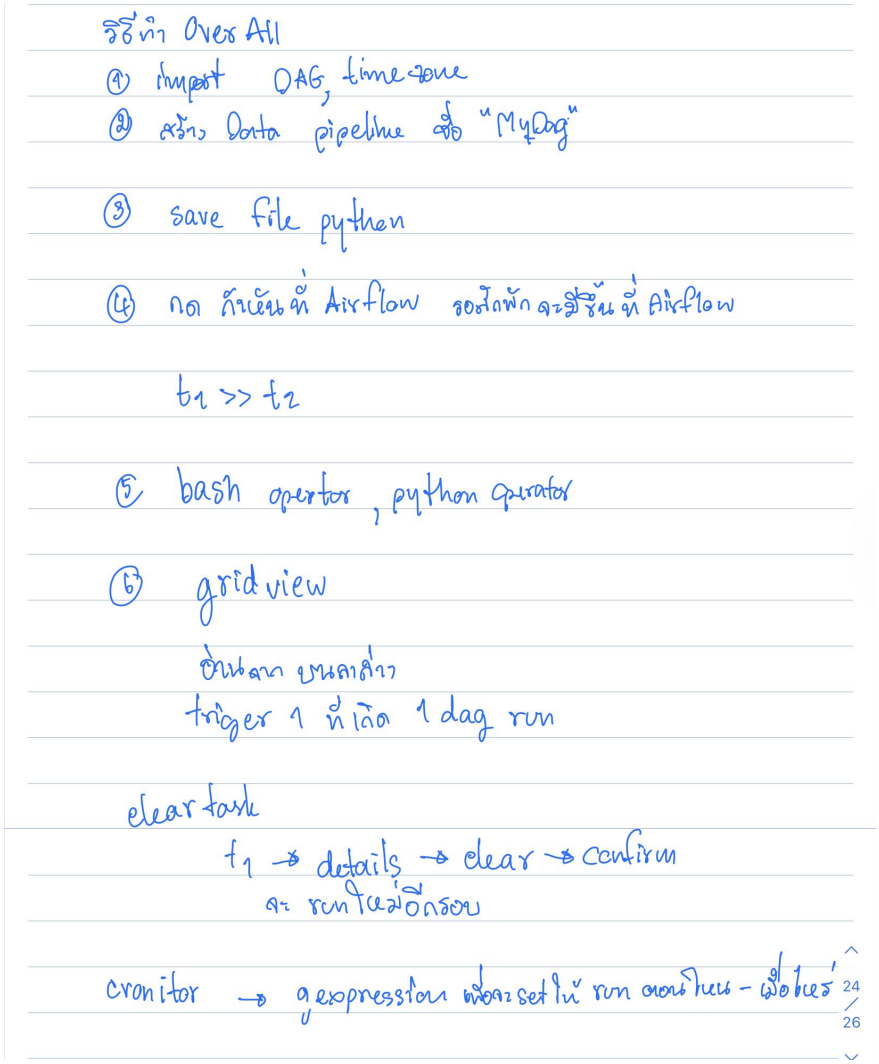
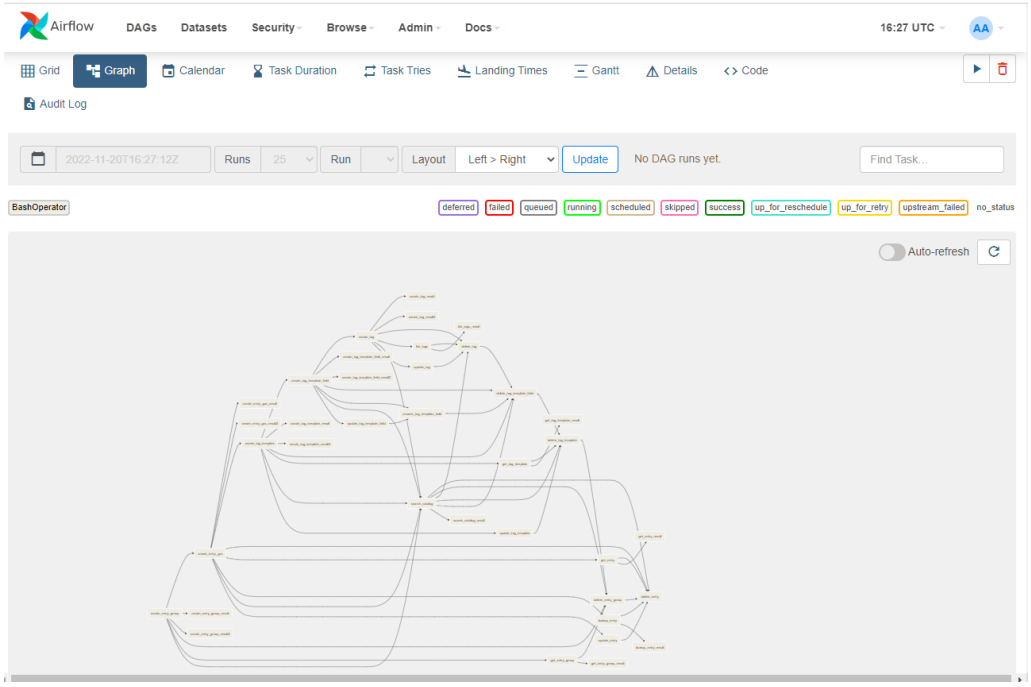
Project: Creating and Automating a Set of Data Pipelines with Airflow

สิ่งที่คาดหวังในโปรเจคนี้

1. นำโค้ดจาก Project: Building a Data Modeling with Postgres (SQL) มาสร้าง data pipeline โดยใช้ Airflow
2. มีการเขียน documentation อธิบายสิ่งที่ตัวเองทำลงไป รวมไปถึงการออกแบบ data model
3. มี instruction ในการรันโค้ดของตัวเอง

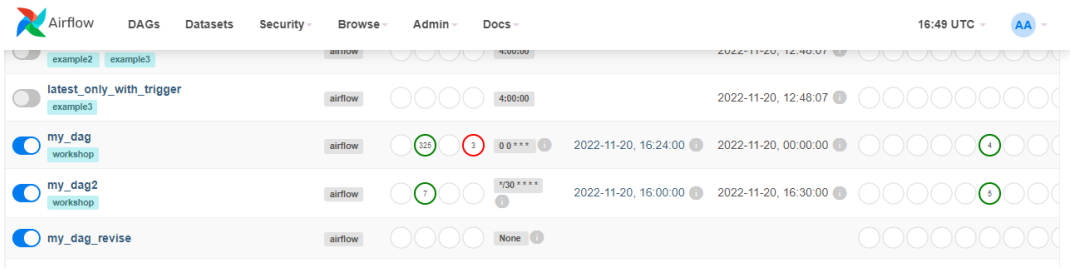
gitpod /workspace/swu-ds525/05-creating-and-scheduling-data-pipelines (main) $ docker-compose up

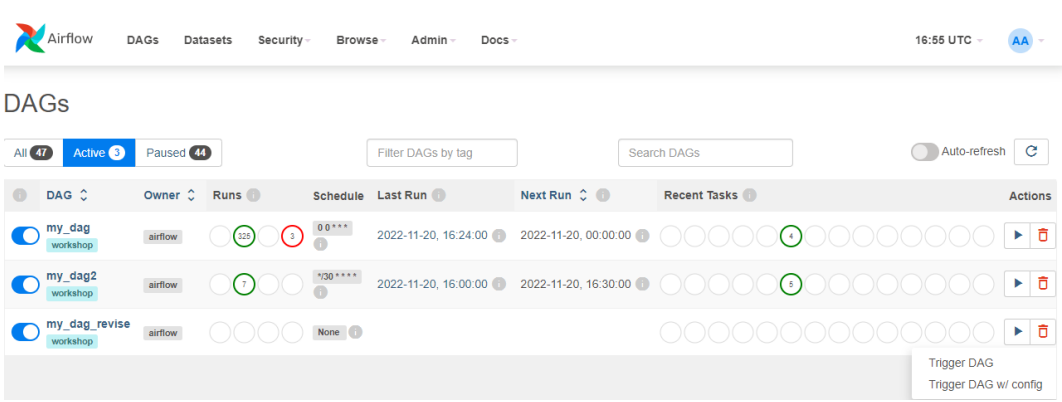


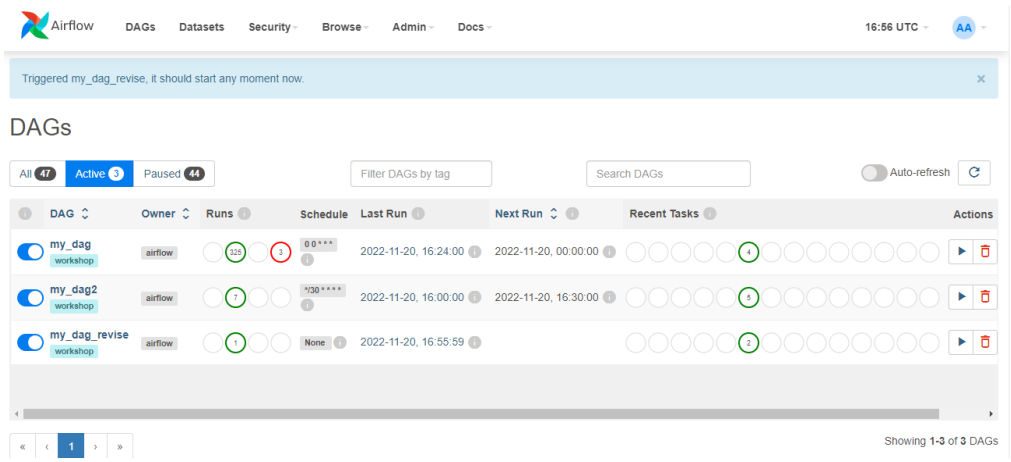


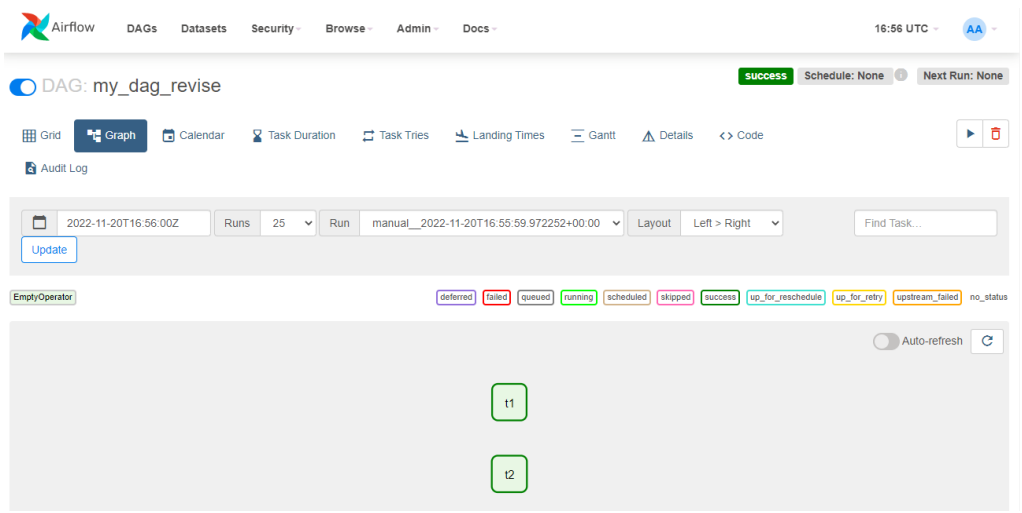
05-creating-and-scheduling-data-pipelines > dags > my_dag_revise.py

```python
#import DAG เป็น pipeline
from airflow import DAG
#import Timezone
from airflow.utils import timezone
#step 2 ใช้ EmptyOperator เลย import EmptyOperator เข้ามา
from airflow.operators.empty import EmptyOperator


#context manager เป็นการประกาศหัว
#"my_dag" ชื่อเดียวกับชื่อ file
#start date 2022, 10, 8
# schedule = None ยังไม่schedule
# step10
# schedule
# schedule เที่ยงคืน คือ 0
#v1  schedule = None ยังไม่set schedule
with DAG(
    "my_dag",
    start_date = timezone.datetime(2022, 10, 8),
    schedule = None,
):
    t1 = EmptyOperator( task_id = "t1")
    t2 = EmptyOperator( task_id = "t2")
```


Airflow
DAGs
Datasets
Security
Browse
Admin
Docs
16:49 UTC
AA
example2
example3
latest_only_with_trigger
example3
airflow
4:00:00
2022-11-20, 12:48:07
my_dag
workshop
airflow
0 0 * * *
2022-11-20, 16:24:00
2022-11-20, 00:00:00
my_dag2
workshop
airflow
*/30 * * * *
2022-11-20, 16:00:00
2022-11-20, 16:30:00
my_dag_revise
airflow
None

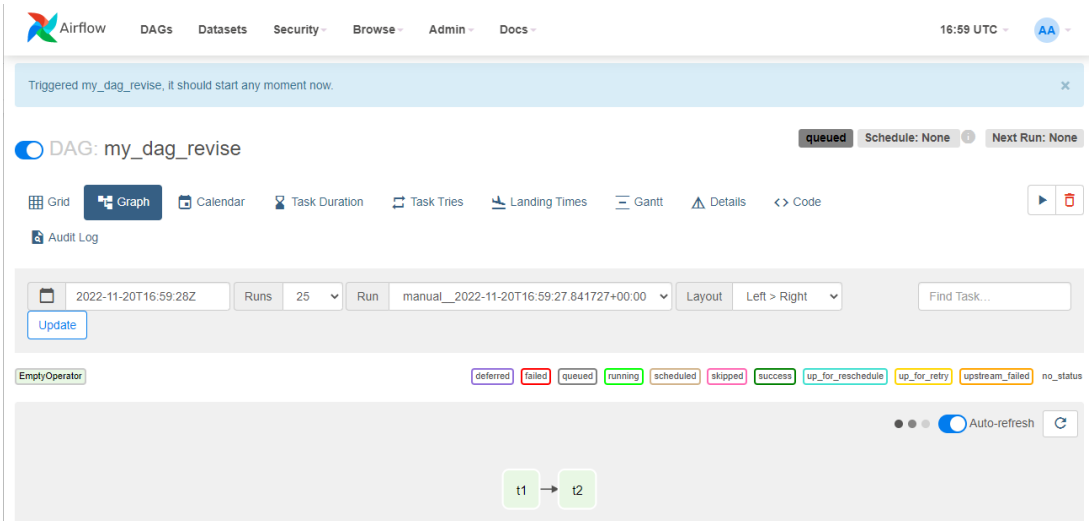

Airflow
DAGs
Datasets
Security
Browse
Admin
Docs
16:55 UTC
AA
DAGs
All 47
Active 3
Paused 44
Filter DAGs by tag
Search DAGs
Auto-refresh
DAG
Owner
Runs
Schedule
Last Run
Next Run
Recent Tasks
Actions
my_dag
workshop
airflow
0 0 * * *
2022-11-20, 16:24:00
2022-11-20, 00:00:00
my_dag2
workshop
airflow
*/30 * * * *
2022-11-20, 16:00:00
2022-11-20, 16:30:00
my_dag_revise
workshop
airflow
None
Trigger DAG
Trigger DAG w/ config


Airflow
DAGs
Datasets
Security
Browse
Admin
Docs
16:56 UTC
AA
Triggered my_dag_revise, it should start any moment now.
DAGs
All 47
Active 3
Paused 44
Filter DAGs by tag
Search DAGs
Auto-refresh
DAG
Owner
Runs
Schedule
Last Run
Next Run
Recent Tasks
Actions
my_dag
workshop
airflow
0 0 * * *
2022-11-20, 16:24:00
2022-11-20, 00:00:00
my_dag2
workshop
airflow
*/30 * * * *
2022-11-20, 16:00:00
2022-11-20, 16:30:00
my_dag_revise
workshop
airflow
None
2022-11-20, 16:55:59
Showing 1-3 of 3 DAGs


Airflow
DAGs
Datasets
Security
Browse
Admin
Docs
16:56 UTC
AA
DAG: my_dag_revise
success
Schedule: None
Next Run: None
Grid
Graph
Calendar
Task Duration
Task Tries
Landing Times
Gantt
Details
Code
Audit Log
2022-11-20T16:56:00Z
Runs
25
Run
manual__2022-11-20T16:55:59.972252+00:00
Layout
Left > Right
Find Task...
Update
EmptyOperator
deferred
failed
queued
running
scheduled
skipped
success
up_for_reschedule
up_for_retry
upstream_failed
no_status
Auto-refresh
t1
t2

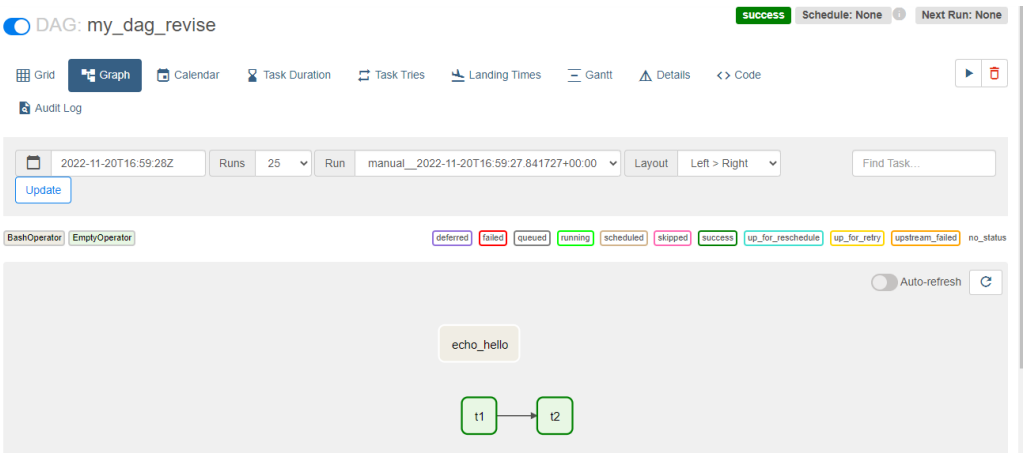
05-creating-and-scheduling-data-pipelines > dags > my_dag_revise.py

```python
#import DAG เป็น pipeline
from airflow import DAG
#import Timezone
from airflow.utils import timezone
#step 2 ใช้ EmptyOperator เลย import EmptyOperator เข้ามา
from airflow.operators.empty import EmptyOperator


#context manager เป็นการประกาศหัว
#"my_dag" ชื่อเดียวกับชื่อ file
#start date 2022, 10, 8
# schedule = None ยังไม่schedule
# step10
# schedule
# schedule เที่ยงคืน คือ 0
# tags =['workshop'] จะทำให้เป็นชัดเจน
#v1  schedule = None ยังไม่set schedule
with DAG(
    "my_dag_revise",
    start_date = timezone.datetime(2022, 10, 8),
    schedule = None,
    tags =["workshop"],
):
    t1 = EmptyOperator( task_id = "t1")
    t2 = EmptyOperator( task_id = "t2")

#t1 รันก่อน t2
    t1 >> t2

```

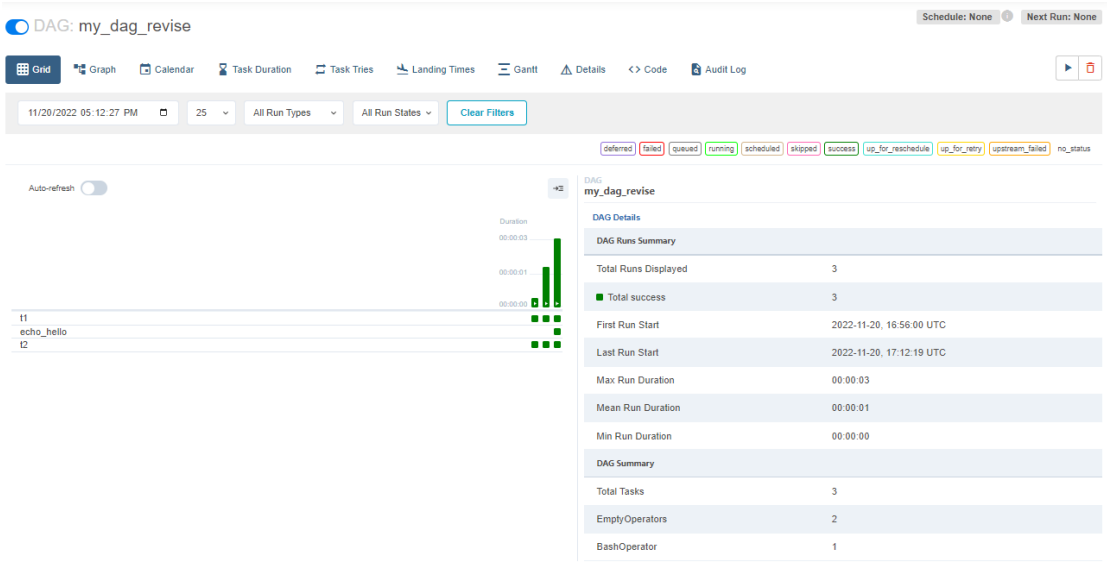


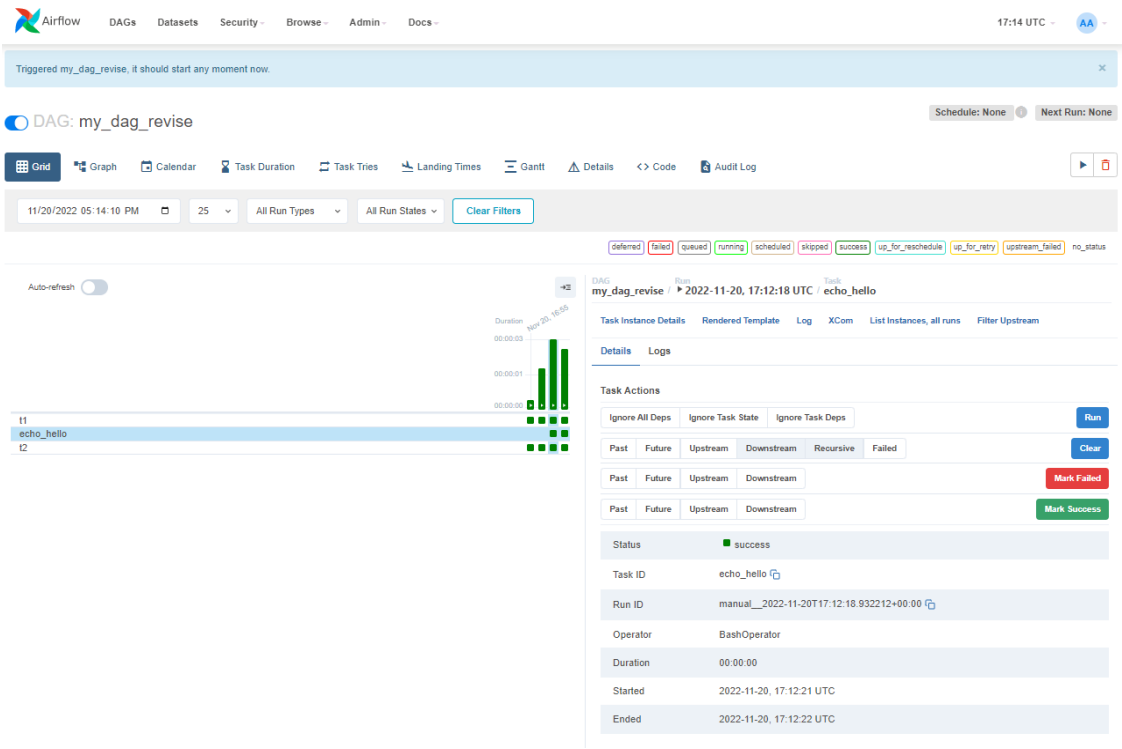
05-creating-and-scheduling-data-pipelines > dags > my_dag_revise.py

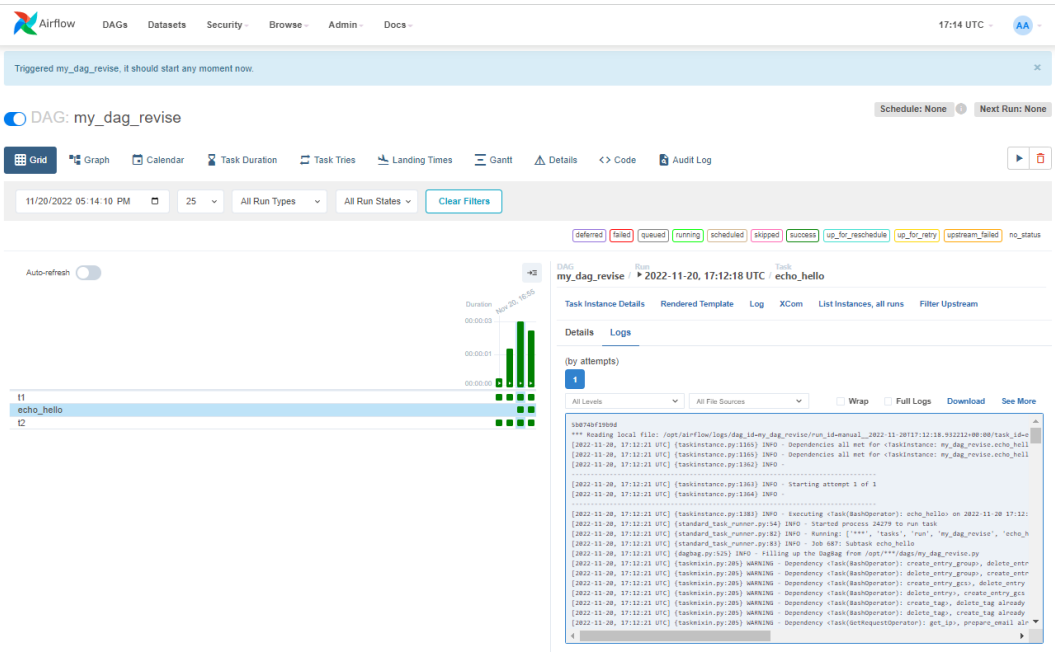
```python
# ):
#     t1 = EmptyOperator( task_id = "t1")
#     t2 = EmptyOperator( task_id = "t2")

# #t1 รันก่อน t2
#     t1 >> t2

#v2
with DAG(
    "my_dag_revise",
    start_date = timezone.datetime(2022, 10, 8),
    schedule = None,
    tags =["workshop"],
):
    t1 = EmptyOperator( task_id = "t1")

    echo_hello = BashOperator(
        task_id = "echo_hello",
        bash_command= "echo 'hello'",
    )

    t2 = EmptyOperator( task_id = "t2")

#t1 รันก่อน t2
    t1 >> t2
```



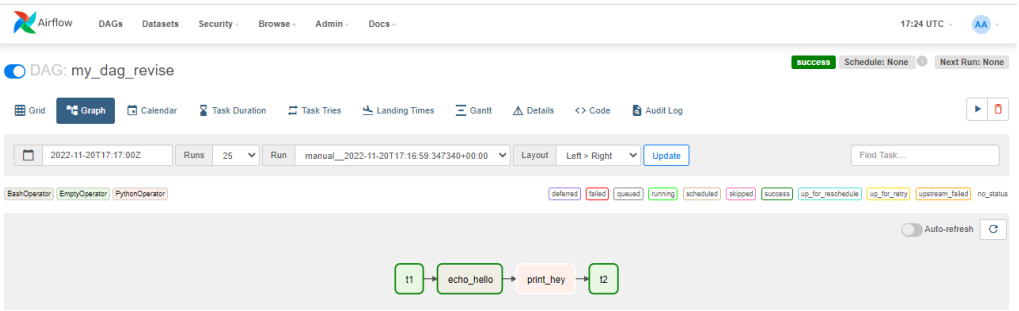

```python
#t1 รันก่อน t2
    t1 >> echo_hello >> t2
```

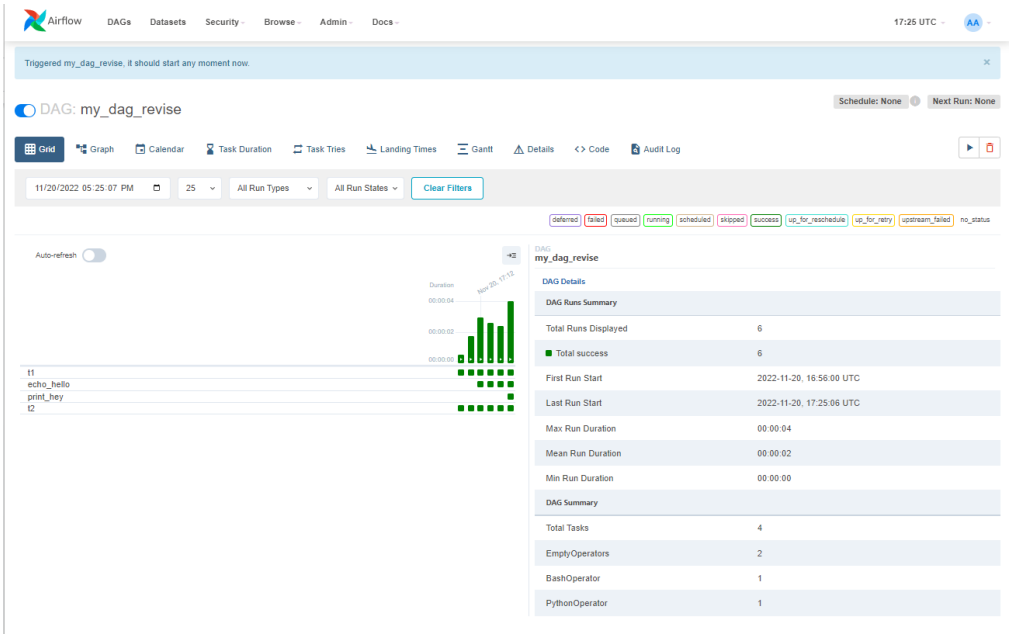

DAG: my_dag_revise
Schedule: None
Next Run: None
Grid
Graph
Calendar
Task Duration
Task Tries
Landing Times
Gantt
Details
Code
Audit Log
11/20/2022 05:12:27 PM
25
All Run Types
All Run States
Clear Filters
deferred
failed
queued
running
scheduled
skipped
success
up_for_reschedule
up_for_retry
upstream_failed
no_status
Auto-refresh
Duration
00:00:03
00:00:01
00:00:00
t1
echo_hello
t2
DAG
my_dag_revise
DAG Details
DAG Runs Summary
Total Runs Displayed 3
Total success 3
First Run Start 2022-11-20, 16:56:00 UTC
Last Run Start 2022-11-20, 17:12:19 UTC
Max Run Duration 00:00:03
Mean Run Duration 00:00:01
Min Run Duration 00:00:00
DAG Summary
Total Tasks 3
EmptyOperators 2
BashOperator 1

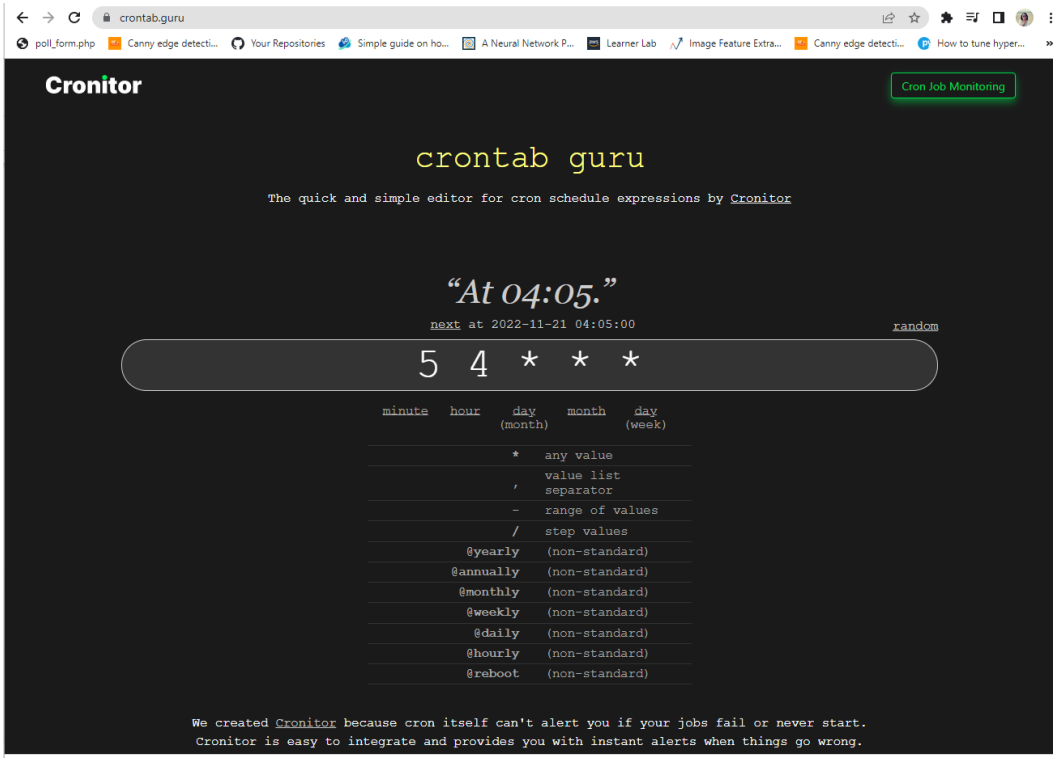

Airflow
DAGs
Datasets
Security
Browse
Admin
Docs
17:14 UTC
AA
Triggered my_dag_revise, it should start any moment now.
DAG: my_dag_revise
Schedule: None
Next Run: None
Grid
Graph
Calendar
Task Duration
Task Tries
Landing Times
Gantt
Details
Code
Audit Log
11/20/2022 05:14:10 PM
25
All Run Types
All Run States
Clear Filters
deferred
failed
queued
running
scheduled
skipped
success
up_for_reschedule
up_for_retry
upstream_failed
no_status
Auto-refresh
Duration
Nov 20, 16:55
00:00:03
00:00:01
00:00:00
t1
echo_hello
t2
DAG
my_dag_revise
Run
2022-11-20, 17:12:18 UTC
Task
echo_hello
Task Instance Details
Rendered Template
Log
XCom
List Instances, all runs
Filter Upstream
Details
Logs
Task Actions
Ignore All Deps
Ignore Task State
Ignore Task Deps
Run
Past
Future
Upstream
Downstream
Recursive
Failed
Clear
Mark Failed
Mark Success
Status success
Task ID echo_hello
Run ID manual__2022-11-20T17:12:18.932212+00:00
Operator BashOperator
Duration 00:00:00
Started 2022-11-20, 17:12:21 UTC
Ended 2022-11-20, 17:12:22 UTC

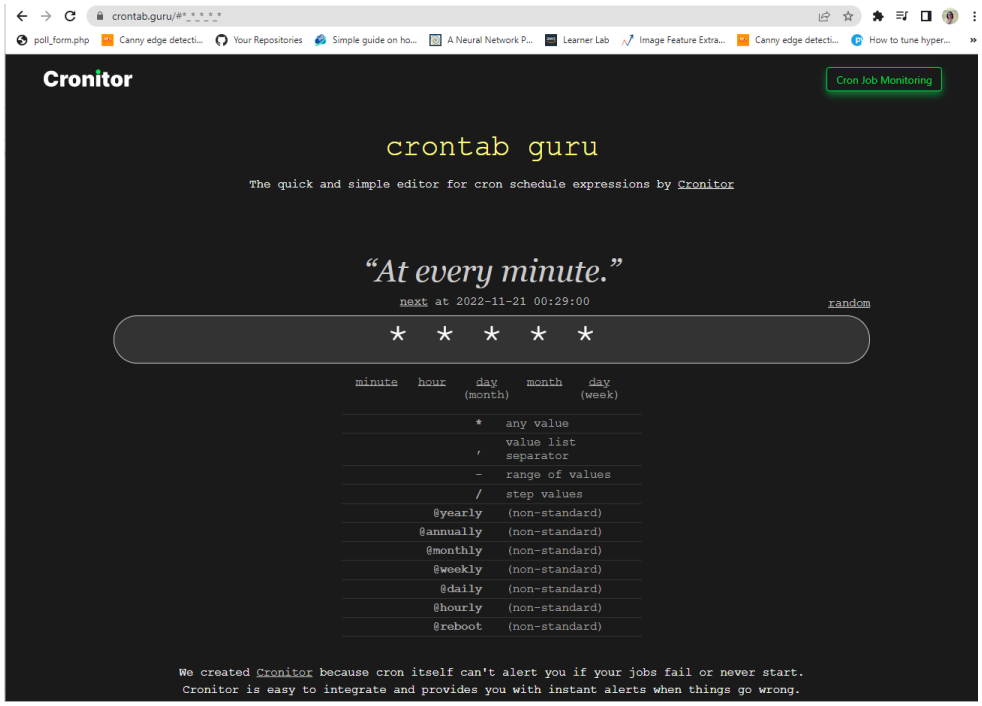


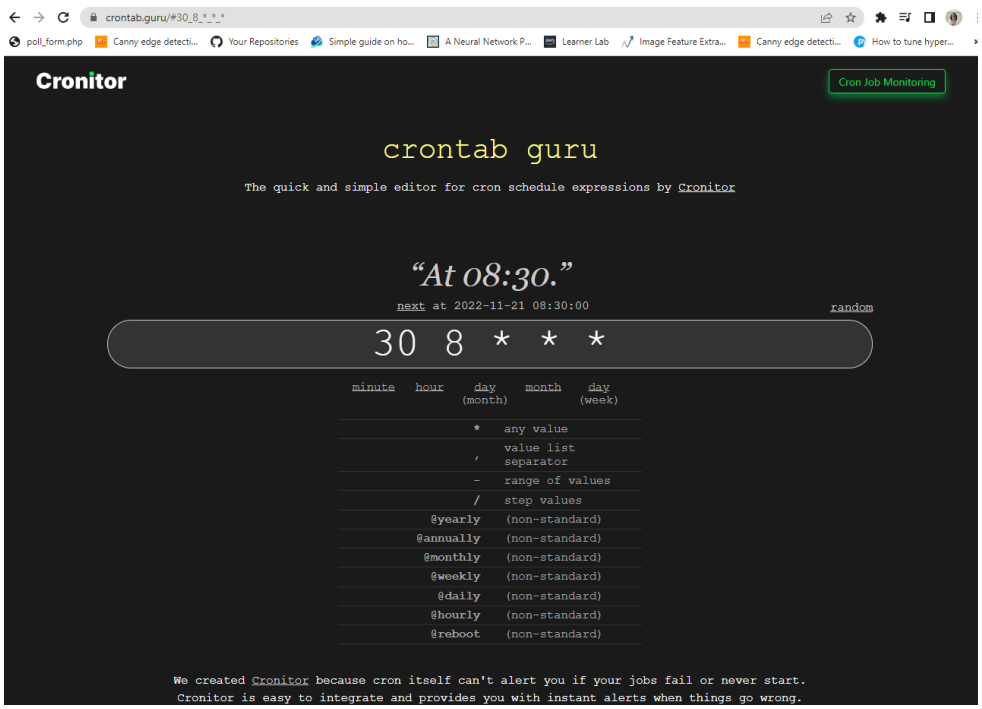

```python
#v3
with DAG(
    "my_dag_revise",
    start_date = timezone.datetime(2022, 10, 8),
    schedule = None,
    tags =["workshop"],
):
    t1 = EmptyOperator( task_id = "t1")

    echo_hello = BashOperator(
        task_id = "echo_hello",
        bash_command= "echo 'hello'",
    )
    def _print_hey():
        print("Hey!")

    print_hey = PythonOperator(
        task_id = "print_hey",
        python_callable = _print_hey,
    )

    t2 = EmptyOperator( task_id = "t2")

#t1 รันก่อน t2
    t1 >> echo_hello >> print_hey >> t2
```

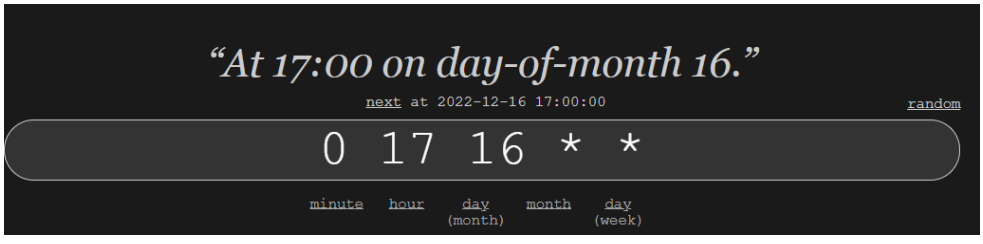



Airflow
DAGs
Datasets
Security
Browse
Admin
Docs
17:25 UTC
Triggered my_dag_revise, it should start any moment now.
DAG: my_dag_revise
Schedule: None
Next Run: None
Grid
Graph
Calendar
Task Duration
Task Tries
Landing Times
Gantt
Details
Code
Audit Log
11/20/2022 05:25:07 PM
25
All Run Types
All Run States
Clear Filters
deferred
failed
queued
running
scheduled
skipped
success
up_for_reschedule
up_for_retry
upstream_failed
no_status
Auto-refresh
Duration
00:00:04
00:00:02
00:00:00
t1
echo_hello
print_hey
t2
DAG
my_dag_revise
DAG Details
DAG Runs Summary
Total Runs Displayed 6
Total success 6
First Run Start 2022-11-20, 16:56:00 UTC
Last Run Start 2022-11-20, 17:25:06 UTC
Max Run Duration 00:00:04
Mean Run Duration 00:00:02
Min Run Duration 00:00:00
DAG Summary
Total Tasks 4
EmptyOperators 2
BashOperator 1
PythonOperator 1

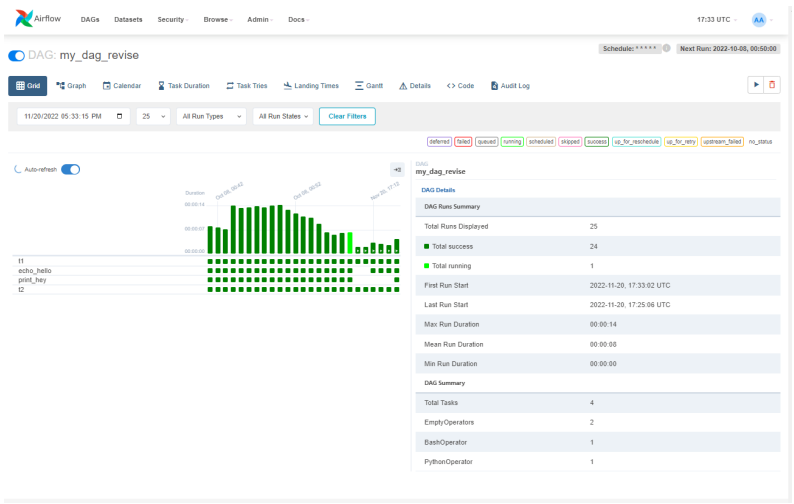

crontab.guru
poll_form.php
Canny edge detecti...
Your Repositories
Simple guide on ho...
A Neural Network P...
Learner Lab
Image Feature Extra...
Canny edge detecti...
How to tune hyper...
Cronitor
Cron Job Monitoring
crontab guru
The quick and simple editor for cron schedule expressions by Cronitor
“At 04:05.”
next at 2022-11-21 04:05:00
random
5 4 * * *
minute
hour
day (month)
month
day (week)
* any value
, value list separator
- range of values
/ step values
@yearly (non-standard)
@annually (non-standard)
@monthly (non-standard)
@weekly (non-standard)
@daily (non-standard)
@hourly (non-standard)
@reboot (non-standard)
We created Cronitor because cron itself can't alert you if your jobs fail or never start.
Cronitor is easy to integrate and provides you with instant alerts when things go wrong.

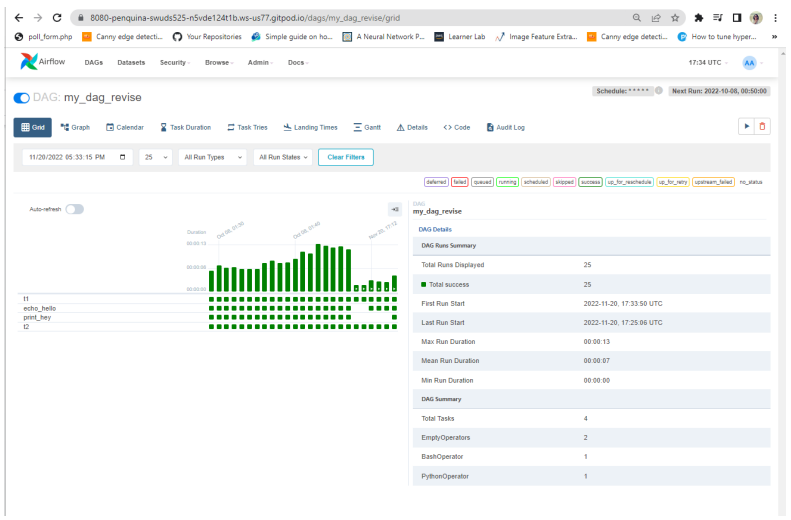

crontab.guru/#*_*_*_*_*
poll_form.php
Canny edge detecti...
Your Repositories
Simple guide on ho...
A Neural Network P...
Learner Lab
Image Feature Extra...
Canny edge detecti...
How to tune hyper...
Cronitor
Cron Job Monitoring
crontab guru
The quick and simple editor for cron schedule expressions by Cronitor
“At every minute.”
next at 2022-11-21 00:29:00
random
* * * * *
minute hour day (month) month day (week)
* any value
, value list separator
- range of values
/ step values
@yearly (non-standard)
@annually (non-standard)
@monthly (non-standard)
@weekly (non-standard)
@daily (non-standard)
@hourly (non-standard)
@reboot (non-standard)
We created Cronitor because cron itself can't alert you if your jobs fail or never start.
Cronitor is easy to integrate and provides you with instant alerts when things go wrong.


crontab.guru/#30_8_*_*_*
poll_form.php
Canny edge detecti...
Your Repositories
Simple guide on ho...
A Neural Network P...
Learner Lab
Image Feature Extra...
Canny edge detecti...
How to tune hyper...
Cronitor
Cron Job Monitoring
crontab guru
The quick and simple editor for cron schedule expressions by Cronitor
“At 08:30.”
next at 2022-11-21 08:30:00
random
30 8 * * *
minute hour day (month) month day (week)
* any value
, value list separator
- range of values
/ step values
@yearly (non-standard)
@annually (non-standard)
@monthly (non-standard)
@weekly (non-standard)
@daily (non-standard)
@hourly (non-standard)
@reboot (non-standard)
We created Cronitor because cron itself can't alert you if your jobs fail or never start.
Cronitor is easy to integrate and provides you with instant alerts when things go wrong.

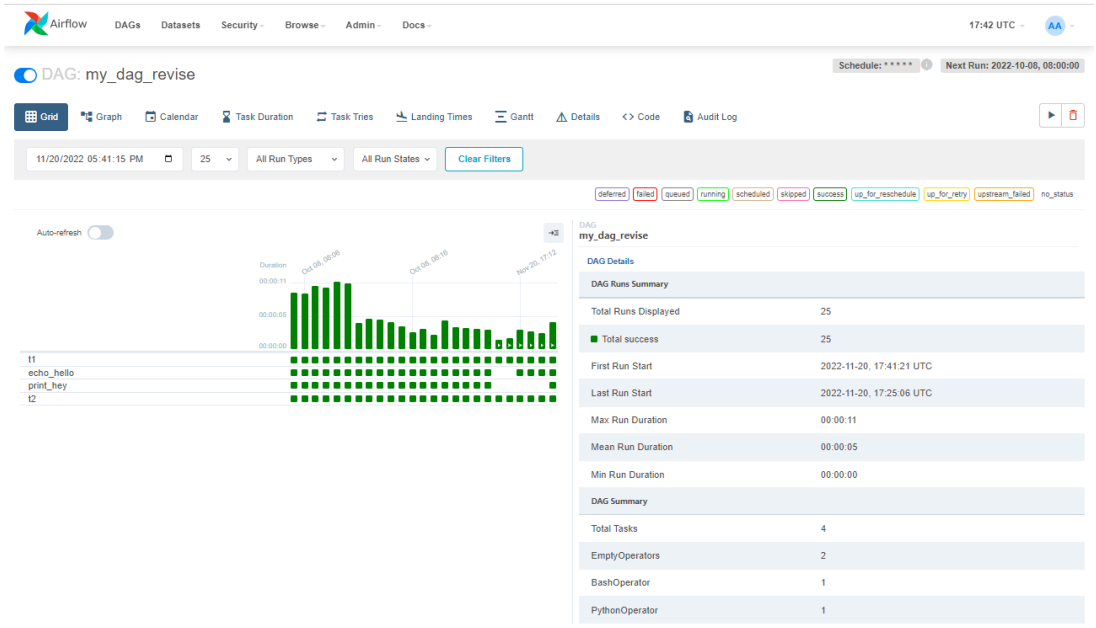

“At 17:00 on day-of-month 16.”
next at 2022-12-16 17:00:00
random
0 17 16 * *
minute hour day (month) month day (week)

```python
with DAG(
    "my_dag_revise",
    start_date = timezone.datetime(2022, 10, 8),
    schedule = "* * * * *",
    tags =["workshop"],
):
    t1 = EmptyOperator( task_id = "t1")

    echo_hello = BashOperator(
        task_id = "echo_hello",
        bash_command= "echo 'hello'",
    )
    def _print_hey():
        print("Hey!")

    print_hey = PythonOperator(
        task_id = "print_hey",
        python_callable = _print_hey,
    )

    t2 = EmptyOperator( task_id = "t2")

#t1 รันก่อน t2
    t1 >> echo_hello >> print_hey >> t2
```

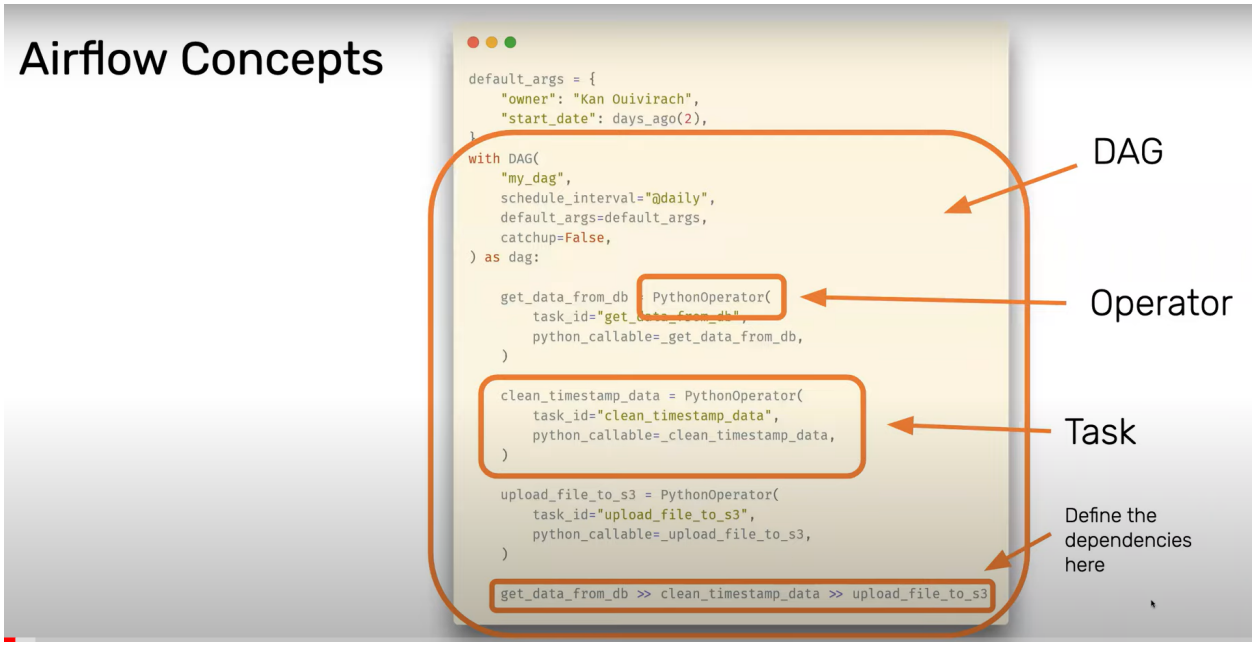




```
#t1 รันก่อน t2
    #t1 >> echo_hello >> print_hey >> t2
    t1 >> [ echo_hello, print_hey] >> t2
```



Week9 ช่วงทบทวนweek 8

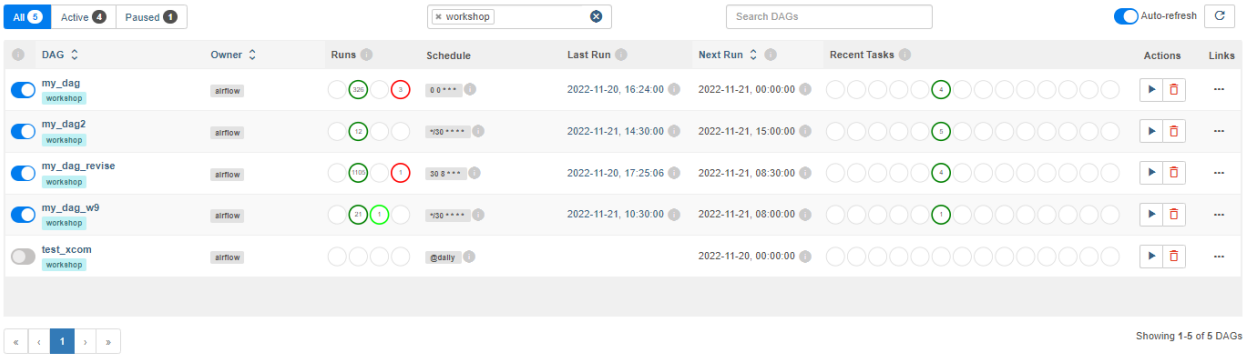


Let's Build this Airflow DAG

DAG runs every 30 minutes

1. EmptyOperator: start
2. BashOperator: echo_hello
3. PythonOperator: say_hello
4. PythonOperator: print_log_messages
5. EmptyOperator: end

DAGs

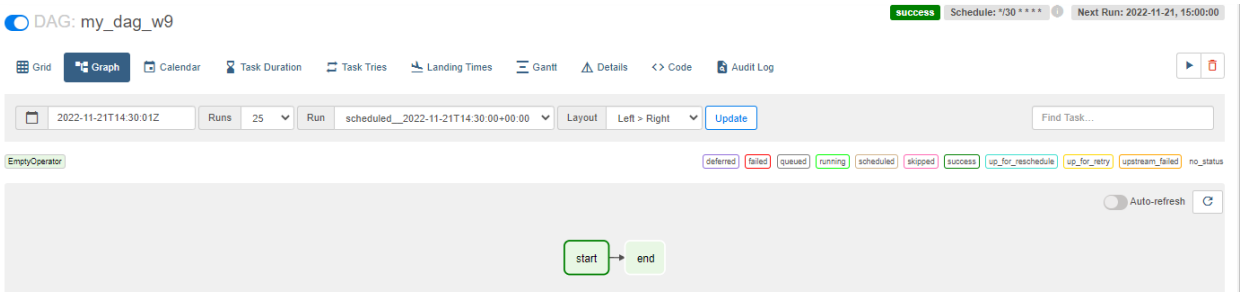


05-creating-and-scheduling-data-pipelines > dags > my_dag_w9.py

```python
from airflow import DAG
from airflow.utils import timezone
from airflow.operators.empty import EmptyOperator

with DAG(
    "my_dag_w9",
    start_date = timezone.datetime(2022,11,21),
    schedule = "*/30 * * * *",
    tags = ["workshop"],
) as dag:

    start = EmptyOperator(task_id = "start")

```

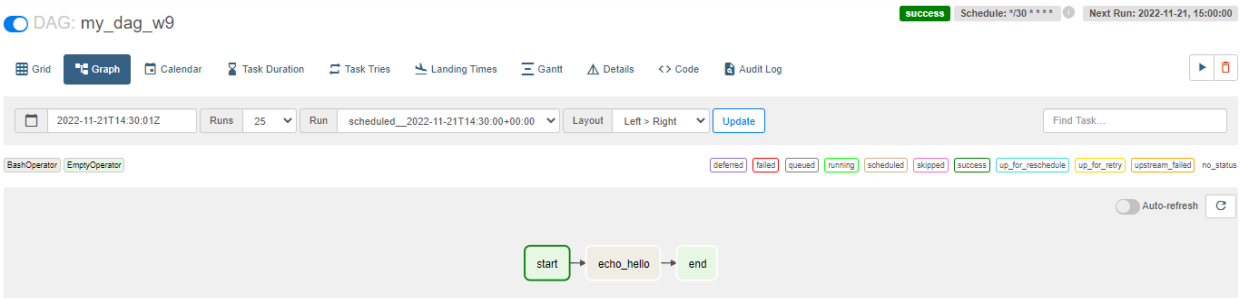
05-creating-and-scheduling-data-pipelines > dags > my_dag_w9.py

```python
from airflow import DAG
from airflow.utils import timezone
from airflow.operators.empty import EmptyOperator

with DAG(
    "my_dag_w9",
    start_date = timezone.datetime(2022,11,21),
    schedule = "*/30 * * * *",
    tags = ["workshop"],
) as dag:

    start = EmptyOperator(task_id = "start")

    end =  EmptyOperator(task_id = "end")

    start >> end
```



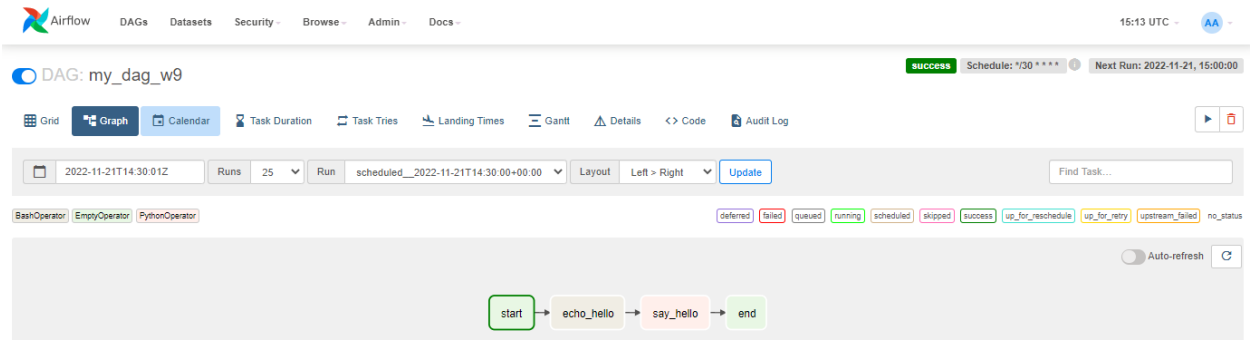
05-creating-and-scheduling-data-pipelines > dags > my_dag_w9.py

```python
from airflow import DAG
from airflow.utils import timezone
from airflow.operators.empty import EmptyOperator
from airflow.operators.bash import BashOperator

with DAG(
    "my_dag_w9",
    start_date = timezone.datetime(2022,11,21),
    schedule = "*/30 * * * *",
    tags = ["workshop"],
) as dag:

    start = EmptyOperator(task_id = "start")

    echo_hello = BashOperator(
        task_id = "echo_hello",
        bash_command = "echo 'hello'",
    )

    end =  EmptyOperator(task_id = "end")

    start >> echo_hello >>end

```



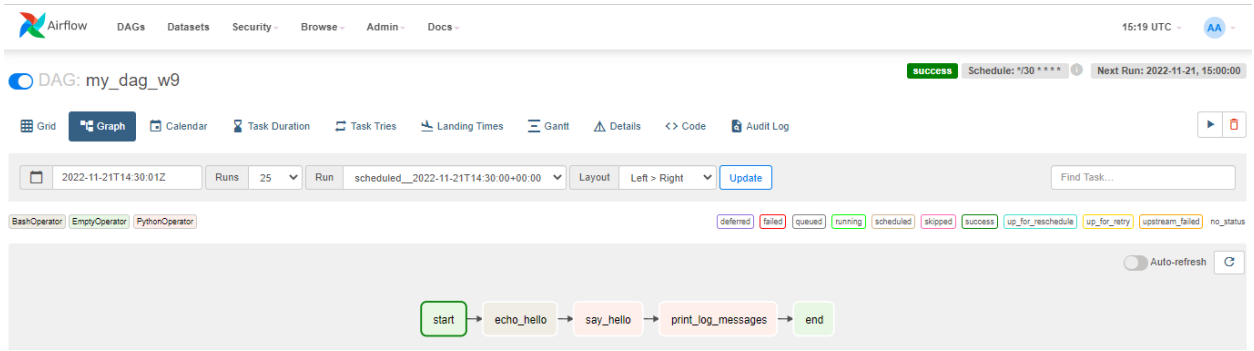
05-creating-and-scheduling-data-pipelines > dags > my_dag_w9.py

```python
from airflow import DAG
from airflow.utils import timezone
from airflow.operators.empty import EmptyOperator
from airflow.operators.bash import BashOperator
from airflow.operators.python import PythonOperator

#ชื่อฟังก์ชั่นต้องไม่เหมือนชื่อtask เลยใส่ _ นำหน้า

def _say_hello():
    print("Hello")

with DAG(
    "my_dag_w9",
    start_date = timezone.datetime(2022,11,21),
    schedule = "*/30 * * * *",
    tags = ["workshop"],
) as dag:

    start = EmptyOperator(task_id = "start")

    echo_hello = BashOperator(
        task_id = "echo_hello",
        bash_command = "echo 'hello'",
    )

    say_hello = PythonOperator(
        task_id = "say_hello",
        python_callable = _say_hello,

    )

    end =  EmptyOperator(task_id = "end")

    start >> echo_hello >> say_hello >> end
```

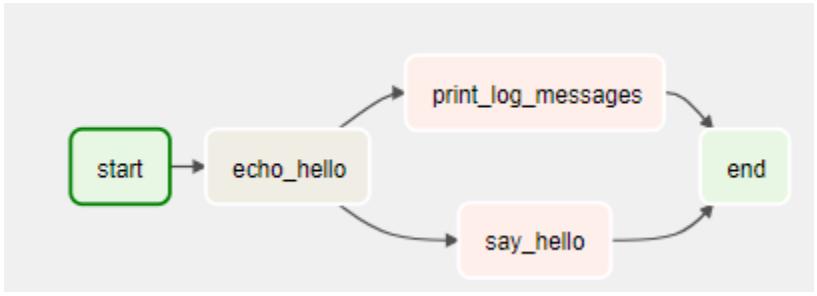


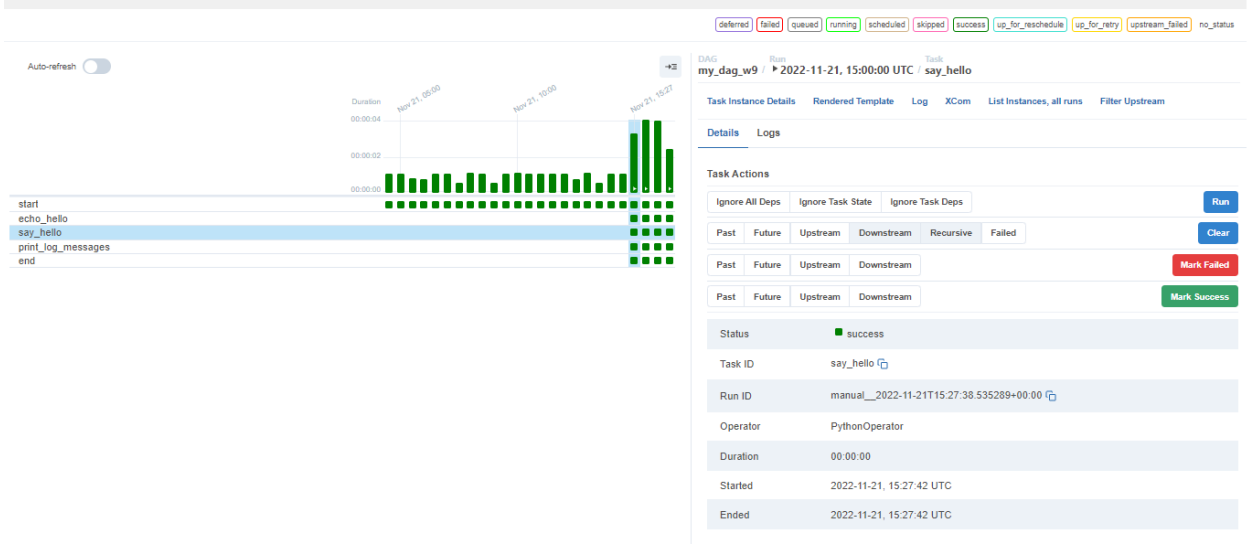
05-creating-and-scheduling-data-pipelines > dags > my_dag_w9.py

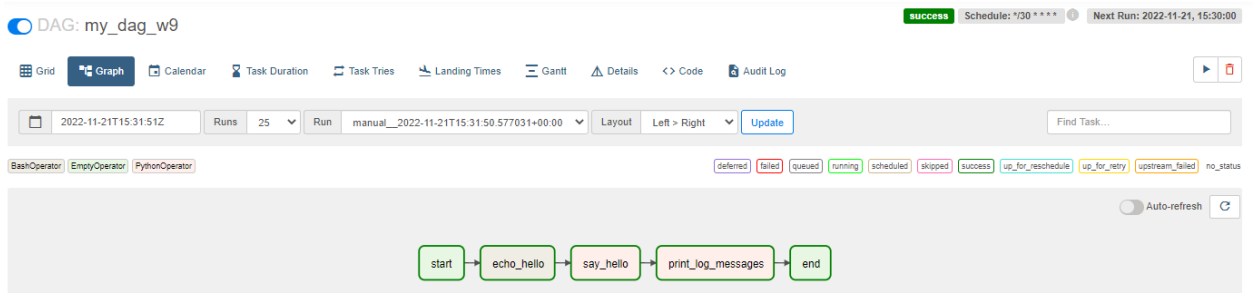
```python
import logging

from airflow import DAG
from airflow.utils import timezone
from airflow.operators.empty import EmptyOperator
from airflow.operators.bash import BashOperator
from airflow.operators.python import PythonOperator

#ชื่อฟังก์ชั่นต้องไม่เหมือนชื่อtask เลยใส่ _ นำหน้า

def _say_hello():
    print("Hello")

#logging มีระดับการlog => info, debug แล้วแต่การทำงาน
def _print_log_messages():
    logging.info("Hello from Log")

with DAG(
    "my_dag_w9",
    start_date = timezone.datetime(2022,11,21),
    schedule = "*/30 * * * *",
    tags = ["workshop"],
) as dag:

    start = EmptyOperator(task_id = "start")

    echo_hello = BashOperator(
        task_id = "echo_hello",
        bash_command = "echo 'hello'",
    )

    say_hello = PythonOperator(
        task_id = "say_hello",
        python_callable = _say_hello,

    )

    print_log_messages = PythonOperator(
        task_id = "print_log_messages",
        python_callable = _print_log_messages,

    )

    end =  EmptyOperator(task_id = "end")

    start >> echo_hello >> say_hello >> print_log_messages >> end

```




```
#    start >> echo_hello >> say_hello >> print_log_messages >> end
    start >> echo_hello >> [ say_hello , print_log_messages ] >> end
```







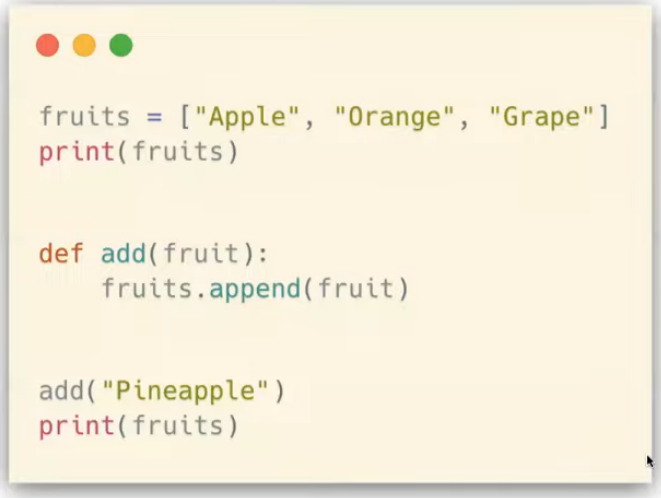
Week 9

Good Data Pipeline

It should have these 4 characteristics

1. **Reproducible:** deterministic and idempotent
2. **Future proof:** backfilling and versioning
3. **Fault tolerance:** automatic retry of failed tasks
4. **Transparent:** clarity of where data are

Idempotent



```
fruits = ["Apple", "Orange", "Grape"]
print(fruits)


def add(fruit):
    fruits.append(fruit)


add("Pineapple")
print(fruits)
```

This code changes the value stored in fruits

Idempotent

```python
fruits = ["Apple", "Orange", "Grape"]
print(fruits)


def add(fruit):
    fruits.append(fruit)


add("Pineapple")
print(fruits)
```

This code changes the value stored in fruits 

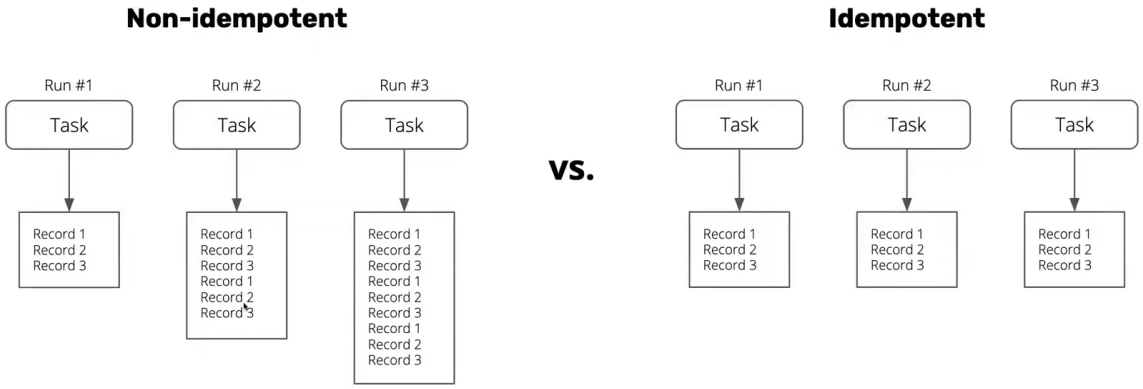
```python
fruits = ["Apple", "Orange", "Grape"]


def add_new(fruit):
    return fruits + [fruit]


new_fruits = add_new("Pineapple")
print(fruits)
print(new_fruits)
```

This code does **NOT** change the value stored in fruits 

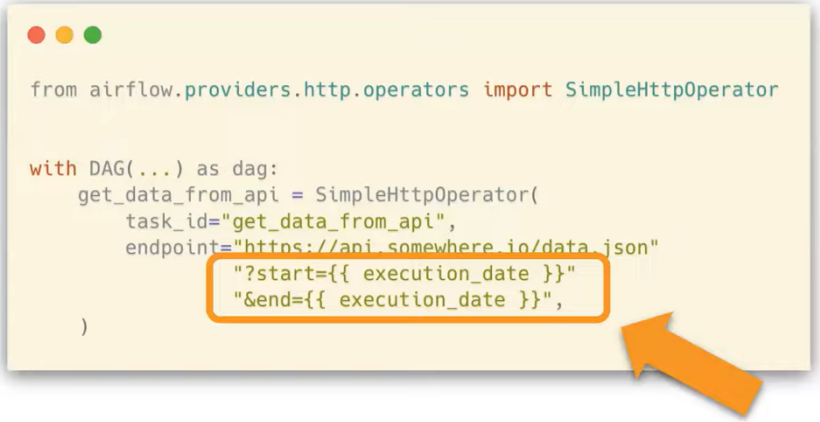
```python
fruits = ["Apple", "Orange", "Grape"]
def add(fruit):
    fruits.append(fruit)

add("Pineapple")
print (" Not Idempotent ")
print(fruits)

add("Pineapple")
add("Pineapple")
add("Pineapple")
add("Pineapple")
print(fruits)

fruits2 = ["Apple", "Orange", "Grape"]
def add_new(fruit2):
    return fruits2 + [fruit2]

new_fruits = add_new("Pineapple")
print (" Idempotent ")
print(new_fruits)

new_fruits = add_new("Pineapple")
new_fruits = add_new("Pineapple")
new_fruits = add_new("Pineapple")
new_fruits = add_new("Pineapple")
print(new_fruits)
```

```
gitpod /workspace/swu-ds525/05-creating-and-scheduling-data-pipelines/dags (main) $ python fruits.py
 Not Idempotent
['Apple', 'Orange', 'Grape', 'Pineapple']
['Apple', 'Orange', 'Grape', 'Pineapple', 'Pineapple', 'Pineapple', 'Pineapple', 'Pineapple']
 Idempotent
['Apple', 'Orange', 'Grape', 'Pineapple']
['Apple', 'Orange', 'Grape', 'Pineapple']
```

Non-idempotent vs. Idempotent



Making Pipeline Idempotent



Templating and Macros

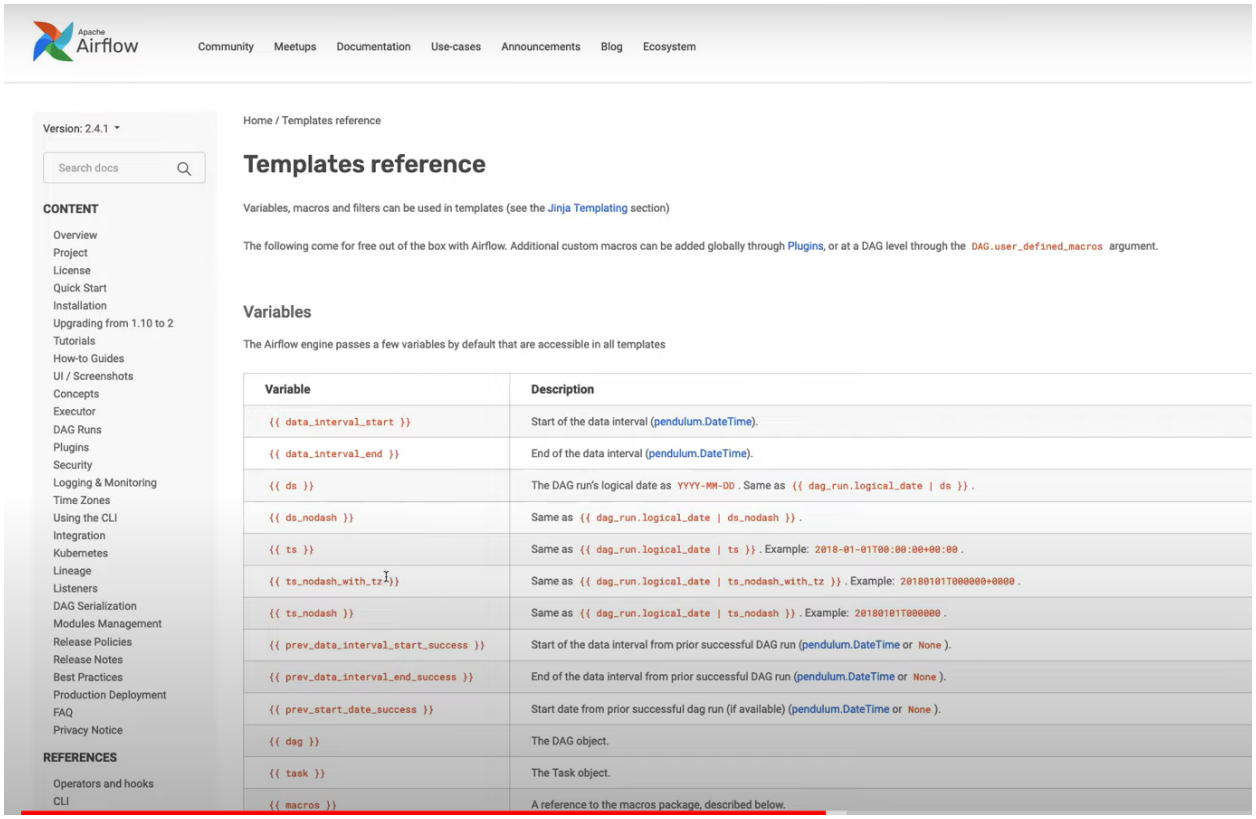
Way to pass dynamic data to your DAGs at runtime

Use cases:

- Turning tasks idempotent
- Timestamp for incremental ETL
- Custom user defined parameters for complex operators

See the default variables and macros in the Macros reference in Airflow docs

airflow template macro



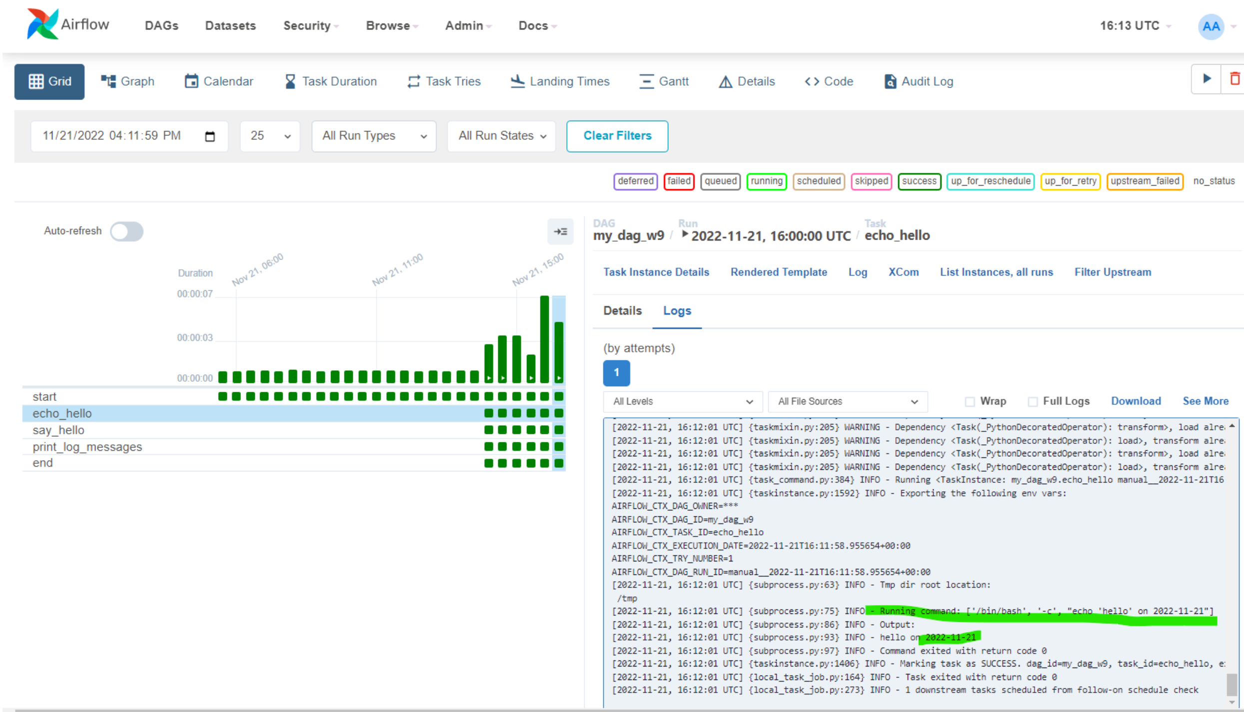
Variables

The Airflow engine passes a few variables by default that are accessible in all templates

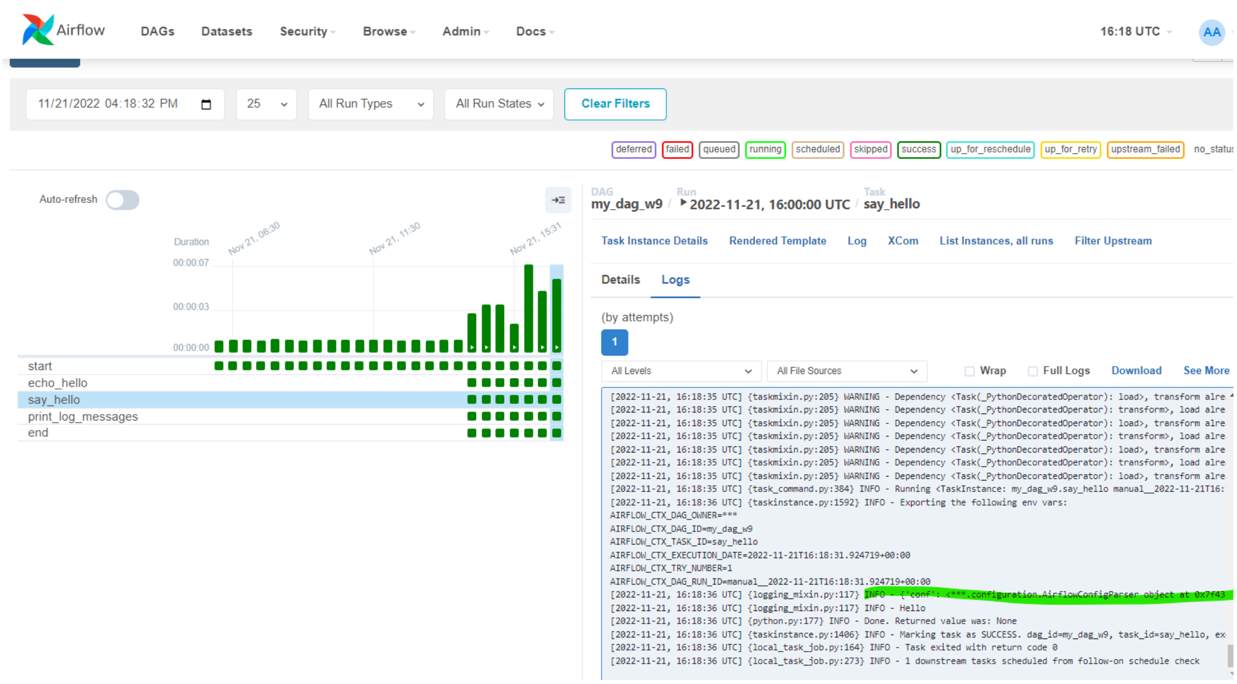
Variable	Description
`{{ data_interval_start }}`	Start of the data interval (pendulum.DateTime).
`{{ data_interval_end }}`	End of the data interval (pendulum.DateTime).
`{{ ds }}`	The DAG run's logical date as `YYYY-MM-DD` . Same as `{{ dag_run.logical_date | ds }}` .
`{{ ds_nodash }}`	Same as `{{ dag_run.logical_date | ds_nodash }}` .
`{{ ts }}`	Same as `{{ dag_run.logical_date | ts }}` . Example: `2018-01-01T00:00:00+00:00` .
`{{ ts_nodash_with_tz }}`	Same as `{{ dag_run.logical_date | ts_nodash_with_tz }}` . Example: `20180101T000000+0000`
`{{ ts_nodash }}`	Same as `{{ dag_run.logical_date | ts_nodash }}` . Example: `20180101T000000` .
`{{ prev_data_interval_start_success }}`	Start of the data interval from prior successful DAG run (pendulum.DateTime or `None`).
`{{ prev_data_interval_end_success }}`	End of the data interval from prior successful DAG run (pendulum.DateTime or `None`).
`{{ prev_start_date_success }}`	Start date from prior successful dag run (if available) (pendulum.DateTime or `None`).
`{{ dag }}`	The DAG object.
`{{ task }}`	The Task object.

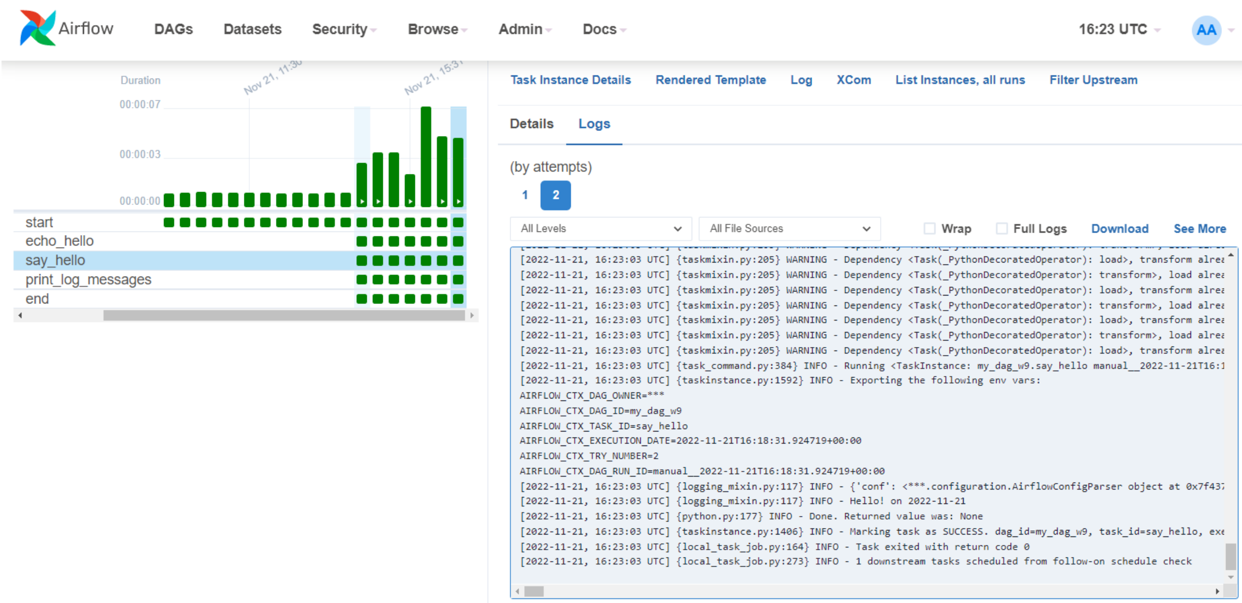
05-creating-and-scheduling-data-pipelines > dags > my_dag_w9.py

```python
import logging

from airflow import DAG
from airflow.utils import timezone
from airflow.operators.empty import EmptyOperator
from airflow.operators.bash import BashOperator
from airflow.operators.python import PythonOperator

#ชื่อฟังก์ชั่นต้องไม่เหมือนชื่อtask เลยใส่ _ นำหน้า

def _say_hello():
    print("Hello")

#logging มีระดับการlog => info, debug แล้วแต่การทำงาน
def _print_log_messages():
    logging.info("Hello from Log")

with DAG(
    "my_dag_w9",
    start_date = timezone.datetime(2022,11,21),
    schedule = "*/30 * * * *",
    tags = ["workshop"],
    catchup = False,
) as dag:

    start = EmptyOperator(task_id = "start")

    echo_hello = BashOperator(
        task_id = "echo_hello",
        bash_command = "echo 'hello' on {{ ds }}",
    )

    say_hello = PythonOperator(
        task_id = "say_hello",
        python_callable = _say_hello,

    )

    print_log_messages = PythonOperator(
        task_id = "print_log_messages",
        python_callable = _print_log_messages,

    )

    end =  EmptyOperator(task_id = "end")

    start >> echo_hello >> say_hello >> print_log_messages >> end
#    start >> echo_hello >> [ say_hello , print_log_messages ] >> end


```

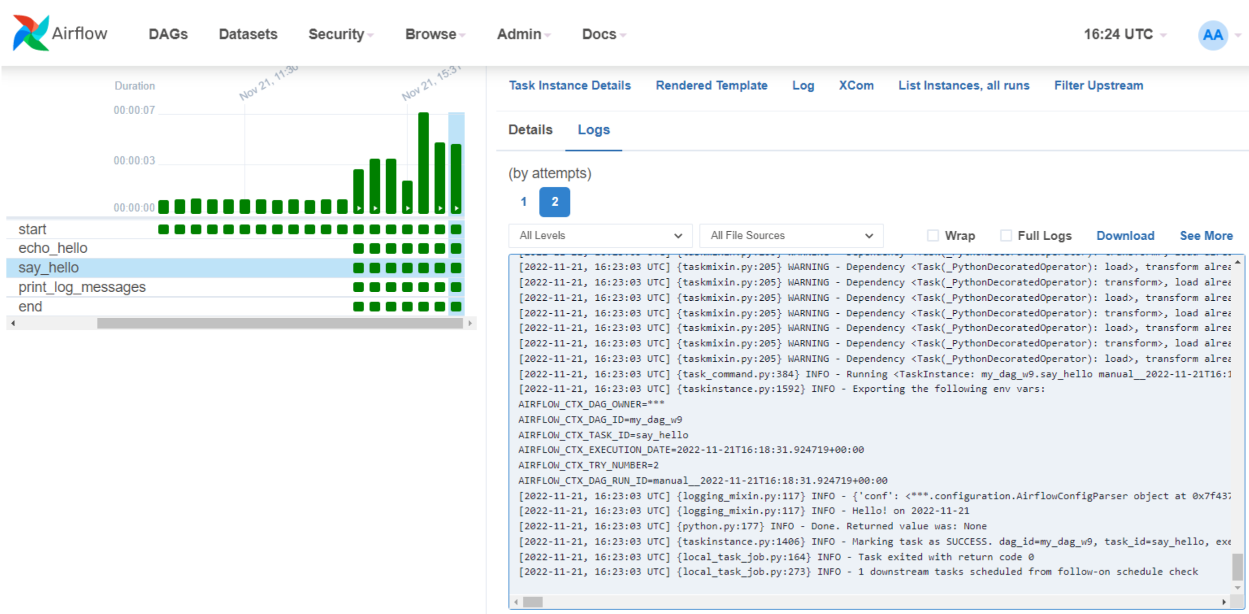


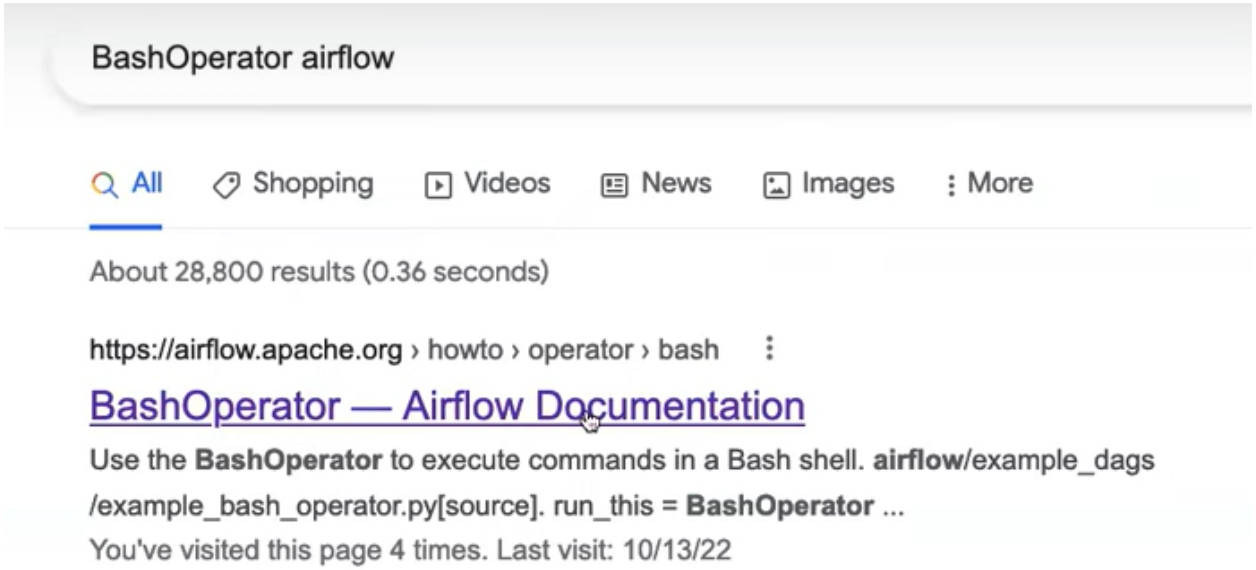

```python
def _say_hello(**context):
    print(context)
    print("Hello")
```

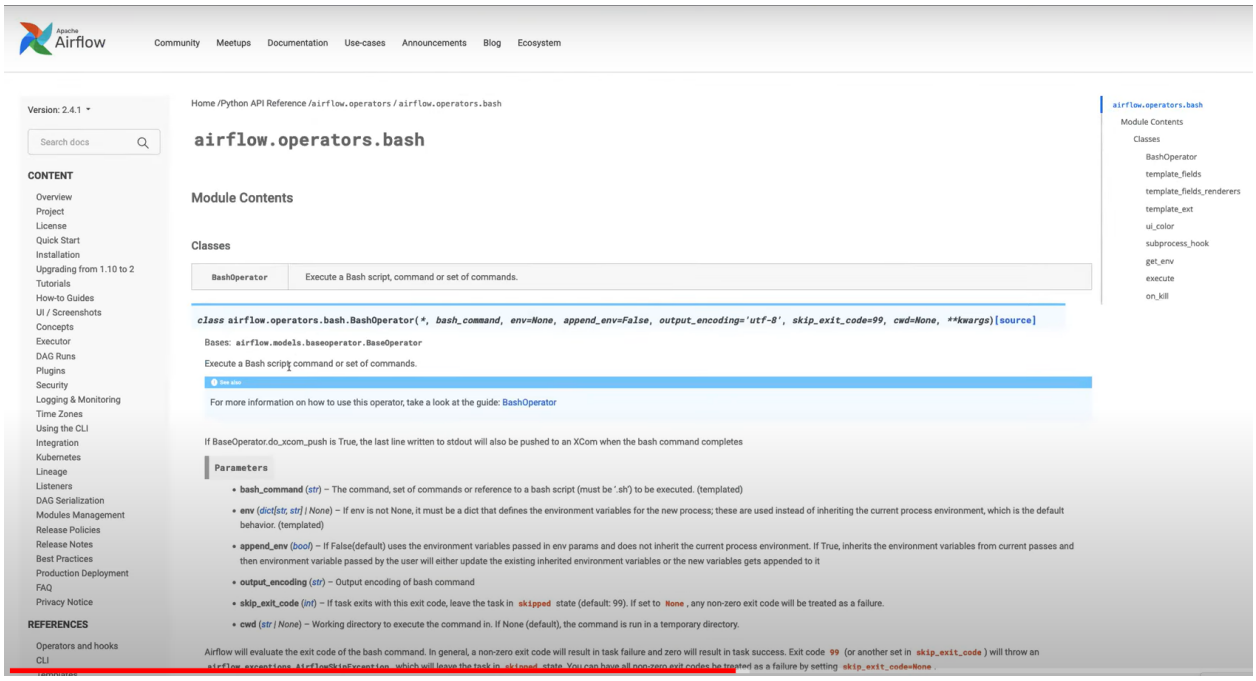





```python
def _say_hello(**context):
    print(context)
    datestamp = context["ds"]
    print(f"Hello! on {datestamp}")
```

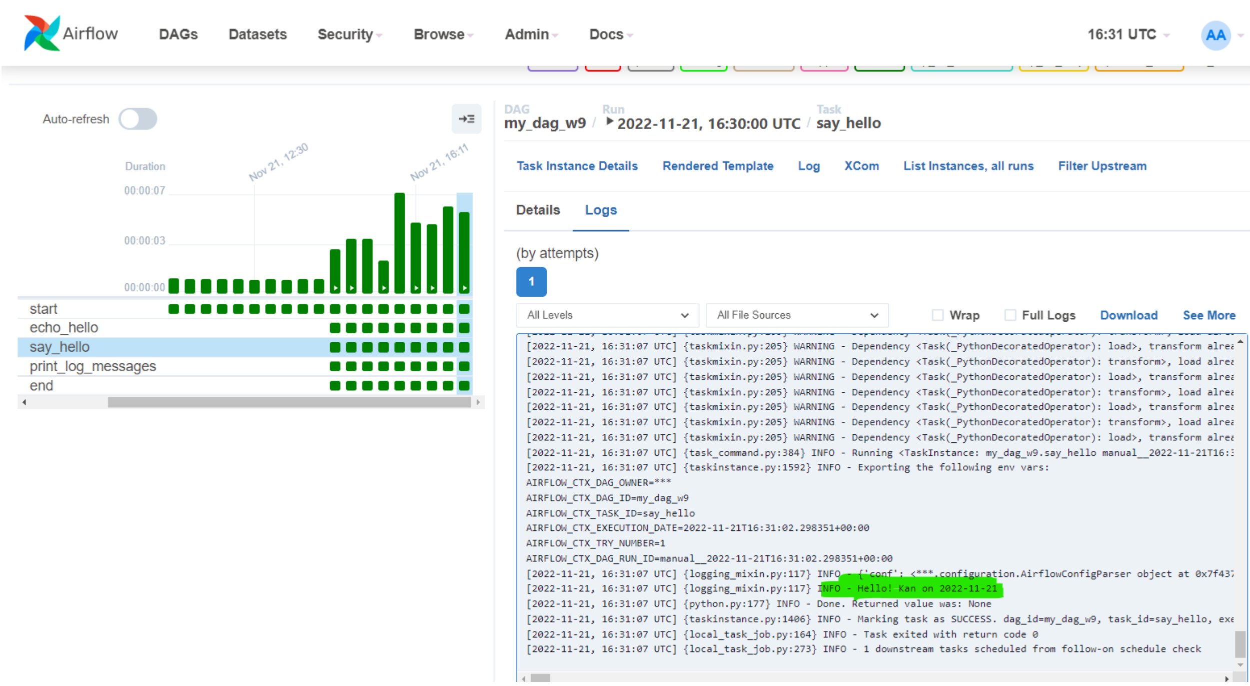







```
template_fields:Sequence[str] = ['templates_dict', 'op_args', 'op_kwargs'] [source]
```

```python
def _say_hello( name="", **context ):
    print(context)
    datestamp = context["ds"]
    print(f"Hello! {name} on {datestamp}")

#logging มีระดับการlog => info, debug แล้วแต่การทำงาน
def _print_log_messages():
    logging.info("Hello from Log")

with DAG(
    "my_dag_w9",
    start_date = timezone.datetime(2022,11,21),
    schedule = "*/30 * * * *",
    tags = ["workshop"],
    catchup = False,
) as dag:

    start = EmptyOperator(task_id = "start")

    echo_hello = BashOperator(
        task_id = "echo_hello",
        bash_command = "echo 'hello' on {{ ds }}",
    )
#    op_kwargs รับข้อมูลเป็น dict
    say_hello = PythonOperator(
        task_id = "say_hello",
        python_callable = _say_hello,
        op_kwargs = {
            "name": "Kan",
        }

    )
```



```python
def _say_hello( name="", **context ):
    print(context)
    datestamp = context["ds"]
    print(f"Hello! {name} on {datestamp}")

#logging มีระดับการlog => info, debug แล้วแต่การทำงาน
def _print_log_messages():
    logging.info("Hello from Log")

with DAG(
    "my_dag_w9",
    start_date = timezone.datetime(2022,11,21),
    schedule = "*/30 * * * *",
    tags = ["workshop"],
    catchup = False,
) as dag:

    start = EmptyOperator(task_id = "start")

    echo_hello = BashOperator(
        task_id = "echo_hello",
        bash_command = "echo 'hello' on {{ ds }}",
    )
#    op_kwargs รับข้อมูลเป็น dict
    say_hello = PythonOperator(
        task_id = "say_hello",
        python_callable = _say_hello,
        op_kwargs = {
            "name": "Kan {{ ds_nodash }}",
        }
    )
```