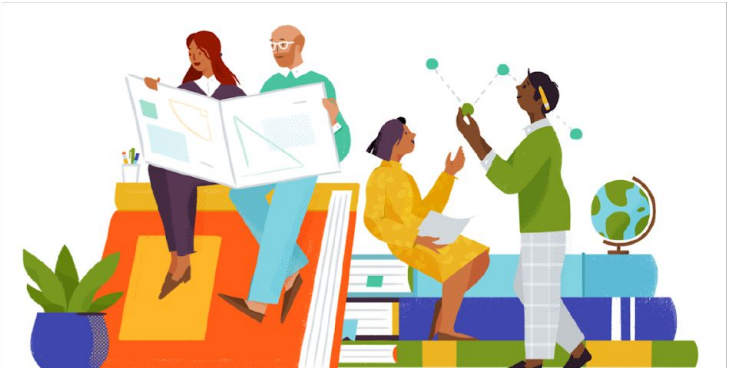
Operating Data Pipeline with Airflow

Ananth Packkildurai



About Slack

2014

Public launch

65

Fortune 100 companies are paid customers

500K

Organizations using slack

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About Slack

1000+

Slack employees

12

Data engineers

8M

Active users

Data usage

1 in 2 per week

access data warehouse

500+

Tables

70 million

Events per minute

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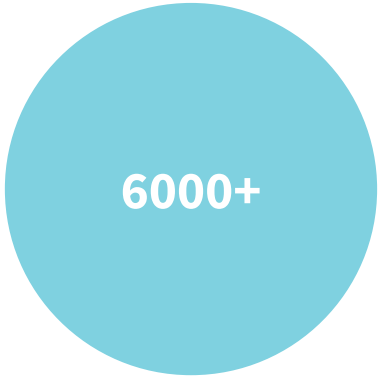
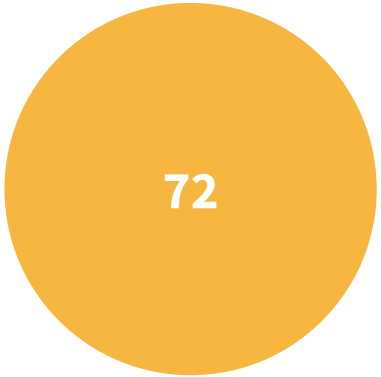
Airflow stats

Active Dags



Tasks Per Day



Contributors

Agenda

1. Airflow Infrastructure
2. Scale Airflow Executor
3. Pipeline Operations
4. Alerting and monitoring

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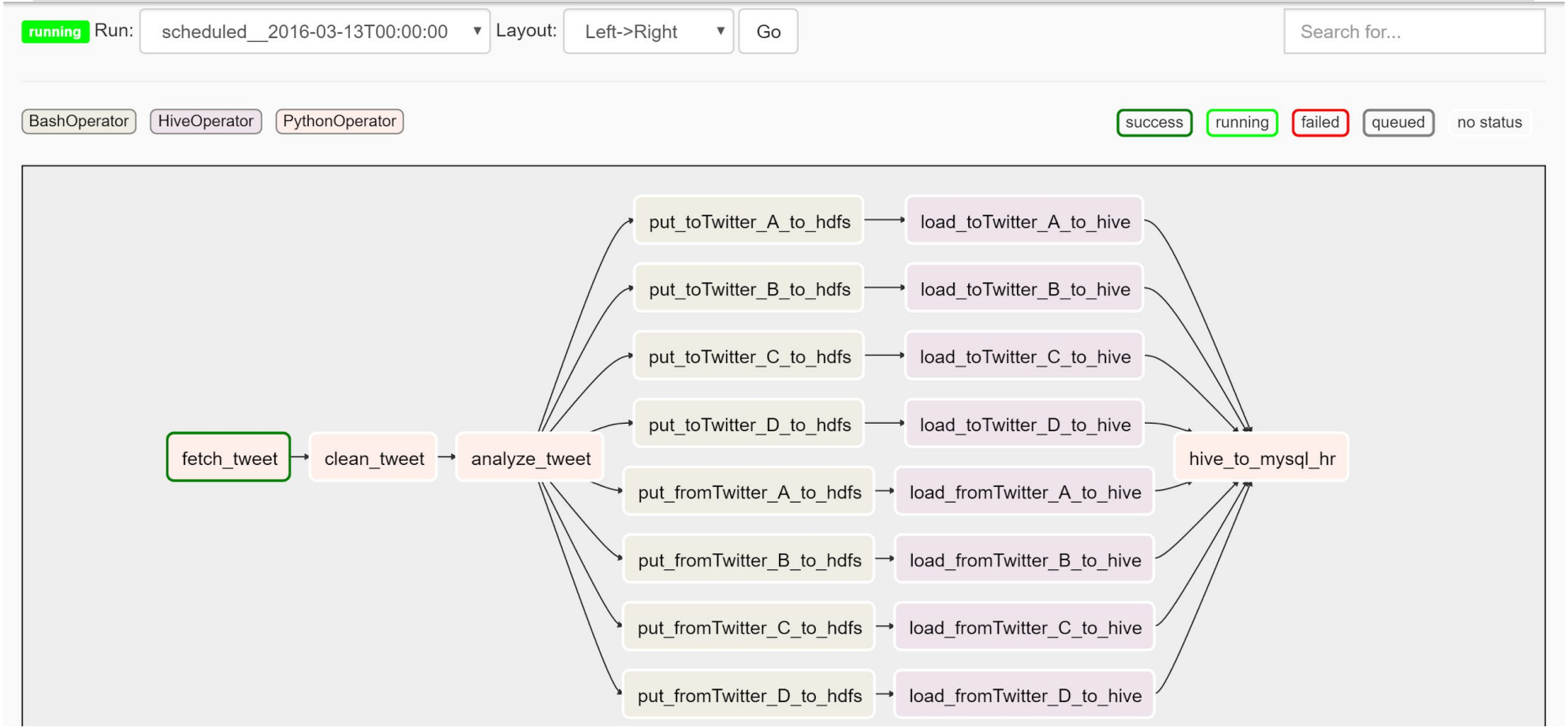
Airflow infrastructure

Airflow overview

- DAG => Graph of airflow tasks (operators)
- Operators =>
  - Sensor Operator (e.g) S3KeySensors
  - Action Operator (e.g) BashOperator, HiveOperator, SparkOperator
  - Transfer Operator (e.g) SalesforceToS3Operator
- Executors:
  - Local Executor
  - Celery Executor
  - Mesos Executor
  - Kubernetes Executor (in progress)

Example DAG


running
Run:
scheduled__2016-03-13T00:00:00
Layout:
Left->Right
Go
Search for...
BashOperator
HiveOperator
PythonOperator
success
running
failed
queued
no status
fetch_tweet
clean_tweet
analyze_tweet
put_toTwitter_A_to_hdfs
load_toTwitter_A_to_hive
put_toTwitter_B_to_hdfs
load_toTwitter_B_to_hive
put_toTwitter_C_to_hdfs
load_toTwitter_C_to_hive
put_toTwitter_D_to_hdfs
load_toTwitter_D_to_hive
put_fromTwitter_A_to_hdfs
load_fromTwitter_A_to_hive
put_fromTwitter_B_to_hdfs
load_fromTwitter_B_to_hive
put_fromTwitter_C_to_hdfs
load_fromTwitter_C_to_hive
put_fromTwitter_D_to_hdfs
load_fromTwitter_D_to_hive
hive_to_mysql_hr

Airflow infrastructure

- Local Executor
- Tarball code deployment
- Continuous deployment with Jenkins
- Flake8, yapf & pytest
- `airflow.sh` shell utility to ensure consistent development environment for all the users.

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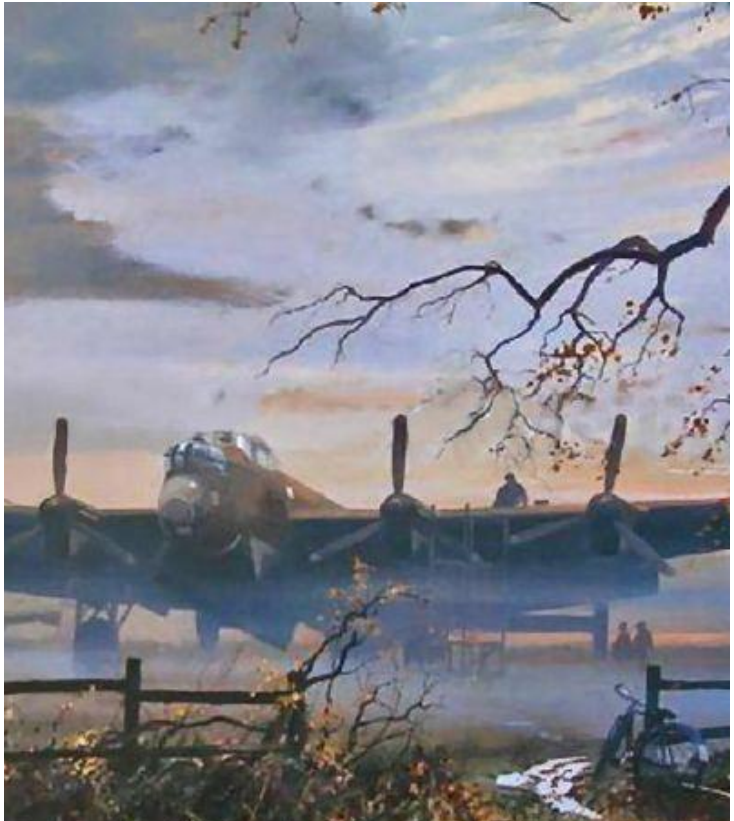
Scale Airflow Executor

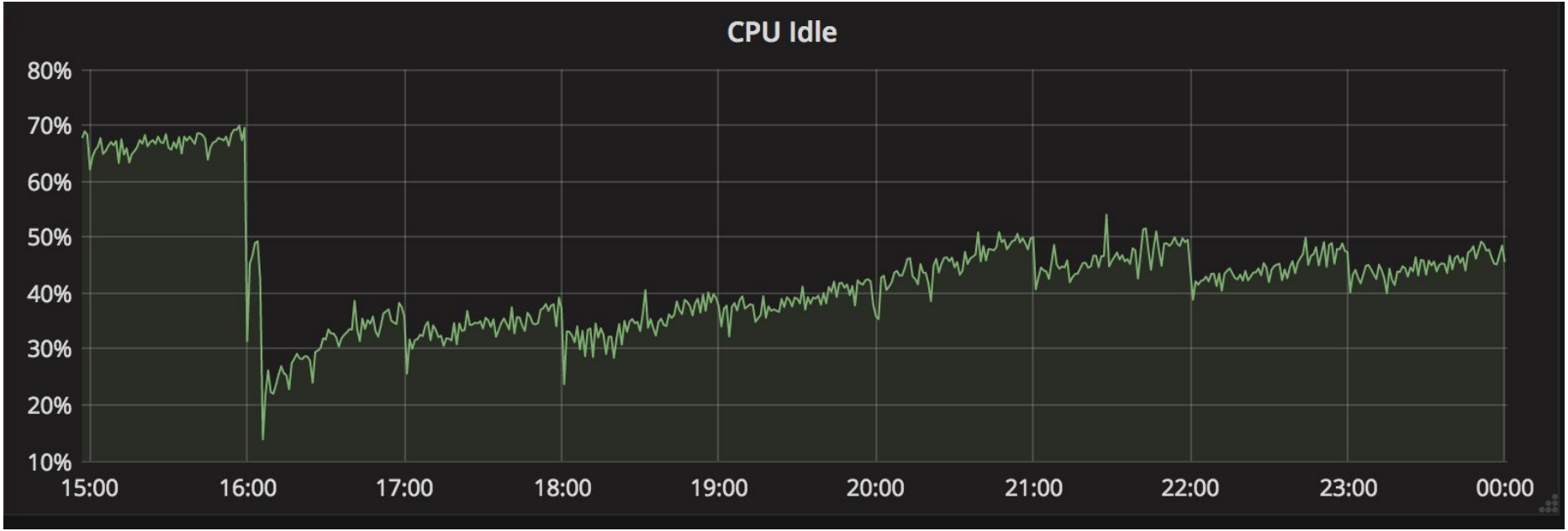
Scale Airflow Executor

It’s just Airflow being Airflow

- Why my task is not running
- Airflow deadlock again
- Airflow not scheduling any tasks



Airflow CPU usage



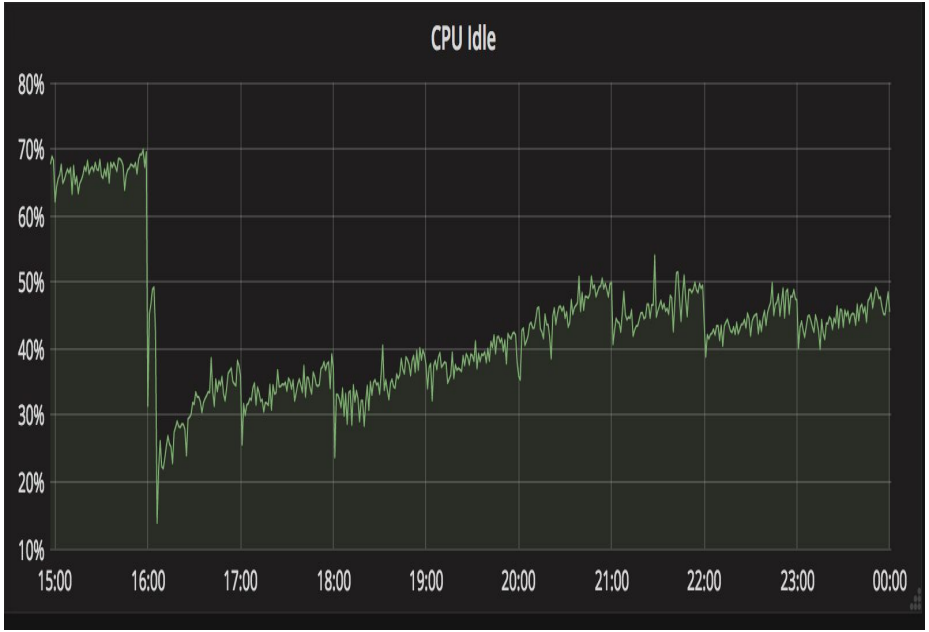
Airflow Multi Retryable Sensors

Airflow local executor launches a new python interpreter per-task, which has been observed to use significant system resources. To minimize the local machine cost of checking external tasks, here we check multiple external tasks in a single task.

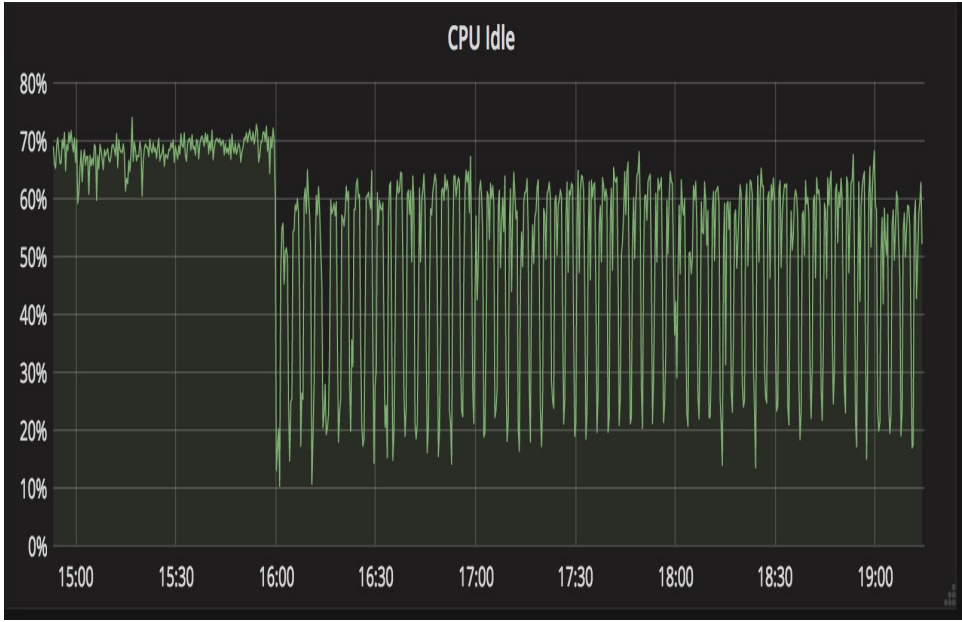
To simplify depending on multiple external tasks, it's recommended using the builder to create new instances:

```
wf = (
    MultiRetryableExternalTaskSensor.Builder(task_id='my_task', dag=dag)
        .waitfor('dag1', 'task1', ...)
        .waitfor('dag2', 'task2', ...)
        .build()
)
```

Retryable Sensors CPU usage



Non-Retryable Sensors Load



Retryable Sensors Load

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Pipeline Operations

Airflow fallacies

- The upstream task success is reliable.
- The task remain static after the success state.
- The DAG structure is static.
- The data quality not part of a task life cycle.

Mario: Global DAG operator

```
~/w/d/bin ››› ./mario --help
Usage: mario [OPTIONS] COMMAND1 [ARGS]... [COMMAND2 [ARGS]...]...

Options:
  --help  Show this message and exit.

Commands:
  clear-downstream  Print Airflow commands to clear all...
  dependencies      Export a .graphml representation of airflow...
  downstream        Find all tasks (across DAGs) that are...
  export_graphml    Export a .graphml representation of airflow...
  render            Render Airflow tasks with local params.
  upstream          Find all tasks (across DAGs) that are...
  waitfor-counts    Prints the number of waitfors that are...
  why               Por que?
```

Airflow operations

Hive Partition Sensor Operator

1. Check task success state
2. Check Hive metastore for partition
3. Check S3 path for the `_SUCCESS` file

DQ Check

```
from slack.airflow.data_quality import DQCheck

MyTaskOperator(
 task_id='my_task',
  dag=dag,
  dq_sql=DQCheck('dw.my_table', unique='my_primary_key').is_positive("count(1)", "row_count", over=1).build()
)
```

DAG cleanup

delete_dag <dag name>

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DAG Policy Validator

test_external_tasks	Check if external tasks point to valid DAGs and tasks.
test_circular_dependencies	Check if tasks have circular dependencies *across* DAGs.
test_priority_weight	Check that production tasks do not depend on a lower priority task.
test_on_failure	Require that high-priority DAGs have an on-failure alert.

DAG Policy Validator

test_sla	Require that high-priority DAGs have an SLA.
test_sla_timing	SLAs timing should make sense. No job should depend on a task that has an equal or longer SLA than it does.
test_has_retry_and_success_callbacks	Require an on_success_callback for tasks with an on_retry_callback.
test_require_dq_for_prod	Require SQ check for all the high priority tasks.

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Alerting and Monitoring

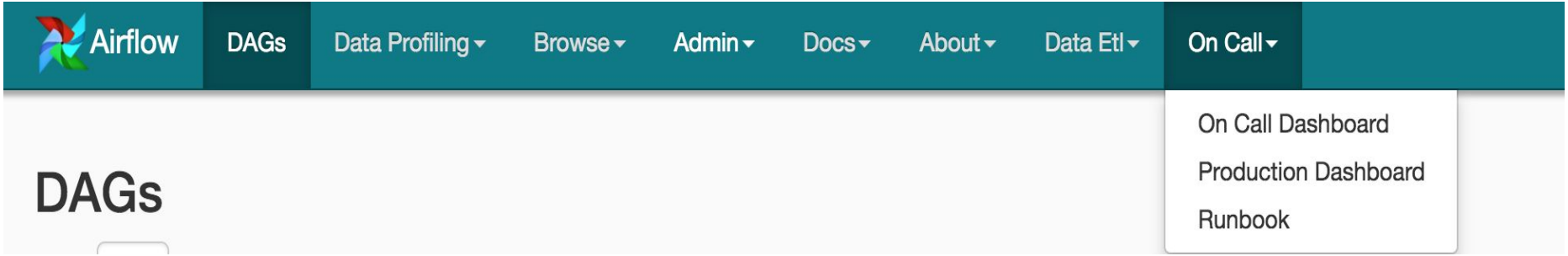
Alerting and Monitoring

- Alerting should be reliable
- Alerts should be actionable.
- Alert when it really matters.
- Suppress repeatable alerts.

OnCall Alert callback

```
from slack.airflow.webhook import Channels, OncallAlertCallback
dag = SlackDAG(
    alerts=OncallAlertCallback(
        channels=Channels.MY_CHANNEL,
        priority='high',
        escalation_chain=['Foo', 'Bar'],
        notes='This task upstream of billing pipeline'
        resources={
            'My runbook': 'https://slack-github.com/path/to/runbook',
        },
        pagerduty_email='data@slack.com',
    ),
)
```

OnCall Alert callback



Sample Alerts

Airflow Alerts APP 5:00 PM

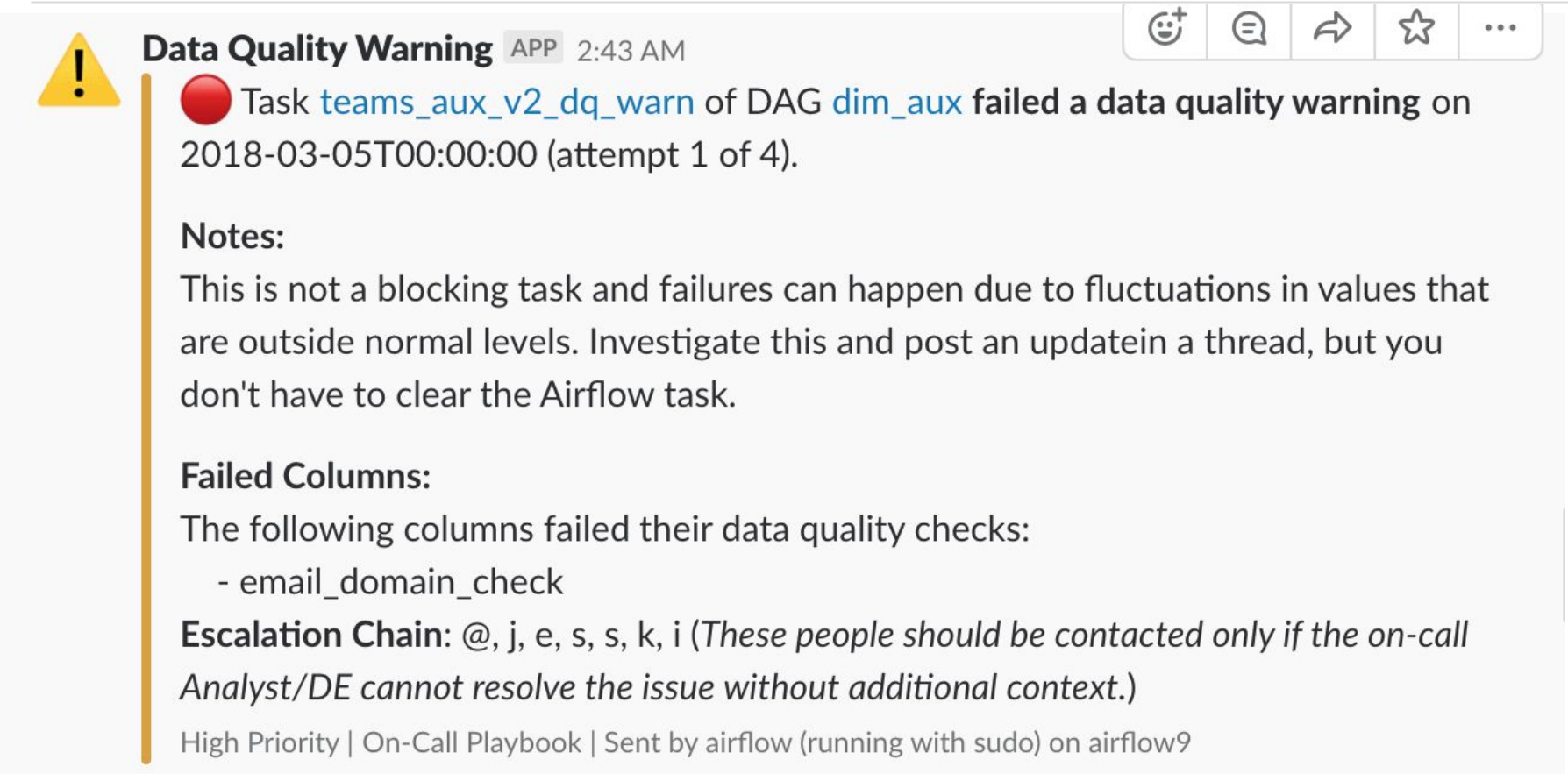
🔴 SLA miss for DAG team_company_segment task **team_company_segment_all_done** on 2018-04-04T00:00:00.

Notes:
This is a core pipeline. No downstream tasks will run until this task succeeds.

Escalation Chain: atl, lj (*These people should be contacted only if the on-call Analyst/DE cannot resolve the issue without additional context.*)

High Priority | On-Call Playbook | Sent by airflow on airflow9

Sample Alerts



Data Quality Warning APP 2:43 AM

🔴 Task teams_aux_v2_dq_warn of DAG dim_aux **failed a data quality warning** on 2018-03-05T00:00:00 (attempt 1 of 4).

Notes:
This is not a blocking task and failures can happen due to fluctuations in values that are outside normal levels. Investigate this and post an updatein a thread, but you don't have to clear the Airflow task.

Failed Columns:
The following columns failed their data quality checks:
- email_domain_check

Escalation Chain: @, j, e, s, s, k, i (*These people should be contacted only if the on-call Analyst/DE cannot resolve the issue without additional context.*)

High Priority | On-Call Playbook | Sent by airflow (running with sudo) on airflow9

Sample Alerts

Data Quality Failure APP 10:43 AM

🔴 Task enterprise_stats of DAG customer_stats **failed a data quality check** on 2018-03-05T00:00:00 (attempt 1 of 4).

Notes:

This is a core pipeline. No downstream tasks will run until this task succeeds.

Failed Columns:

The following columns failed their data quality checks:

- row_count

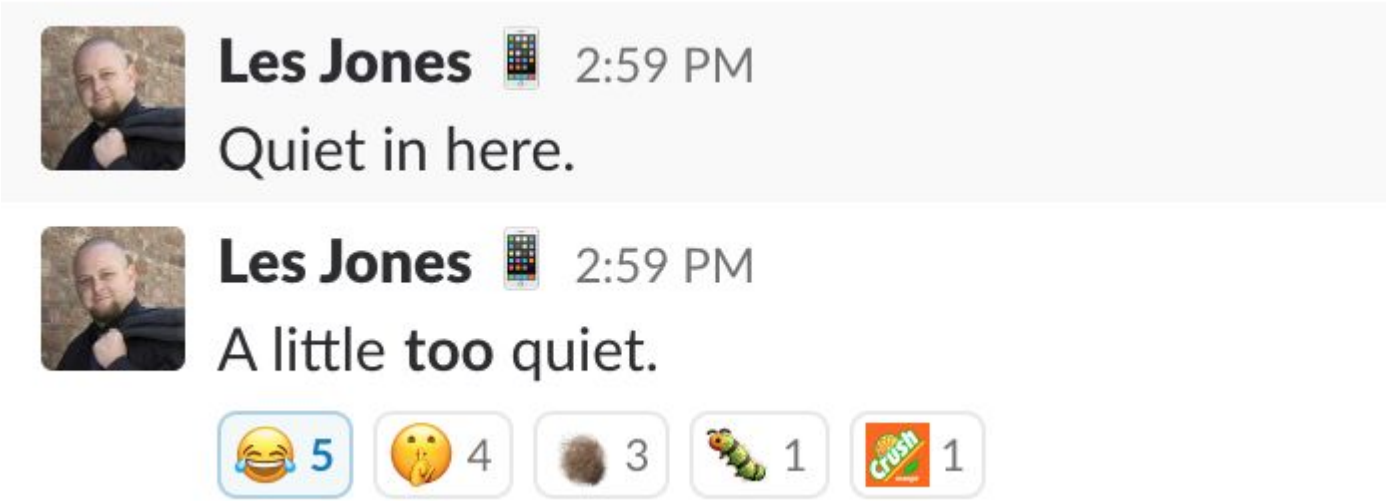
Triage Resources:

- Customer Stats runbook

Show less

High Priority | On-Call Playbook | Sent by airflow (running with sudo) on airflow9

A little too quiet



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Summary

Summary

- Keep your infrastructure simple
- You don’t own the platform, the users own it
- Automation is God

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Thank You!