

Introduction to Airflow

INTRODUCTION TO AIRFLOW IN PYTHON



Mike Metzger
Data Engineer

What is data engineering?

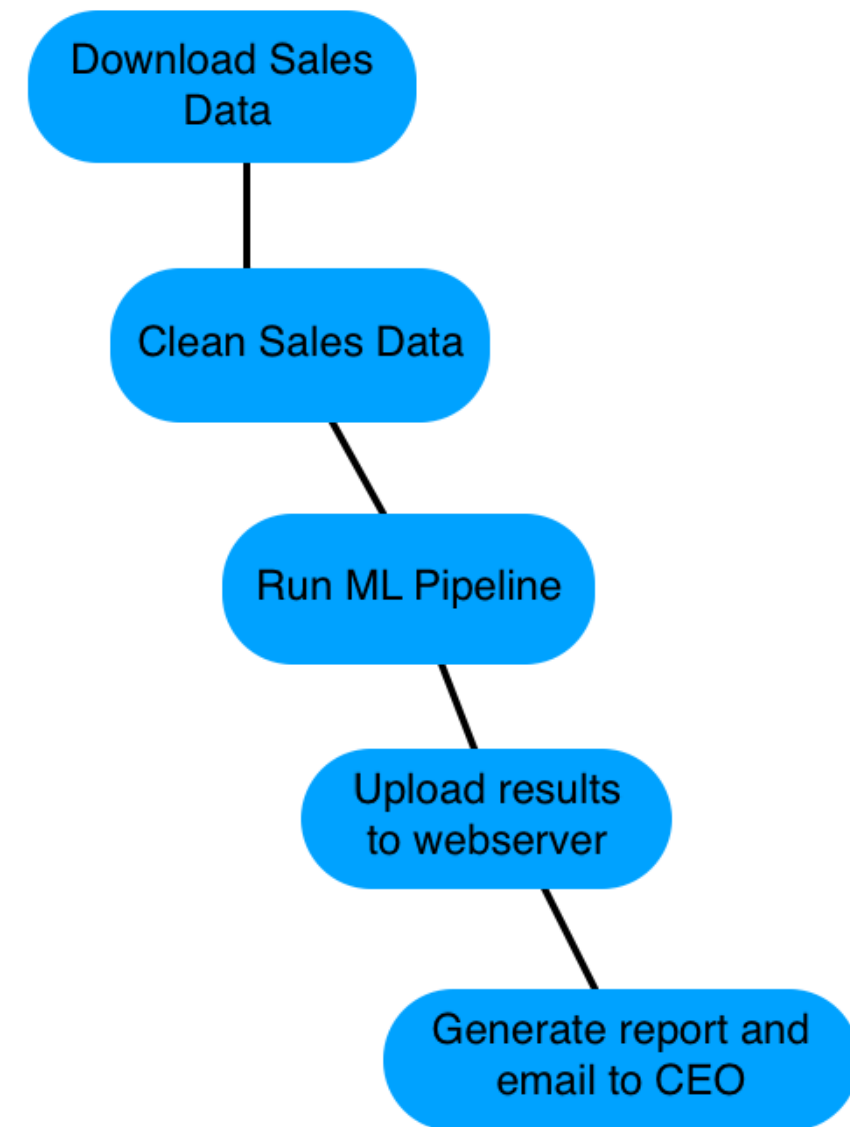
Data engineering is:

- Taking any action involving data and turning it into a reliable, repeatable, and maintainable process.

What is a workflow?

A *workflow* is:

- A set of steps to accomplish a given data engineering task
 - Such as: downloading files, copying data, filtering information, writing to a database, etc
- Of varying levels of complexity
- A term with various meaning depending on context



What is Airflow?

Airflow is a platform to program workflows, including:

- Creation
- Scheduling
- Monitoring



Airflow continued...

- Can implement programs from any language, but workflows are written in Python
- Implements workflows as DAGs: Directed Acyclic Graphs
- Accessed via code, command-line, or via web interface



¹ <https://airflow.apache.org/docs/stable/>

Other workflow tools

Other tools:

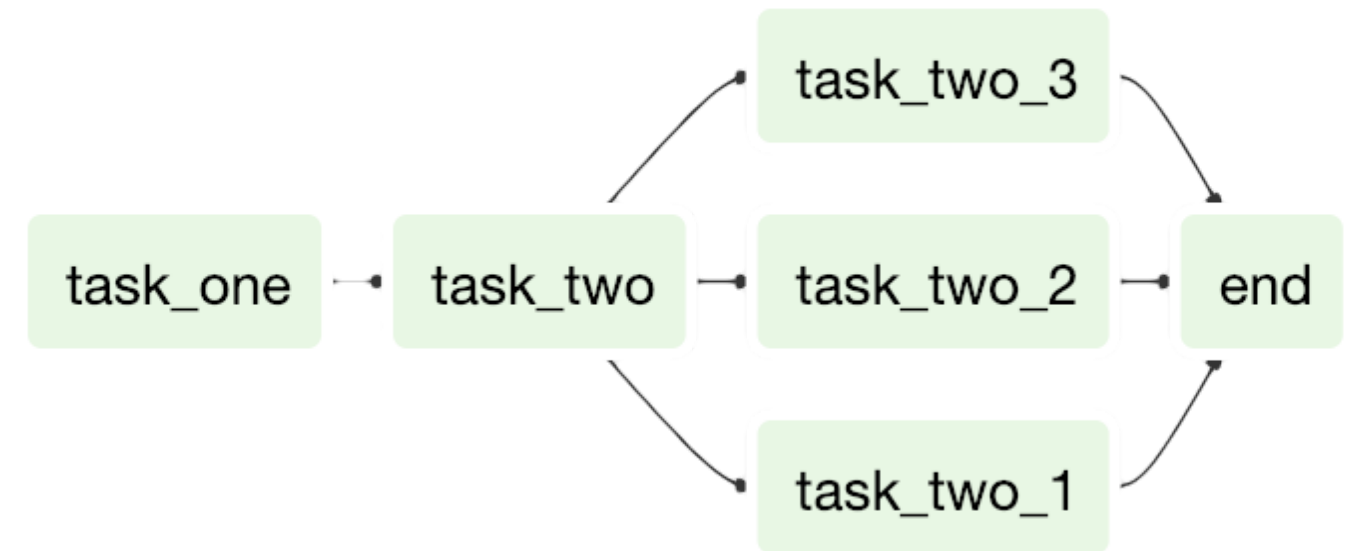
- Luigi
- SSIS
- Bash scripting



Quick introduction to DAGs

A *DAG* stands for *Directed Acyclic Graph*

- In Airflow, this represents the set of tasks that make up your workflow.
- Consists of the tasks and the dependencies between tasks.
- Created with various details about the DAG, including the name, start date, owner, etc.
- Further depth in the next lesson.



DAG code example

Simple DAG definition:

```
etl_dag = DAG(  
    dag_id='etl_pipeline',  
    default_args={"start_date": "2020-01-08"}  
)
```


Running a workflow in Airflow

Running a simple Airflow task

```
airflow run <dag_id> <task_id> <start_date>
```

Using a DAG named *example-etl*, a task named *download-file* and a start date of 2020-01-10:

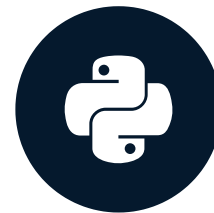
```
airflow run example-etl download-file 2020-01-10
```

Let's practice!

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Airflow DAGs

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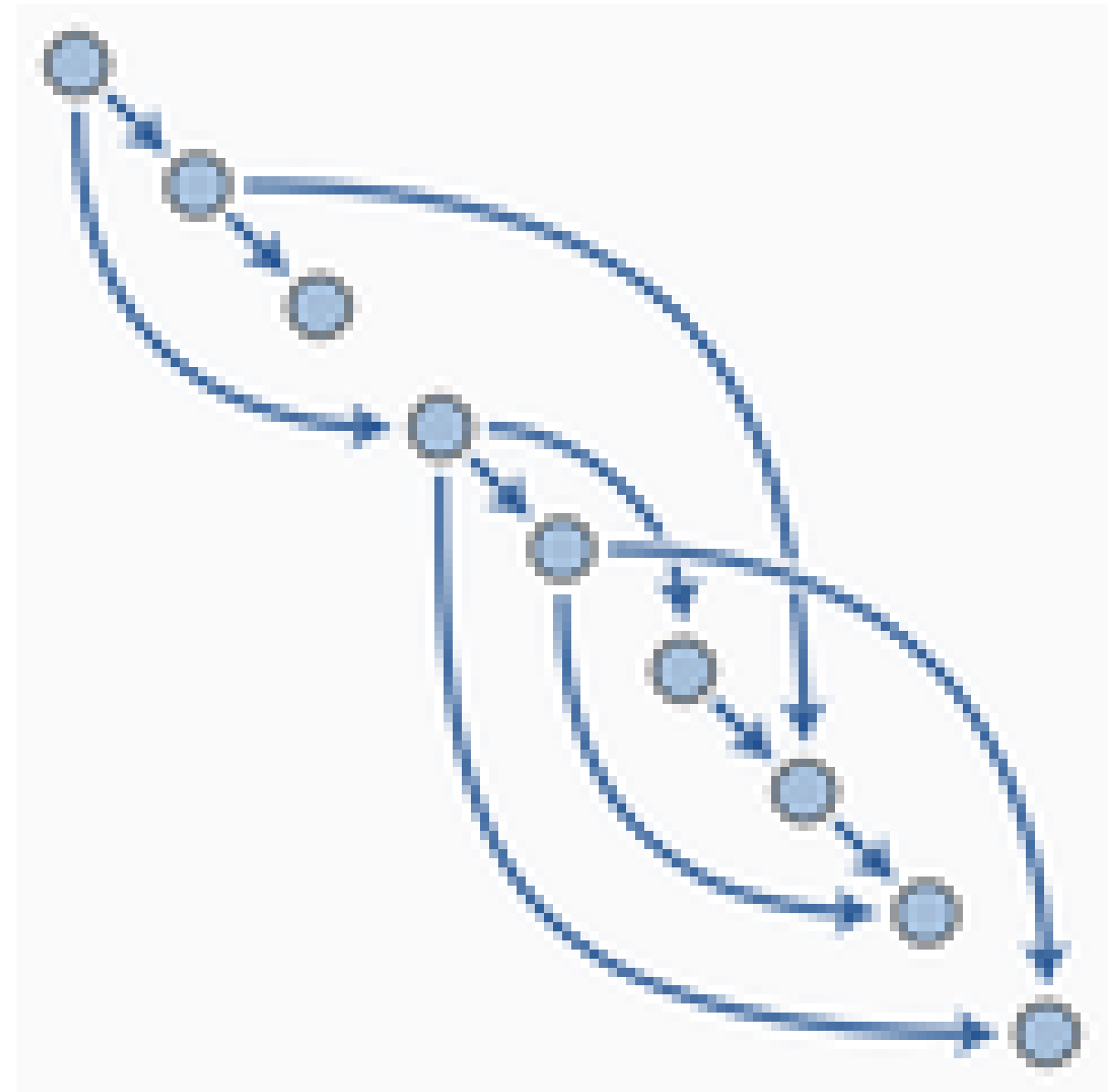


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What is a DAG?

DAG, or *Directed Acyclic Graph*:

- *Directed*, there is an inherent flow representing dependencies between components.
- *Acyclic*, does not loop / cycle / repeat.
- *Graph*, the actual set of components.
- Seen in Airflow, Apache Spark, Luigi



¹ https://en.m.wikipedia.org/wiki/Directed_acyclic_graph

DAG in Airflow

Within Airflow, DAGs:

- Are written in Python (but can use components written in other languages).
- Are made up of components (typically *tasks*) to be executed, such as operators, sensors, etc.
- Contain dependencies defined explicitly or implicitly.
 - ie, Copy the file to the server before trying to import it to the database service.

Define a DAG

Example DAG:

```
from airflow.models import DAG

from datetime import datetime
default_arguments = {
    'owner': 'jdoe',
    'email': 'jdoe@datacamp.com',
    'start_date': datetime(2020, 1, 20)
}

etl_dag = DAG( 'etl_workflow', default_args=default_arguments )
```

DAGs on the command line

Using `airflow`:

- The `airflow` command line program contains many subcommands.
- `airflow -h` for descriptions.
- Many are related to DAGs.
- `airflow list_dags` to show all recognized DAGs.

Command line vs Python

Use the command line tool to:

- Start Airflow processes
- Manually run DAGs / Tasks
- Get logging information from Airflow

Use Python to:

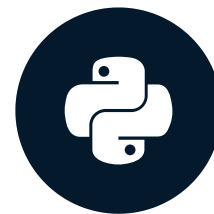
- Create a DAG
- Edit the individual properties of a DAG

Let's practice!

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Airflow web interface

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DAGs view

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DAGs

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DAGs

Search:

		DAG	Schedule	Owner	Recent Tasks 	Last Run 	DAG Runs 	Links
	<input type="checkbox"/> Off	example_dag	1 day, 0:00:00	airflow	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>		<div><div></div><div></div><div></div></div>	        
	<input type="checkbox"/> Off	update_state	1 day, 0:00:00	airflow	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>		<div><div></div><div></div><div></div></div>	        

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Hide Paused DAGs

DAGs view DAGs

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DAGs view schedule

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DAGs view owner

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DAGs

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Hide Paused DAGs

DAGs view recent tasks

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DAGs view last run

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DAGs

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DAGs view last three

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Data Profiling ▾

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DAGs view example_dag

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Search:

		DAG	Schedule	Owner	Recent Tasks 	Last Run 	DAG Runs 	Links
	 Off	example_dag	1 day, 0:00:00	airflow	          		  	       
	 Off	update_state	1 day, 0:00:00	airflow	          		  	       

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DAG detail view

 Airflow

DAGs

Data Profiling ▾

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Admin ▾

Docs ▾


About ▾


2020-01-22 14:24:46 UTC


Off


DAG: example_dag


schedule: 1 day, 0:00:00


 Graph View


 Tree View


 Task Duration


 Task Tries


 Landing Times


 Gantt

 Details

 Code

 Trigger DAG

 Refresh

 Delete


Base date:


Number of runs: 25 ▾

Go


☐ BashOperator

☒ success ☒ running ☒ failed ☒ skipped ☒ up_for_reschedule ☒ up_for_retry ☒ queued ☒ no_status

 [DAG]

 generate_random_number

DAG graph view

 Airflow

DAGs

Data Profiling ▾

Browse ▾

Admin ▾

Docs ▾


About ▾


2020-01-22 14:37:28 UTC


Off


DAAG: example_dag


schedule: 1 day, 0:00:00


 Graph View


 Tree View


 Task Duration


 Task Tries


 Landing Times


 Gantt

 Details

 Code

 Trigger DAG

 Refresh

 Delete

None

Base date: 2020-01-22 14:34:23

Number of runs: 25 ▾

Run: ▾

Layout: Left->Right ▾

Go

Search for...

BashOperator

success

running

failed

skipped


up_for_reschedule

up_for_retry


queued

no_status

generate_random_number



DAG code view

 Airflow

DAGs

Data Profiling ▾

Browse ▾

Admin ▾

Docs ▾

About ▾

2020-01-23 14:48:35 UTC

Off

DAG: example_dag

schedule: 1 day, 0:00:00

⚙ Graph View

🌳 Tree View

📊 Task Duration

📄 Task Tries

🛩 Landing Times

📅 Gantt

📋 Details

⚡ Code

▶ Trigger DAG

↻ Refresh


✖ Delete

example_dag

Toggle wrap

```
1 from airflow.models import DAG
2 from airflow.operators.bash_operator import BashOperator
3
4 dag = DAG(
5     dag_id = 'example_dag',
6     default_args={"start_date": "2019-10-01"}
7 )
8
9 part1 = BashOperator(
10     task_id='generate_random_number',
11     bash_command='echo $RANDOM',
12     dag=dag
13 )
14
```

Logs

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DAGs

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SLA Misses

Task Instances

Logs

Jobs

DAG Runs

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2020-02-04 22:00:32 UTC

Logs

List (4) [Add Filter ▾](#)

Id	Dttm	Dag Id	Task Id	Event	Execution Date	Owner	Extra
4	02-04T22:00:04.465529+00:00	example_dag		graph		anonymous	[('dag_id', 'example_dag'), ('execution_date', '')]
3	02-04T21:59:58.805269+00:00	example_dag		tree		anonymous	[('dag_id', 'example_dag')]
2	02-04T21:55:47.926018+00:00			cli_scheduler		repl	{"host_name": "2adf449f2e33", "full_command": "[/usr/local/bin/airflow",

Web UI vs command line

In most cases:

- Equally powerful depending on needs
- Web UI is easier
- Command line tool may be easier to access depending on settings

Let's practice!

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