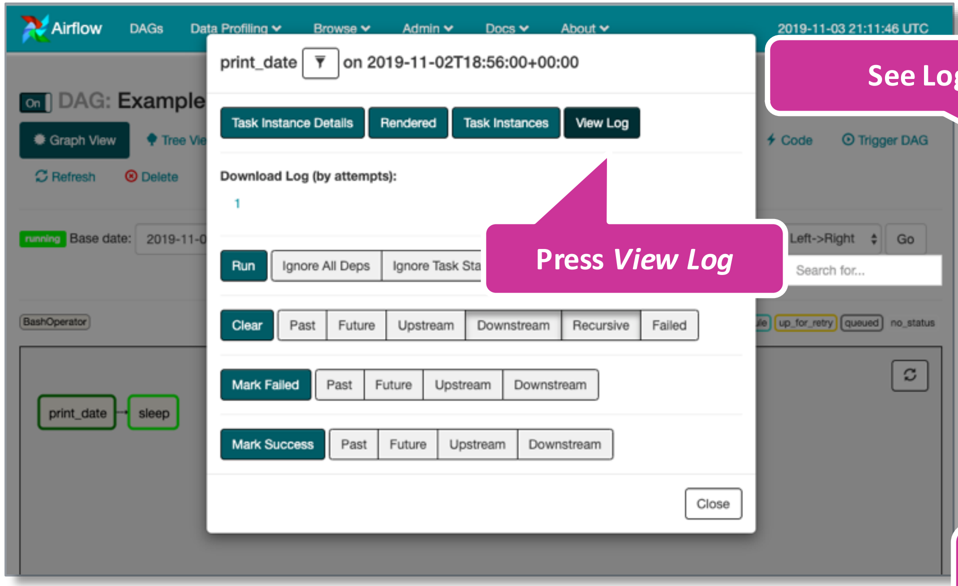
See executing DAG:



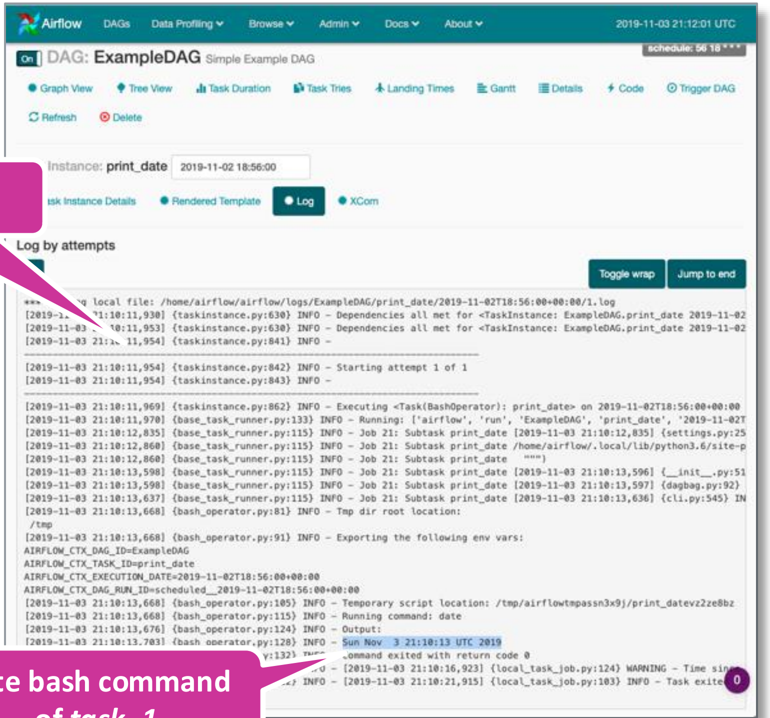
running Base date: 2019-11-02 18:56:01 Number of runs: 25 Run: scheduled__2019-11-02T18:56:00+00:00 Layout: Left->Right Go

Spoon Interface

View Log of task *print_date*:



Press *View Log*



```
***   g local file: /home/airflow/airflow/logs/ExampleDAG/print_date/2019-11-02T18:56:00+00:00/1.log
[2019-1    21:10:11,930] {taskinstance.py:630} INFO - Dependencies all met for <TaskInstance: ExampleDAG.print_date 2019-11-02
[2019-11-03    10:11,953] {taskinstance.py:630} INFO - Dependencies all met for <TaskInstance: ExampleDAG.print_date 2019-11-02
[2019-11-03 21:1   11,954] {taskinstance.py:841} INFO -
--------------------------------------------------------------------------------
[2019-11-03 21:10:11,954] {taskinstance.py:842} INFO - Starting attempt 1 of 1
[2019-11-03 21:10:11,954] {taskinstance.py:843} INFO -
--------------------------------------------------------------------------------
[2019-11-03 21:10:11,969] {taskinstance.py:862} INFO - Executing <Task(BashOperator): print_date> on 2019-11-02T18:56:00+00:00
[2019-11-03 21:10:11,970] {base_task_runner.py:133} INFO - Running: ['airflow', 'run', 'ExampleDAG', 'print_date', '2019-11-02T
[2019-11-03 21:10:12,835] {base_task_runner.py:115} INFO - Job 21: Subtask print_date [2019-11-03 21:10:12,835] {settings.py:25
[2019-11-03 21:10:12,860] {base_task_runner.py:115} INFO - Job 21: Subtask print_date /home/airflow/.local/lib/python3.6/site-p
[2019-11-03 21:10:12,860] {base_task_runner.py:115} INFO - Job 21: Subtask print_date   """)
[2019-11-03 21:10:13,598] {base_task_runner.py:115} INFO - Job 21: Subtask print_date [2019-11-03 21:10:13,596] {__init__.py:51
[2019-11-03 21:10:13,598] {base_task_runner.py:115} INFO - Job 21: Subtask print_date [2019-11-03 21:10:13,597] {dagbag.py:92}
[2019-11-03 21:10:13,637] {base_task_runner.py:115} INFO - Job 21: Subtask print_date [2019-11-03 21:10:13,636] {cli.py:545} IN
[2019-11-03 21:10:13,668] {bash_operator.py:81} INFO - Tmp dir root location:
 /tmp
[2019-11-03 21:10:13,668] {bash_operator.py:91} INFO - Exporting the following env vars:
AIRFLOW_CTX_DAG_ID=ExampleDAG
AIRFLOW_CTX_TASK_ID=print_date
AIRFLOW_CTX_EXECUTION_DATE=2019-11-02T18:56:00+00:00
AIRFLOW_CTX_DAG_RUN_ID=scheduled__2019-11-02T18:56:00+00:00
[2019-11-03 21:10:13,668] {bash_operator.py:105} INFO - Temporary script location: /tmp/airflowtmpassn3x9j/print_datevz2ze8bz
[2019-11-03 21:10:13,668] {bash_operator.py:115} INFO - Running command: date
[2019-11-03 21:10:13,676] {bash_operator.py:124} INFO - Output:
[2019-11-03 21:10:13,703] {bash_operator.py:128} INFO - Sun Nov  3 21:10:13 UTC 2019
                                      y:132} INFO - Command exited with return code 0
                                             O - [2019-11-03 21:10:16,923] {local_task_job.py:124} WARNING - Time sin
                                             } INFO - [2019-11-03 21:10:21,915] {local_task_job.py:103} INFO - Task exite
```

See Log

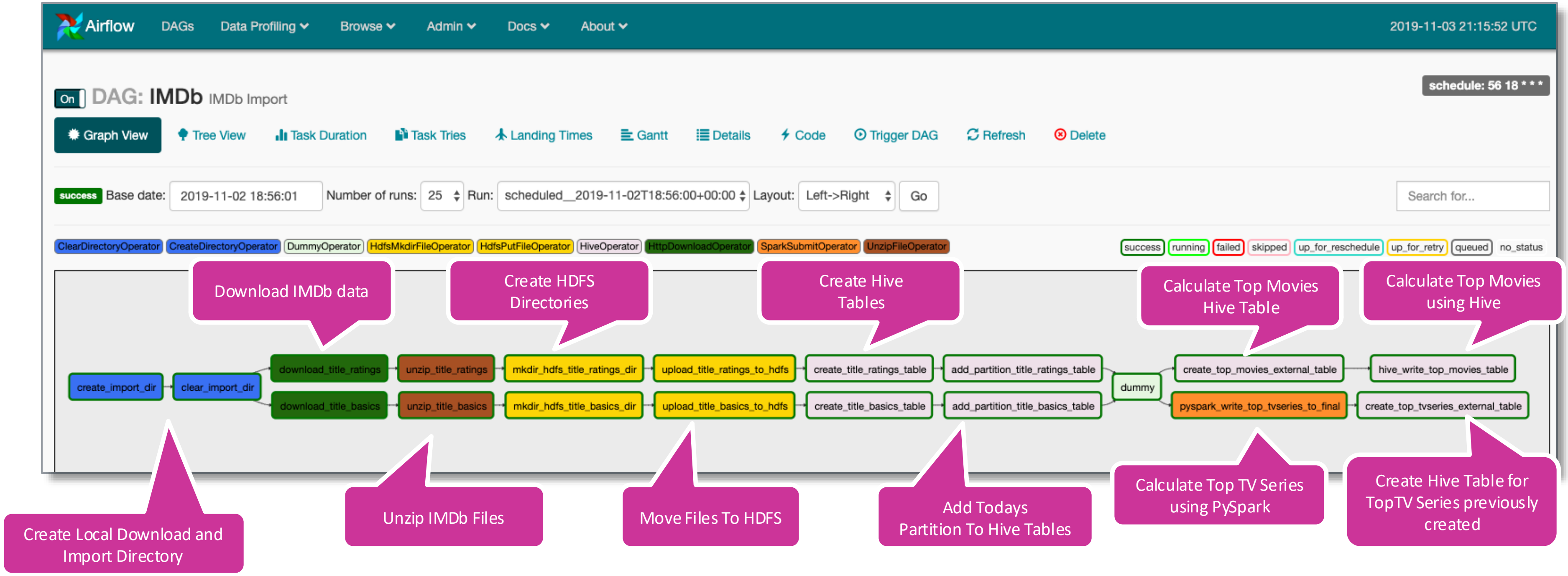
date bash command of *task_1*

Exercises II

Use Apache Airflow to solve exercises based on IMDb data

Spoon Interface

See executing DAG:



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Pentaho Data Integration Exercises – **IMDB**

1. Execute IMDb DAG

2. Use Airflow and previous IMDb DAG to do following changes (`vi /home/airflow/airflow/dags/imdb.py`):

   a) **Extend Airflow IMDb DAG** to also download ***name.basics.tsv.gz***

   b) **Extend Airflow IMDb DAG** to also import ***name.basics.tsv*** to HDFS
   raw layer.

   c) **Create Hive table *name_basics*** for ***name.basics.tsv*** in raw layer within DAG.
   Table should be partitioned by year, month and day of load date like the other tables.

   d) **Create table *actors*** and **extend IMDb Airflow DAG** to fill table using Hive or PySpark:
   - make use of all columns within table name_basics
   - add column ***alive*** which contains alive if actor is alive or dead if actor is dead
   - add column ***age*** which contains current age of actor (calculated by using birth and death year)

   e) Run DAG

Well Done

WE‘RE DONE

FOR

...TODAY

Stop Your VM Instances

```
gcloud compute instances stop big-data
```