데이터 관리론

Data Engineering with Apache Airflow

Data Engineering with Apache Airflow

Unleash the Power of Automation → Apach Airflow
https://www.youtube.com/watch?v=qNOGVu4v4xA&t=272s

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에어비앤비
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에어비앤비
회사

airbnb

에어비앤비는 2008년 8월 시작된 세계 최대의 숙박 공유 서비스이다. 자신의 방이나 집, 별장 등 사람이 지낼 수 있는 모든 공간을 임대할 수 있다. 2013년 기준, 192개국 3만 4800여 개 장소에 대한 숙박을 중개하고 있으며, 2초당 한 건 씩 예약이 이뤄지고 있다. 위키백과

주가: ABNB (NASDAQ) US$136.14 -0.86 (-0.63%)
12월 29일 오후 4:00 GMT-5 - 면책조항

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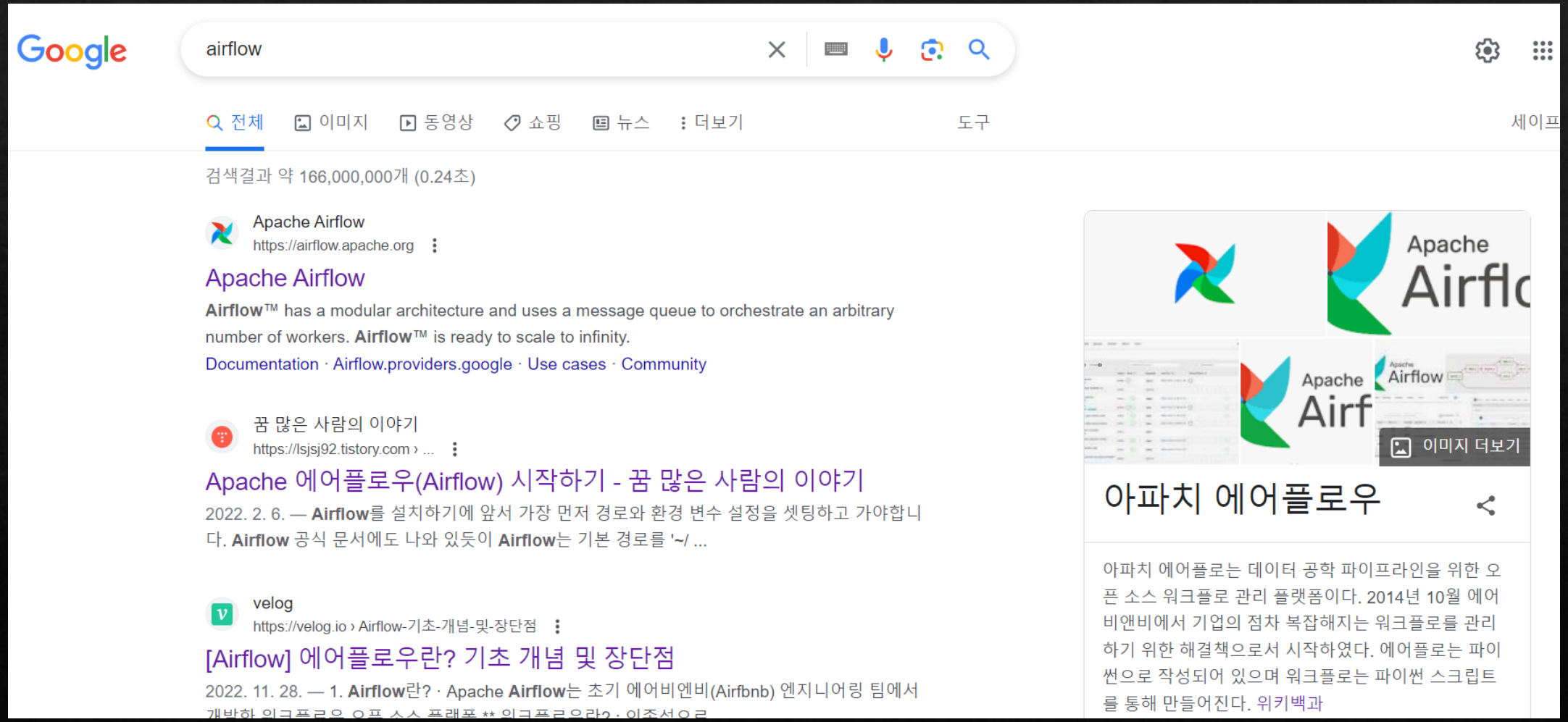
CEO: 브라이언 체스키 (2008년–)

창립자: 브라이언 체스키, 조 게비아, 네이선 블레차르지크

Apache Airflow



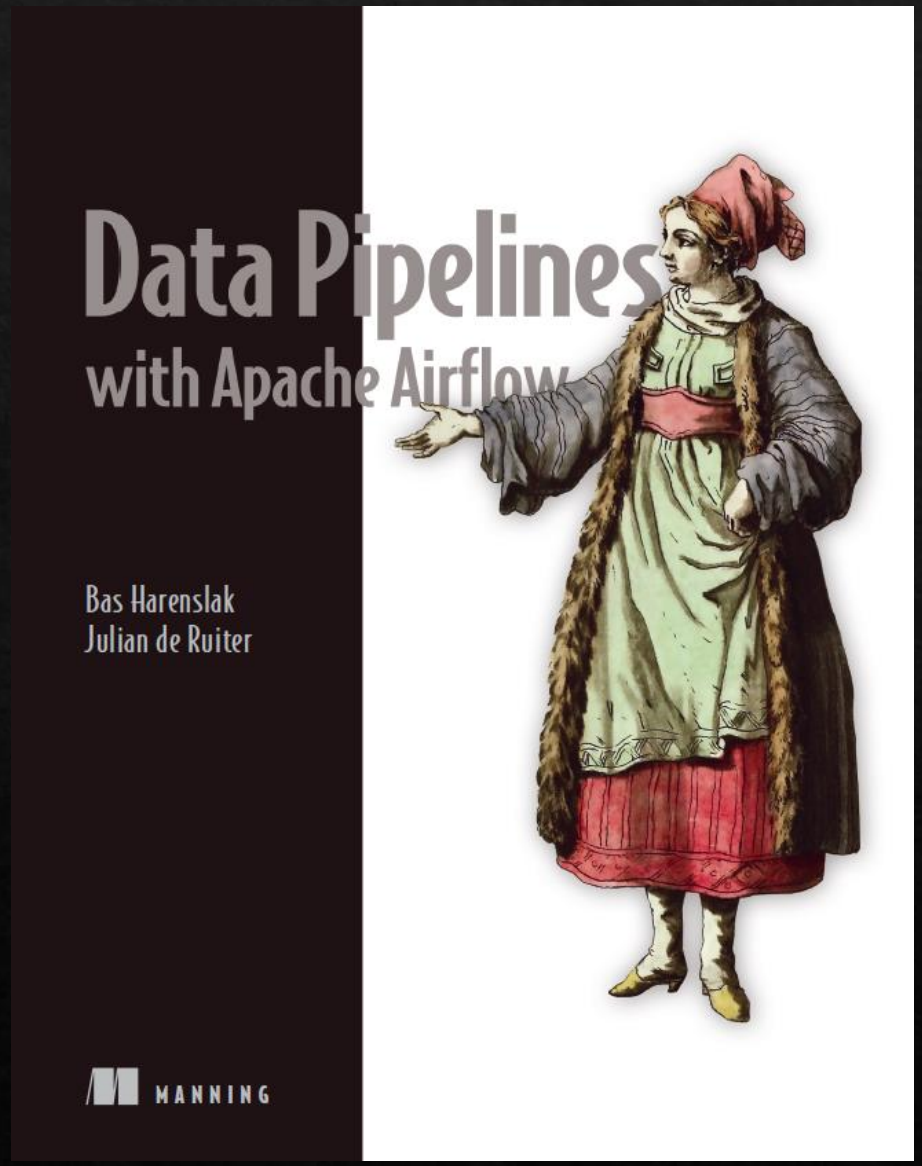
Apache Airflow

- Apache Airflow is an open-source workflow management platform for data engineering pipelines.
  - It started at Airbnb in October 2014[1] as a solution to manage the company's increasingly complex workflows.

- Apache Airflow, a **batch-oriented framework** for building **data pipelines.**

- Airflow is best thought of as a spider in a web: it sits in the middle of your data processes and **coordinates(orchestrates)** work happening across the different (distributed) systems.

The Book



brief contents

Meet Apache Airflow

- Introducing Data Pipelines
- Introducing Apache Airflow

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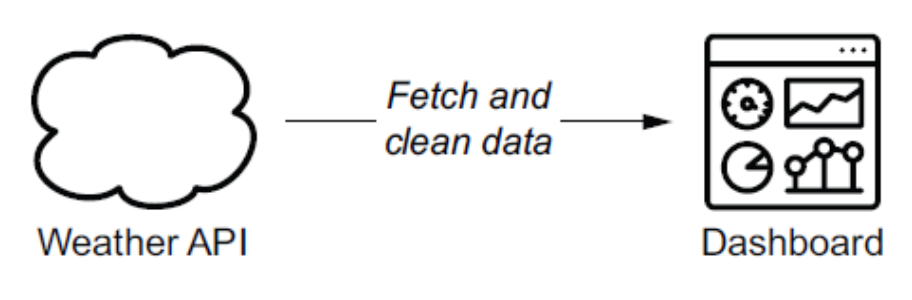
Introducing data pipelines

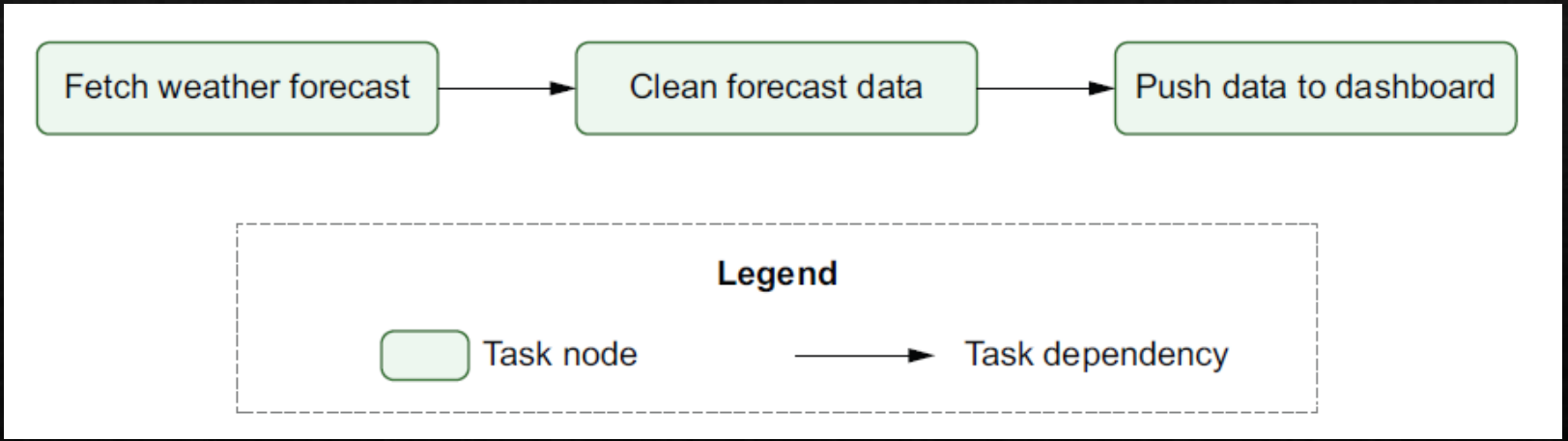
- To implement live weather dashboard, we need to perform something like the following steps:
  1. Fetch weather forecast data from a weather API.
  2. Clean or otherwise transform the fetched data (e.g., converting temperatures from Fahrenheit to Celsius or vice versa), so that the data suits our purpose.
  3. Push the transformed data to the weather dashboard.



- Overview of the weather dashboard use case, in which weather data is fetched from an external API and fed into a dynamic dashboard

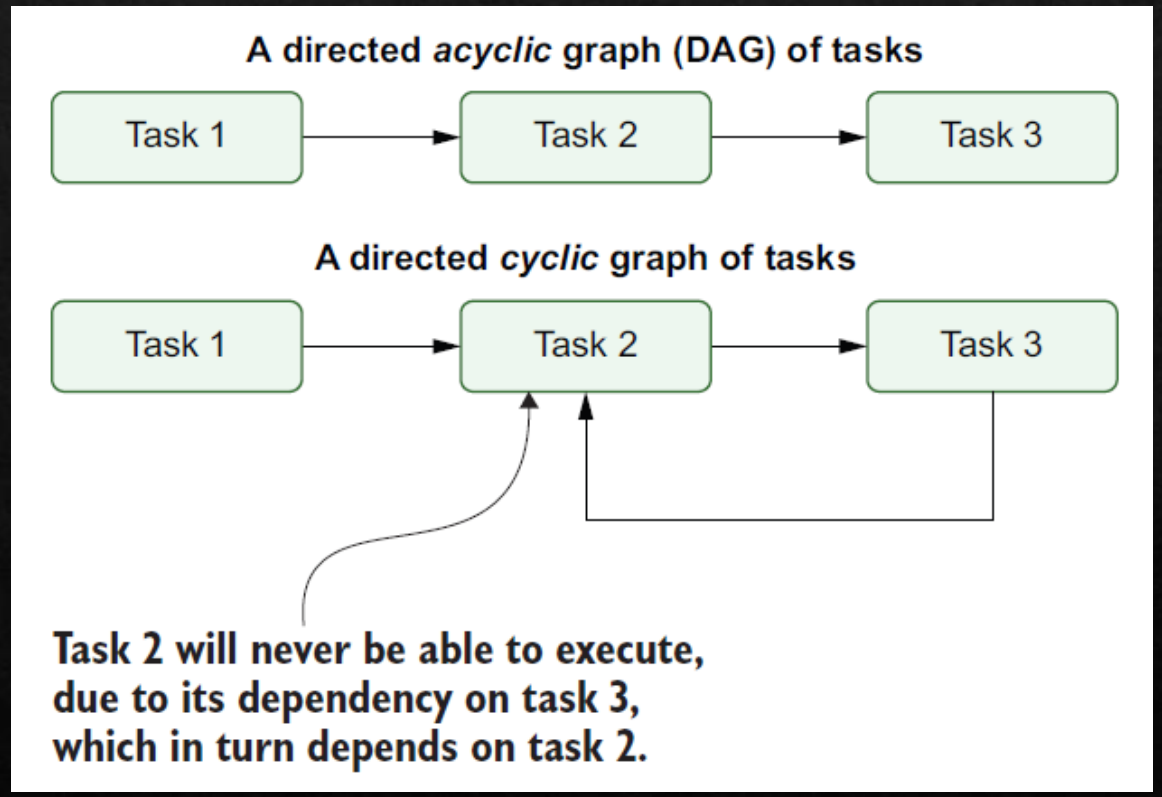
Data Pipelines as graphs

- Graph representation of the data pipeline for the weather dashboard.
  - Nodes represent tasks and directed edges represent dependencies between tasks (with an edge pointing from task A to task B, indicating that task A needs to be run before task B).



Directed Acyclic Graph (DAG)

- The graph contains directed edges and does not contain any loops or cycles (acyclic).



- Cycles in graphs prevent task execution due to circular dependencies.
- In acyclic graphs (top), there is a clear path to execute the three different tasks.
- However, in cyclic graphs (bottom), there is no longer a clear execution path due to the interdependency between tasks 2 and 3.

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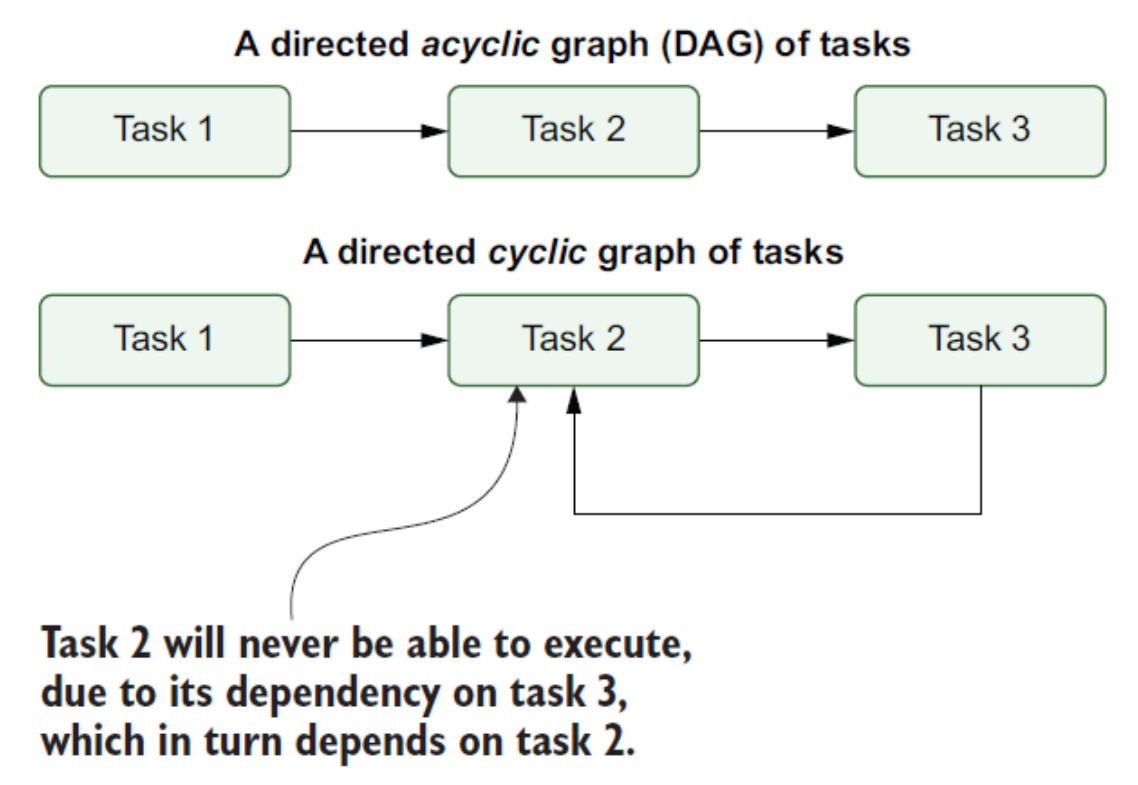

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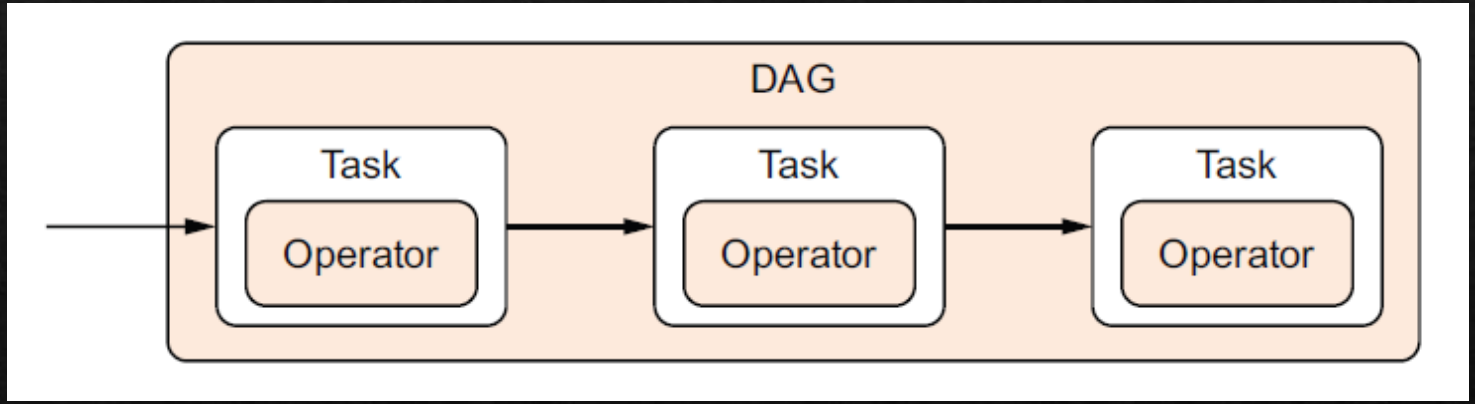
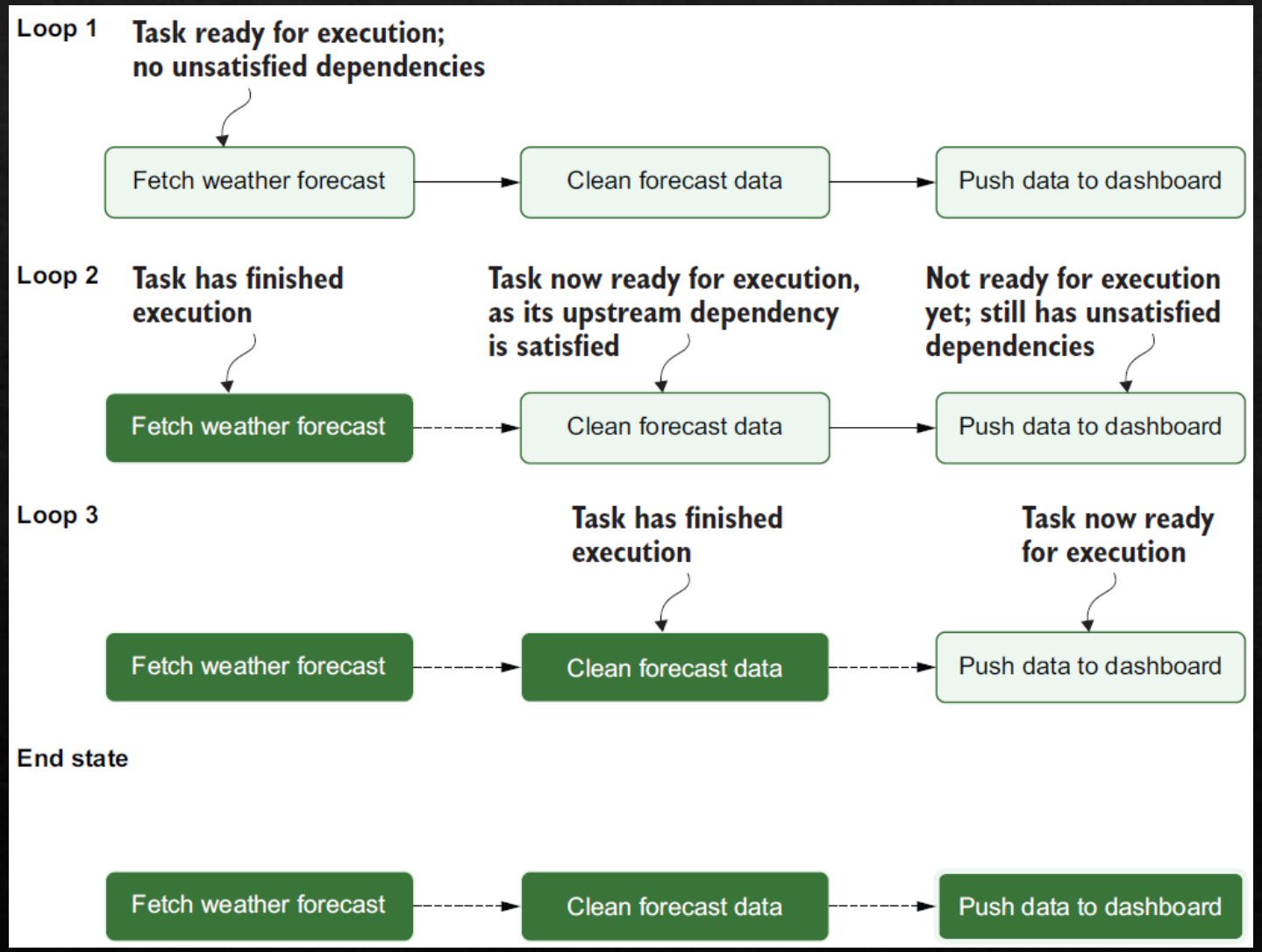
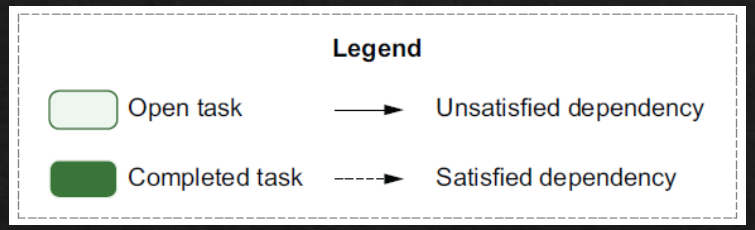
Task/Operator

- DAGs and operators are used by Airflow users. Tasks are internal components to manage operator state and display state changes (e.g., started/finished) to the user.



Pipeline graphs vs. sequential scripts

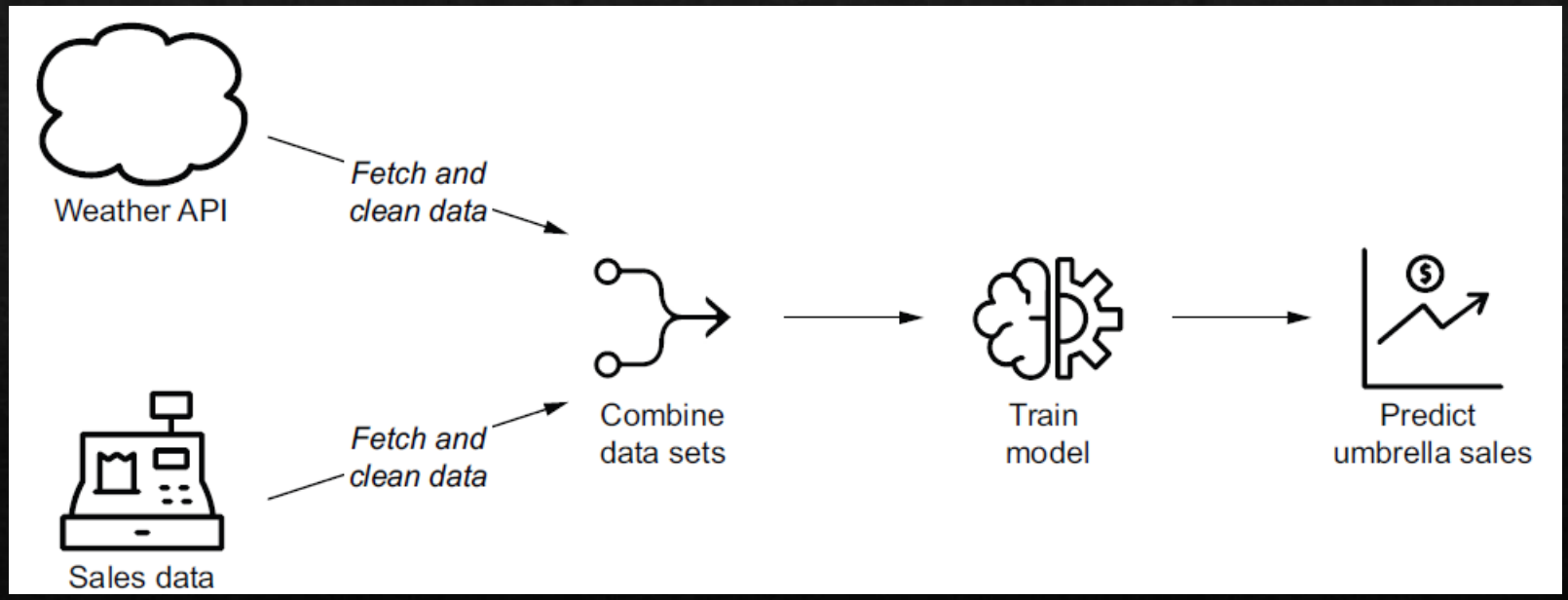




- Using the DAG structure to execute tasks in the data pipeline in the correct order: depicts each task's state during each of the loops through the algorithm, demonstrating how this leads to the completed execution of the pipeline (end state)

Pipeline graphs vs. sequential scripts

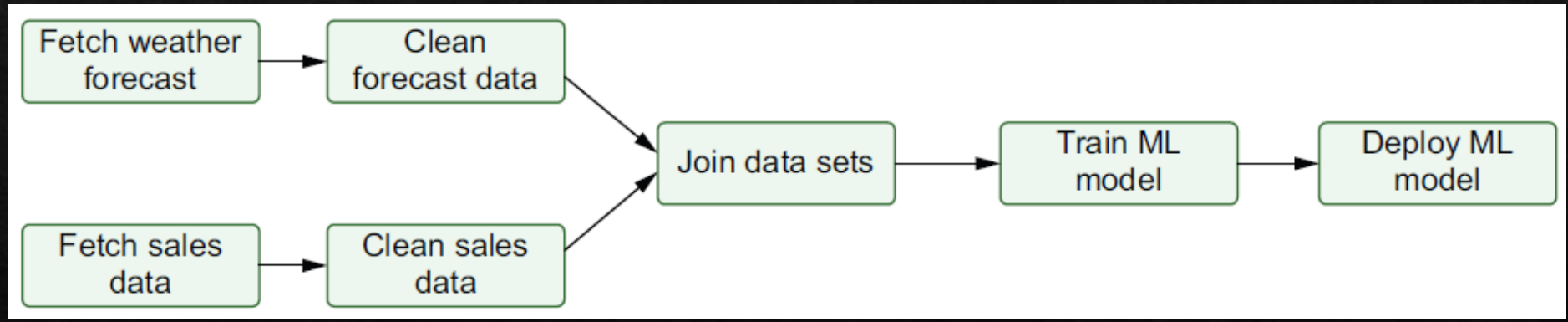
- To build a pipeline for training the ML model, we need to implement something like the following steps:



➢ Overview of the umbrella demand use case, in which historical weather and sales data are used to train a model that predicts future sales demands depending on weather forecasts

Divide-and-conquer algorithm

- A divide-and-conquer algorithm recursively breaks down a problem into two or more sub-problems of the same or related type, until these become simple enough to be solved directly.



- The useful property of the graph-based representation is that it clearly separates pipelines into small incremental tasks rather than having one monolithic script or process that does all the work.

Running pipeline using workflow managers

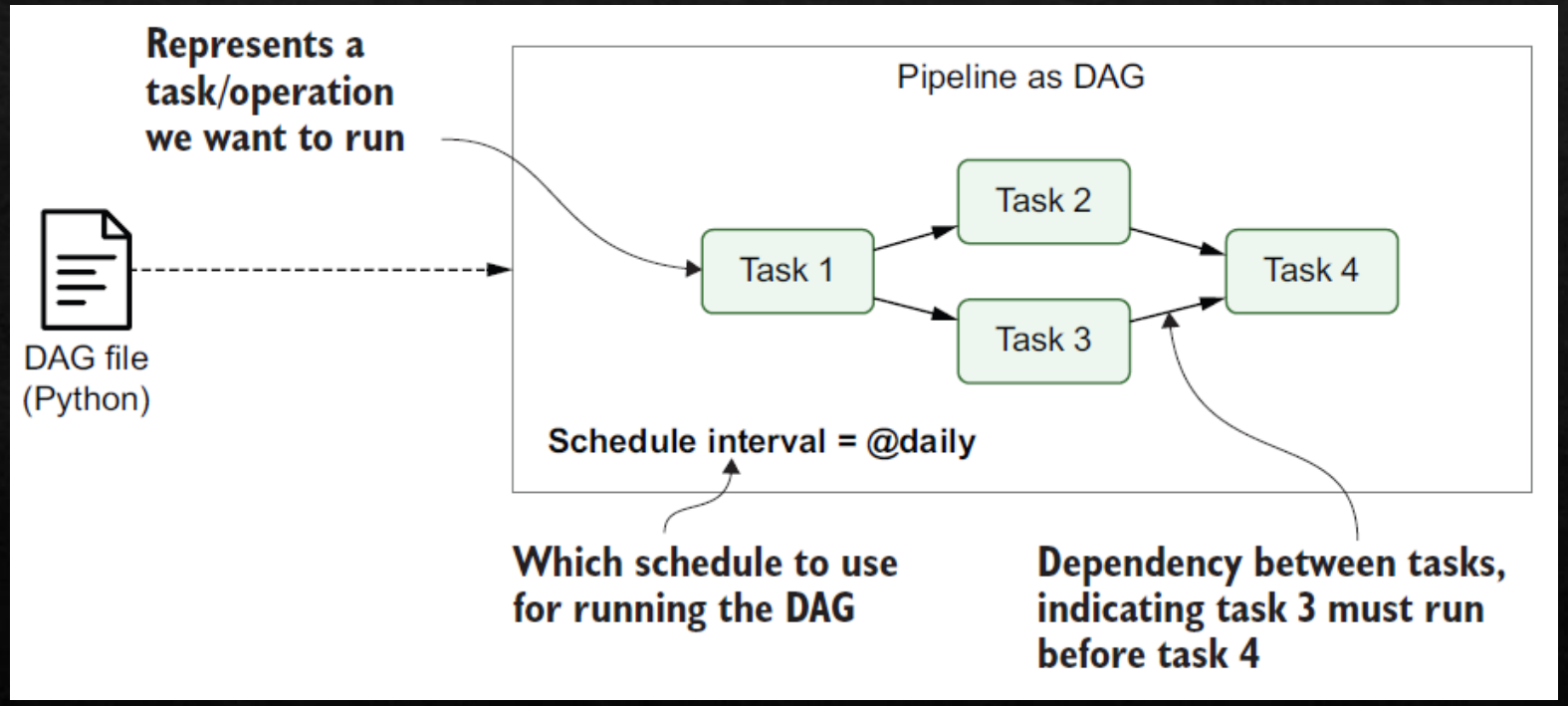
Name	Originated at[a]	Workflows defined in	Written in	Scheduling	Backfilling	User interface[b]	Installation platform	Horizontally scalable
Airflow	Airbnb	Python	Python	Yes	Yes	Yes	Anywhere	Yes
Argo	Applatix	YAML	Go	Third party[c]		Yes	Kubernetes	Yes
Azkaban	LinkedIn	YAML	Java	Yes	No	Yes	Anywhere	
Conductor	Netflix	JSON	Java	No		Yes	Anywhere	Yes
Luigi	Spotify	Python	Python	No	Yes	Yes	Anywhere	Yes
Make		Custom DSL	C	No	No	No	Anywhere	No
Metaflow	Netflix	Python	Python	No		No	Anywhere	Yes
Nifi	NSA	UI	Java	Yes	No	Yes	Anywhere	Yes
Oozie		XML	Java	Yes	Yes	Yes	Hadoop	Yes

Meet Apache Airflow

- Introducing Data Pipelines
- Introducing Apache Airflow

Defining pipelines flexibly in (Python) code

- In Airflow, you define your DAGs using Python code in DAG files, which are essentially Python scripts that describe the structure of the corresponding DAG.

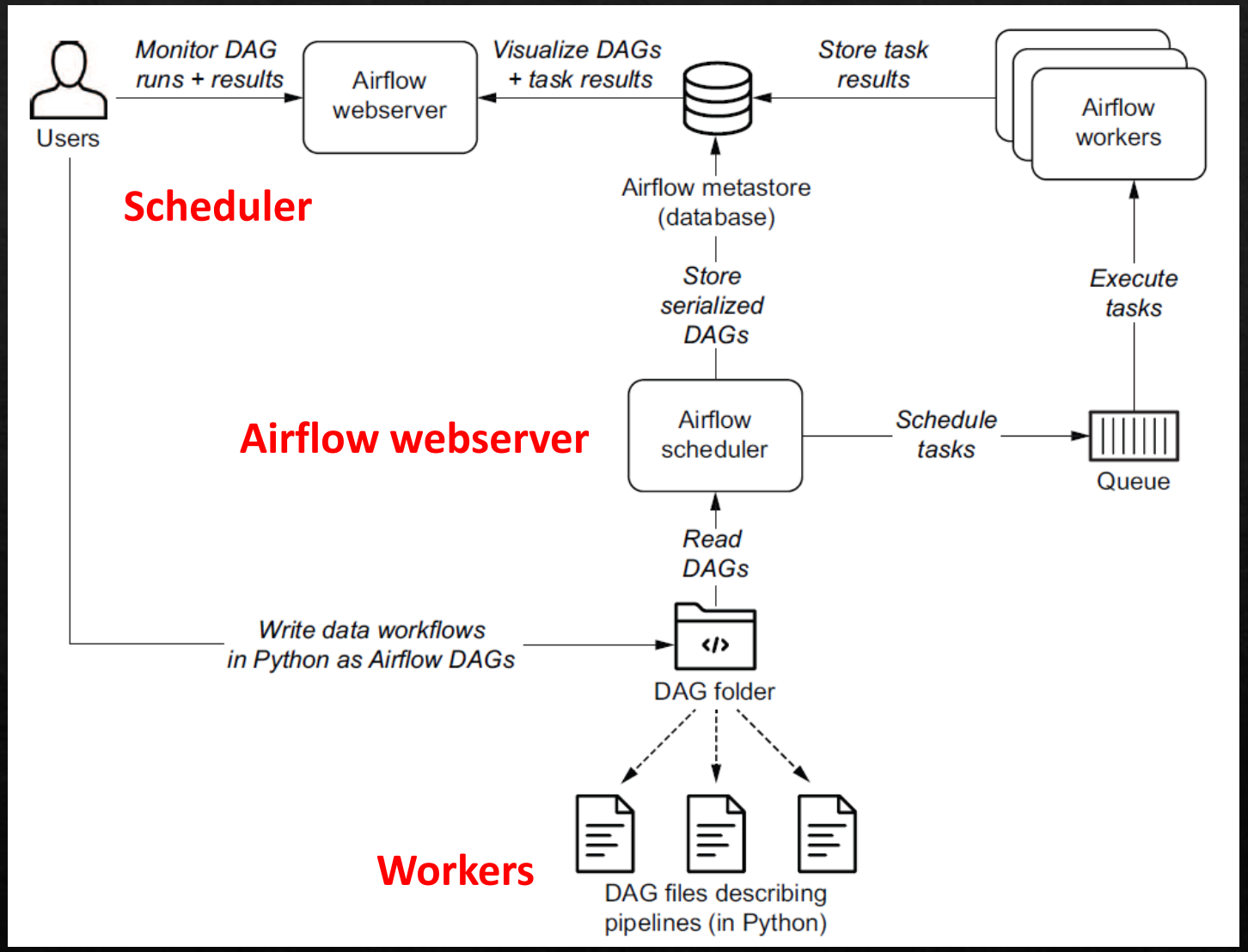


- Airflow pipelines are defined as DAGs using Python code in DAG files.
- Each DAG file typically defines one DAG, which describes the different tasks and their dependencies.
- Besides this, the DAG also defines a schedule interval that determines when the DAG is executed by Airflow.

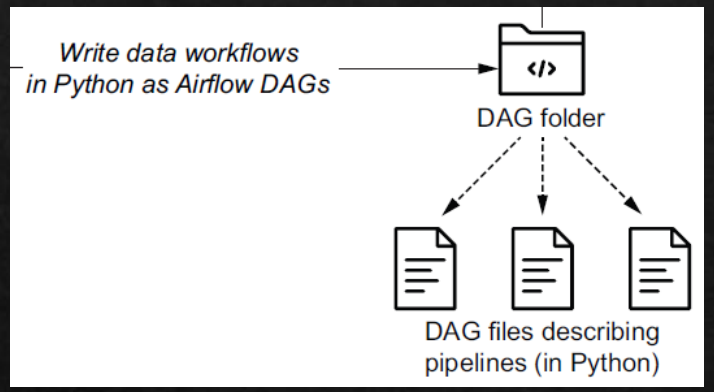
Scheduling and executing pipelines

- The Airflow scheduler
  - Parses DAGs, checks their schedule interval, and (if the DAGs' schedule has passed) starts scheduling the DAGs' tasks for execution by passing them to the Airflow workers.
- The Airflow workers
  - Pick up tasks that are scheduled for execution and execute them. As such, the workers are responsible for actually "doing the work."
- The Airflow webserver
  - Visualizes the DAGs parsed by the scheduler and provides the main interface for users to monitor DAG runs and their results.

Overview of the main components involved in Airflow



Workers



File Edit Selection View Go Run ··· airflow

EXPLORER

OPEN EDITORS 5 unsaved

AIRFLOW

dags

__pycache__

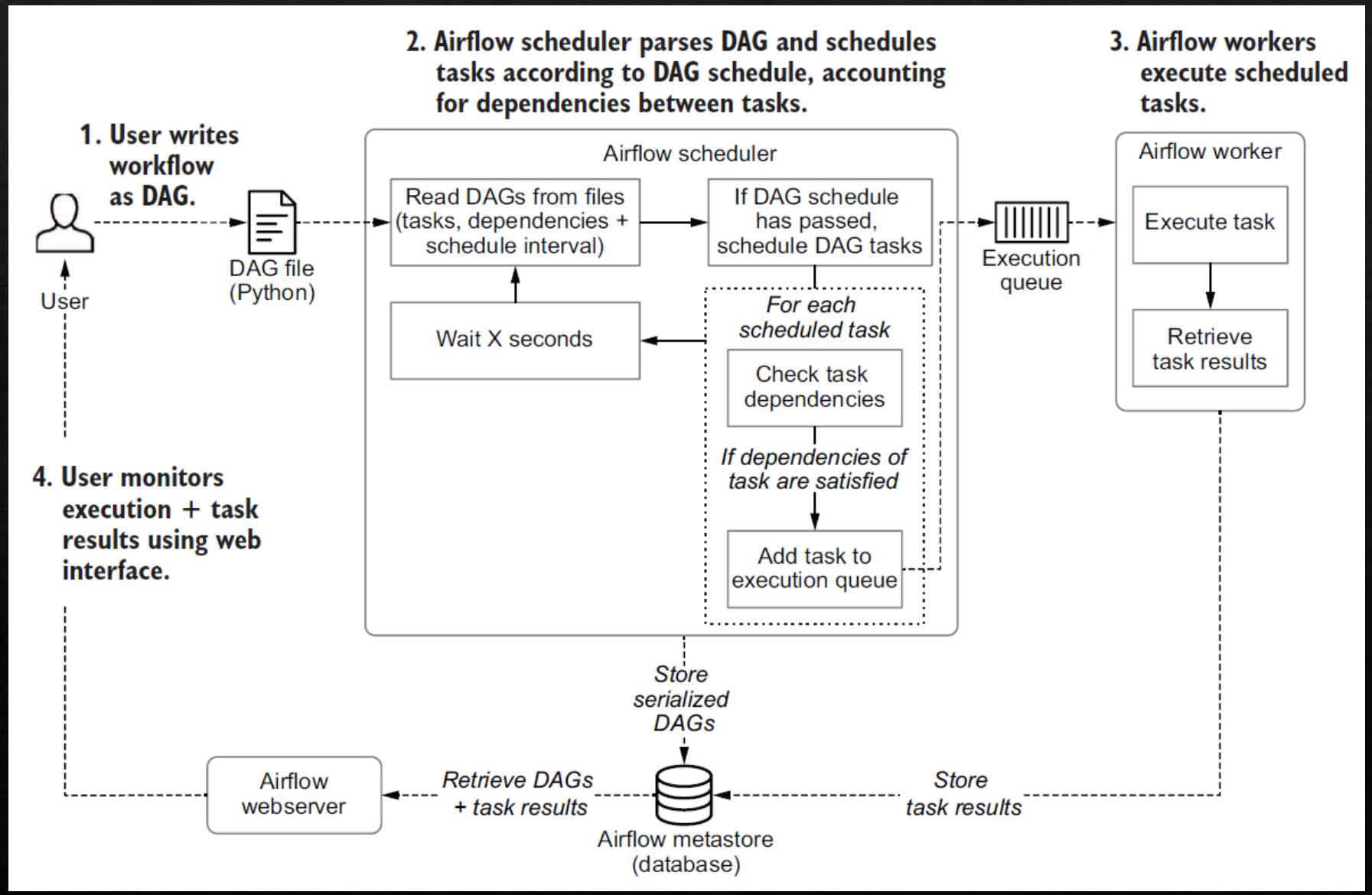
dags_01_umbrella.py 1
dags_02_download_rocket_launches.py
dags_02_mkdir_download_rocket_launches.py
dags_04_listing_04_01.py
dags_0301_unscheduled.py 1
dags_base_branch_operator.py
dags_bash_operator.py
dags_bash_select_fruit.py
dags_bash_with_template.py
dags_branch_python_operator.py
dags_conn_test.py
dags_email_operator.py
dags_python_email_xcom.py
dags_python_import.py
dags_python_operator.py
dags_python_show_templates.py
dags_python_task_decorator.py
dags_python_with_branch_decorator.py
dags_python_with_op_args.py
dags_python_with_op_kwargs.py
dags_python_with_template.py

dags_base_branch_operator.py | dags_python_with_trigger_rule_eg1.py | dags_01_umbrella.py

dags > dags_01_umbrella.py > ...

```python
"""DAG demonstrating the umbrella use case with dummy operators."""

import airflow.utils.dates
from airflow import DAG
from airflow.operators.dummy import DummyOperator

dag = DAG(
    dag_id="01_umbrella",
    description="Umbrella example with DummyOperators.",
    start_date=airflow.utils.dates.days_ago(5),
    schedule_interval="@daily",
)

fetch_weather_forecast = DummyOperator(task_id="fetch_weather_forecast", dag=dag)
fetch_sales_data = DummyOperator(task_id="fetch_sales_data", dag=dag)
clean_forecast_data = DummyOperator(task_id="clean_forecast_data", dag=dag)
clean_sales_data = DummyOperator(task_id="clean_sales_data", dag=dag)
join_datasets = DummyOperator(task_id="join_datasets", dag=dag)
train_ml_model = DummyOperator(task_id="train_ml_model", dag=dag)
deploy_ml_model = DummyOperator(task_id="deploy_ml_model", dag=dag)

# Set dependencies between all tasks
fetch_weather_forecast >> clean_forecast_data
fetch_sales_data >> clean_sales_data
[clean_forecast_data, clean_sales_data] >> join_datasets
join_datasets >> train_ml_model >> deploy_ml_model
```

Schematic overview of the Airflow Process

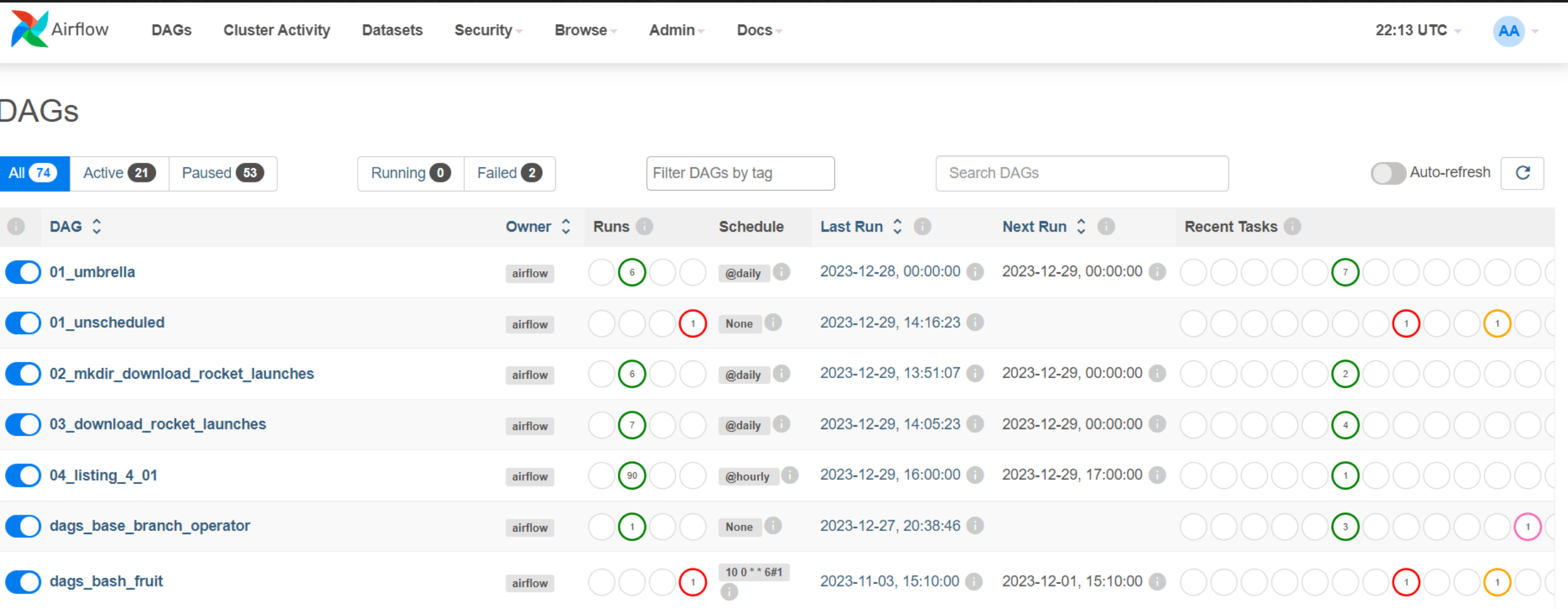


- Airflow pipelines Schematic overview of the process involved in developing and executing pipelines as DAGs using Airflow

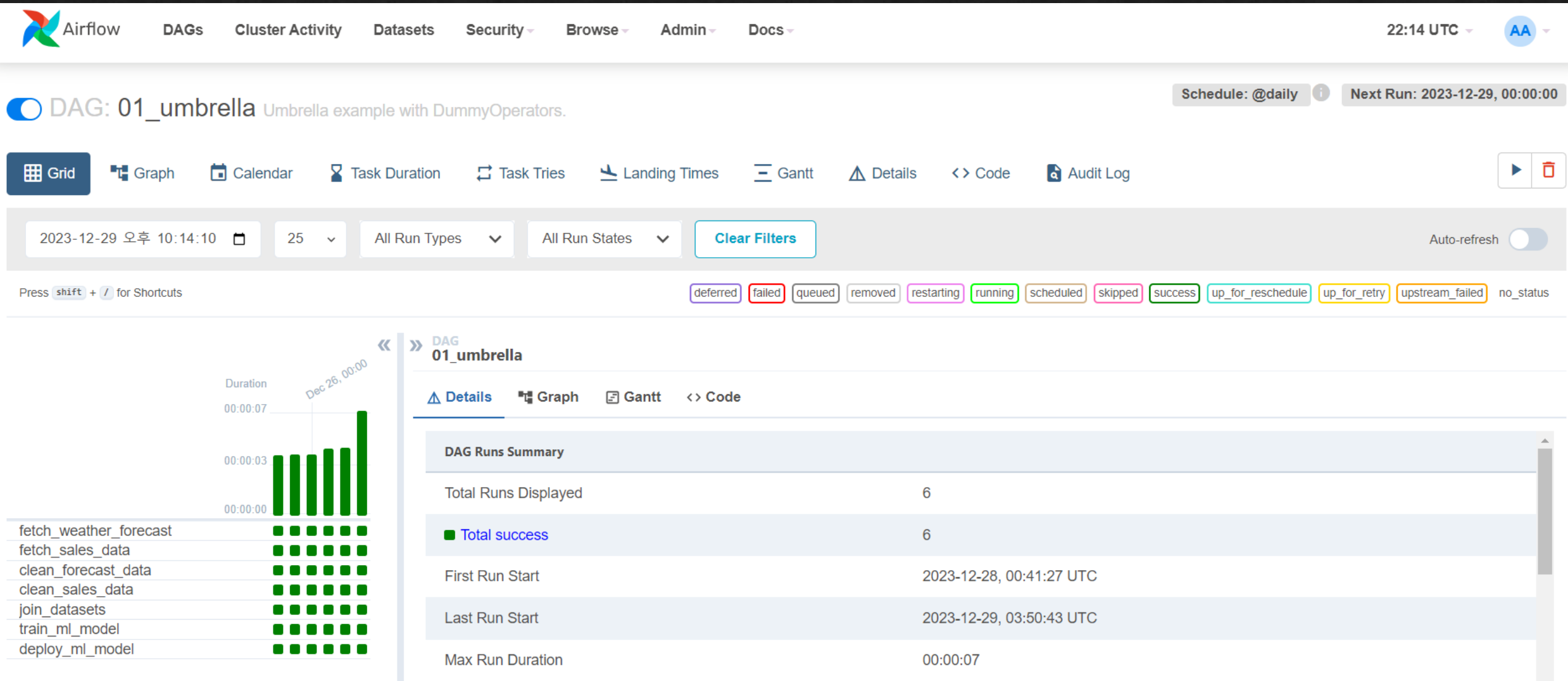
The Extensive web interface

- Monitoring and handling failures
- Incremental loading and backfilling

The Extensive web interface



The Extensive web interface



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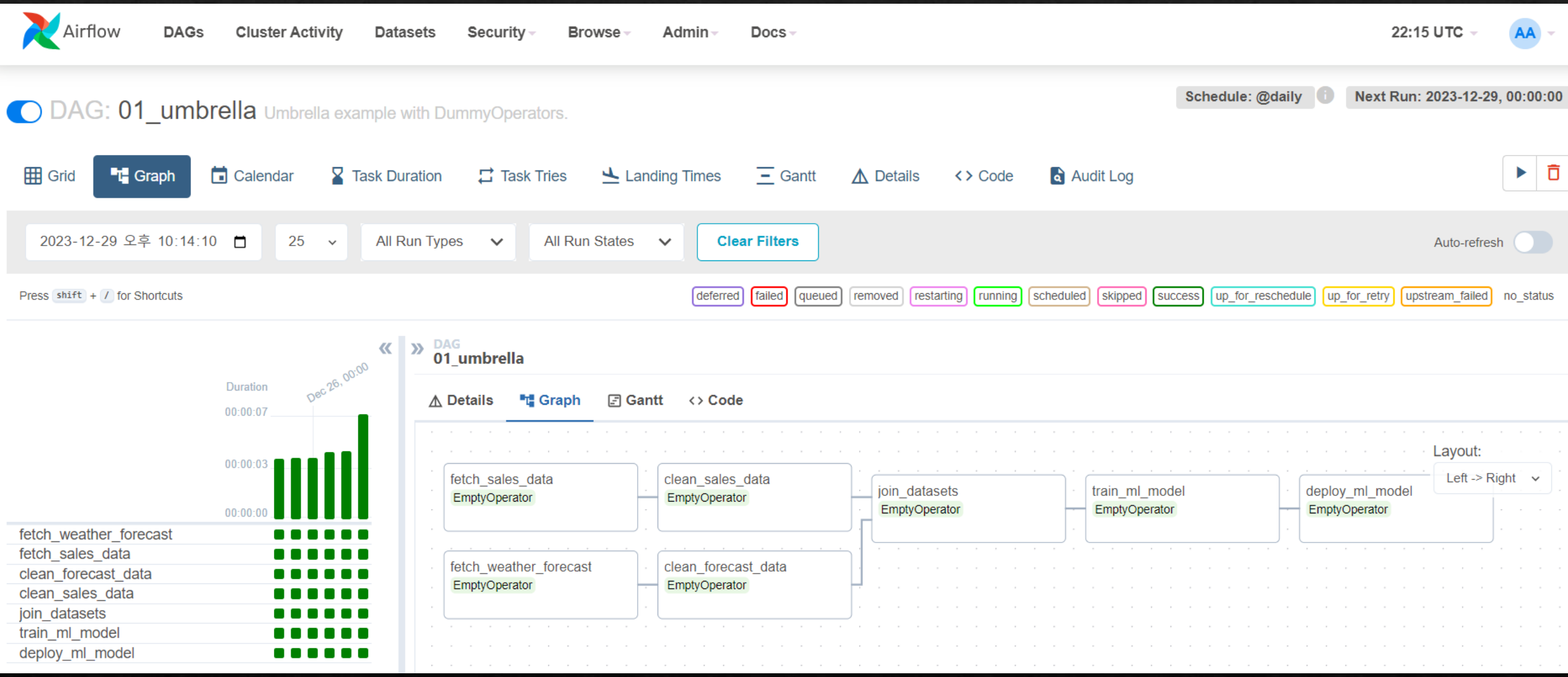

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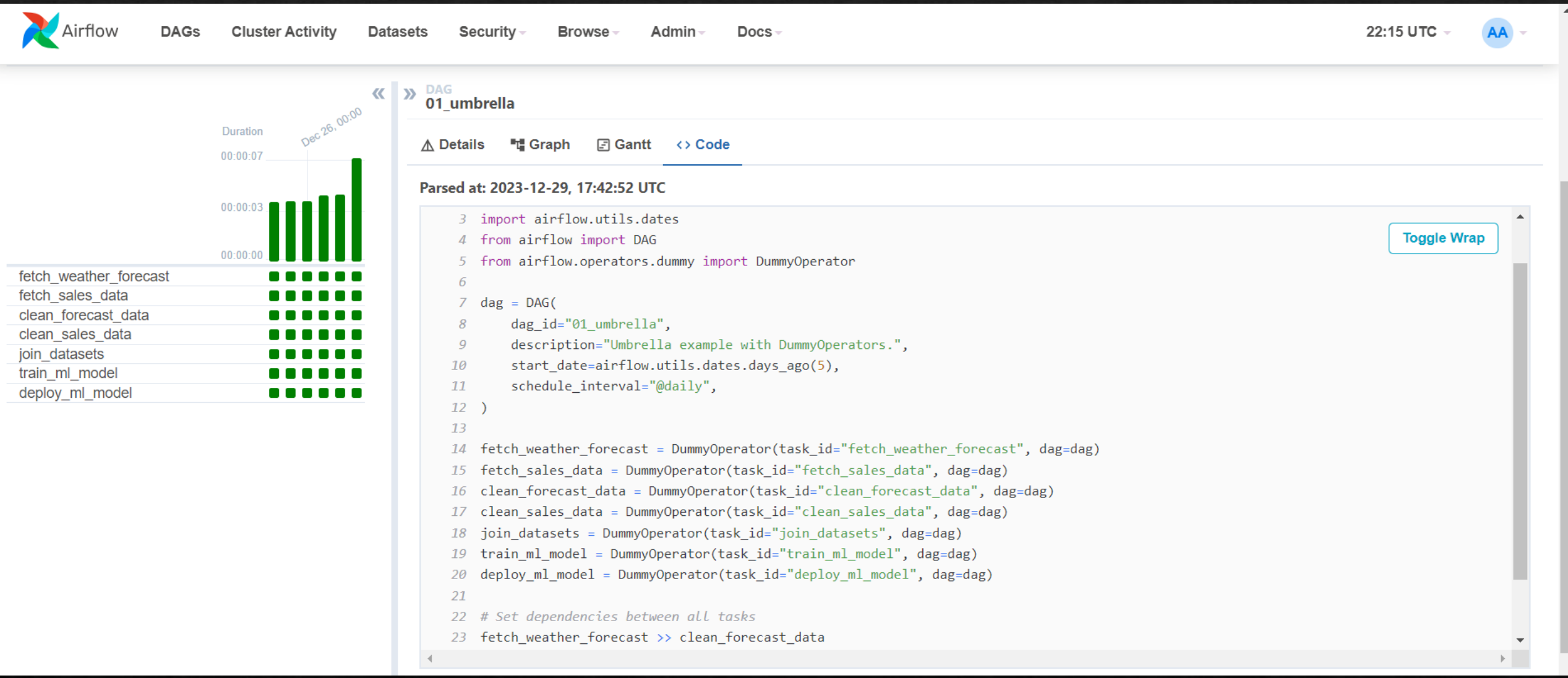

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