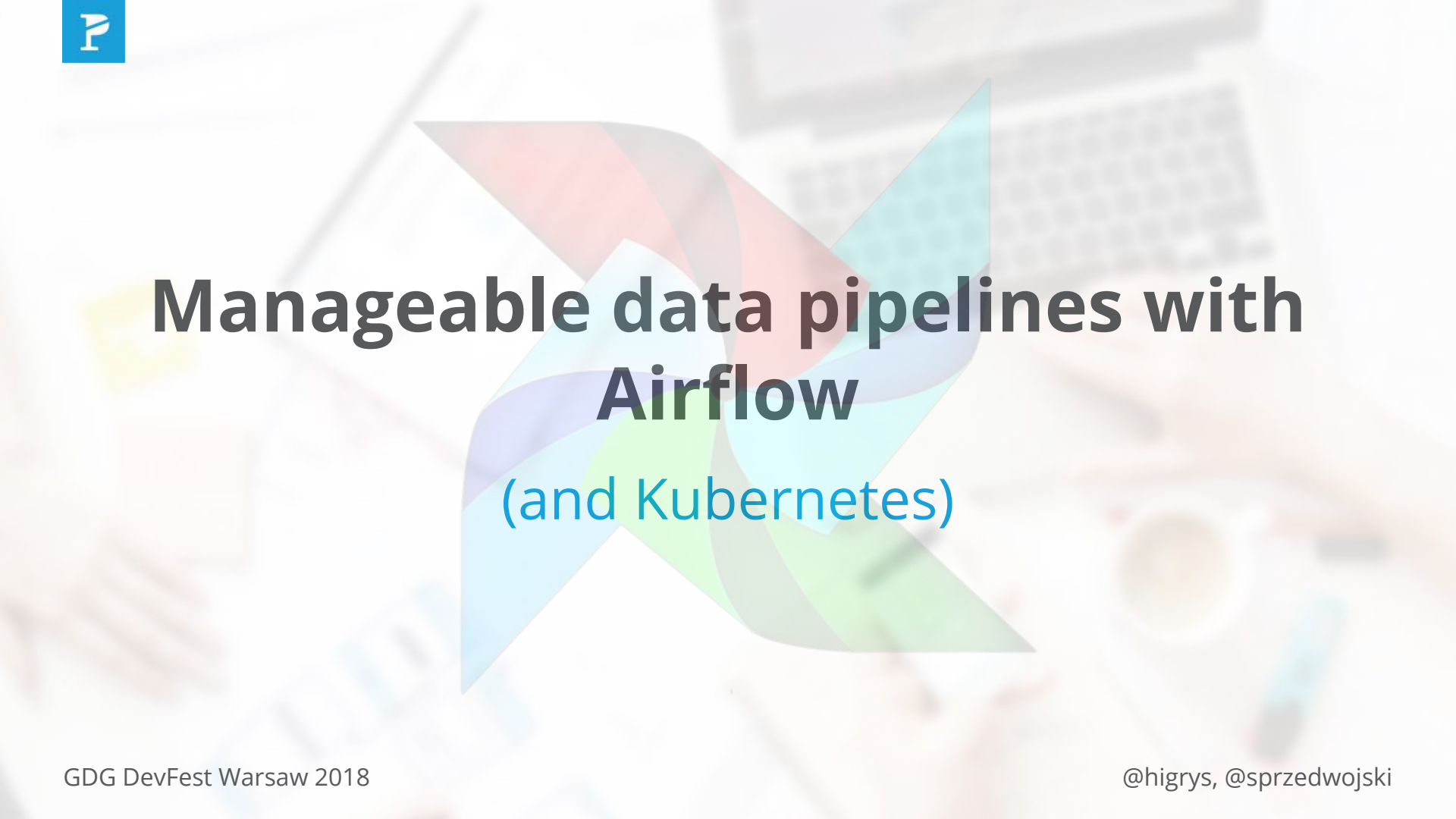
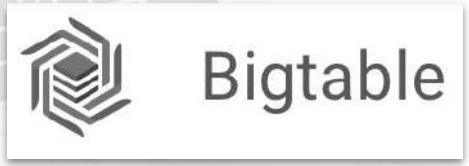


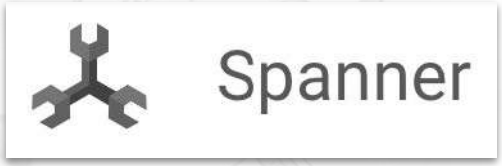
Manageable data pipelines with Airflow

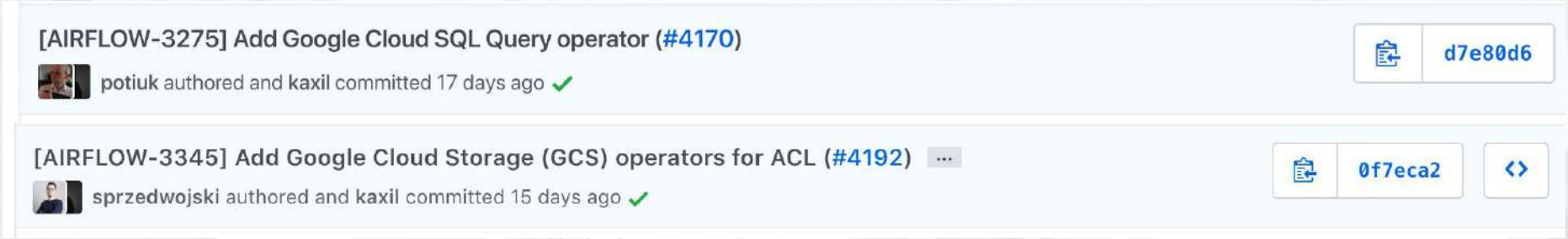
(and Kubernetes)

@higrys, @sprzedwojski

Google Cloud Platform







Airflow

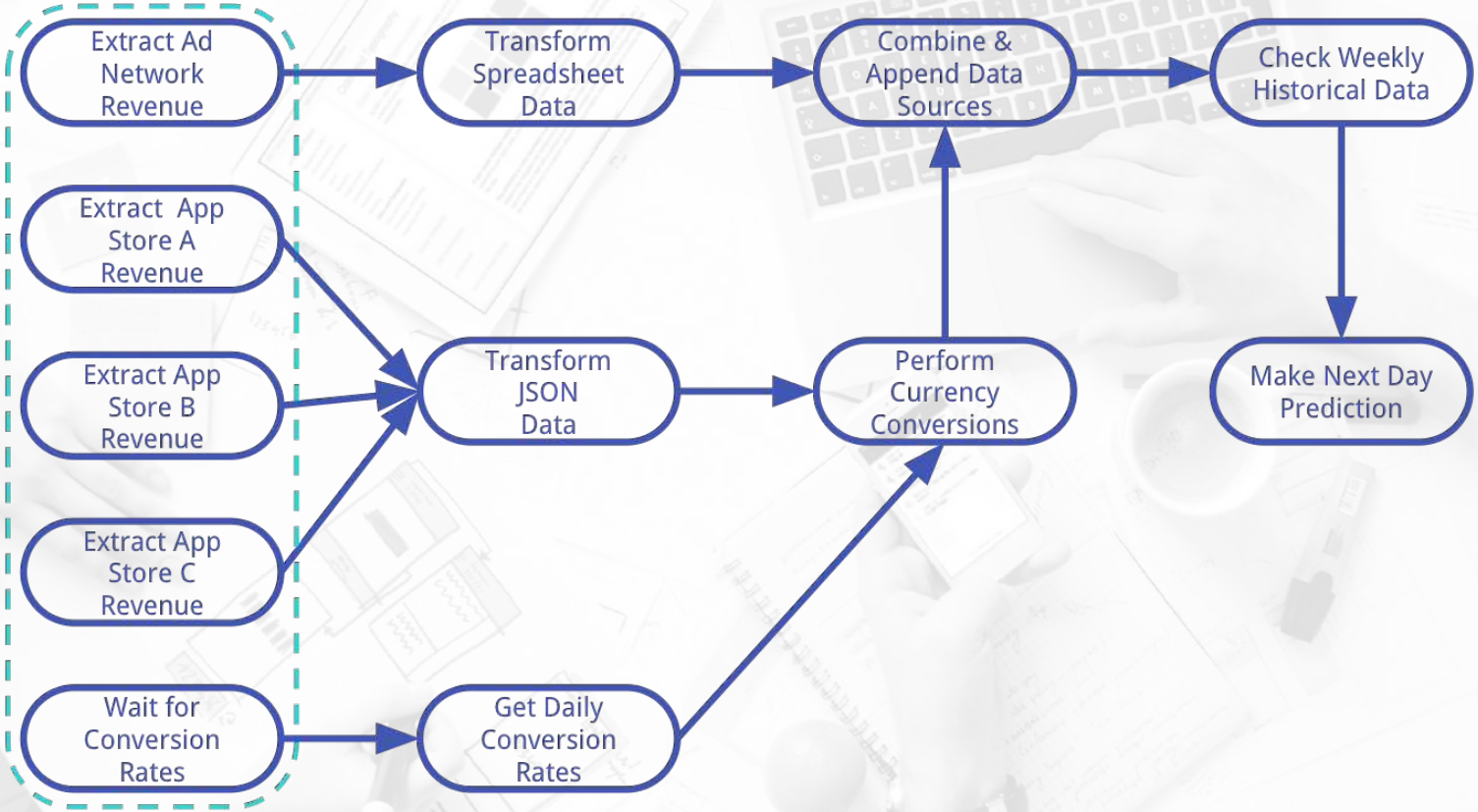
Airflow is a platform to programmatically author, schedule and monitor workflows.

Dynamic/Elegant

Extensible

Scalable

Workflows



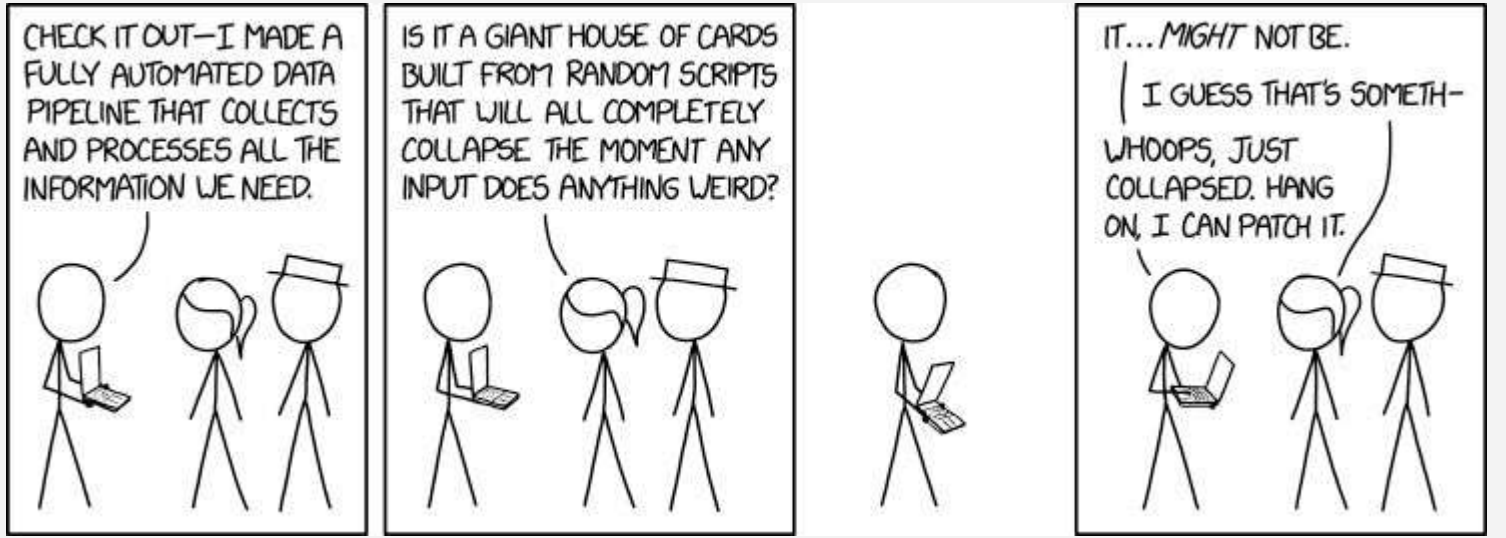
Source: https://medium.com/@dustinstansbury/understanding-apache-airflows-key-concepts-a96efed52b1a

Companies using Airflow

(>200 officially)

Data Pipeline

https://xkcd.com/2054/



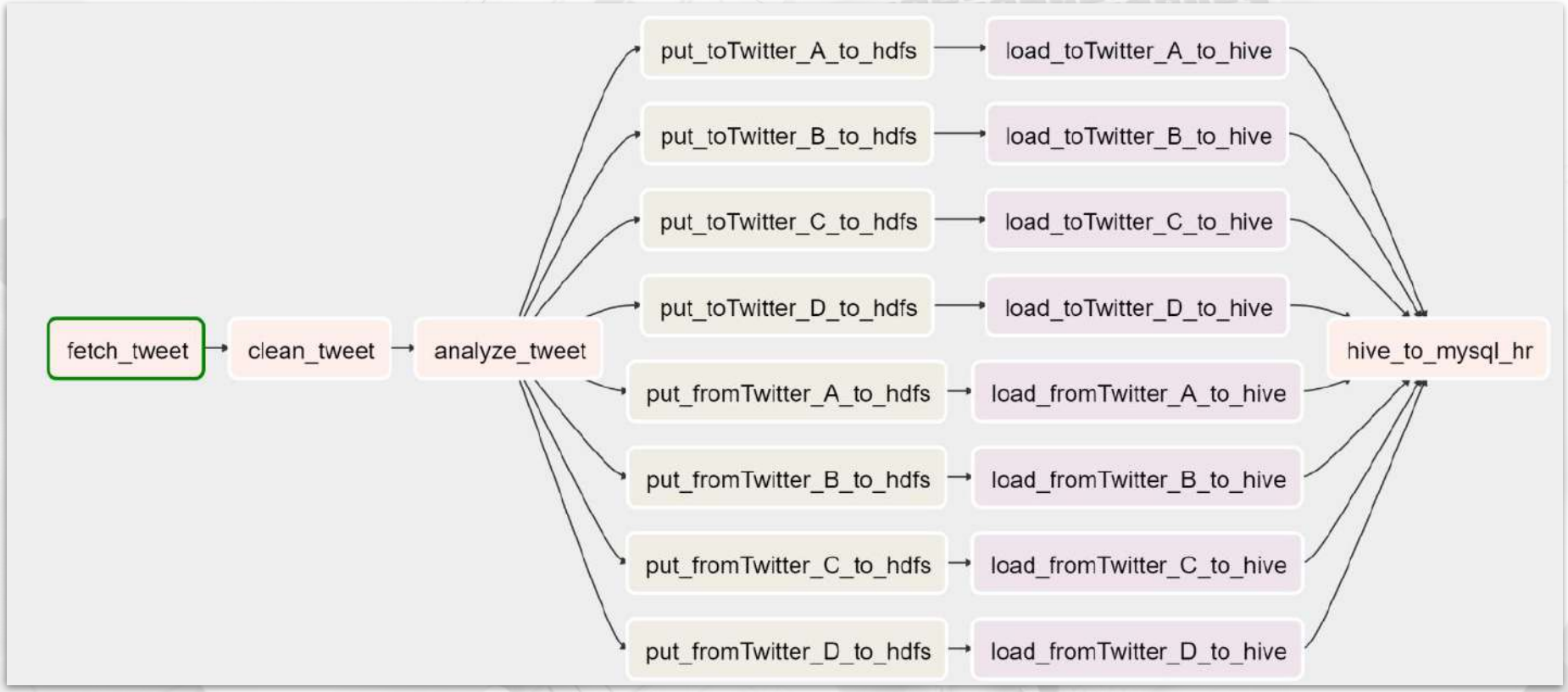
Airflow vs. other workflow platforms

- Programming workflows
  - writing code not XML
  - versioning as usual
  - automated testing as usual
  - complex dependencies between tasks
- Managing workflows
  - aggregate logs in one UI
  - tracking execution
  - re-running, backfilling (run all missed runs)

Airflow use cases

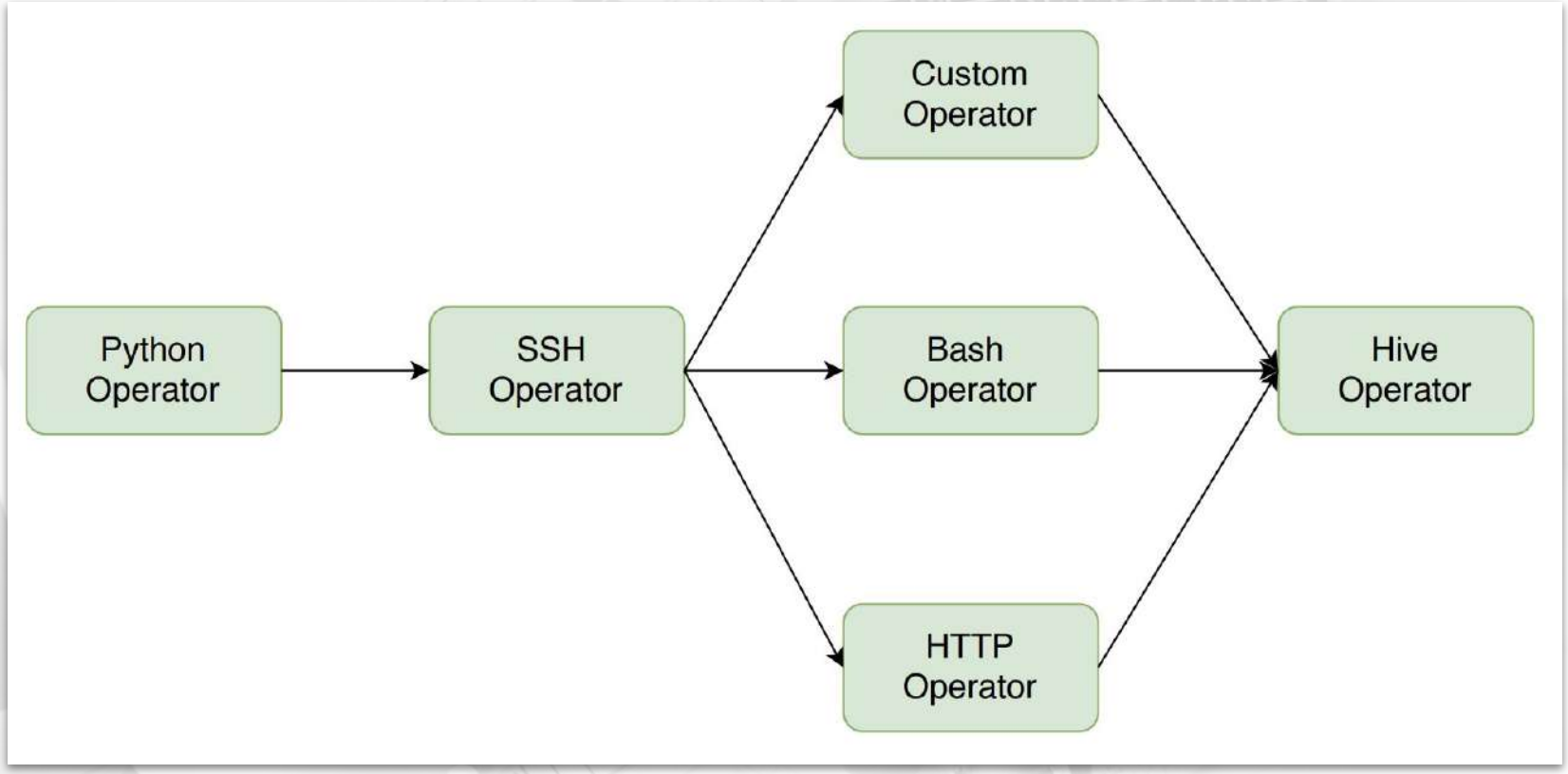
- ETL jobs
- ML pipelines
- Regular operations:
  - Delivering data
  - Performing backups
- ...

Core concepts - Directed Acyclic Graph (DAG)



Source: https://github.com/apache/incubator-airflow/blob/master/airflow/contrib/example_dags/example_twitter_README.md

Core concepts - Operators



Source: https://blog.usejournal.com/testing-in-airflow-part-1-dag-validation-tests-dag-definition-tests-and-unit-tests-2aa94970570c

Operator types

- Action Operators
  - Python, Bash, Docker, GCEInstanceStart, ...
- Sensor Operators
  - S3KeySensor, HivePartitionSensor, BigtableTableWaitForReplicationOperator , ...
- Transfer Operators
  - MsSqlToHiveTransfer, RedshiftToS3Transfer, …

Operator and Sensor

```
class ExampleOperator(BaseOperator):
    def execute(self, context):
        # Do something
        pass
```

Operator and Sensor

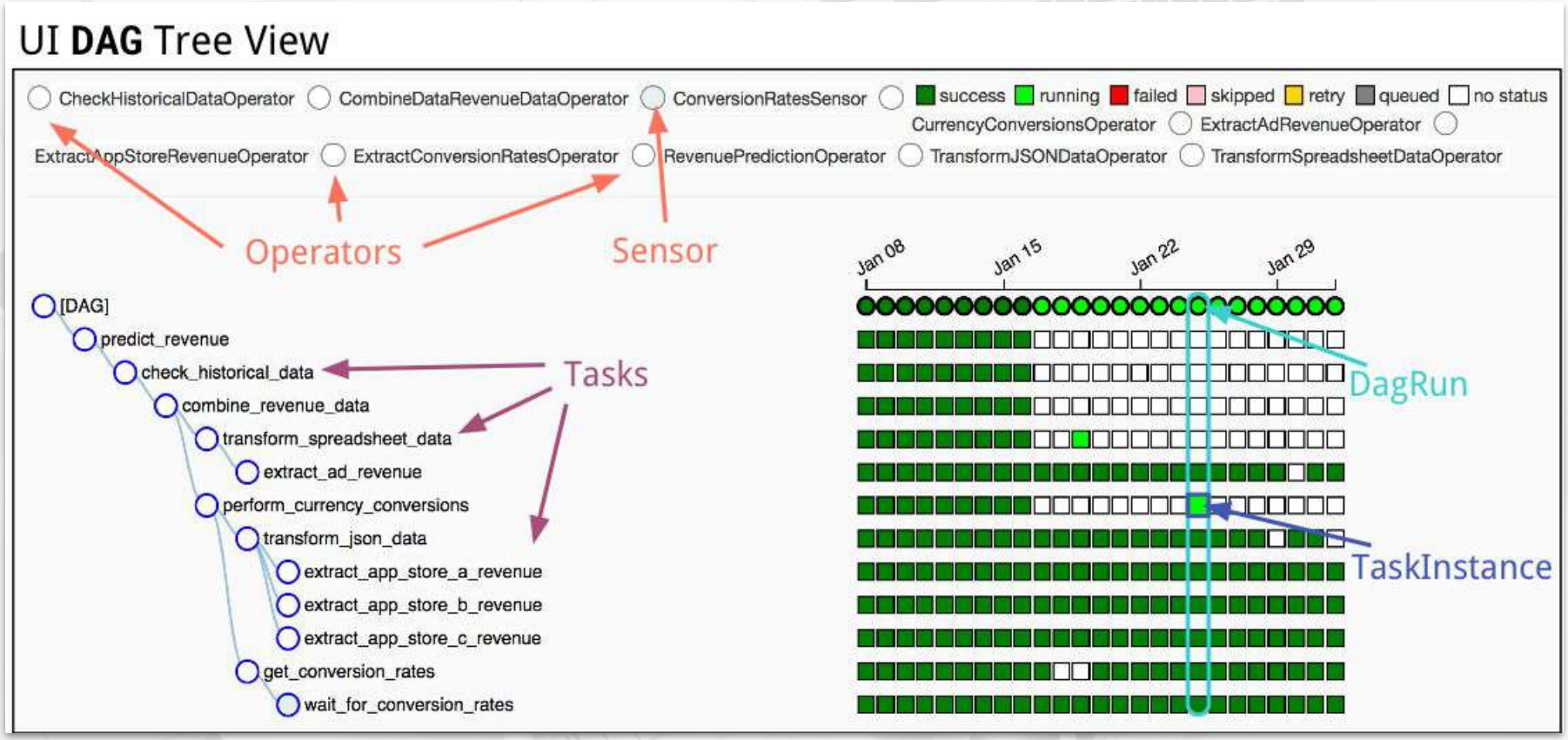
```
class ExampleOperator(BaseOperator):
    def execute(self, context):
        # Do something
        pass

class ExampleSensorOperator(BaseSensorOperator):
    def poke(self, context):
        # Check if the condition occurred
        return True
```

Operator good practices

- Idempotent
- Atomic
- No direct data sharing
  - Small portions of data between tasks: XCOMs
  - Large amounts of data: S3, GCS, etc.

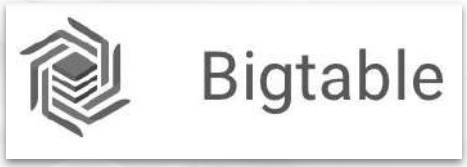
Core concepts - Tasks, TaskInstances, DagRuns

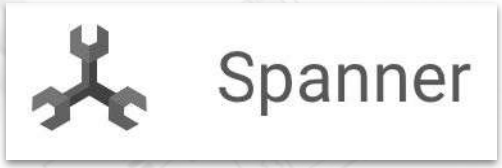


Source: https://medium.com/@dustinstansbury/understanding-apache-airflows-key-concepts-a96efed52b1a

Show me the code!

Google Cloud Platform

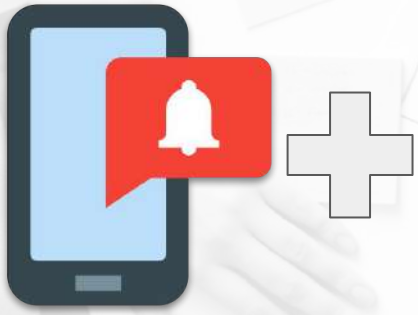


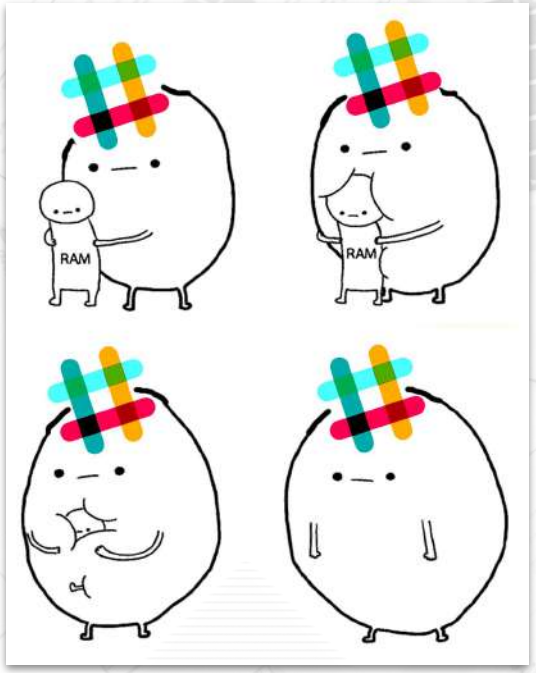


Source: https://www.logolynx.com/images/logolynx/0b/0b42e766caee6dcd7355c1c95ddaaa1c.png

Source: http://www.faicoach.com/wp-content/uploads/2017/10/cash-burn.jpg

The solution



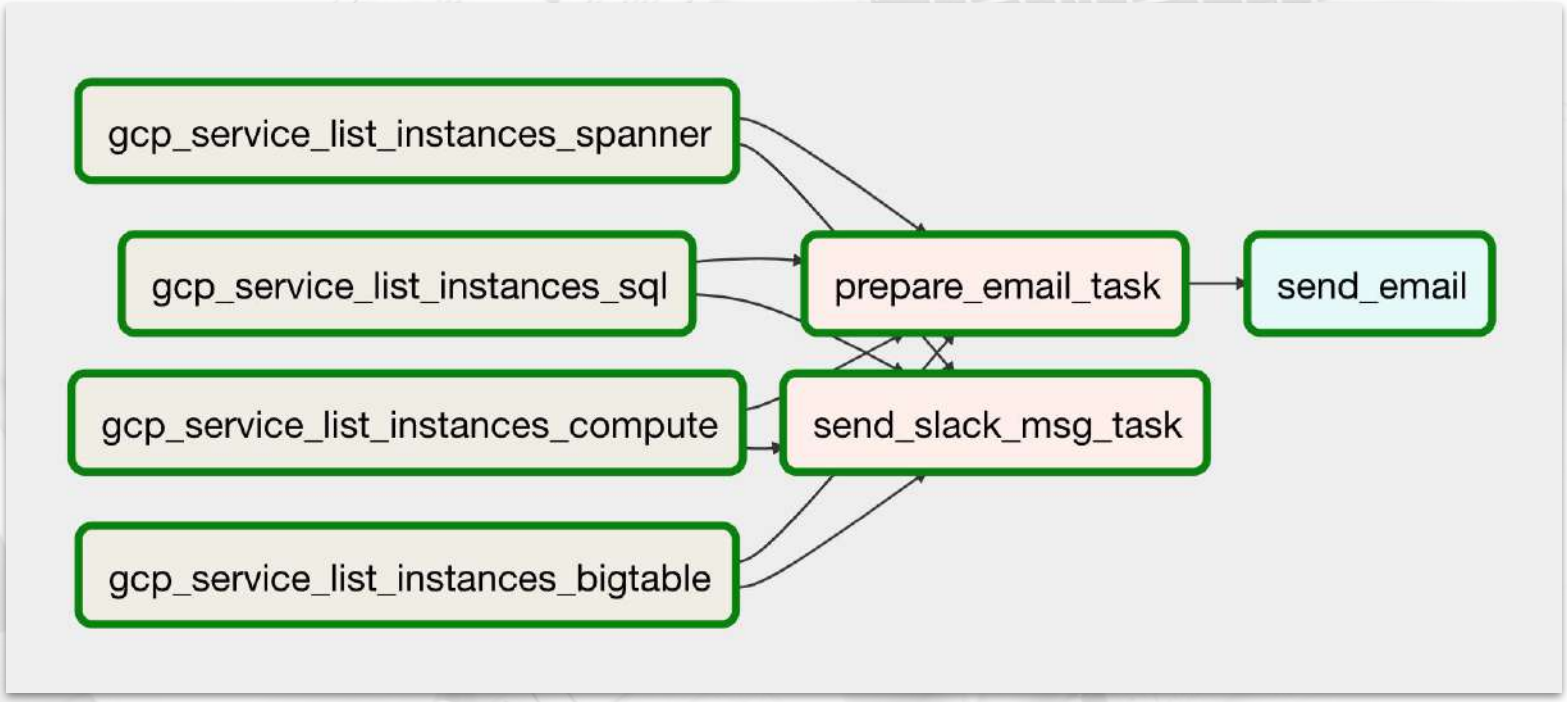


Sources:
https://services.garmin.cn/appsLibraryBusinessServices_v0/rest/apps/9b5dabf3-925b
https://malloc.fi/static/images/slack-memory-management.png
https://i.gifer.com/9GXs.gif

Solution components

- Generic
  - BashOperator
  - PythonOperator
- Specific
  - EmailOperator

The DAG


gcp_service_list_instances_spanner
gcp_service_list_instances_sql
gcp_service_list_instances_compute
gcp_service_list_instances_bigtable
prepare_email_task
send_slack_msg_task
send_email

Initialize DAG

```
dag = DAG(dag_id='gcp_spy',
          ...
)
```

Initialize DAG

```
dag = DAG(dag_id='gcp_spy',
          default_args={
              'start_date': utils.dates.days_ago(1),
              'retries': 1
          },
          ...
)
```

Initialize DAG

```
dag = DAG(dag_id='gcp_spy',
          default_args={
              'start_date': utils.dates.days_ago(1),
              'retries': 1
          },
          schedule_interval='0 16 * * *'
)
```

List of instances

```
bash_task = BashOperator(
    task_id="gcp_service_list_instances_sql",
    ...
)
```

List of instances

```
bash_task = BashOperator(
    task_id="gcp_service_list_instances_sql",
    bash_command=
    "gcloud sql instances list | tail -n +2 | grep -oE '^[^ ]+' "
    "| tr '\n' ' '",
    ...
)
```

List of instances

```
bash_task = BashOperator(
    task_id="gcp_service_list_instances_sql",
    bash_command=
    "gcloud sql instances list | tail -n +2 | grep -oE '^[^ ]+' "
    "| tr '\n' ' '",
    xcom_push=True,
    ...
)
```

List of instances

```
bash_task = BashOperator(
    task_id="gcp_service_list_instances_sql",
    bash_command=
    "gcloud sql instances list | tail -n +2 | grep -oE '^[^ ]+' "
    "| tr '\n' ' '",
    xcom_push=True,
    dag=dag
)
```

All services

```
GCP_SERVICES = [
    ('sql', 'Cloud SQL'),
    ('spanner', 'Spanner'),
    ('bigtable', 'BigTable'),
    ('compute', 'Compute Engine'),
]
```

List of instances - all services

```
????
    bash_task = BashOperator(
        task_id="gcp_service_list_instances_sql",
        bash_command=
        "gcloud sql instances list | tail -n +2 | grep -oE '^[^ ]+' "
        "| tr '\n' ' '",
        xcom_push=True,
        dag=dag
    )
```

List of instances - all services

```
for gcp_service in GCP_SERVICES:
    bash_task = BashOperator(
        task_id="gcp_service_list_instances_{}".format(gcp_service[0]),
        bash_command=
        "gcloud {} instances list | tail -n +2 | grep -oE '^[^ ]+' "
        "| tr '\n' ' '".format(gcp_service[0]),
        xcom_push=True,
        dag=dag
    )
```

Send Slack message

```
send_slack_msg_task = PythonOperator(
    python_callable=send_slack_msg,
    provide_context=True,
    task_id='send_slack_msg_task',
    dag=dag
)
```

Send Slack message

```
send_slack_msg_task = PythonOperator(
    python_callable=send_slack_msg,
    provide_context=True,
    task_id='send_slack_msg_task',
    dag=dag
)
```

```
def send_slack_msg(**context):
    for gcp_service in GCP_SERVICES:
        result = context['task_instance'].\
            xcom_pull(task_ids='gcp_service_list_instances_{}'
                      .format(gcp_service[0]))
    ...
```

```
def send_slack_msg(**context):
    for gcp_service in GCP_SERVICES:
        result = context['task_instance'].\
            xcom_pull(task_ids='gcp_service_list_instances_{}'
                      .format(gcp_service[0]))
    ...
```

```
def send_slack_msg(**context):
    for gcp_service in GCP_SERVICES:
        result = context['task_instance'].\
            xcom_pull(task_ids='gcp_service_list_instances_{}'
                      .format(gcp_service[0]))
    data = ...
    ...
```

```
def send_slack_msg(**context):
    for gcp_service in GCP_SERVICES:
        result = context['task_instance'].\
            xcom_pull(task_ids='gcp_service_list_instances_{}'
                      .format(gcp_service[0]))
    data = ...
    requests.post(
        url=SLACK_WEBHOOK,
        data=json.dumps(data),
        headers={'Content-type': 'application/json'}
    )
```

Prepare email

```
prepare_email_task = PythonOperator(
    python_callable=prepare_email,
    provide_context=True,
    task_id='prepare_email_task',
    dag=dag
)
```

Prepare email

```
prepare_email_task = PythonOperator(
    python_callable=prepare_email,
    provide_context=True,
    task_id='prepare_email_task',
    dag=dag
)
```

```
def prepare_email(**context):
    for gcp_service in GCP_SERVICES:
        result = context['task_instance'].\
            xcom_pull(task_ids='gcp_service_list_instances_{}'
                      .format(gcp_service[0]))
    ...
    html_content = ...
    context['task_instance'].xcom_push(key='email', value=html_content)
```

```
def prepare_email(**context):
    for gcp_service in GCP_SERVICES:
        result = context['task_instance'].\
            xcom_pull(task_ids='gcp_service_list_instances_{}'
                      .format(gcp_service[0]))
    ...
    html_content = ...
    context['task_instance'].xcom_push(key='email', value=html_content)
```

Send email

```
send_email_task = EmailOperator(
    task_id='send_email',
    to='szymon.przedwojski@polidea.com',
    subject=INSTANCES_IN_PROJECT_TITLE,
    html_content=...,
    dag=dag
)
```

Send email

```
send_email_task = EmailOperator(
    task_id='send_email',
    to='szymon.przedwojski@polidea.com',
    subject=INSTANCES_IN_PROJECT_TITLE,
    html_content=
    "{{ task_instance.xcom_pull(task_ids='prepare_email_task', key='email') }}",
    dag=dag
)
```

Dependencies

```
for gcp_service in GCP_SERVICES:
    bash_task = BashOperator(
        ...
    )
    bash_task >> send_slack_msg_task
    bash_task >> prepare_email_task
```

Dependencies

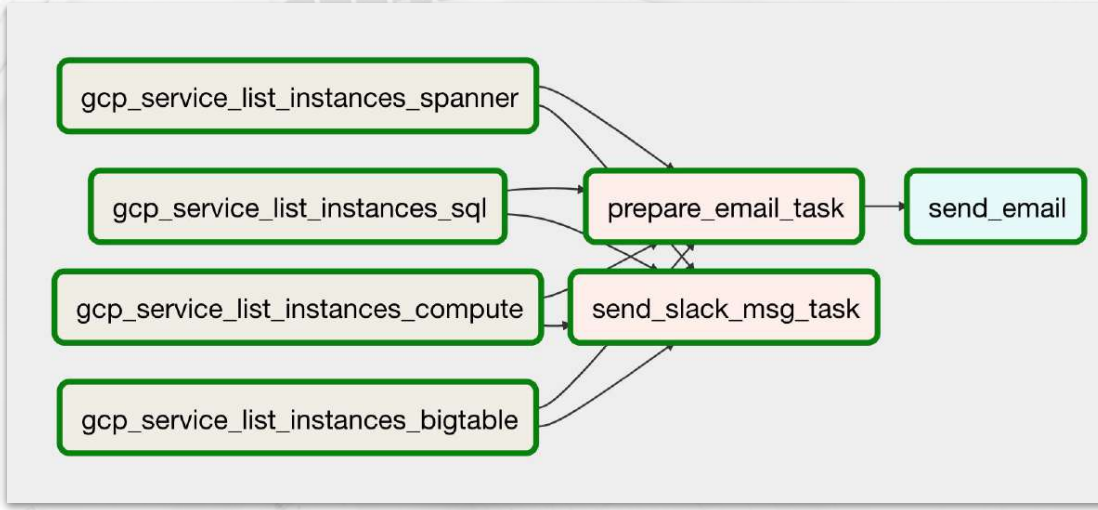
```
for gcp_service in GCP_SERVICES:
    bash_task = BashOperator(
        ...
    )
    bash_task >> send_slack_msg_task
    bash_task >> prepare_email_task

prepare_email_task >> send_email_task
```

Dependencies

```
for gcp_service in GCP_SERVICES:
    bash_task = BashOperator(
        ...
    )
    bash_task >> send_slack_msg_task
    bash_task >> prepare_email_task

prepare_email_task >> send_email_task
```

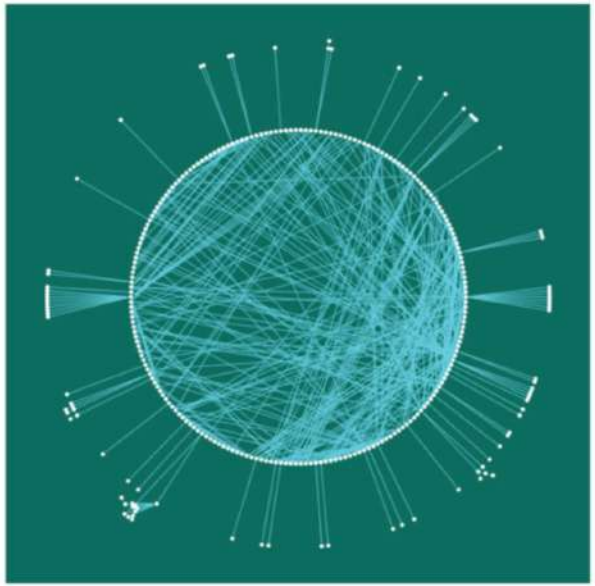


Demo

https://github.com/PolideaInternal/airflow-gcp-spy

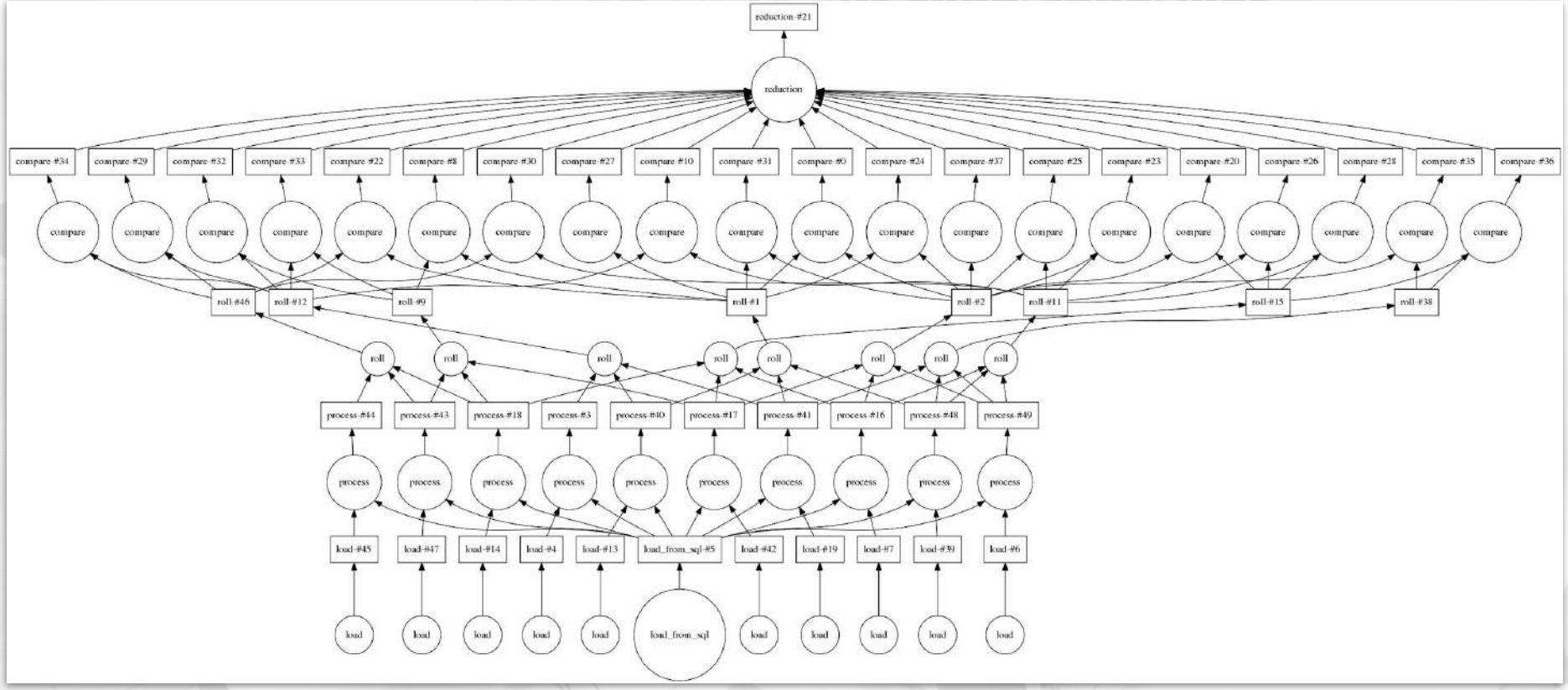
Complex DAGs

Real Pipelines of Clover

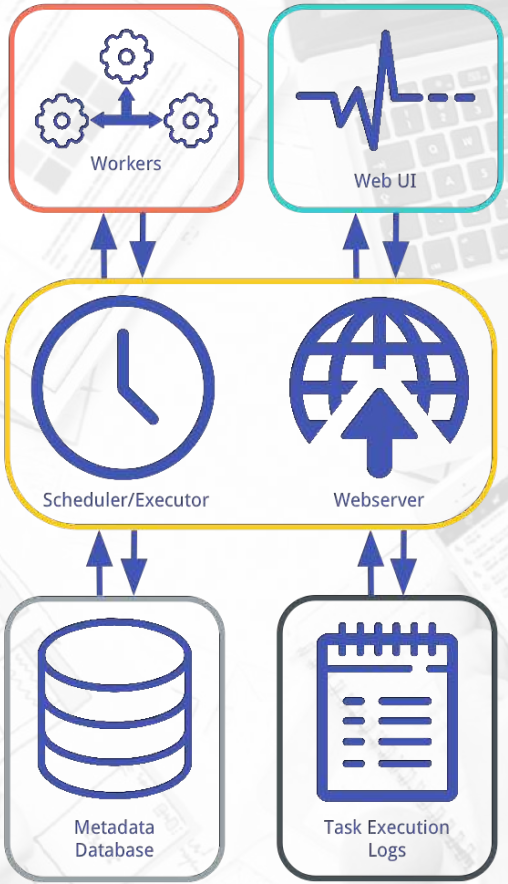


Source: https://speakerdeck.com/pybay/2016-matt-davis-a-practical-introduction-to-airflow?slide=13

Complex, Manageable, DAGs

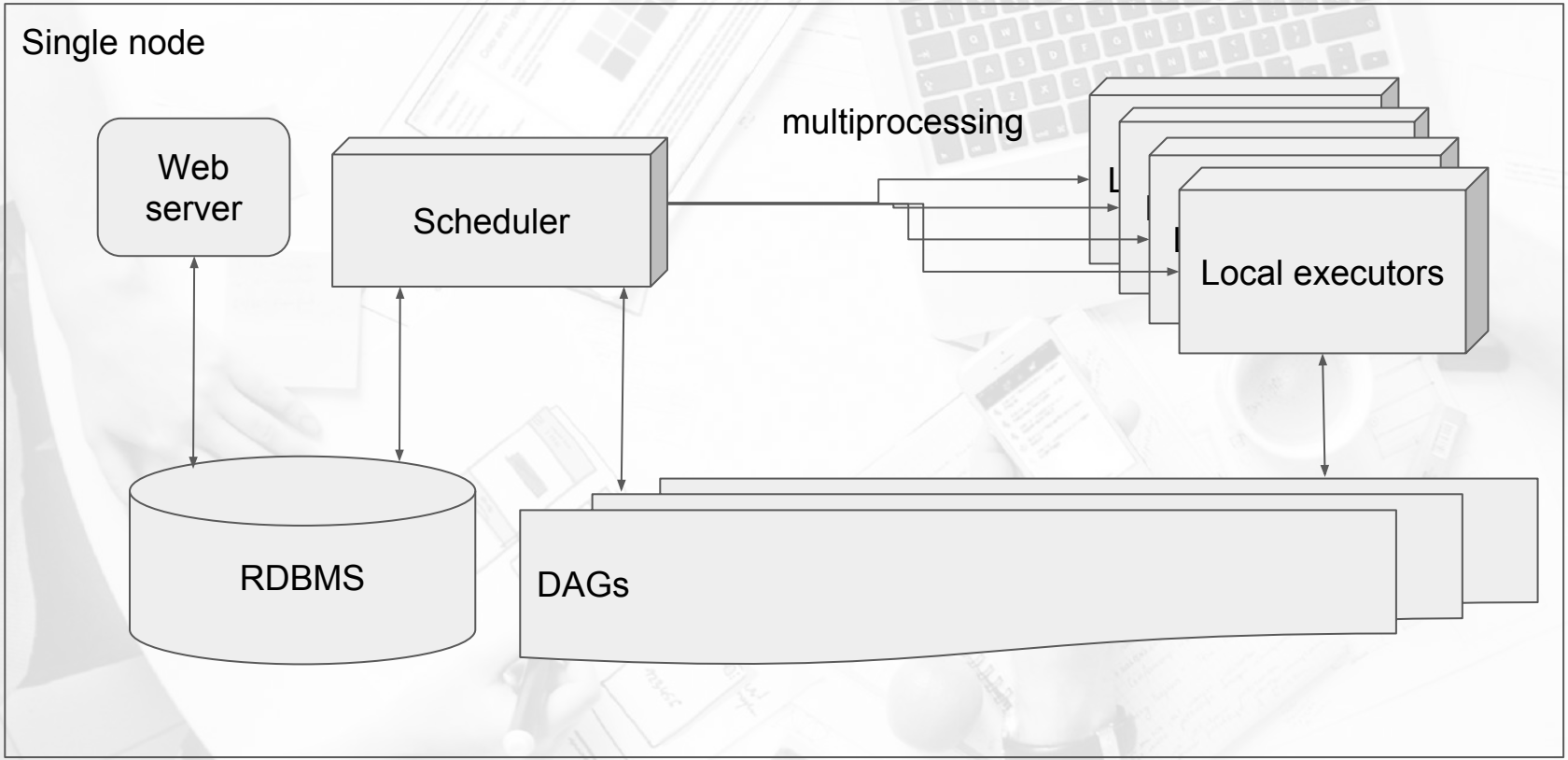


Airflow's General Architecture

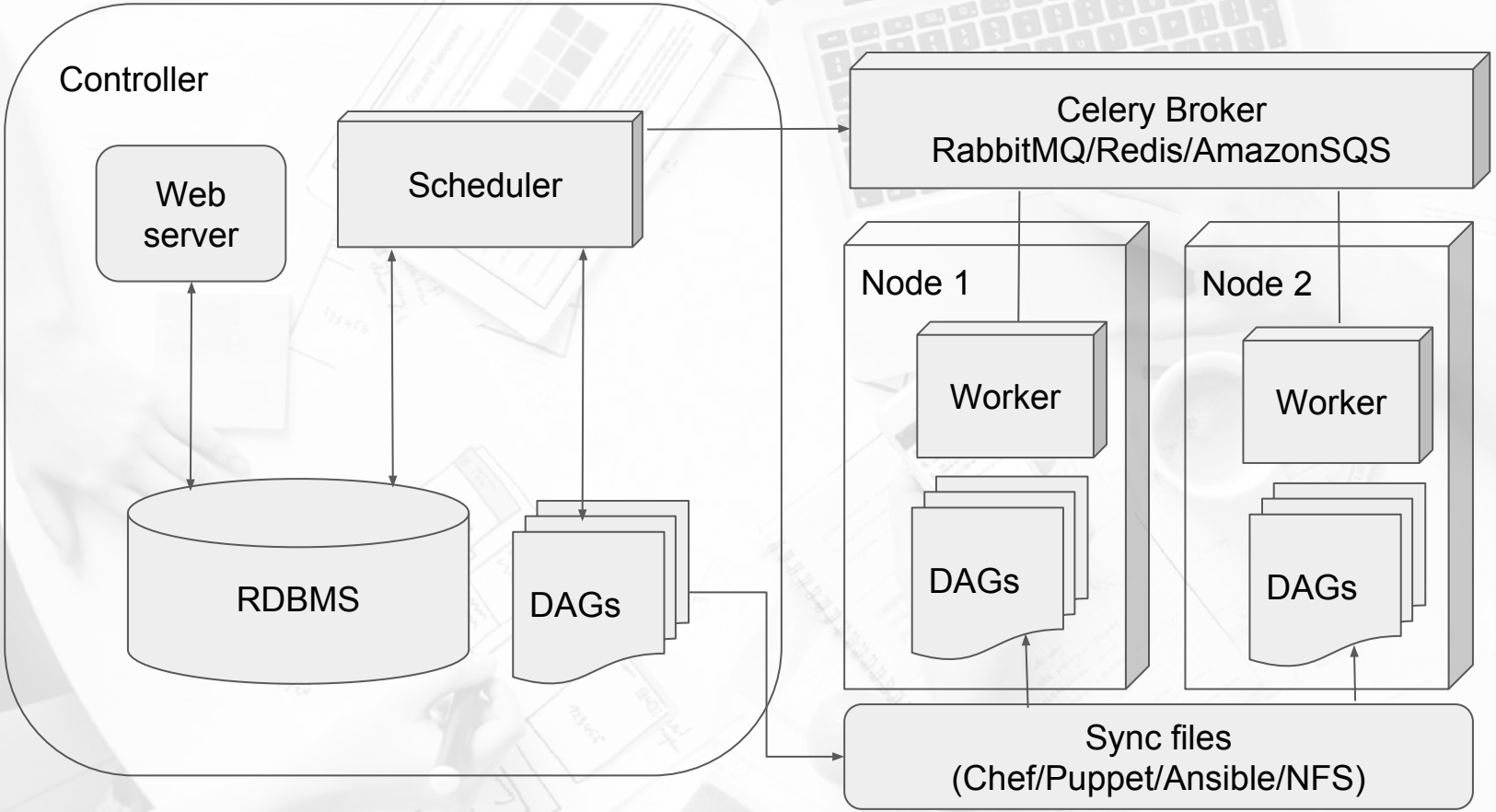


Source: https://medium.com/@dustinstansbury/understanding-apache-airflows-key-concepts-a96efed52b1a

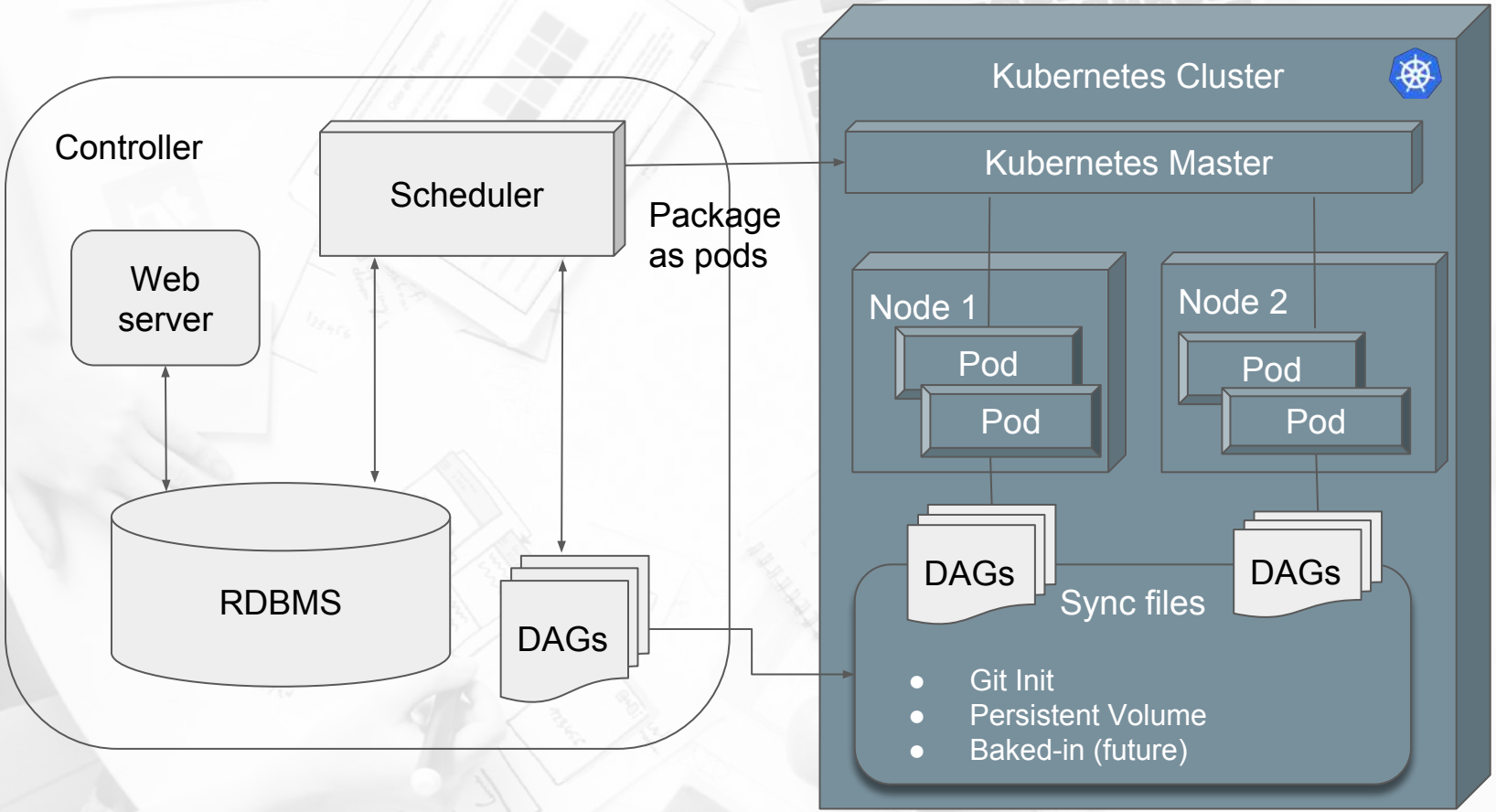
Local Executor



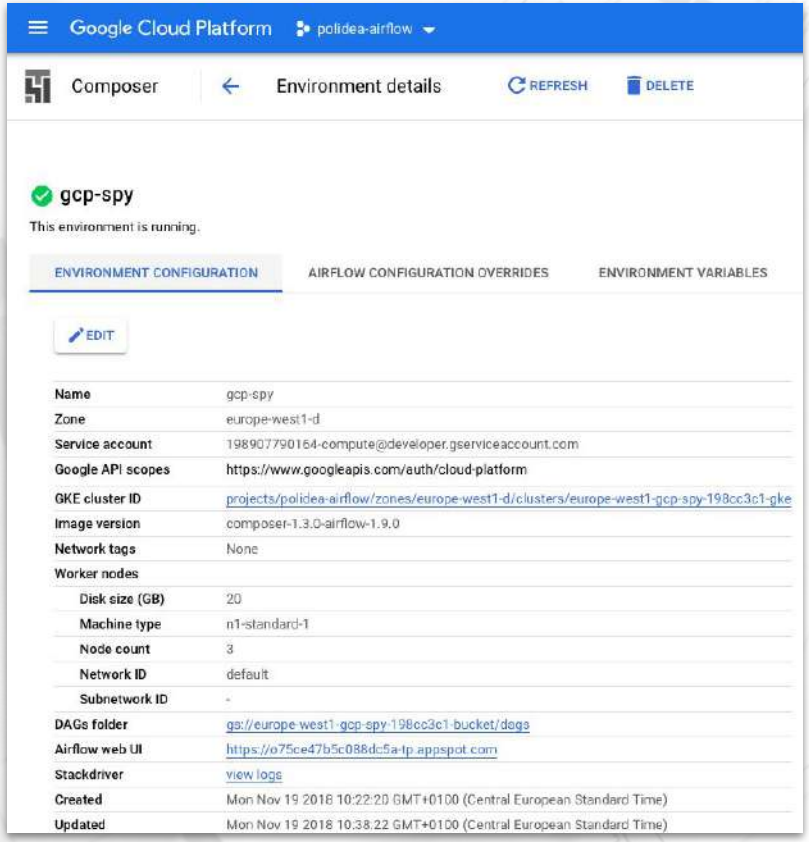
Celery Executor

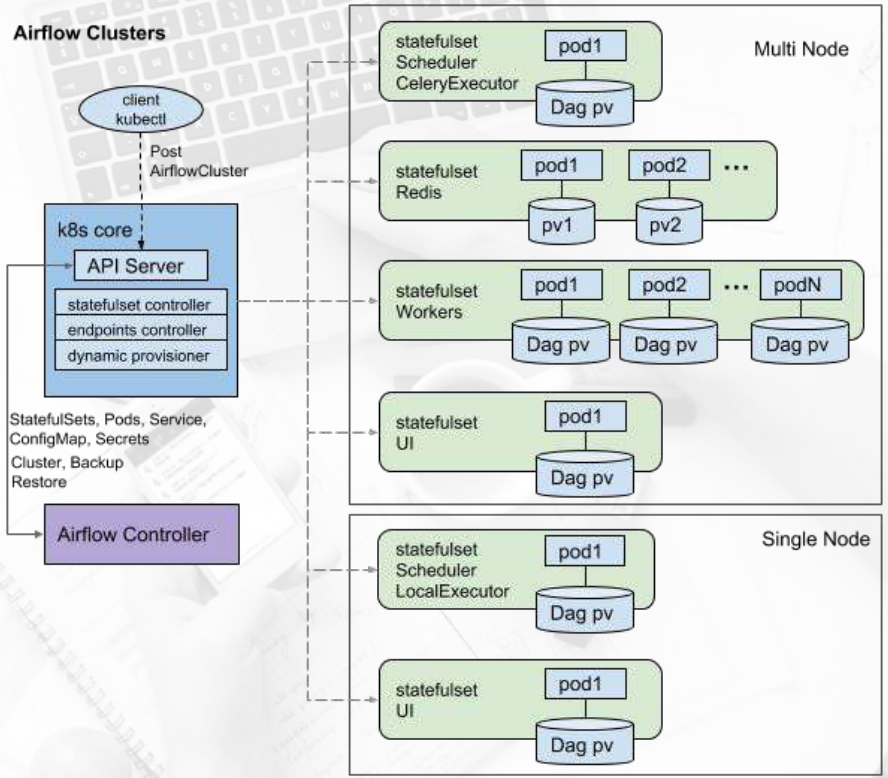


(Beta): Kubernetes Executor



GCP - Composer





https://github.com/GoogleCloudPlatform/airflow-operator

@higrys, @sprzedwojski

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https://airflow.apache.org/_images/pin_large.png


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