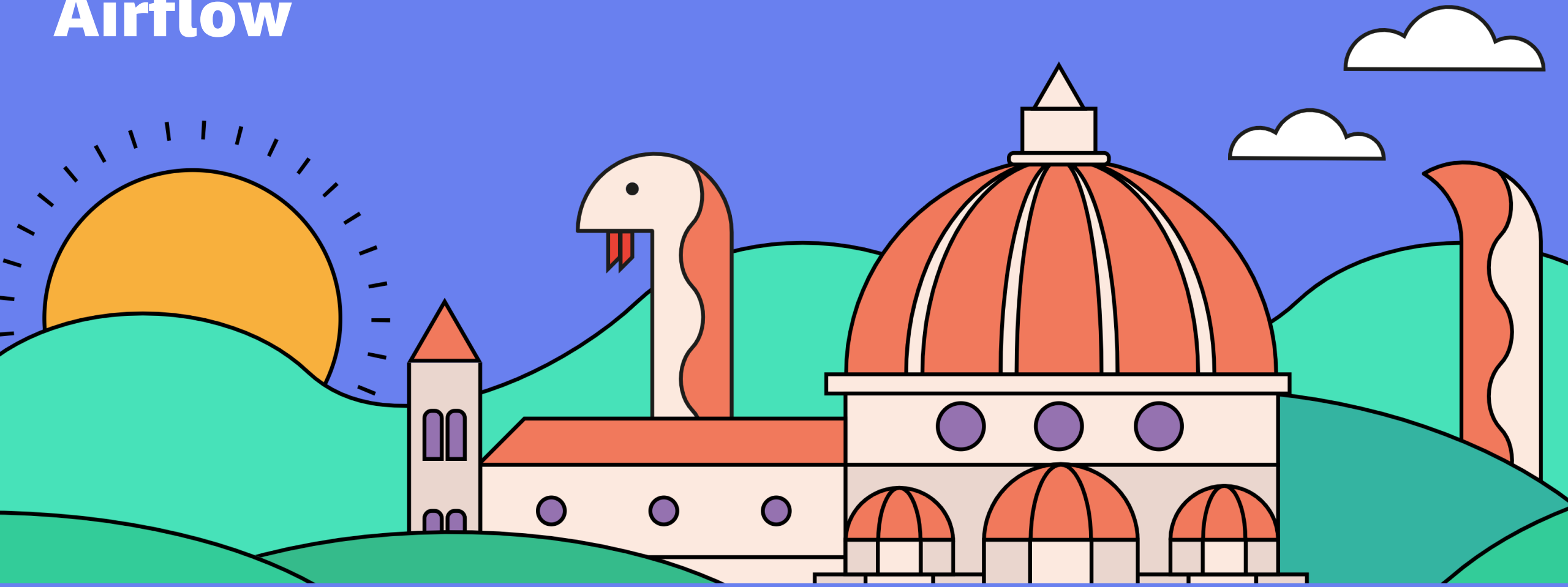
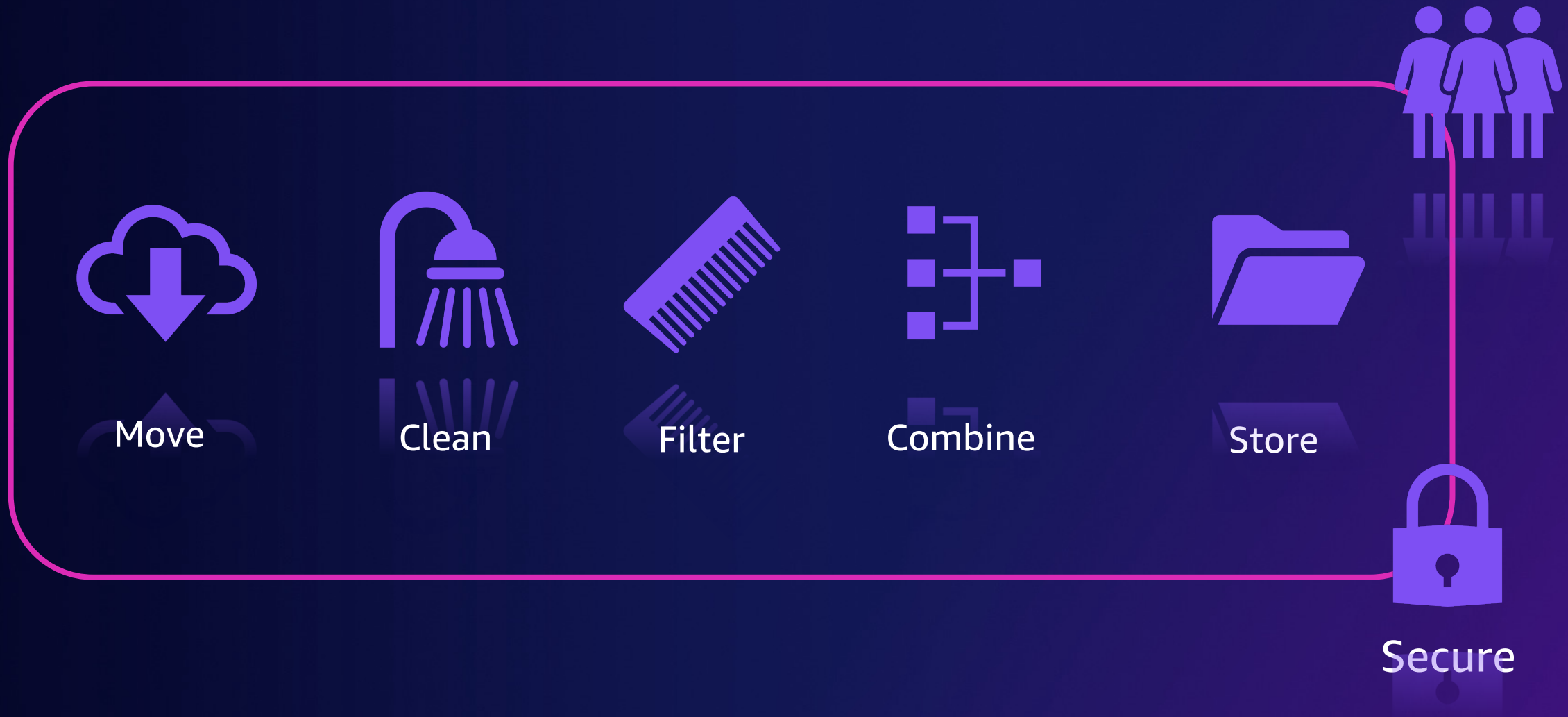
Building data pipelines with Apache Airflow



Ricardo Sueiras

Developer Advocate for Open Source | Amazon Web Services

What is in your data pipeline?



orchestration

/ɔːkɪˈstreɪʃ(ə)n/

noun

1. the arrangement or scoring of music for orchestral performance.

2. the planning or coordination of the elements of a situation to produce a desired effect

Introducing Apache Airflow

Apache
Airflow

workflow

/ˈwəːkfləʊ/

noun

1. the sequence of steps (tasks) involved in moving from the beginning to the end of a working process

DAG

```
from airflow import DAG

default_args = {
    'owner': 'airflow',
    'depends_on_past': False,
    'email': ['ricsue@amazon.com'],
    'email_on_failure': False,
    'email_on_retry': False
}

DAG_ID = ‘daily_dw_ingest’

dag = DAG(
    dag_id=DAG_ID,
    default_args=default_args,
    description='First Apache Airflow DAG',
    schedule_interval=None,
    start_date=days_ago(2),
    tags=['devcon','demo'],
)
```

dag_id=daily_dw_ingest

Task

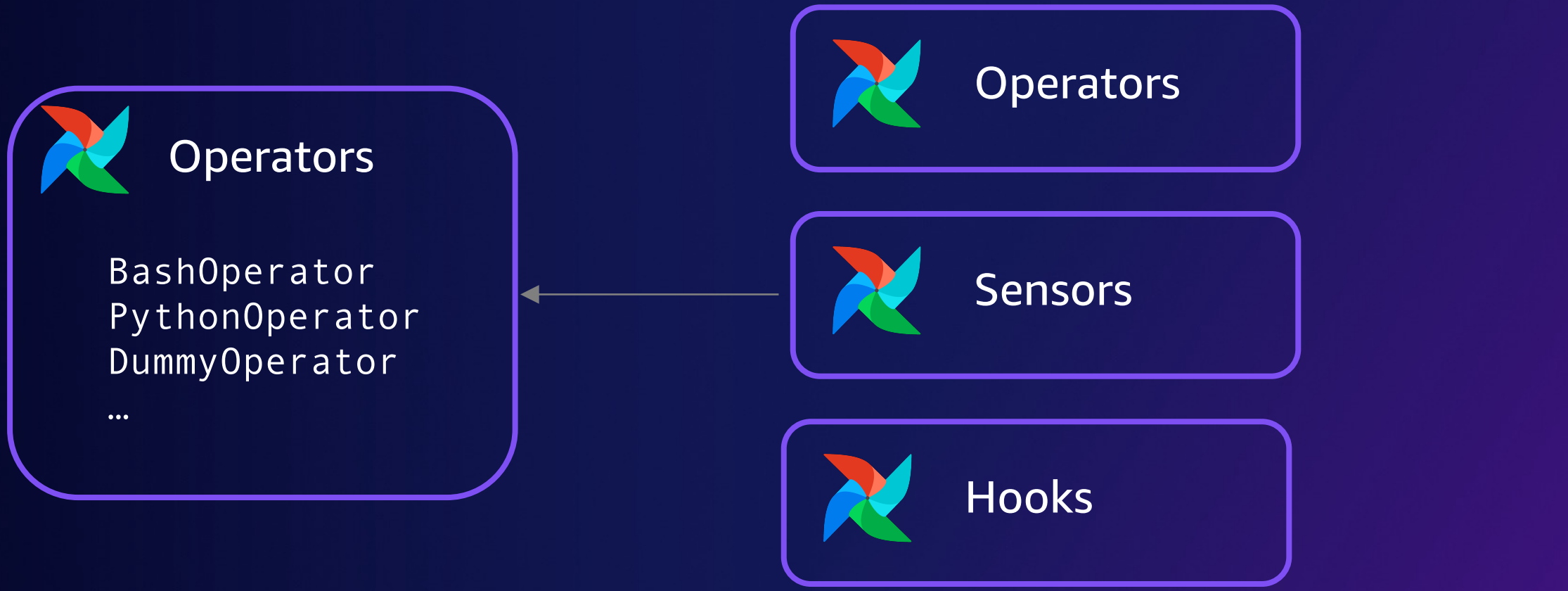
```
move_file = BashOperator(

        task_id='move_current_file',

        bash_command="cd {work_dir} && mv
{source_file} {destination_file}”

        dag=dag
    )
```

task_id=move_current_file



Operators

- Airbyte
- Alibaba
- Amazon
- Apache Beam
- Apache Cassandra
- Apache Drill
- Apache Druid
- Apache HDFS
- Apache Hive
- Apache Kylin
- Apache Livy
- Apache Pig
- Apache Pinot
- Apache Spark
- Apache Sqoop
- Asana
- Celery
- IBM Cloudant
- Kubernetes
- Databricks
- Datadog
- Dingding
- Discord
- Docker
- Elasticsearch
- Exasol
- Facebook
- File Transfer Protocol (FTP)
- Github
- Google
- gRPC
- Hashicorp
- Hypertext Transfer Protocol (HTTP)
- Influx DB
- Internet Message Access Protocol (IMAP)
- Java Database Connectivity (JDBC)
- Jenkins
- Jira
- Microsoft Azure
- Microsoft PowerShell Remoting Protocol (PSRP)
- Microsoft SQL Server (MSSQL)
- Windows Remote Management (WinRM)
- MongoDB
- MySQL
- Neo4J
- ODBC
- OpenFaaS
- Opsgenie
- Oracle
- Pagerduty
- Papermill
- Plexus
- PostgreSQL
- Presto
- Qubole
- Redis
- Salesforce
- Samba
- Segment
- Sendgrid
- SFTP
- Singularity
- Slack
- Snowflake
- SQLite
- SSH
- Tableau
- Telegram
- Trino
- Vertica
- Yandex
- Zendesk

DAG

Task

```
from airflow import DAG
from datetime import datetime
from
airflow.providers.amazon.aws.operators.ecs
import ECSOperator

default_args = { 'owner': 'ubuntu',
'start_date': datetime(2019, 8, 14),
'retry_delay': timedelta(seconds=60*60) }
..
..
..
```

task_id=copy_data

Task

```
from airflow import DAG
from datetime import datetime
from
airflow.providers.amazon.aws.operators.ecs
import ECSOperator

default_args = { 'owner': 'ubuntu',
'start_date': datetime(2019, 8, 14),
'retry_delay': timedelta(seconds=60*60) }
..
..
..
```

task_id=store_raw_data

Task

```
from airflow import DAG
from datetime import datetime
from
airflow.providers.amazon.aws.operators.ecs
import ECSOperator

default_args = { 'owner': 'ubuntu',
'start_date': datetime(2019, 8, 14),
'retry_delay': timedelta(seconds=60*60) }
..
..
..
```

task_id=clean data

Task

```
from airflow import DAG
from datetime import datetime
from
airflow.providers.amazon.aws.operators.ecs
import ECSOperator

default_args = { 'owner': 'ubuntu',
'start_date': datetime(2019, 8, 14),
'retry_delay': timedelta(seconds=60*60) }
..
..
..
```

task_id=process_data

Task

```
from airflow import DAG
from datetime import datetime
from
airflow.providers.amazon.aws.operators.ecs
import ECSOperator

default_args = { 'owner': 'ubuntu',
'start_date': datetime(2019, 8, 14),
'retry_delay': timedelta(seconds=60*60) }
..
..
..
```

task_id=move_to_datawarehouse

Import python libraries

Define standard settings

Define workflow name

Define workflow settings

```
from airflow import DAG

default_args = {
    'owner': 'airflow',
    'depends_on_past': False,
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    'email_on_failure': False,
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dag = DAG(
    dag_id=DAG_ID,
    default_args=default_args,
    description='First Apache Airflow DAG',
    schedule_interval=None,
    start_date=days_ago(2),
    tags=['devcon','demo'],
)
```
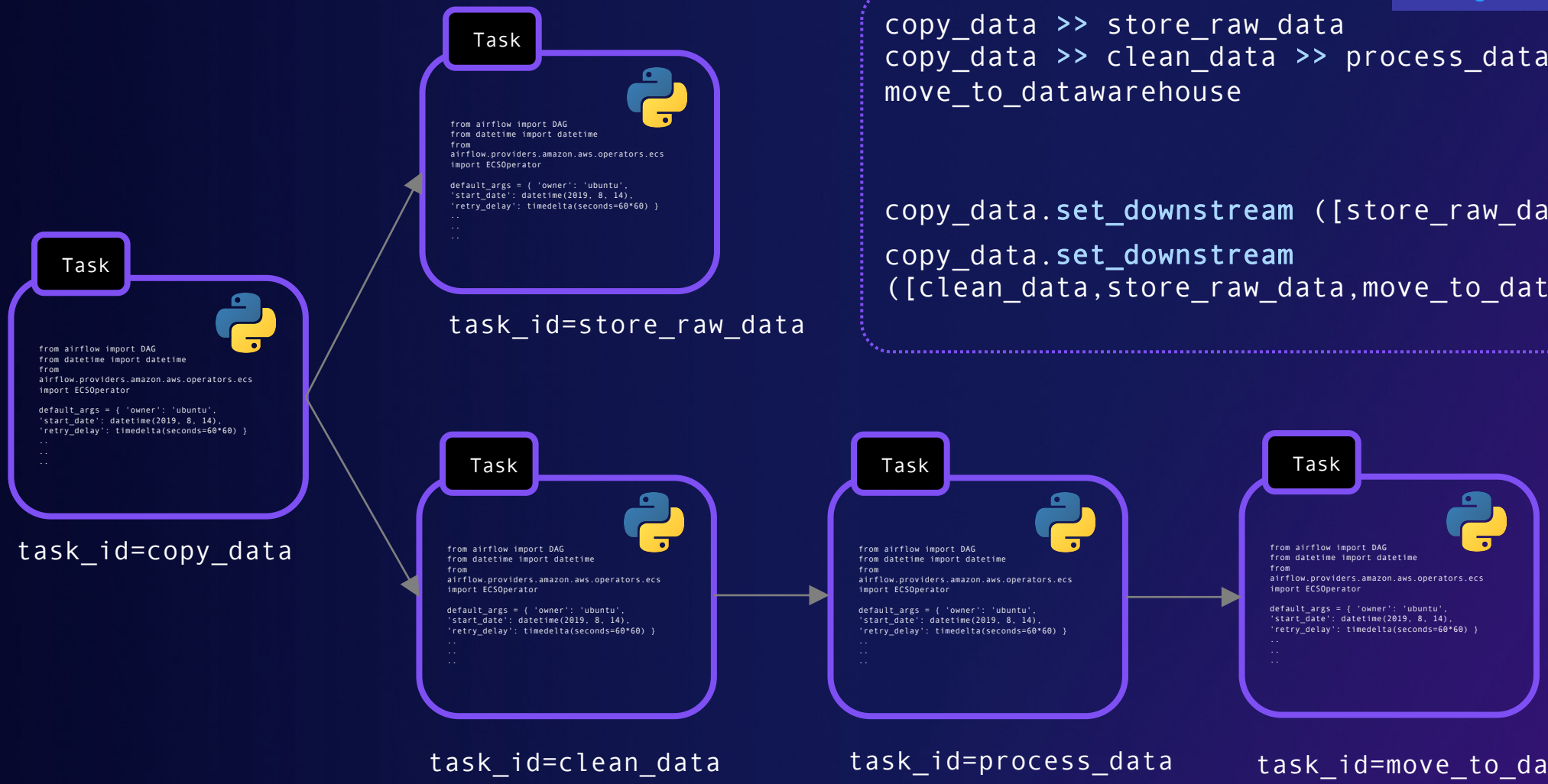
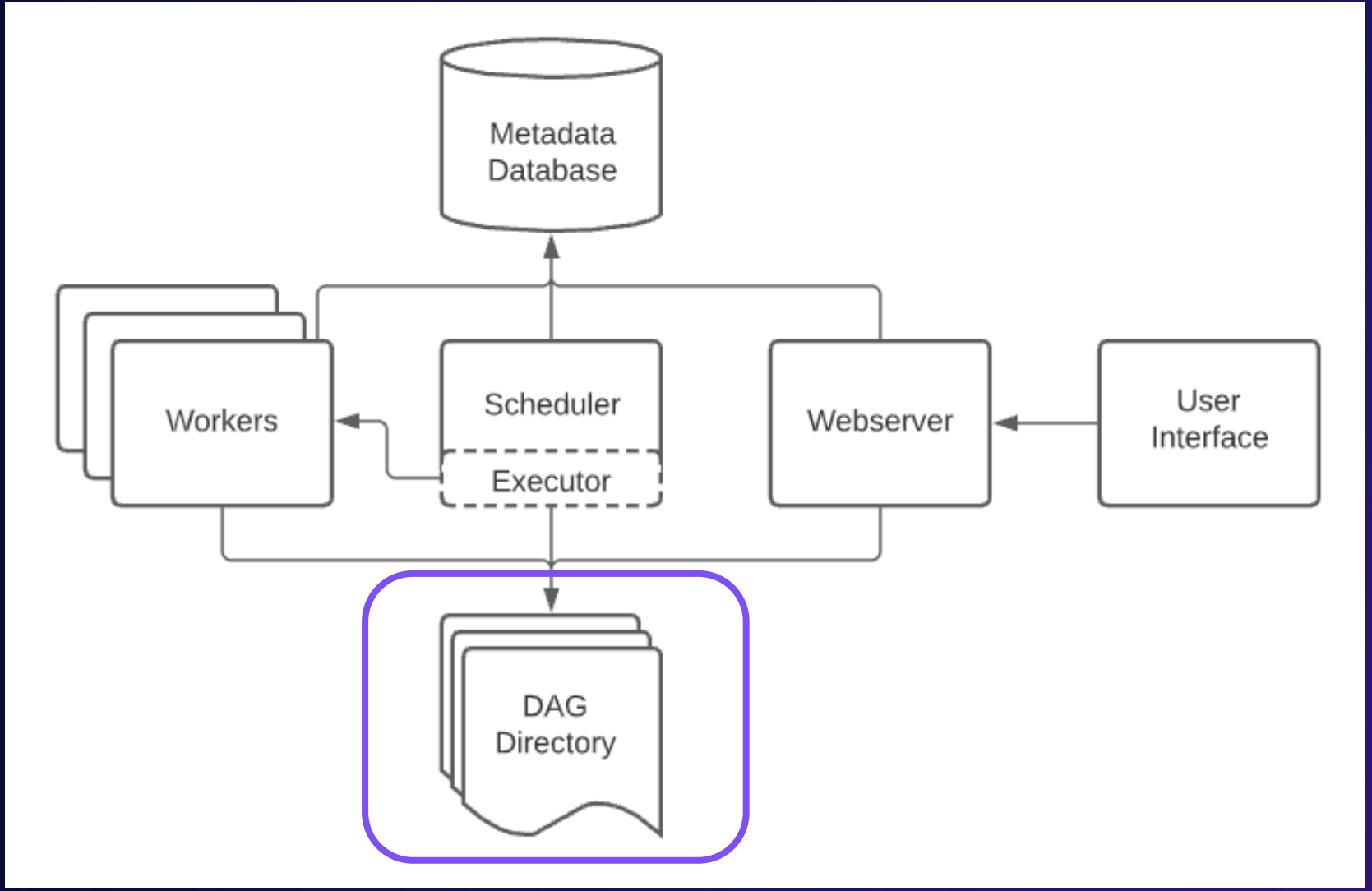

Control flow



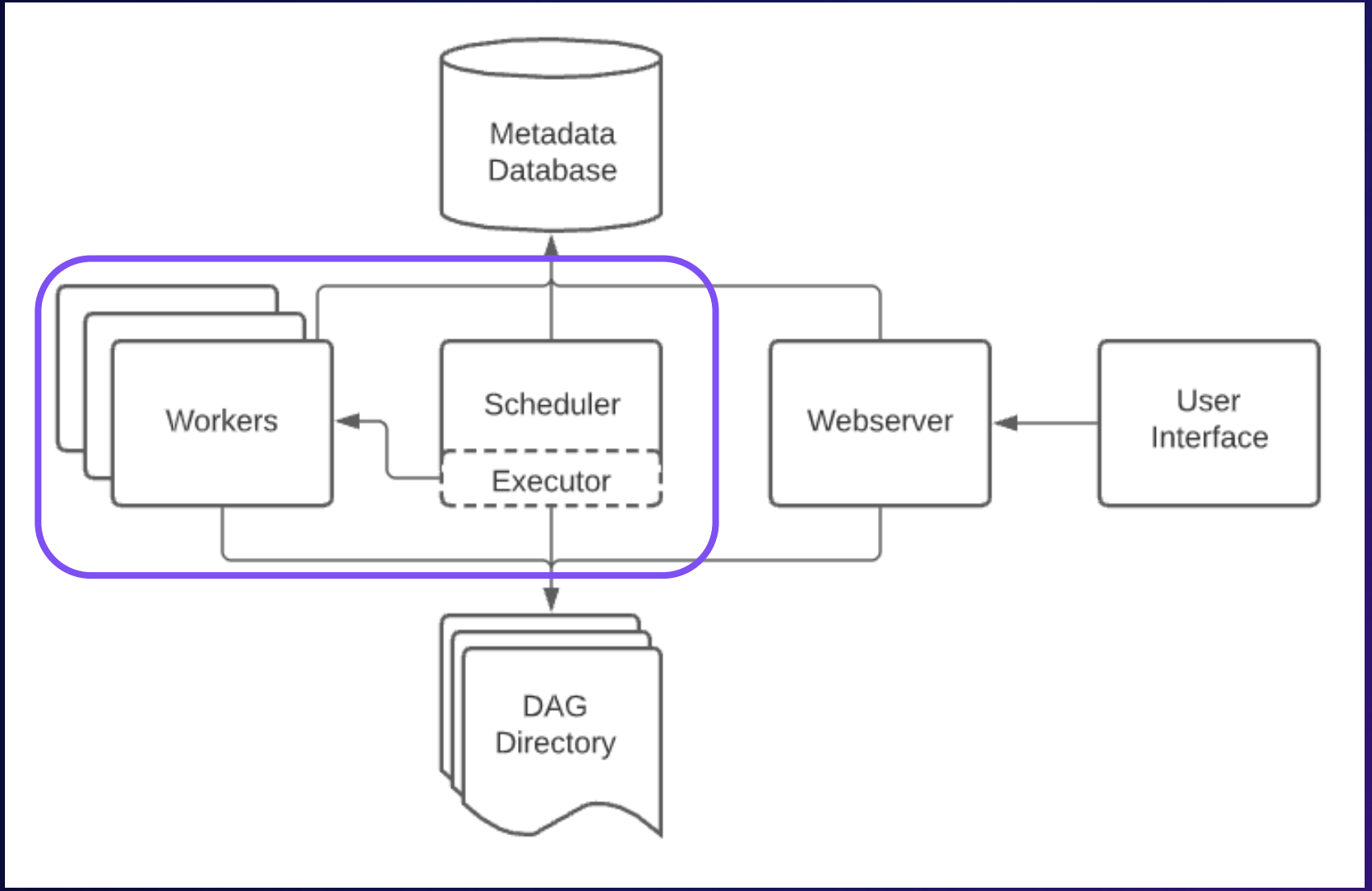
Defining task dependencies

```
copy_data >> store_raw_data
copy_data >> clean_data >> process_data >>
move_to_datawarehouse


copy_data.set_downstream ([store_raw_data])
copy_data.set_downstream
([clean_data,store_raw_data,move_to_datawarehouse])
```

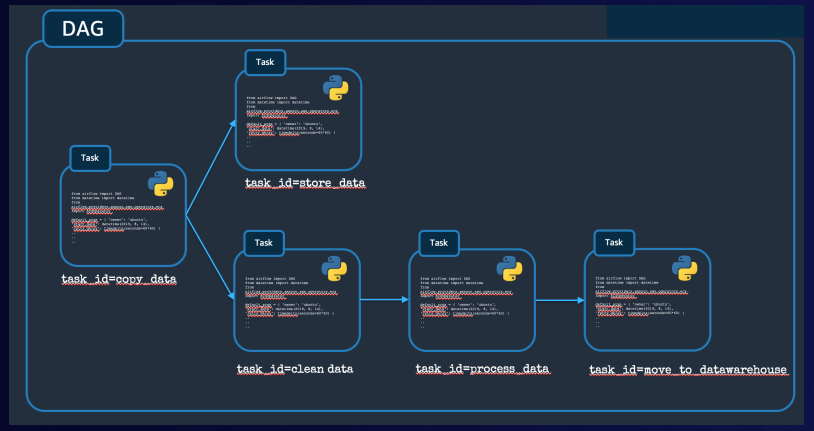
Deploying your DAGs



Apache Airflow Scheduler and Workers



Scheduling our Workflows (DAGs)



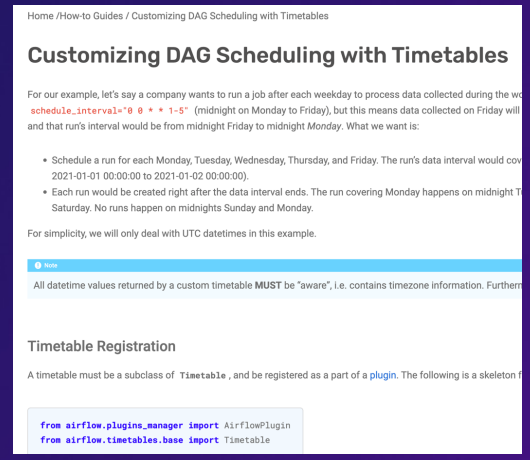

```
dag = DAG(
        dag_id="daily_dw_ingest ",
        schedule_interval=None,
        start_date=datetime.datetime(2022, 2, 1),
        catchup=False,
        tags=["example"],
    )
```

schedule_interval

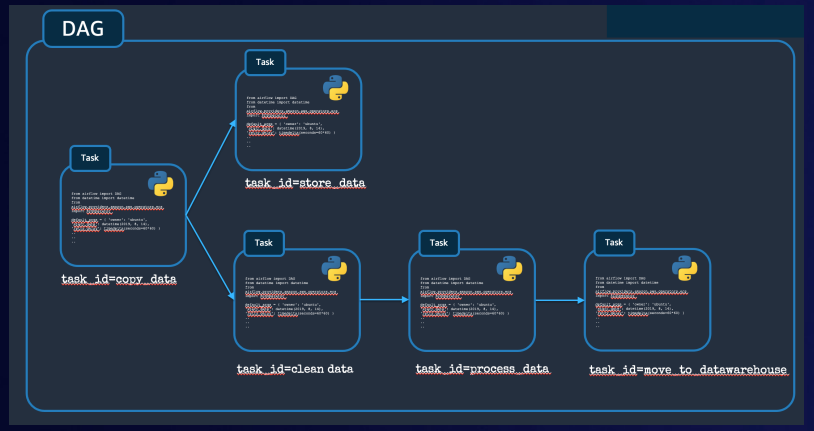
schedule_interval="/10 * * * *" – every 10 min*
*schedule_interval="0 */2 * * *" – every 2 hours*
*schedule_interval="0 */1 * * *"* - every hour
schedule_interval="*/5 * * * *" – every 5 mins

New

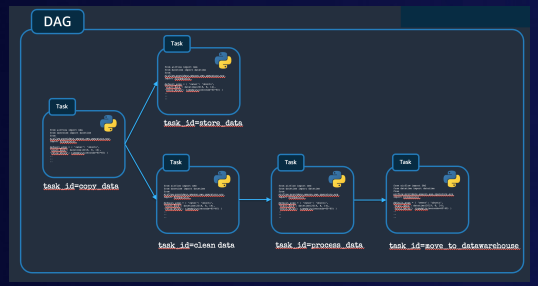
To provide more scheduling flexibility, determining when a DAG should run is now done with **Timetables**.



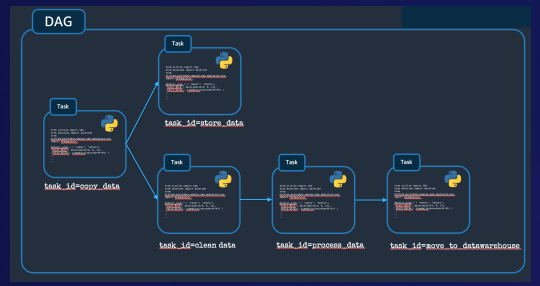
Understanding how workflows (DAGs) run



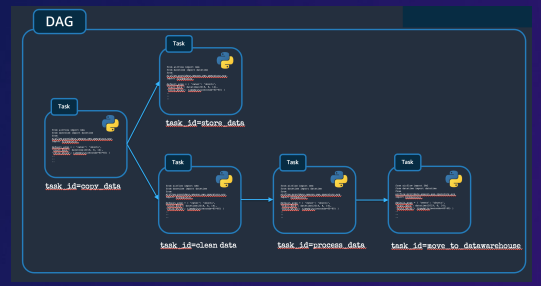

```
dag = DAG(
        dag_id="daily_dw_ingest ",
        schedule_interval="0 */1 * * *",
        start_date=datetime.datetime(2022, 2, 1),
        catchup=True,
        tags=["example"],
    )
```



Execution Date: 1st Feb, 2022, 01:00

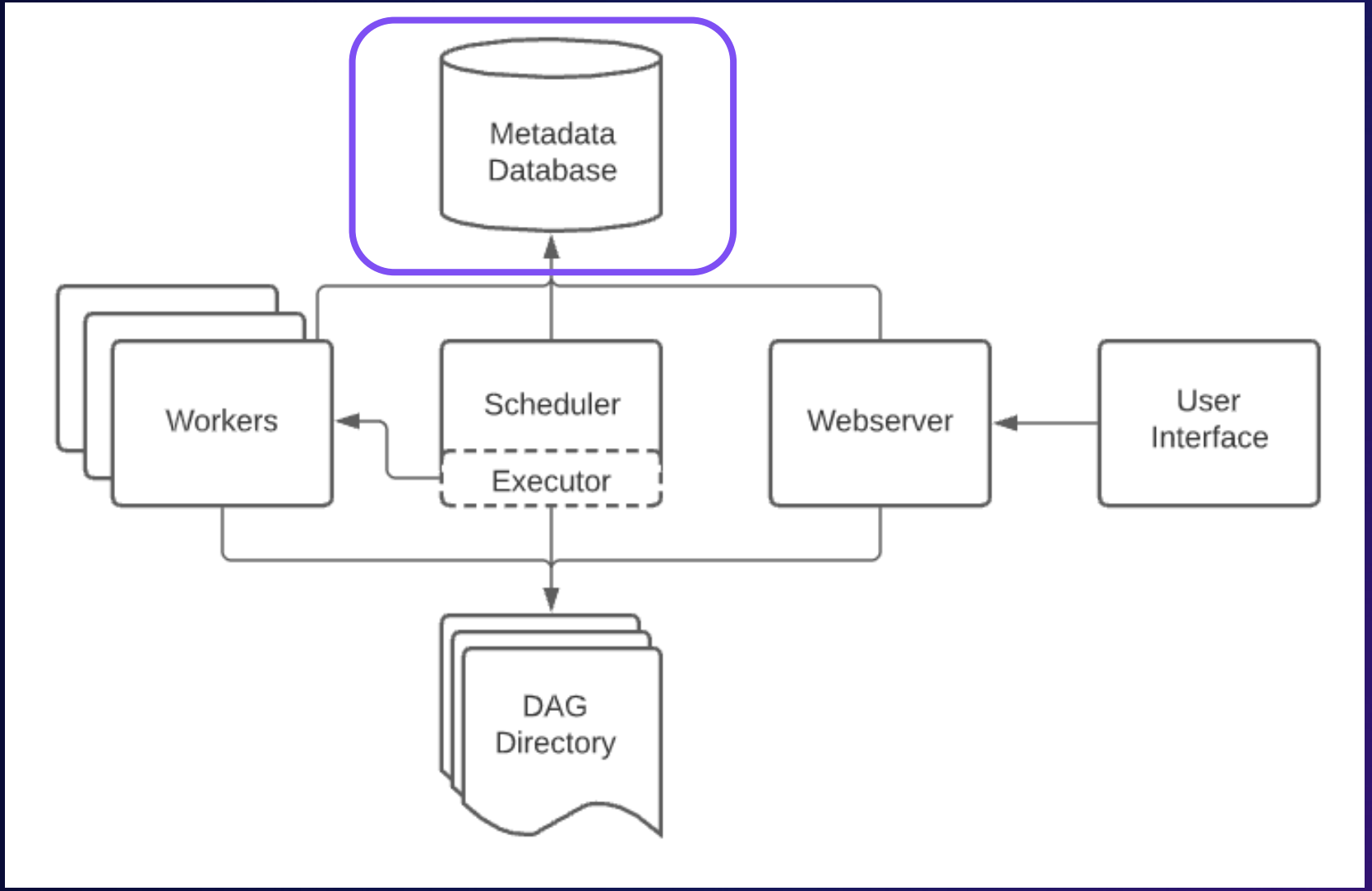


Execution Date: 1st Feb, 2022, 02:00

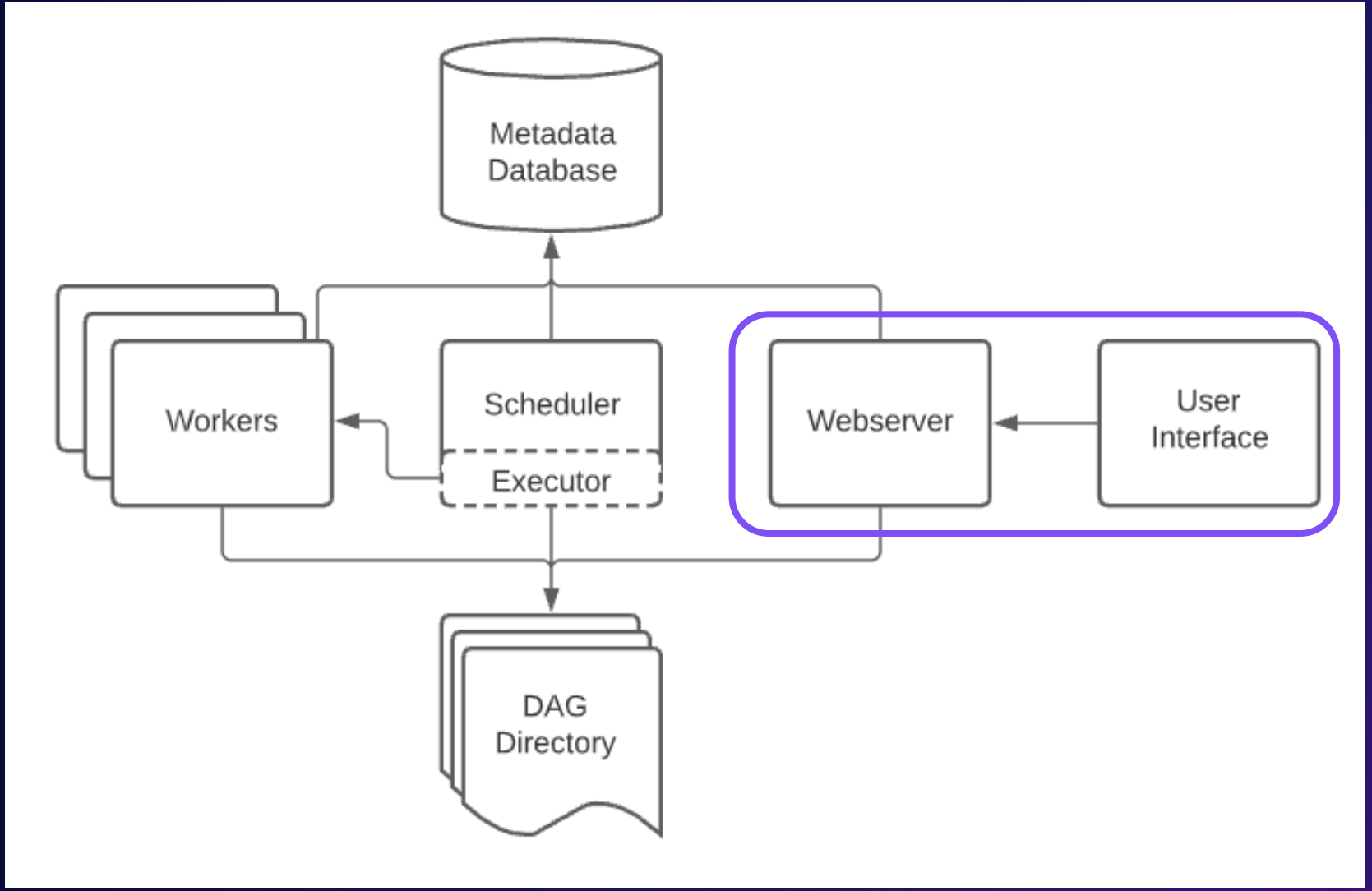


Execution Date: 1st Feb, 2022, 03:00 …

Apache Airflow Metadata



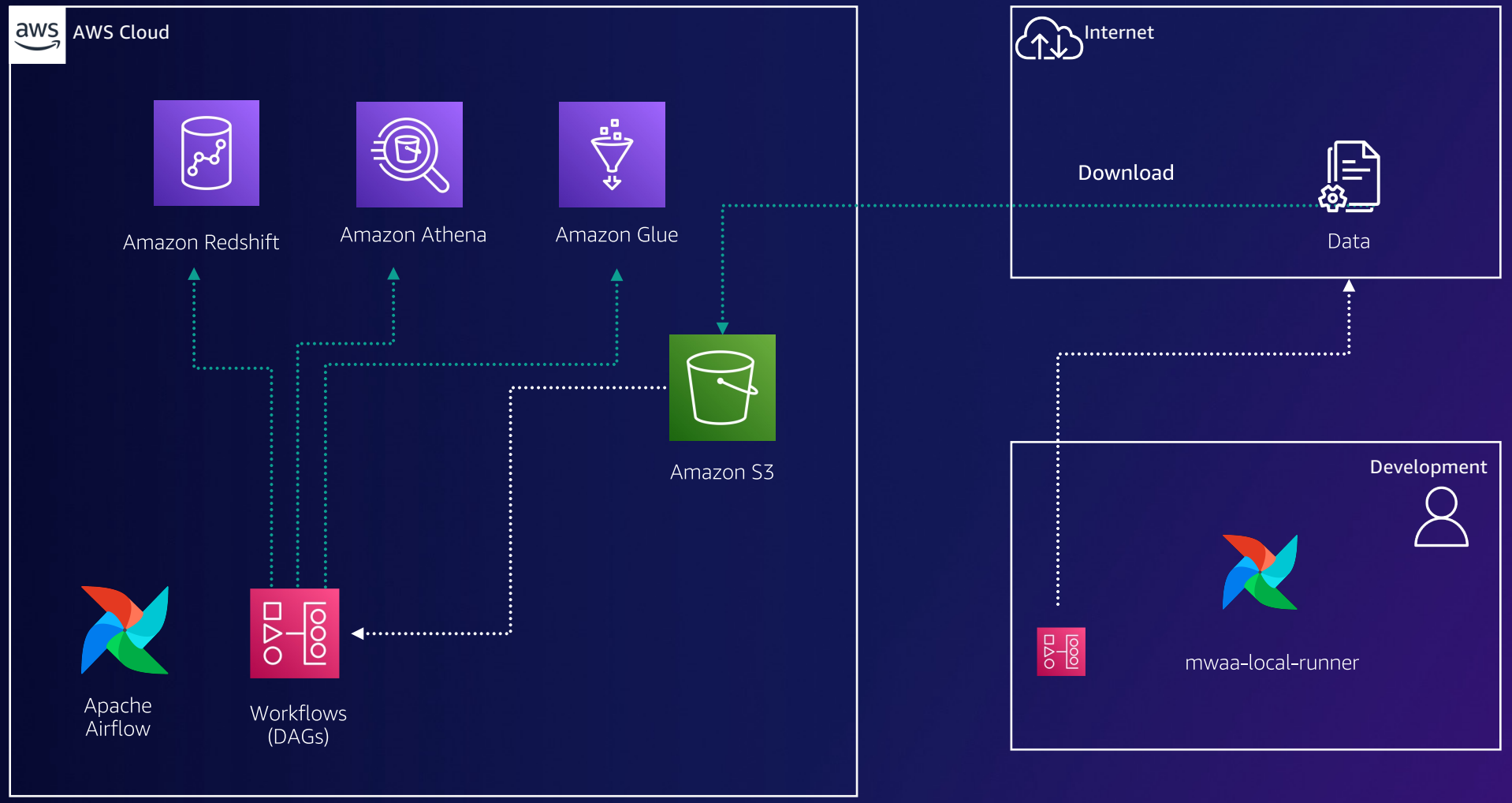
Apache Airflow UI



Demo

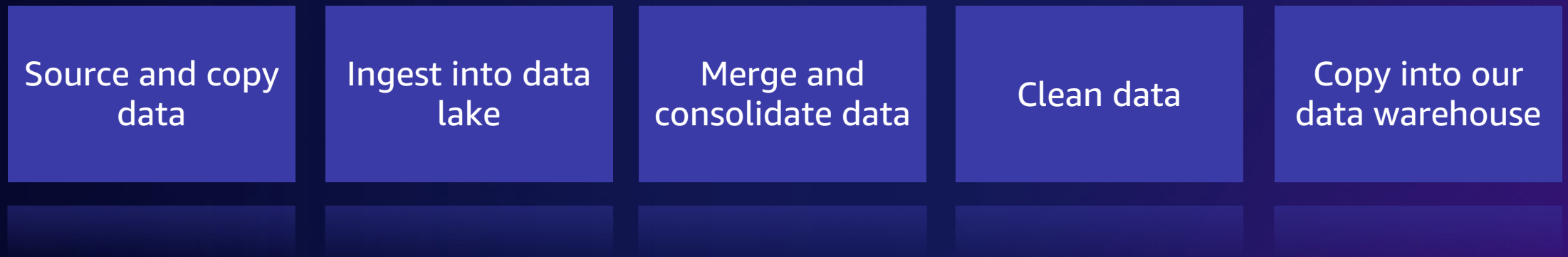
Building our data pipeline

Demo



Building our data pipeline

Demo



Building our data pipeline

Demo

Source and copy data

Task

PythonOperator

```
files_to_s3 = PythonOperator(
      task_id="files_to_s3",
      python_callable=download_zip)
```

Task

S3SensorKey

```
check_s3_for_key = S3KeySensor(
      task_id='check_s3_for_key’,
      bucket_key=check_s3,
      wildcard_match=True,
      bucket_name=s3_bucket_name,
      aws_conn_id='aws_default’,
      timeout=20,
      poke_interval=5)
```

Building our data pipeline

Demo

Ingest into data lake

Task

AWSAthenaOperator

```
create_athena_movie_table = AWSAthenaOperator(
        task_id="create_athena_movie_table",
        query=create_athena_movie_table_query,
        database=athena_db,
        output_location='s3://'+s3_bucket_name+"/"+a
thena_results+'create_athena_movie_table')
```

Building our data pipeline

Demo

Ingest into data lake

Task

AWSAthenaOperator

```
create_athena_movie_table_query="""
CREATE EXTERNAL TABLE IF NOT EXISTS
{database}.ML_Latest_Small_Movies (
`movieId` int,`title` string,`genres` string )
ROW FORMAT SERDE
'org.apache.hadoop.hive.serde2.lazy.LazySimpleSerDe'
WITH SERDEPROPERTIES ('serialization.format' =
',','field.delim' = ',' )
LOCATION 's3://{s3_bucket_name}/{s3_key}ml-latest-
small/movies.csv/ml-latest-small/'
TBLPROPERTIES (
'has_encrypted_data'='false',
'skip.header.line.count'='1'
);
""".format(database=athena_db, s3_bucket_name=s3_bucket_name,
s3_key=s3_key)
```

Building our data pipeline

Demo

Merge and consolidate data

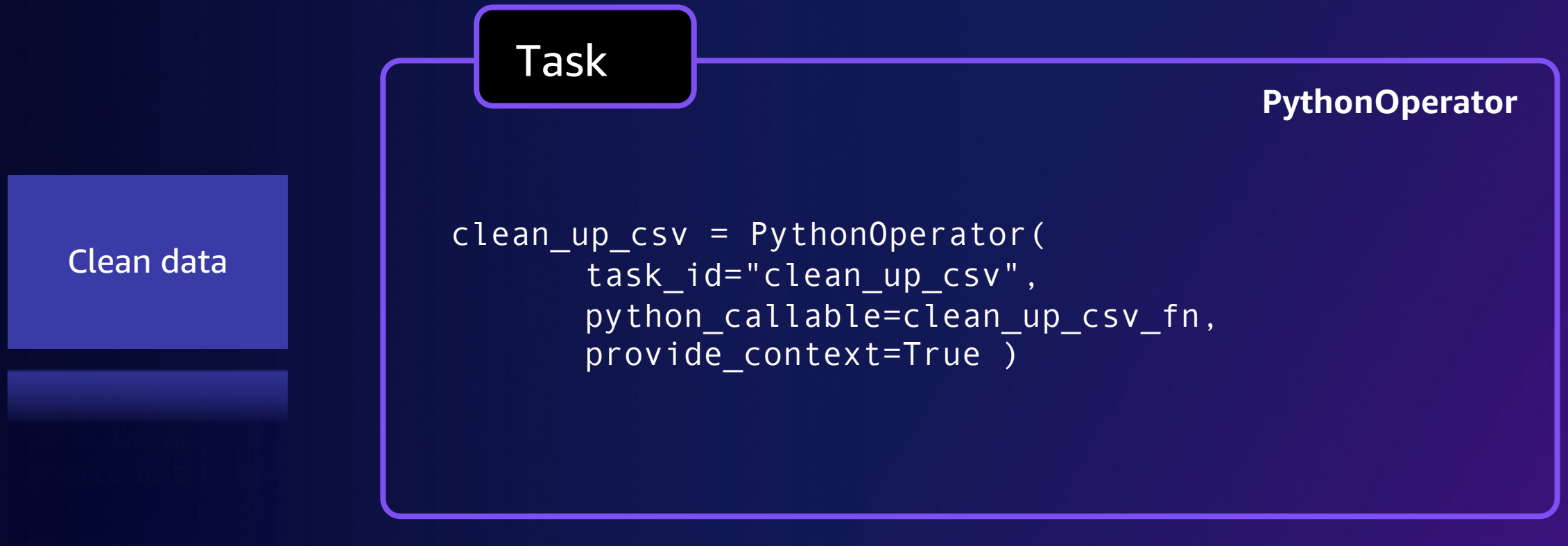
Task

AWSAthenaOperator

```
join_athena_tables = AWSAthenaOperator(
        task_id="join_athena_tables",
        query=join_tables_athena_query,
        database=athena_db,
        output_location='s3://'+s3_bucket_name+"/"+a
thena_results+'join_athena_tables'
)
```

Building our data pipeline

Demo



Building our data pipeline

Demo

Copy into our data warehouse

Task

S3ToRedshiftOperator

```
task_transfer_s3_to_redshift = S3ToRedshiftOperator(
        s3_bucket=s3_bucket_name,
        s3_key="athena-results/join_athena_tables/{{
task_instance.xcom_pull(task_ids='join_athena_tables',
key='return_value') }}_clean.csv",
        schema='PUBLIC’,
        redshift_conn_id='redshift_default’,
        table=redshift_table_name,
        copy_options=['csv IGNOREHEADER 1’],
        task_id='transfer_s3_to_redshift',)
```

Demo

Apache Airflow evolution

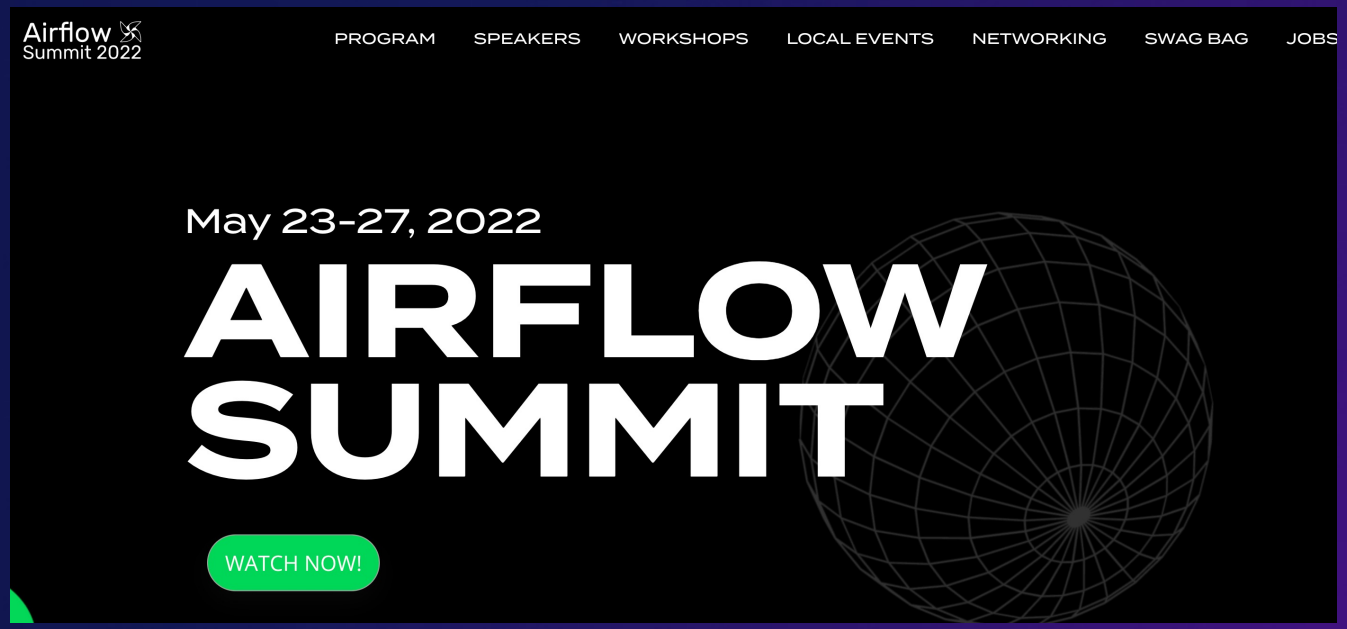
Optimisations around the scheduler utilisation and performance

Optimisations around the scheduler utilisation and performance

More options for asynchronous workflows

Writing cleaner DAGs (closer to Python)

Improvements to the UI



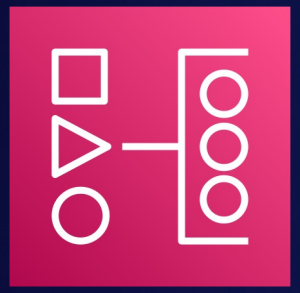
https://airflowsummit.org/

Contributing to Apache Airflow

The Apache Airflow community makes contributing to this project both a welcoming and straight forward experience.

https://dev.to/aws

Resources



Demo code

https://bit.ly/3sY19fP

Apache Airflow

https://airflow.apache.org

Thank you!

Ricardo Sueiras

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https://eventbox.dev/survey/QT0NYO6

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