AIRFLOW SUMMIT

3.0

Fine-Tuning Airflow: Parameters You May Not Know About

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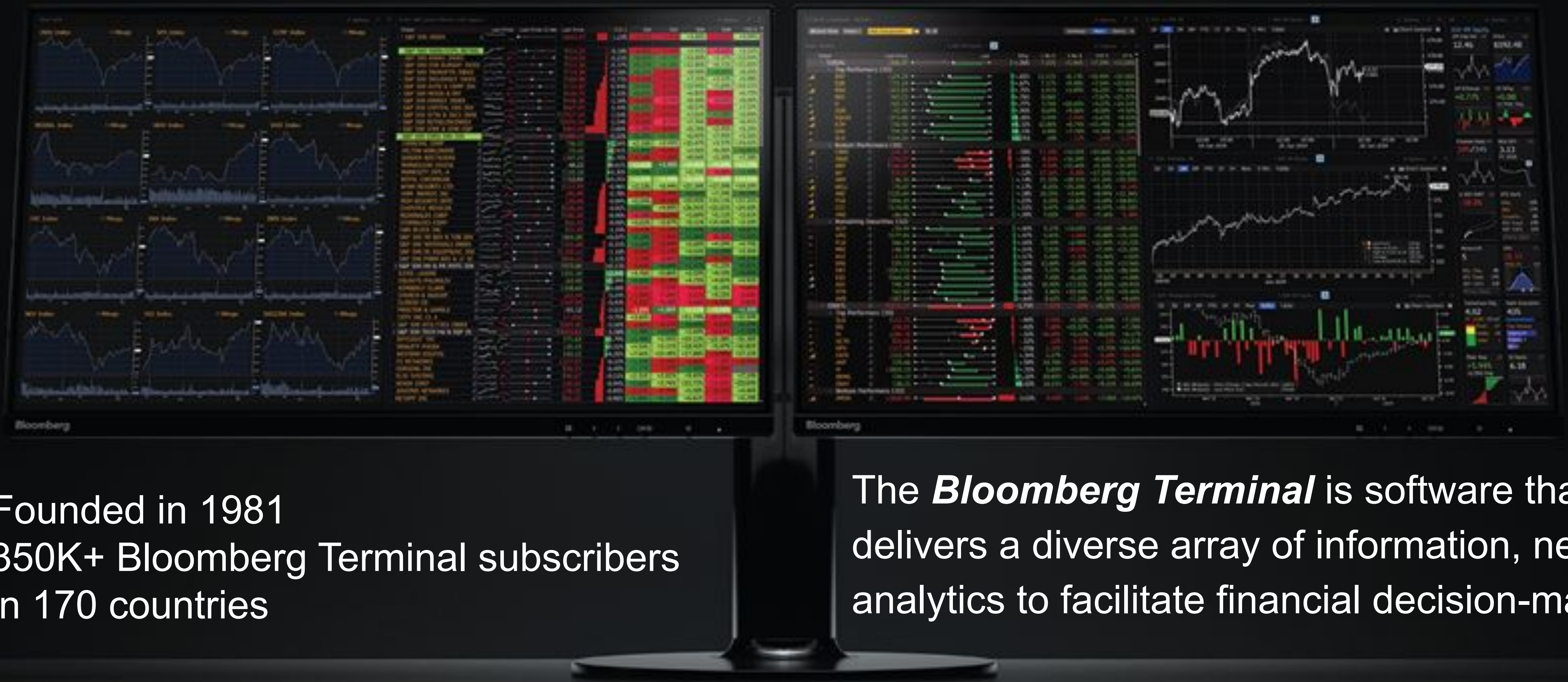
Agenda

- A Brief Introduction to Bloomberg
- Our Team and the Role of Apache Airflow
- Understanding Airflow Configurations
- Case Studies: How Configurations Resolved Four (4) Distinct Production Issues
- Key Insights and Takeaways

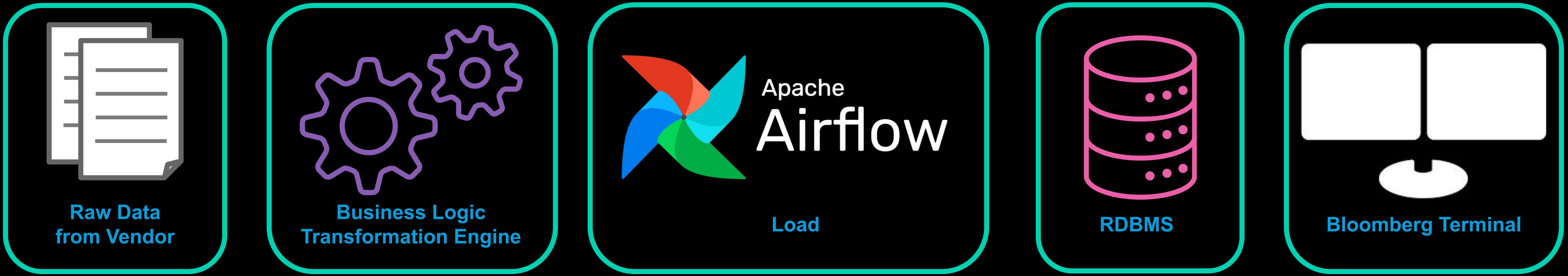


Founded in 1981
350K+ Bloomberg Terminal subscribers in 170 countries

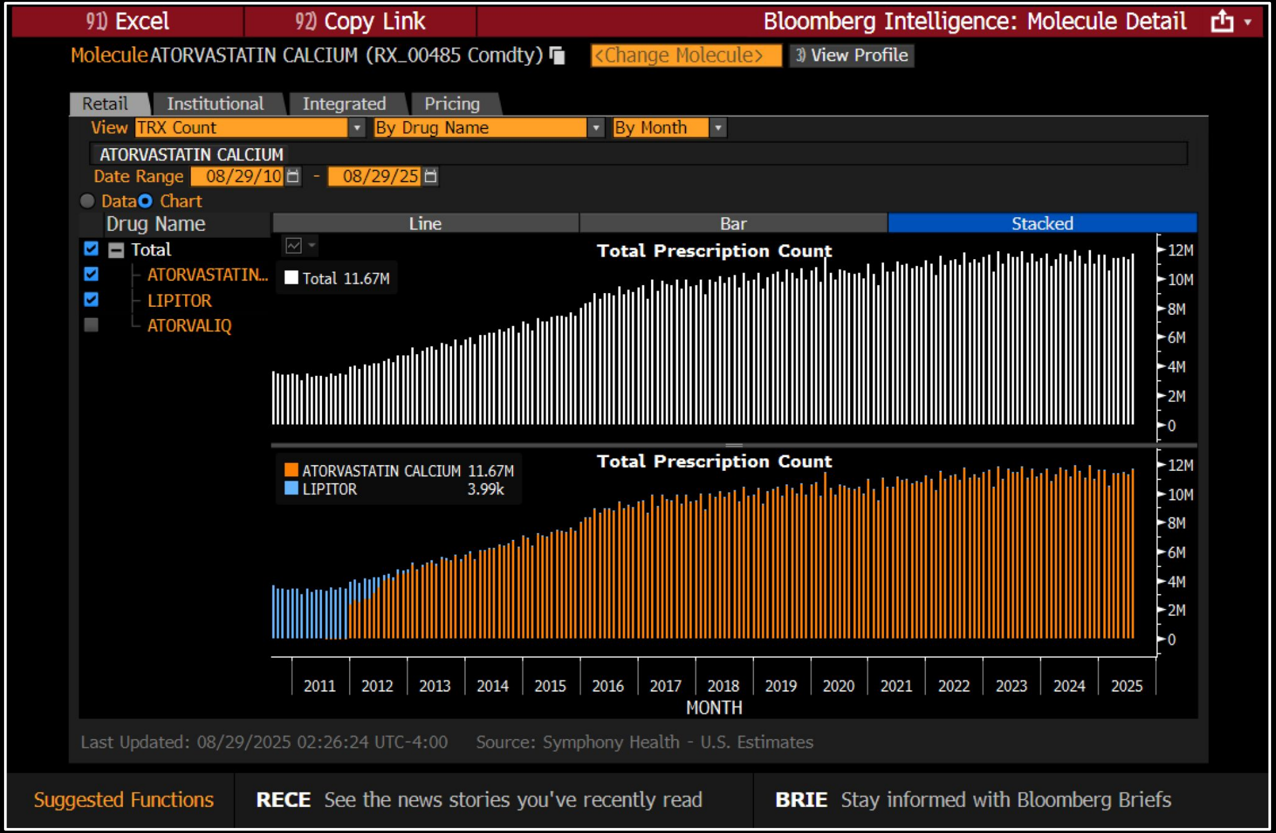
The ***Bloomberg Terminal*** is software that delivers a diverse array of information, news and analytics to facilitate financial decision-making.

Our Team and the Role of Airflow

- Data Platform Engineering
- Manage & orchestrate data workflows for global financial professionals
- Ingestion of Alternative Data:
  - Pharmaceutical drug pricing and sales
  - Airline flight totals and jet fuel consumption
- Transform click and drag configurations into data pipelines



Alternative Data On The Terminal



91) Excel | 92) Copy Link | Bloomberg Intelligence: Molecule Detail

Molecule ATORVASTATIN CALCIUM (RX_00485 Comdty) <Change Molecule> 3) View Profile

Retail | Institutional | Integrated | Pricing

View TRX Count | By Drug Name | By Month

ATORVASTATIN CALCIUM

Date Range 08/29/10 - 08/29/25

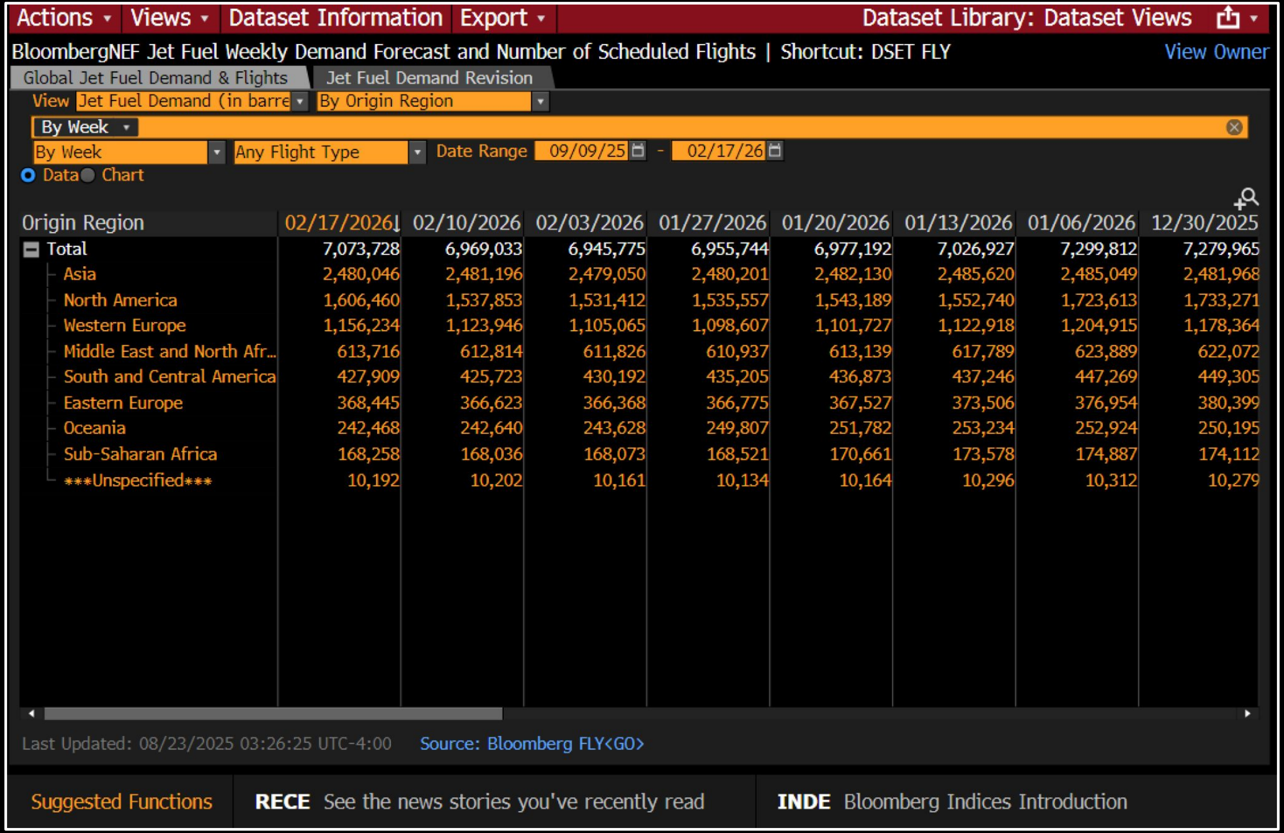
Data ● Chart

Drug Name

- ☑ Total
  - ☑ ATORVASTATIN...
  - ☑ LIPITOR
  - ATORVALIQ

Last Updated: 08/29/2025 02:26:24 UTC-4:00 Source: Symphony Health - U.S. Estimates

Suggested Functions | **RECE** See the news stories you've recently read | **BRIE** Stay informed with Bloomberg Briefs



Actions | Views | Dataset Information | Export | Dataset Library: Dataset Views

BloombergNEF Jet Fuel Weekly Demand Forecast and Number of Scheduled Flights | Shortcut: DSET FLY View Owner

Global Jet Fuel Demand & Flights | Jet Fuel Demand Revision

View Jet Fuel Demand (in barre | By Origin Region

By Week

By Week | Any Flight Type | Date Range 09/09/25 - 02/17/26

● Data Chart

Origin Region	02/17/2026	02/10/2026	02/03/2026	01/27/2026	01/20/2026	01/13/2026	01/06/2026	12/30/2025
Total	7,073,728	6,969,033	6,945,775	6,955,744	6,977,192	7,026,927	7,299,812	7,279,965
Asia	2,480,046	2,481,196	2,479,050	2,480,201	2,482,130	2,485,620	2,485,049	2,481,968
North America	1,606,460	1,537,853	1,531,412	1,535,557	1,543,189	1,552,740	1,723,613	1,733,271
Western Europe	1,156,234	1,123,946	1,105,065	1,098,607	1,101,727	1,122,918	1,204,915	1,178,364
Middle East and North Afr...	613,716	612,814	611,826	610,937	613,139	617,789	623,889	622,072
South and Central America	427,909	425,723	430,192	435,205	436,873	437,246	447,269	449,305
Eastern Europe	368,445	366,623	366,368	366,775	367,527	373,506	376,954	380,399
Oceania	242,468	242,640	243,628	249,807	251,782	253,234	252,924	250,195
Sub-Saharan Africa	168,258	168,036	168,073	168,521	170,661	173,578	174,887	174,112
Unspecified	10,192	10,202	10,161	10,134	10,164	10,296	10,312	10,279

Last Updated: 08/23/2025 03:26:25 UTC-4:00 Source: Bloomberg FLY<GO>

Suggested Functions | **RECE** See the news stories you've recently read | **INDE** Bloomberg Indices Introduction

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Understanding Airflow Configurations

- Parameters control how Airflow behaves
- Govern:
  - DAG parsing
  - Scheduler heartbeat
  - Database interactions
  - Task queueing & retries
  - Metadata cleanup & observability
- Airflow provides default values, but often need to be customized
- Defined via:
  - Configuration file
  - Environment variables: AIRFLOW__{SECTION}__{KEY}

Case Studies: How Configurations Resolved Four (4) Distinct Production Issues?

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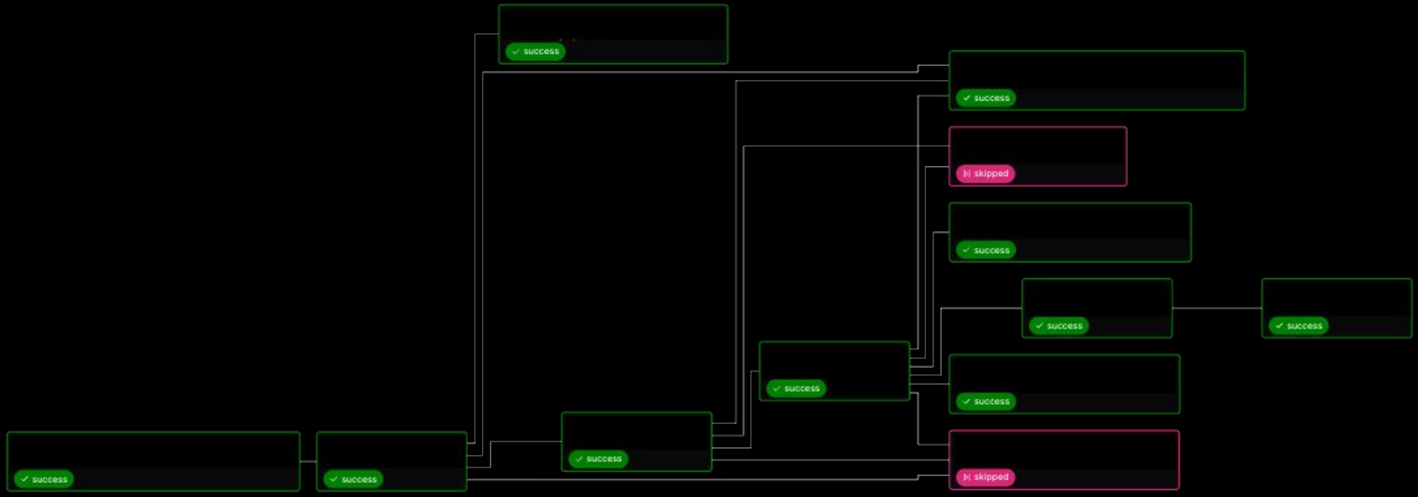
Case 1: Dynamic DAGs Not Parsed

Case 1: Dynamic DAGs Not Parsed

- We have 2,500+ dynamic DAGs
  - Each corresponding to a distinct dataset data pipeline
  - Similarity between DAGs, but slightly different based on configs
  - Configs come in **different permutations** and **vary** for each dataset
  - Dynamic DAGs avoid creating the same DAG, same tasks with slight modifications

Case 1: Dynamic DAGs Not Parsed

- create_dynamic_dags.py file generates dynamic DAGs at runtime
  - Calls services to:
    - Get a list of tables in our system
    - Obtain the tree of task descendants
  - Creates a dynamic DAG using those relationships
  - Some complex DAGs can have 150+ tasks
  - Process is resource intensive



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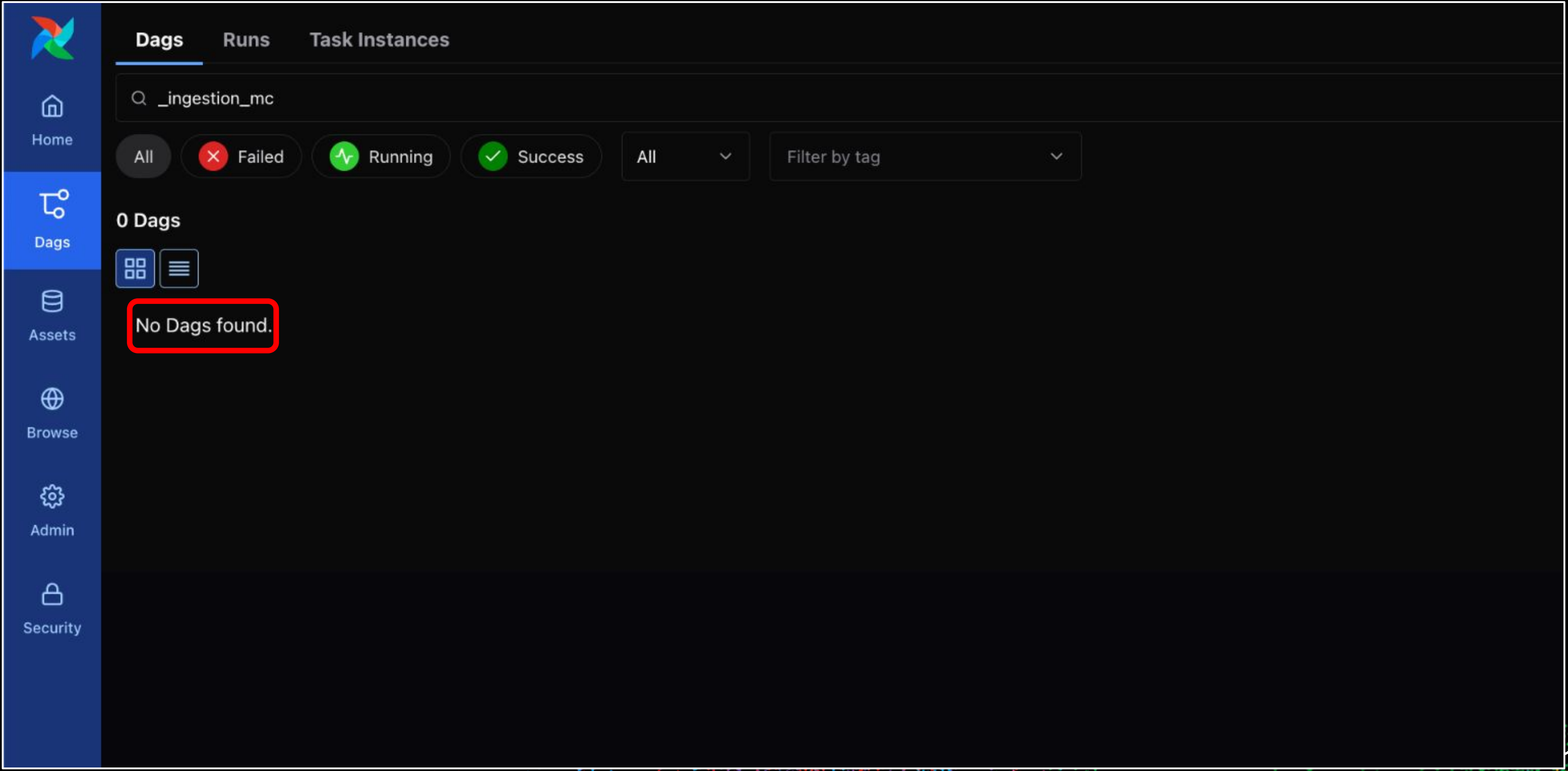
Case 1: Dynamic DAGs Not Parsed

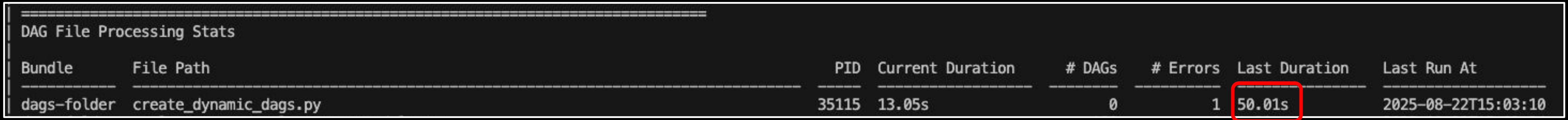


0 Dags

No Dags found.

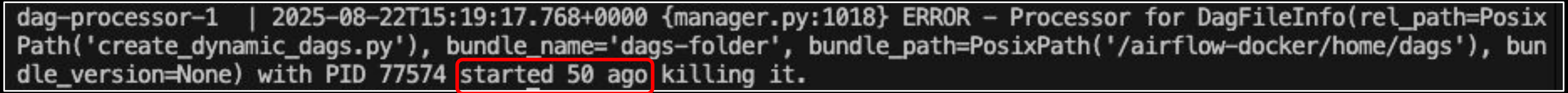
Debugging DAG Processor Logs

In the logs, the value *50* appears in multiple places



```
=================================================================================
DAG File Processing Stats

Bundle       File Path                                                            PID    Current Duration     # DAGs    # Errors  Last Duration     Last Run At
-----------  -------------------------------------------------------------------  -----  -------------------  --------  --------  ---------------   -------------------
dags-folder  create_dynamic_dags.py                                               35115  13.05s                      0         1  50.01s            2025-08-22T15:03:10
```



```
dag-processor-1  | 2025-08-22T15:19:17.768+0000 {manager.py:1018} ERROR - Processor for DagFileInfo(rel_path=Posix
Path('create_dynamic_dags.py'), bundle_name='dags-folder', bundle_path=PosixPath('/airflow-docker/home/dags'), bun
dle_version=None) with PID 77574 started 50 ago killing it.
```

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[dag_processor] dag_file_processor_timeout

dag_file_processor_timeout

How long before timing out a DagFileProcessor, which processes a dag file ⬅

Type:

integer

Default:

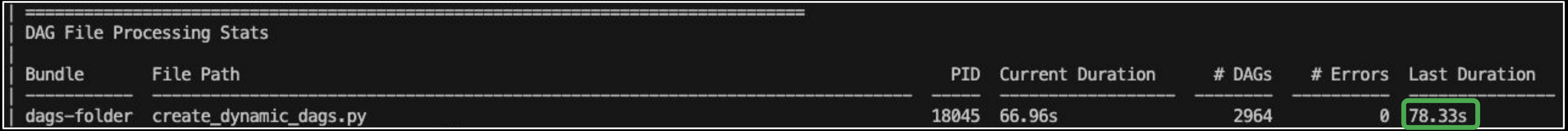
`50`

Environment Variable:

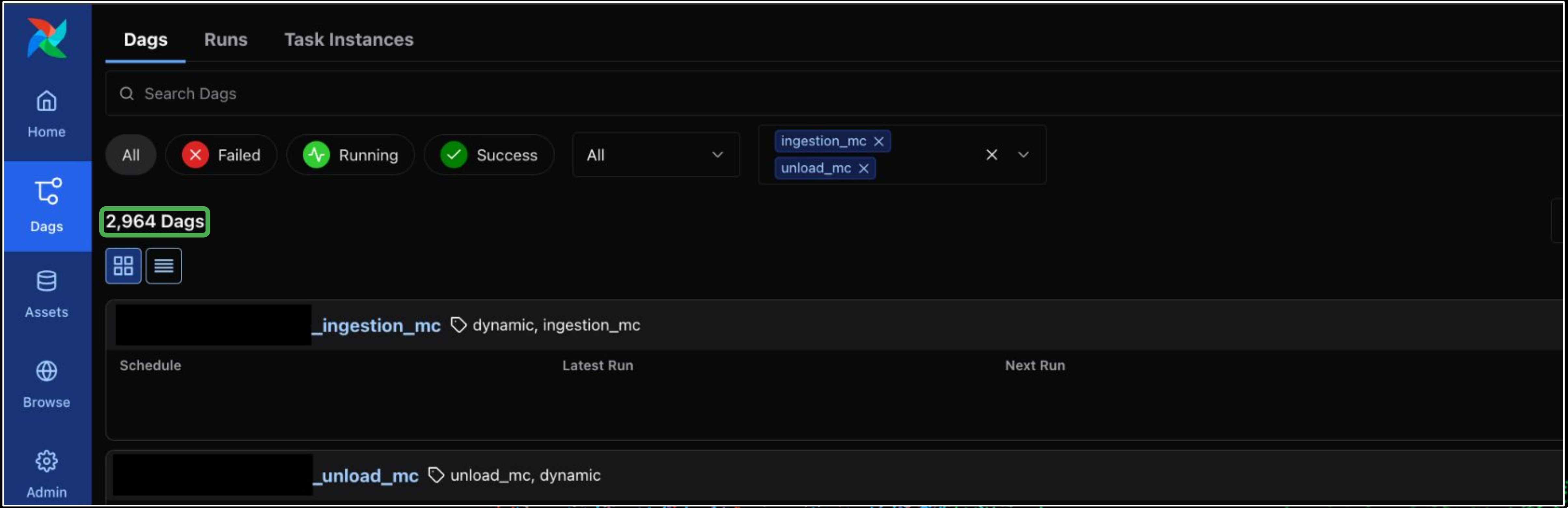
`AIRFLOW__DAG_PROCESSOR__DAG_FILE_PROCESSOR_TIMEOUT`

Increase Timeout

```
[dag_processor]
dag_file_processor_timeout = 500
```



```
| ================================================================================
| DAG File Processing Stats
|
| Bundle       File Path                                                                  PID  Current Duration    # DAGs    # Errors  Last Duration
| -----------  ------------------------------------------------------------------------  -----  -----------------  --------  --------  -------------
| dags-folder  create_dynamic_dags.py                                                   18045  66.96s                  2964         0  78.33s
```



Dags Runs Task Instances

Search Dags

All | Failed | Running | Success | All | ingestion_mc × unload_mc ×

2,964 Dags

[redacted]_ingestion_mc dynamic, ingestion_mc

Schedule Latest Run Next Run

[redacted]_unload_mc unload_mc, dynamic

Case 1: Solution

- Increasing [dag_processor] dag_file_processor_timeout allowed us to:
  - Quickly fix the issue
  - Find the right value for the current processing times
  - Buy time to think about long term solutions
    - Cleaning up unused datasets
    - Splitting dynamic DAGs into multiple files
    - Dedicating more compute resources to the dag processor

Case 2: DAG Parsing Delay

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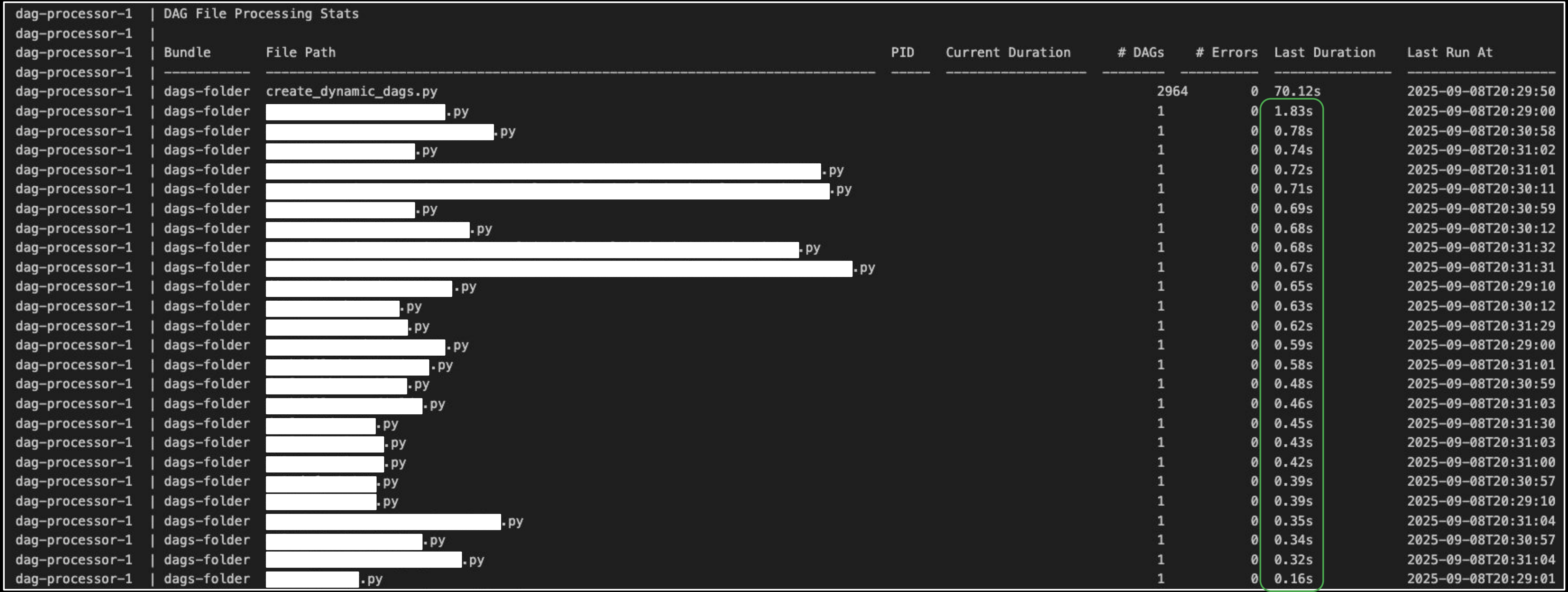
Case 2: DAG Parsing Delay



```
dag-processor-1  | DAG File Processing Stats
dag-processor-1  |
dag-processor-1  | Bundle       File Path                                                                      PID     Current Duration     # DAGs    # Errors  Last Duration    Last Run At
dag-processor-1  | -----------  -----------------------------------------------------------------------------  -----  ------------------  ---------  ---------  ----------------  -------------------
dag-processor-1  | dags-folder  create_dynamic_dags.py                                                                                       2964          0  70.12s            2025-09-08T20:29:50
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  1.83s             2025-09-08T20:29:00
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.78s             2025-09-08T20:30:58
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.74s             2025-09-08T20:31:02
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.72s             2025-09-08T20:31:01
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.71s             2025-09-08T20:30:11
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.69s             2025-09-08T20:30:59
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.68s             2025-09-08T20:30:12
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.68s             2025-09-08T20:31:32
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.67s             2025-09-08T20:31:31
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.65s             2025-09-08T20:29:10
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.63s             2025-09-08T20:30:12
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.62s             2025-09-08T20:31:29
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.59s             2025-09-08T20:29:00
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.58s             2025-09-08T20:31:01
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.48s             2025-09-08T20:30:59
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.46s             2025-09-08T20:31:03
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.45s             2025-09-08T20:31:30
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.43s             2025-09-08T20:31:03
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.42s             2025-09-08T20:31:00
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.39s             2025-09-08T20:30:57
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.39s             2025-09-08T20:29:10
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.35s             2025-09-08T20:31:04
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.34s             2025-09-08T20:30:57
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.32s             2025-09-08T20:31:04
dag-processor-1  | dags-folder  [redacted].py                                                                                                   1          0  0.16s             2025-09-08T20:29:01
```

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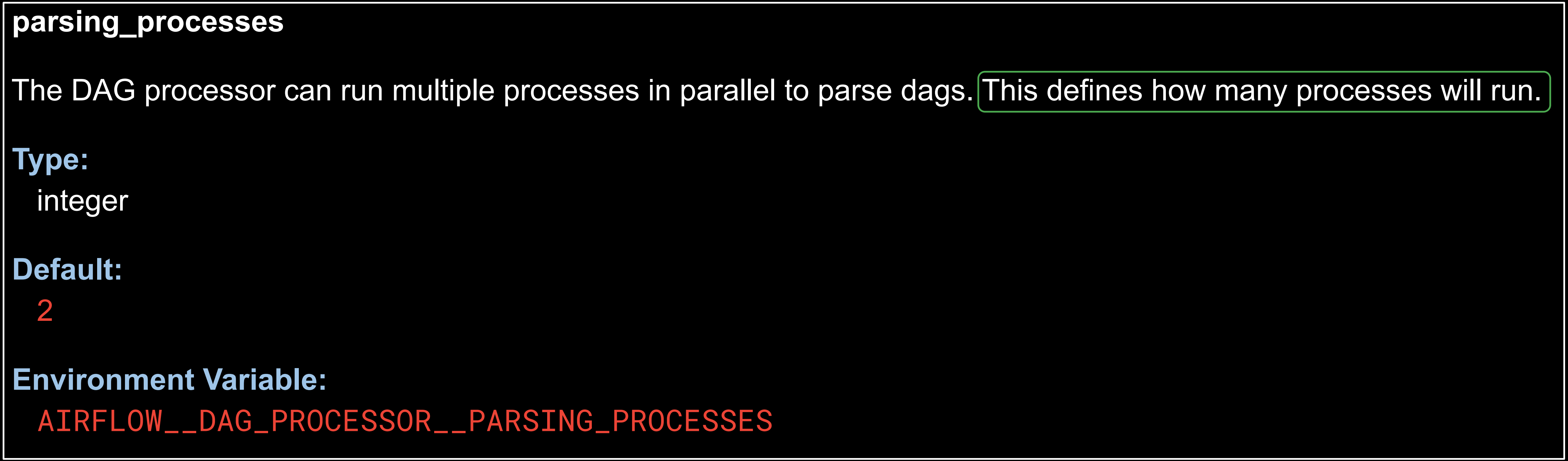
[dag_processor] parsing_processes



parsing_processes

The DAG processor can run multiple processes in parallel to parse dags. This defines how many processes will run.

Type:
integer

Default:
`2`

Environment Variable:
`AIRFLOW__DAG_PROCESSOR__PARSING_PROCESSES`

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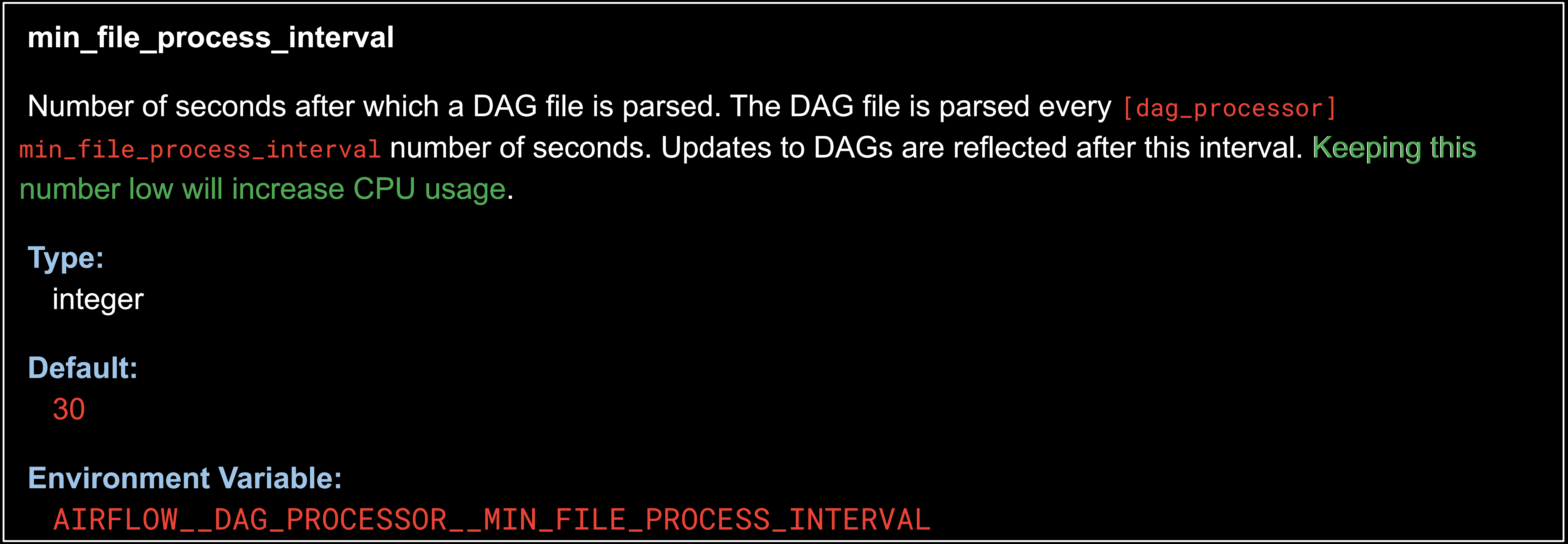
[dag_processor] min_file_process_interval



min_file_process_interval

Number of seconds after which a DAG file is parsed. The DAG file is parsed every `[dag_processor] min_file_process_interval` number of seconds. Updates to DAGs are reflected after this interval. Keeping this number low will increase CPU usage.

Type:
integer

Default:
`30`

Environment Variable:
`AIRFLOW__DAG_PROCESSOR__MIN_FILE_PROCESS_INTERVAL`

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Case 2: Solution

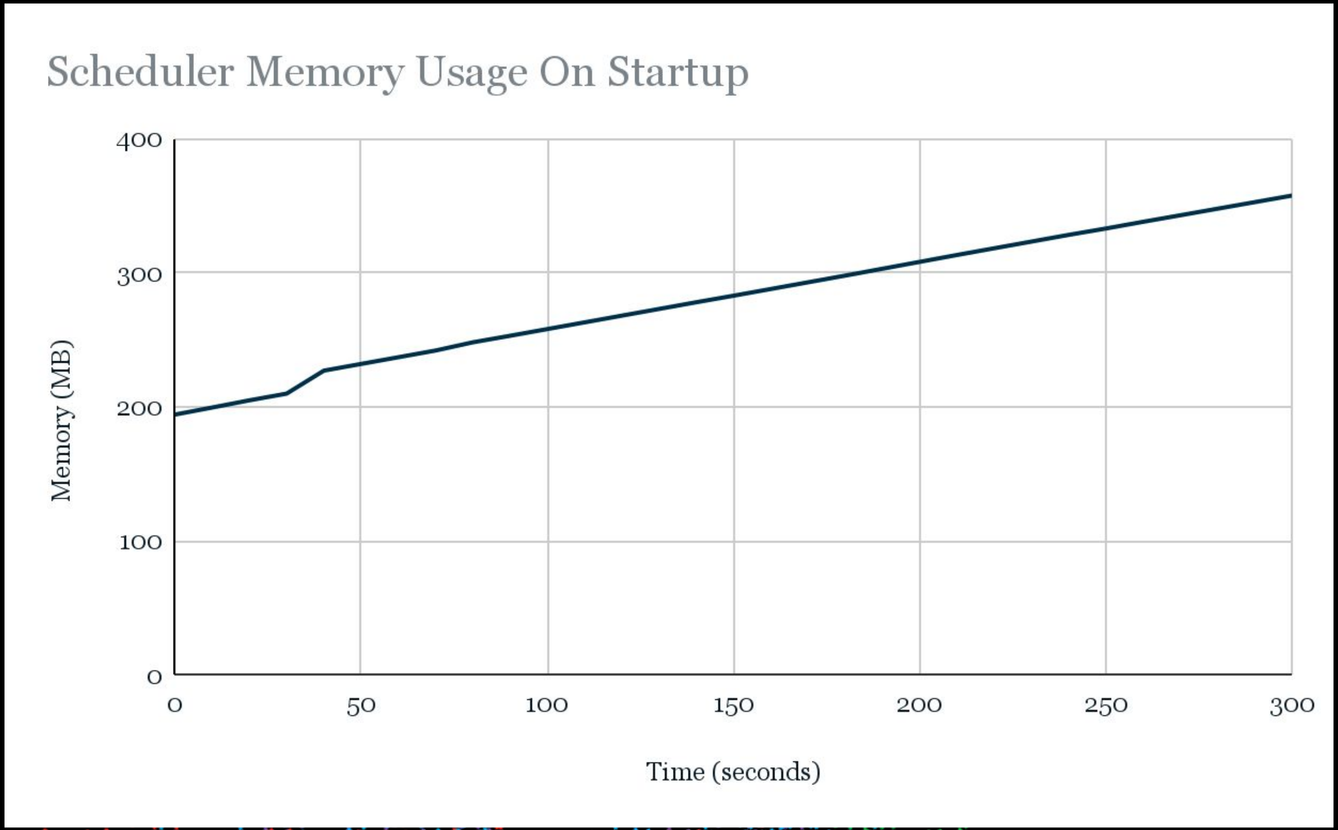
- Tweaking parsing_processes and min_file_process_interval allowed us to:
    - Get faster DAG processing runs each iteration
    - Get DAG processor to run more frequently
    - Get close to “live” updates to DAG structures
    - Change no code

- Be wary of the CPU usage trade-off

Case 3: Scheduler Memory Leak

Case 3: Scheduler Memory Leak

- Scheduler was using an increasing amount of memory
- This was eventually causing it to get killed and restarted
- Symptoms of a memory leak



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Scheduler RSS (Resident Set Size)

```
docker compose exec -it scheduler sh -lc \
'while true; do ps -o pid,rss,command -p $(pgrep -f "scheduler"); \
sleep 10; done'
```

```
  PID   RSS COMMAND
   16 198828 /opt/bb/bin/python3 /opt/bb/bin/airflow scheduler
  PID   RSS COMMAND
   16 204204 /opt/bb/bin/python3 /opt/bb/bin/airflow scheduler
  PID   RSS COMMAND
   16 209708 /opt/bb/bin/python3 /opt/bb/bin/airflow scheduler
  PID   RSS COMMAND
   16 214828 /opt/bb/bin/python3 /opt/bb/bin/airflow scheduler
  PID   RSS COMMAND
   16 232376 /opt/bb/bin/python3 /opt/bb/bin/airflow scheduler
  PID   RSS COMMAND
   16 237496 /opt/bb/bin/python3 /opt/bb/bin/airflow scheduler
  PID   RSS COMMAND
   16 242616 /opt/bb/bin/python3 /opt/bb/bin/airflow scheduler
```

[scheduler] enable_tracemalloc

enable_tracemalloc

Added in version 3.0.0.

Whether to enable memory allocation tracing in the scheduler. If enabled, Airflow will start tracing memory allocation and log the top 10 memory usages at the error level upon receiving the signal SIGUSR1. This is an expensive operation and generally should not be used except for debugging purposes.

Type:

Boolean

Default:

False

Environment Variable:

`AIRFLOW__SCHEDULER__ENABLE_TRACEMALLOC`

[scheduler] enable_tracemalloc

enable_tracemalloc

Added in version 3.0.0.

Whether to enable memory allocation tracing in the scheduler. If enabled, Airflow will start tracing memory allocation and log the top 10 memory usages at the error level upon receiving the signal SIGUSR1. This is an expensive operation and generally should not be used except for debugging purposes.

Type:

Boolean

Default:

False

Environment Variable:

`AIRFLOW__SCHEDULER__ENABLE_TRACEMALLOC`

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Tracemalloc Report

```
docker compose exec -it scheduler sh -c \
'kill -SIGUSR1 $(pgrep -f "airflow scheduler")'
```

```
scheduler-1  | 2025-09-10T19:49:26.114+0000 {scheduler_job_runner.py:307} ERROR - scheduler memory
usage:
scheduler-1  |  Top 10
scheduler-1  |  /airflow-docker/home/plugins/leaky_plugin.py:7: size=25.0 MiB, count=51, average=502 KiB
scheduler-1  |  <frozen importlib._bootstrap_external>:757: size=2521 KiB, count=22861, average=113 B
scheduler-1  |  /opt/bb/lib/python3.12/site-packages/sqlalchemy/sql/schema.py:1730: size=351 KiB,
count=455, average=790 B
scheduler-1  |  /opt/bb/lib/python3.12/site-packages/gunicorn/config.py:247: size=217 KiB, count=644,
average=346 B
scheduler-1  |  /opt/bb/lib/python3.12/site-packages/sqlalchemy/util/langhelpers.py:1185: size=180 KiB,
count=789, average=233 B
scheduler-1  |  <frozen abc>:106: size=123 KiB, count=445, average=284 B
scheduler-1  |  <frozen abc>:123: size=122 KiB, count=1612, average=77 B
scheduler-1  |  /opt/bb/lib/python3.12/site-packages/sqlalchemy/sql/annotation.py:166: size=75.1 KiB,
count=118, average=651 B
```

Case 3: Solution

```
docker compose exec -it scheduler sh -c \
'kill -SIGUSR1 $(pgrep -f "airflow scheduler")'
```

```
scheduler-1  | 2025-09-10T20:34:04.807+0000 {scheduler_job_runner.py:307} ERROR - scheduler
memory usage:
scheduler-1  |  Top 10
scheduler-1  |  <frozen importlib._bootstrap_external>:757: size=2521 KiB, count=22860,
average=113 B
scheduler-1  |  /opt/bb/lib/python3.12/site-packages/sqlalchemy/sql/schema.py:1730: size=357
KiB, count=461, average=794 B
scheduler-1  |  /opt/bb/lib/python3.12/site-packages/gunicorn/config.py:247: size=217 KiB,
count=644, average=346 B
scheduler-1  |  /opt/bb/lib/python3.12/site-packages/sqlalchemy/util/langhelpers.py:1185:
size=197 KiB, count=868, average=233 B
scheduler-1  |  <frozen abc>:106: size=123 KiB, count=445, average=284 B
```

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Case 3: Solution

```
docker compose exec -it scheduler sh -lc \
'while true; do ps -o pid,rss,command -p $(pgrep -f "scheduler"); \
sleep 10; done'
```

```
PID    RSS COMMAND
   20 207968 /opt/bb/bin/python3 /opt/bb/bin/airflow scheduler
  PID    RSS COMMAND
   20 207968 /opt/bb/bin/python3 /opt/bb/bin/airflow scheduler
  PID    RSS COMMAND
   20 207968 /opt/bb/bin/python3 /opt/bb/bin/airflow scheduler
  PID    RSS COMMAND
   20 207968 /opt/bb/bin/python3 /opt/bb/bin/airflow scheduler
  PID    RSS COMMAND
   20 207968 /opt/bb/bin/python3 /opt/bb/bin/airflow scheduler
  PID    RSS COMMAND
   20 207968 /opt/bb/bin/python3 /opt/bb/bin/airflow scheduler
  PID    RSS COMMAND
   20 207968 /opt/bb/bin/python3 /opt/bb/bin/airflow scheduler
```

Case 4: Observability

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Case 4: Observability

- With many components running, we need to make sure we have observability into components

- Ways to identify issues early for previous problems encountered:
    - No DAGs parsed
    - High DAG parsing run times

- Health of scheduler, DagRun, Celery, etc.

[metrics] statsd_on

```
pip install 'apache-airflow[statsd]'
```

statsd_on

Added in version 2.0.0.

Enables sending metrics to StatsD.

Type:

Boolean

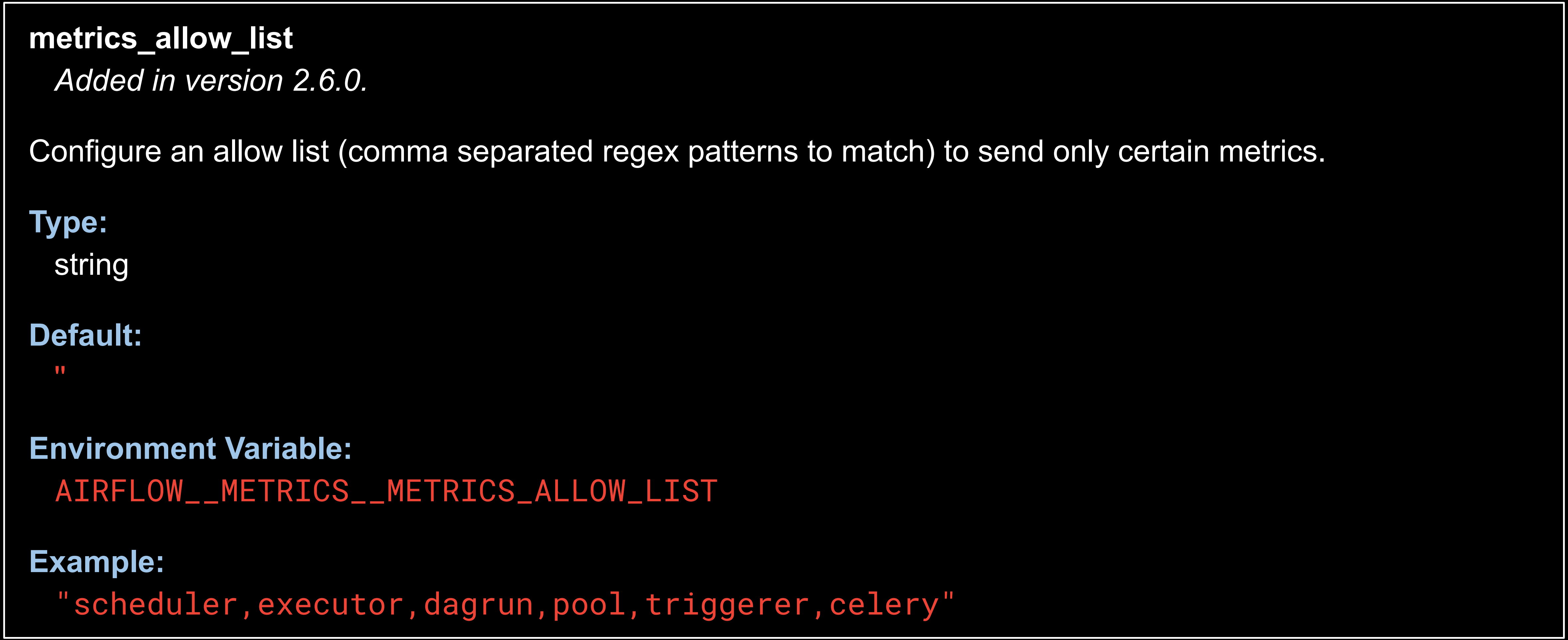
Default:

False

Environment Variable:

`AIRFLOW__METRICS__STATSD_ON`

[metrics] metrics_allow_list



metrics_allow_list

Added in version 2.6.0.

Configure an allow list (comma separated regex patterns to match) to send only certain metrics.

Type:

string

Default:

`''`

Environment Variable:

`AIRFLOW__METRICS__METRICS_ALLOW_LIST`

Example:

`"scheduler,executor,dagrun,pool,triggerer,celery"`

Case 4: Solution

```
[metrics]
metrics_allow_list = dag_processing,dagrun
```

- `dag_processing.last_run.seconds_ago.<dag_file>`
  - Alert if it's been too long since last run
- `dag_processing.last_duration.<dag_file>`
  - Alert if DAG files are taking too long to process
- `dagrun.<dag_id>.first_task_scheduling_delay`
  - Alert if there is a large delay for first task runs for DAGs of interest

Takeaways

- Small config tweaks: big impact on scale, stability and observability
  - [dag_processor] dag_file_processor_timeout
  - [dag_processor] parsing_processes
  - [dag_processor] min_file_process_interval
  - [scheduler] enable_tracemalloc ⬅
  - [metrics] statsd_on
  - [metrics] metrics_allow_list
- Test with different values of configurations in lower environments
- Temporarily changing configs can buy time to look into long term solutions
- Read the documentation and keep up to date with latest configurations

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Thank you!

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