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Allegro's Airflow Journey: From On-Prem to Cloud Orchestration at Scale

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TL;DR

How to get to over **250** active Airflow environments and **survive**

Operate data platform for almost **1000 users** with over **16,000 DAGs**

How to save **$1,147,233** on airflow orchestration costs and **FAR MORE** in human time

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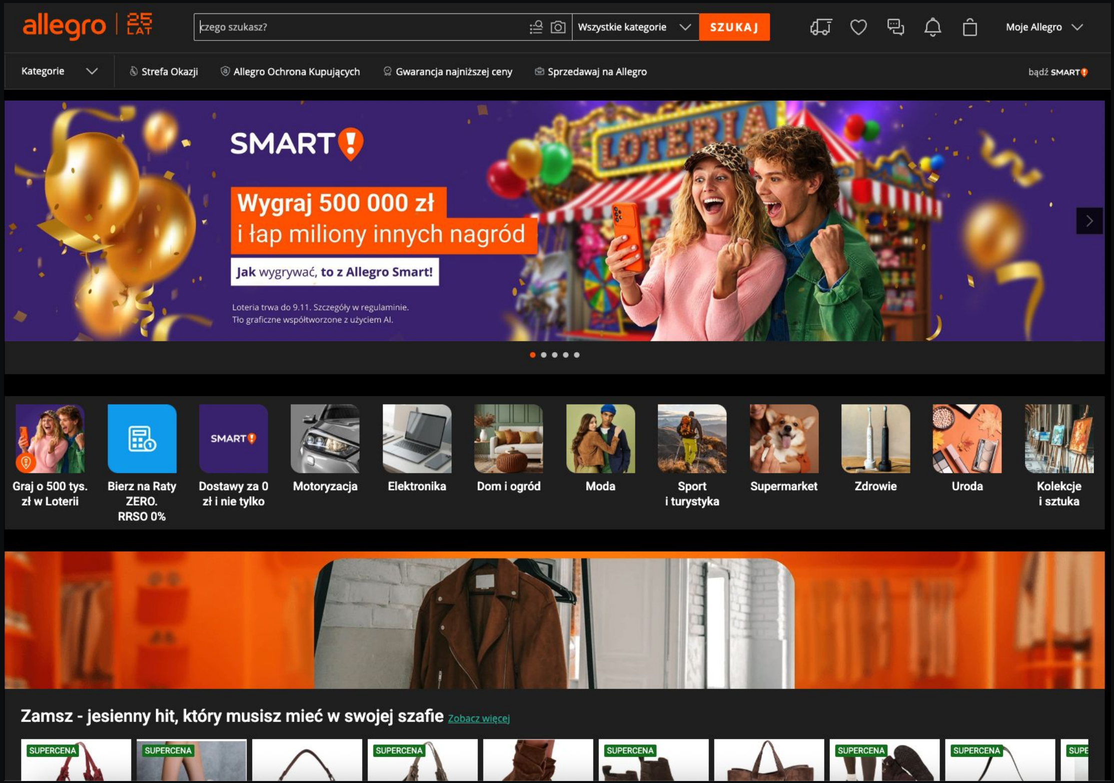
About Allegro

- Allegro.pl + CZ, SK, HU
- 25 years on the market
- ~21,1 million active buyers
- ~20 millions users per month
- > 160k merchants
- ~7000 people across CEE



SMART!

Wygraj 500 000 zł i łap miliony innych nagród

Jak wygrywać, to z Allegro Smart!

Loteria trwa do 9.11. Szczegóły w regulaminie.
Tło graficzne współtworzone z użyciem AI.

Zamsz - jesienny hit, który musisz mieć w swojej szafie Zobacz więcej

From on-prem to cloud scale

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History points

2012-07 - Hadoop Cluster in our DC (CHD3)

2015-12 - Oozie + Tez support

2017-08 - Airflow As A Service (AaaS) in Allegro (Airflow **1.8.1**)

2022-04 - Migrating Data Platform to the Cloud: AaaS -> Cloud Composer (Google)

2023-03:

- Hadoop Outro
- AaaS - At the peak 249 dedicated instances for Dev, Testing & Production envs (**1.9.0/1.10.12**)

2023-06 - End of Support for Airflow as a Service

Organization

- Teams organization
  - Over 100 teams
  - Over 900 internal users
  - Different competence levels
- Projects groups on GCP - **360**
  - 3 environments each (dev/test/prod)
- Composers - **175** instances (DEV - **48**, TEST - **43**, PROD - **84**)

Conway's law!

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Current state

- Main use cases
  - Data processings
  - MLOps
  - Governance
  - Utils

- Infrastructure
  - Composer environments: 175
  - # DAGs: 15.6k
  - # Tasks: 166k
  - Over 300 types of operators

Orchestrated tasks

- 38k BQ processings
- 35k BQ Sensors
- 8k Spark processings
- 11k Snowflake processings
- 5k DBT processings
- 15.5k PythonOperators

.... and 50k other

mongoDB
salesforce
Jira
tableau

~~Problems~~
Solutions

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Data Platform

- DAG authoring and deployment process
- Cloud resource management
  - Datasets & Tables
  - Also Cloud Composer environment
- Governance
  - Access management
  - GDPR
  - Ownership attribution
  - Auditability
- Documentation and support

Gen AI - Gemini

User

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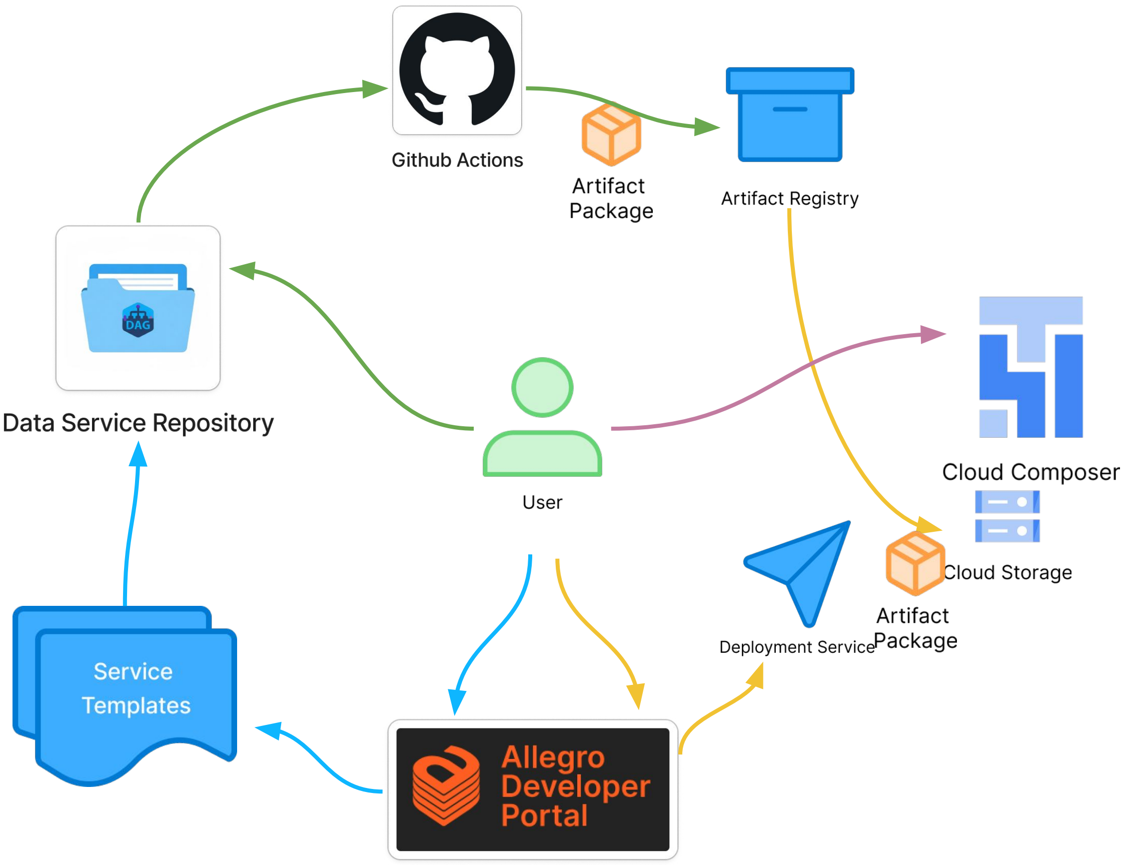
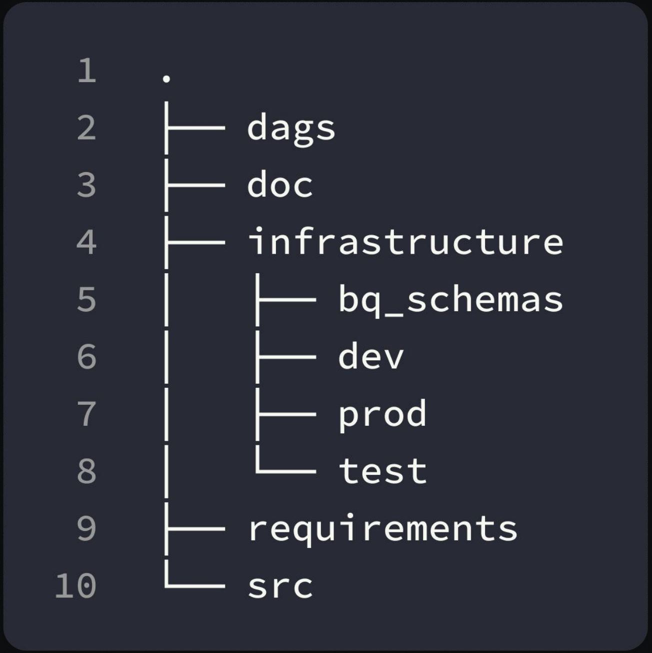
DAG authoring flow

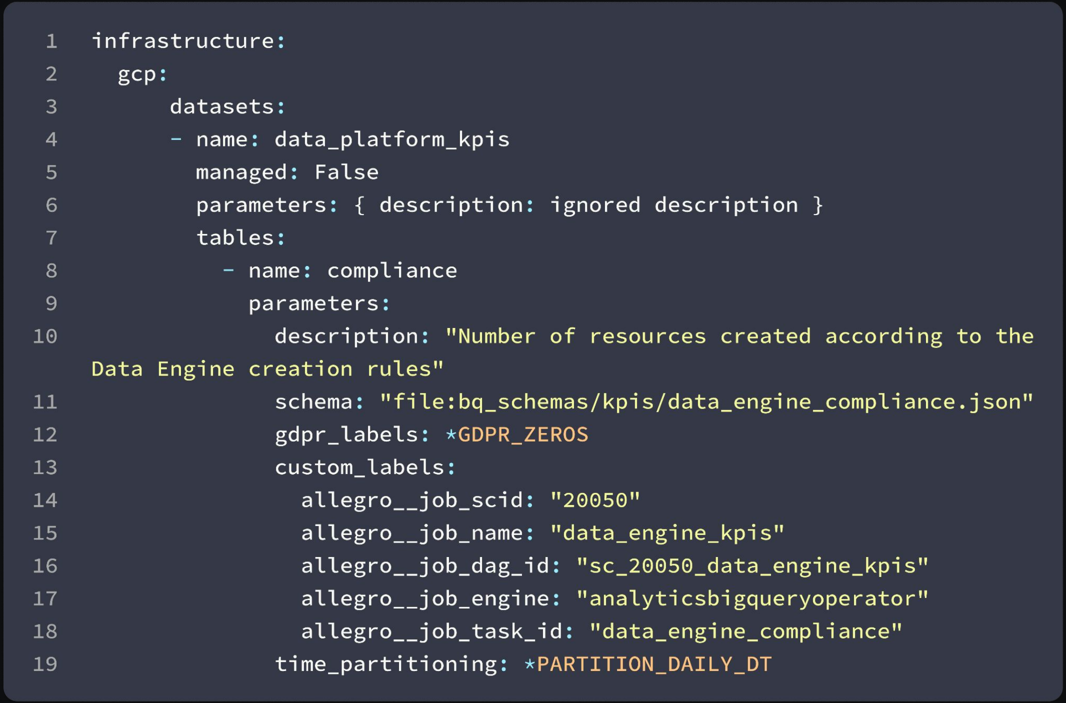
Flow elements:

- Service generation based on predefined template
- Processing defining and build automation
- Target environment deployment





```
.
├── dags
├── doc
├── infrastructure
│   ├── bq_schemas
│   ├── dev
│   ├── prod
│   └── test
├── requirements
└── src
```



```yaml
infrastructure:
  gcp:
      datasets:
      - name: data_platform_kpis
        managed: False
        parameters: { description: ignored description }
        tables:
          - name: compliance
            parameters:
              description: "Number of resources created according to the Data Engine creation rules"
              schema: "file:bq_schemas/kpis/data_engine_compliance.json"
              gdpr_labels: *GDPR_ZEROS
              custom_labels:
                allegro__job_scid: "20050"
                allegro__job_name: "data_engine_kpis"
                allegro__job_dag_id: "sc_20050_data_engine_kpis"
                allegro__job_engine: "analyticsbigqueryoperator"
                allegro__job_task_id: "data_engine_compliance"
              time_partitioning: *PARTITION_DAILY_DT
```

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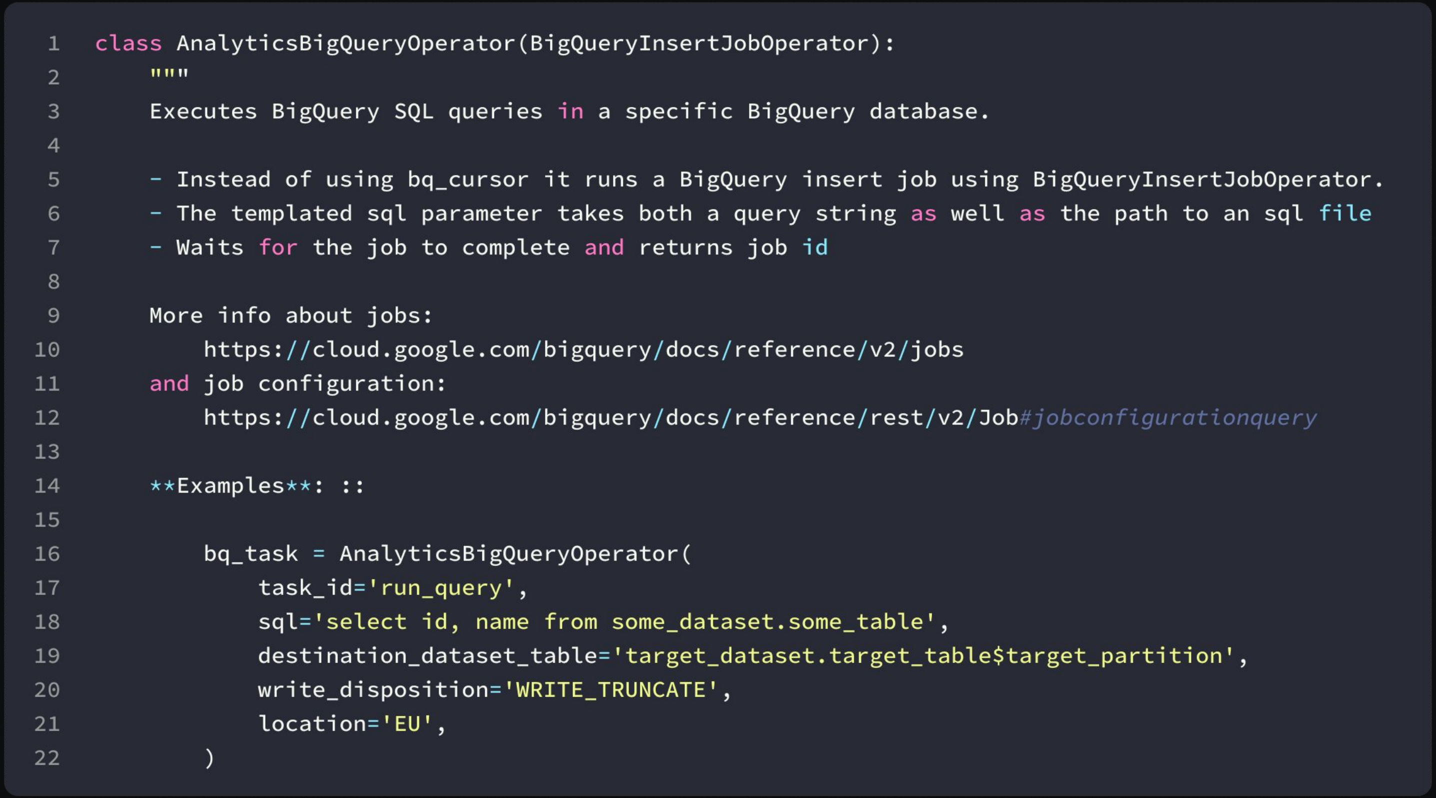
Data Platform - operators

- Core provider operators are great but…
  - are of general purpose
- data-engine-composer-extras - allegro airflow extension library
  - Common utils
  - Curated fine-tuned operator set
    - Artifact-structure-oriented
    - Curated default values
    - Governance labels
  - Pre-installed on each environment via dedicated terraform module



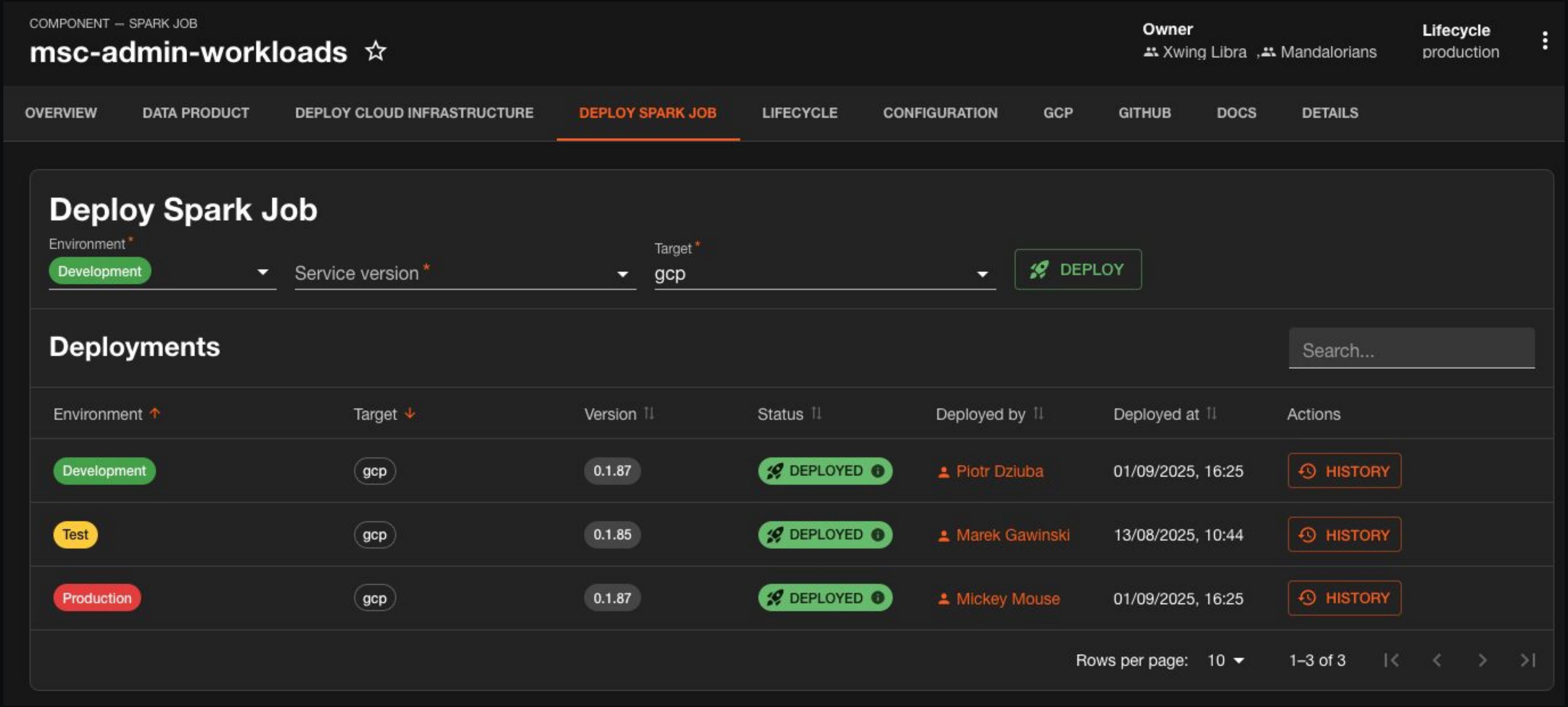
```python
class AnalyticsBigQueryOperator(BigQueryInsertJobOperator):
    """
    Executes BigQuery SQL queries in a specific BigQuery database.

    - Instead of using bq_cursor it runs a BigQuery insert job using BigQueryInsertJobOperator.
    - The templated sql parameter takes both a query string as well as the path to an sql file
    - Waits for the job to complete and returns job id

    More info about jobs:
        https://cloud.google.com/bigquery/docs/reference/v2/jobs
    and job configuration:
        https://cloud.google.com/bigquery/docs/reference/rest/v2/Job#jobconfigurationquery

    **Examples**: ::

        bq_task = AnalyticsBigQueryOperator(
            task_id='run_query',
            sql='select id, name from some_dataset.some_table',
            destination_dataset_table='target_dataset.target_table$target_partition',
            write_disposition='WRITE_TRUNCATE',
            location='EU',
        )
```



COMPONENT — SPARK JOB

msc-admin-workloads ☆

Owner
Xwing Libra , Mandalorians

Lifecycle
production

Deploy Spark Job

Environment *: Development

Service version *

Target *: gcp

Deployments

Environment ↑	Target ↓	Version	Status	Deployed by	Deployed at	Actions
Development	gcp	0.1.87	DEPLOYED	Piotr Dziuba	01/09/2025, 16:25	HISTORY
Test	gcp	0.1.85	DEPLOYED	Marek Gawinski	13/08/2025, 10:44	HISTORY
Production	gcp	0.1.87	DEPLOYED	Mickey Mouse	01/09/2025, 16:25	HISTORY

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Data Platform - is the story complete?

- Self-service data platform
  - It’s easy to get started with DAG authoring
  - It’s easy to get your own airflow environment
- Airflow as first go-to solution for any regular task handling
- Numerous teams with different level of expertise

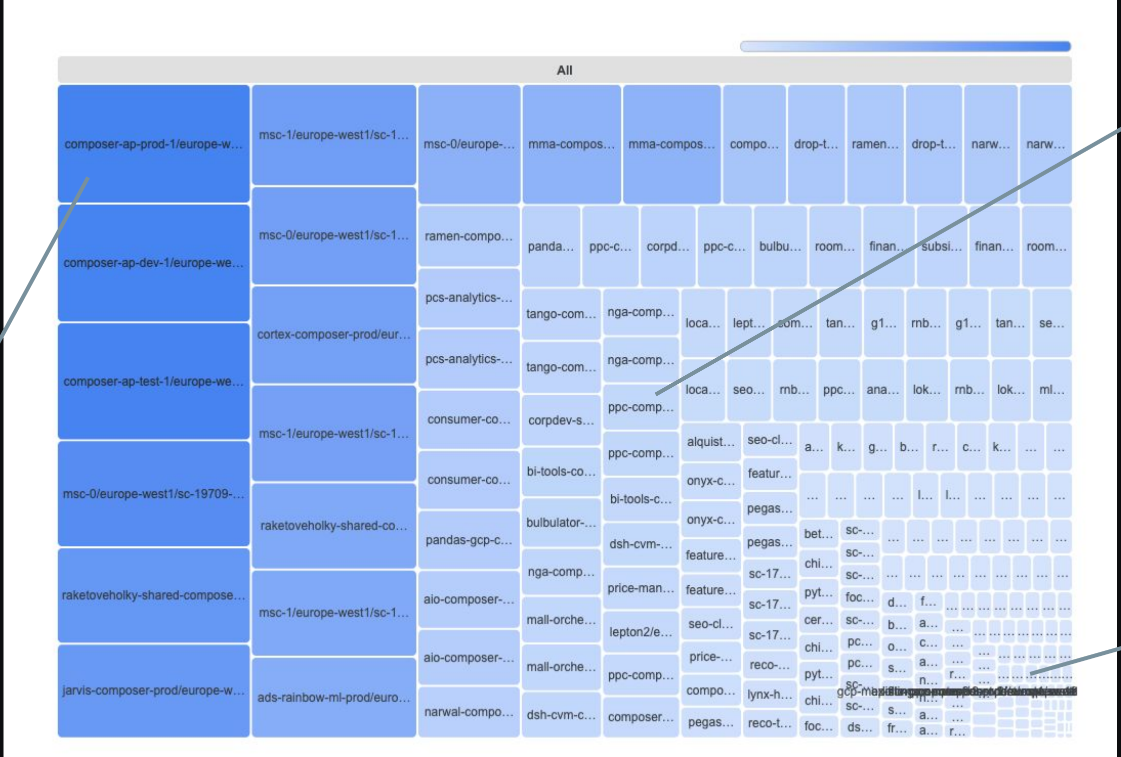
- Can there be any downsides?

DAG distribution

180 cloud composer instances

16k DAGs

100 teams



63 DAGs

7 DAGs

524 DAGs

Fragmentation consequences

Cost

$$$ * 180 = $$$$$

Maintenance time

4h*/ month x 180 = 720h / month = 4 FTE

* Estimation based on surveyed average of 4h maint time per month per team

Managed Shared Composer

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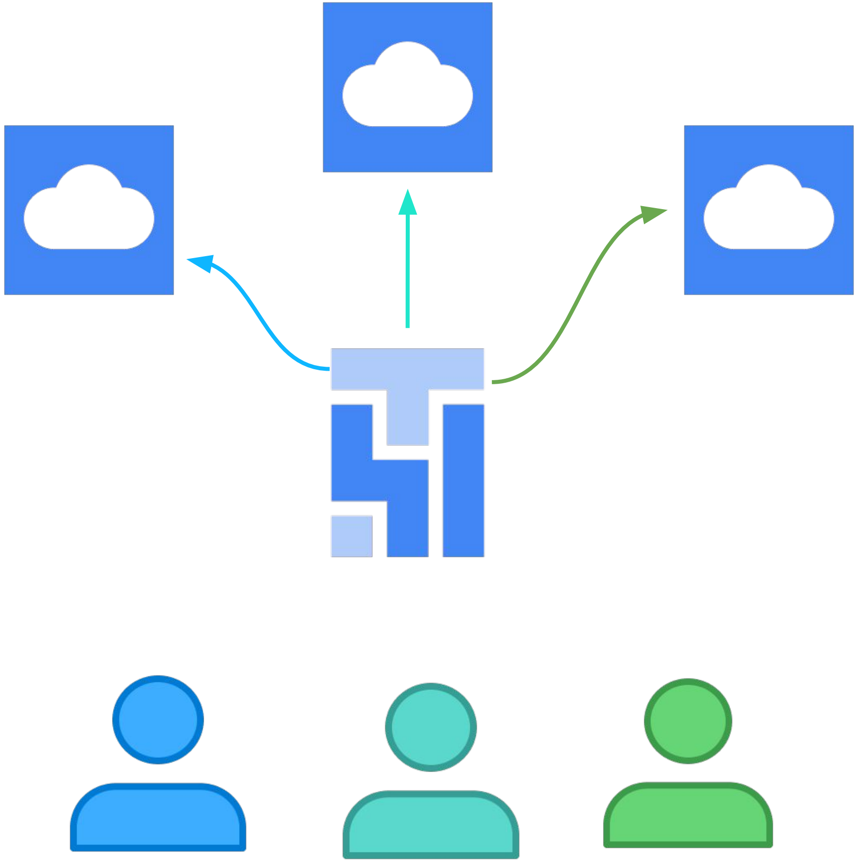
Shared Environment

Multiple teams

Each with one or more GCP projects

Ready-to-use Cloud Composer environment



Shared environment ingredients

User project

SA impersonation binding

Composer

Composer bucket access

Composer User role

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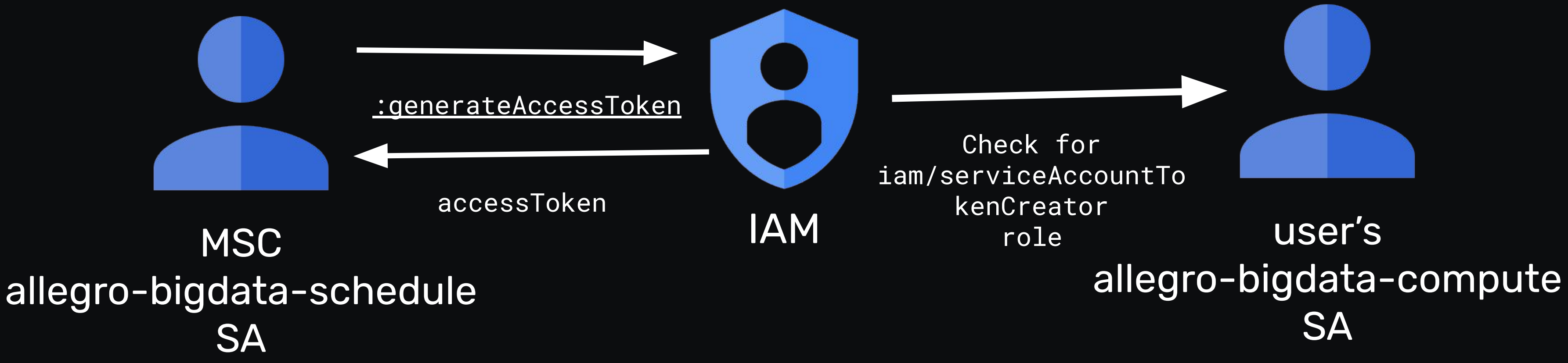
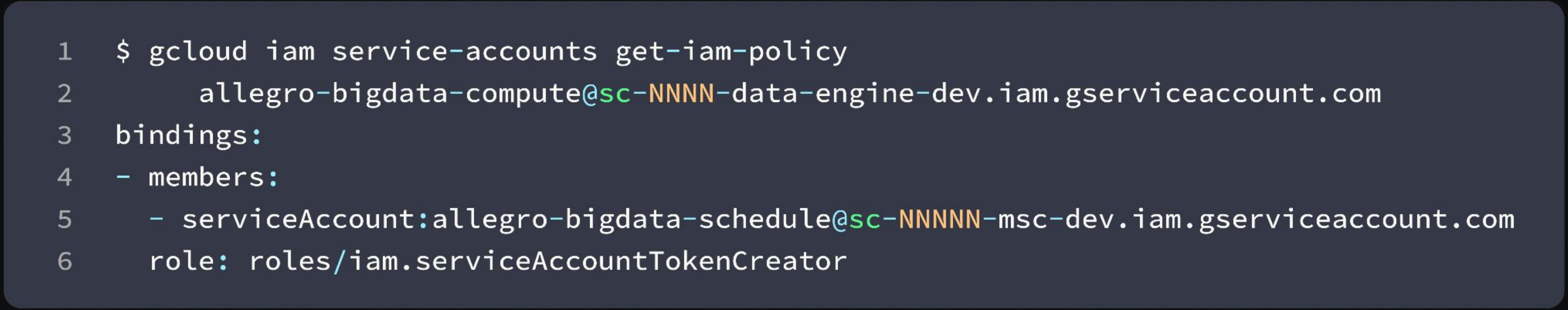
Service Account impersonation



Impersonation - IAM config



```
$ gcloud iam service-accounts get-iam-policy
     allegro-bigdata-compute@sc-NNNN-data-engine-dev.iam.gserviceaccount.com
bindings:
- members:
  - serviceAccount:allegro-bigdata-schedule@sc-NNNNN-msc-dev.iam.gserviceaccount.com
  role: roles/iam.serviceAccountTokenCreator
```

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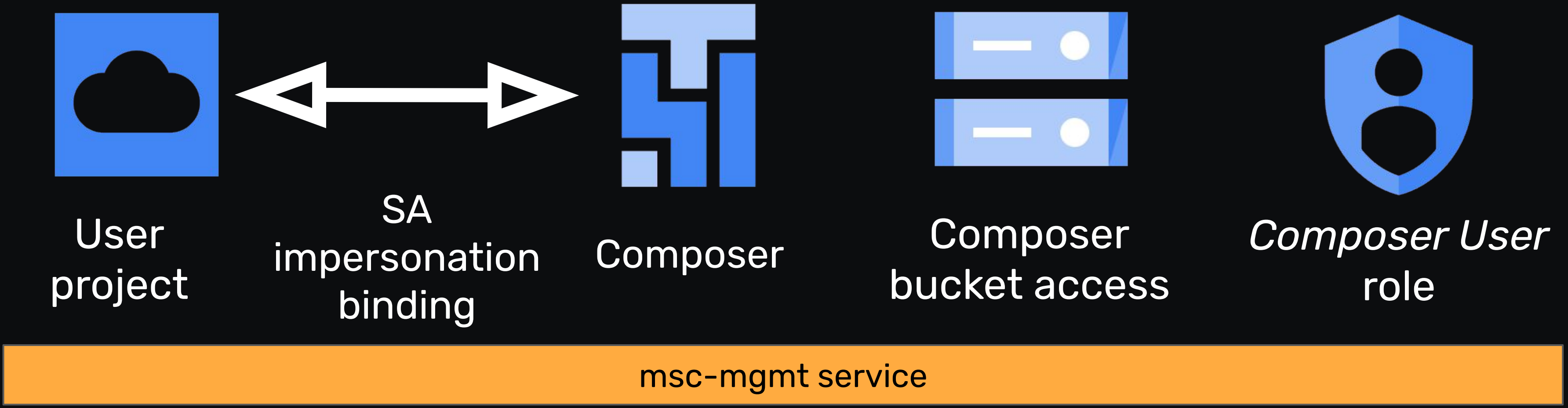
Impersonation - DAG code

```
gcp_project = f'sc-NNNN-data-engine-{env}'
gcp_service_account = f'allegro-bigdata-compute@{gcp_project}.iam.gserviceaccount.com'
IMPERSONATION_CHAIN = [gcp_service_account]

DEFAULT_DAG_ARGS = {
  …
    'project_id': gcp_project,
    'impersonation_chain': IMPERSONATION_CHAIN
}
```

Shared environment ingredients



User project

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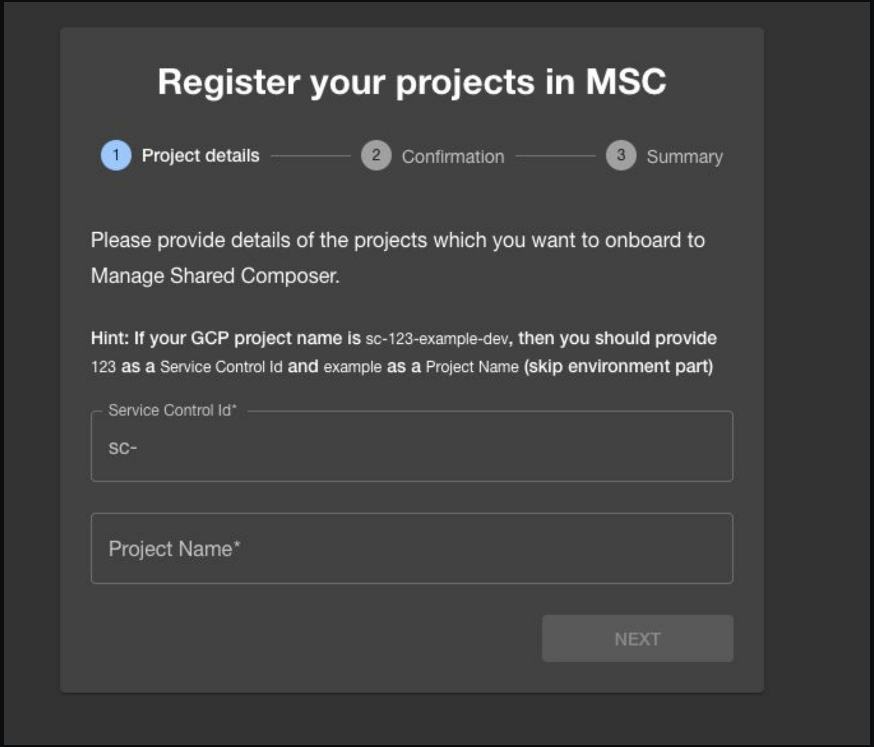
Composer User role

msc-mgmt service



Register your projects in MSC

Please provide details of the projects which you want to onboard to Manage Shared Composer.

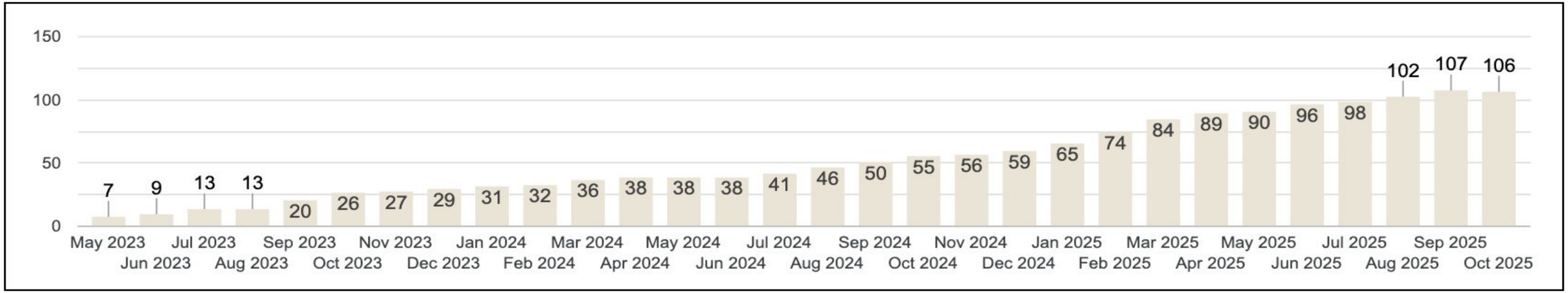
Hint: If your GCP project name is sc-123-example-dev**, then you should provide** 123 **as a** Service Control Id **and** example **as a** Project Name **(skip environment part)**

Service Control Id*: sc-

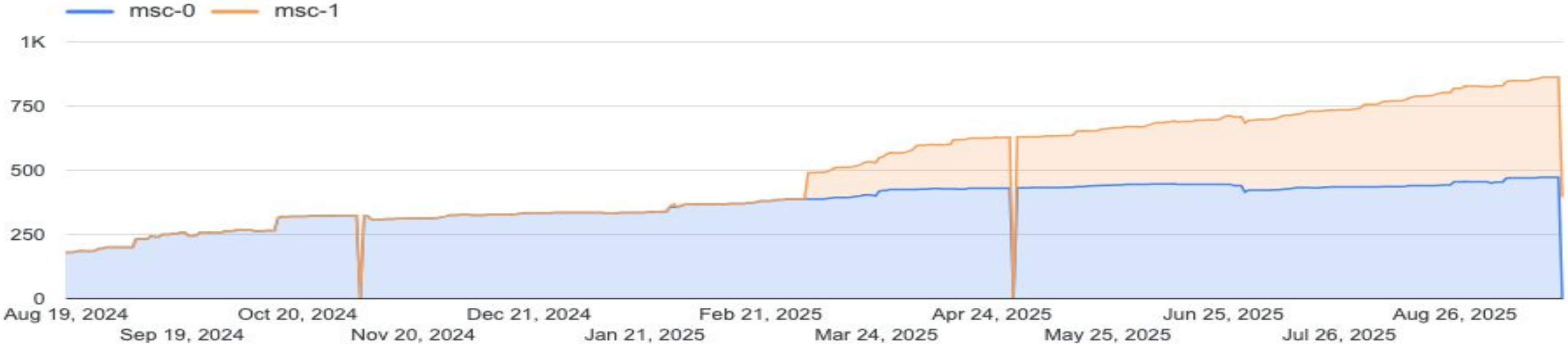
Project Name*:

Adoption

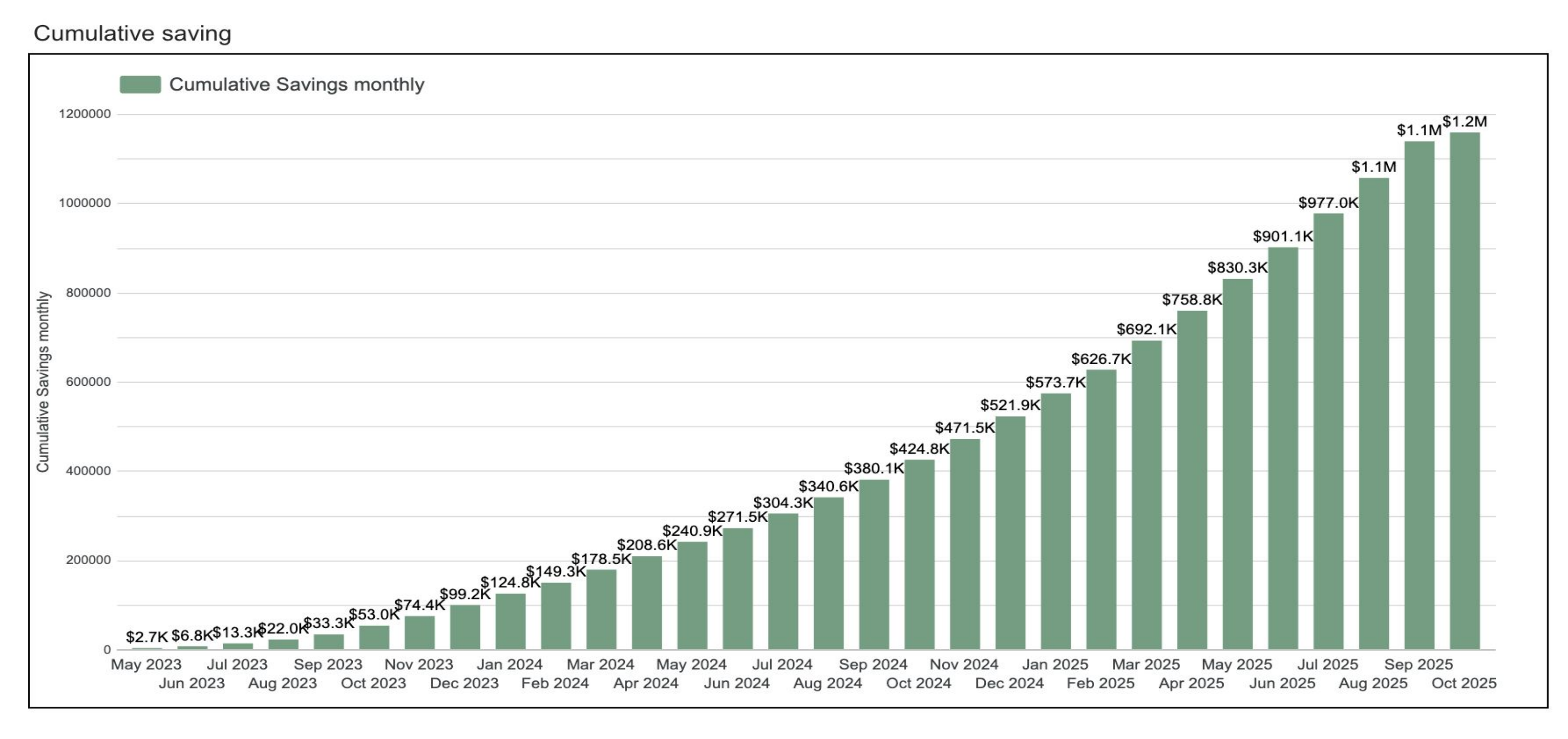
MSC Members Count



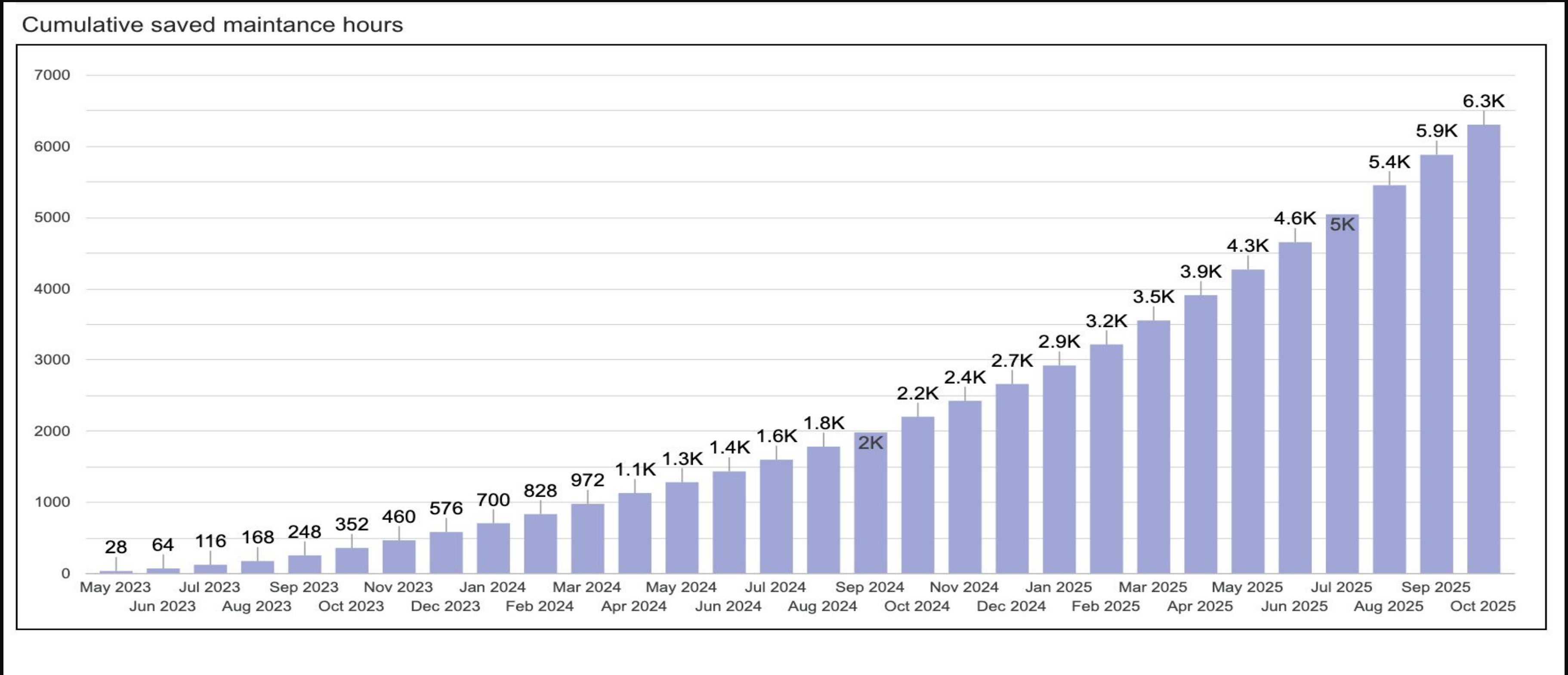
# Production DAGs



Cloud costs savings



Maintenance time saved



*Estimation based on surveyed average of 4h maint time per month per team

Shared environment challenges

- No place for special handling
- DAGs maintenance is still a member duty
- Noisy neighbours
- Limited access restrictions
- Single point of failure

Conclusions

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Conclusions - opinionated ;)

- Airflow can be a backbone of wide variety of solutions
- Planning for maintenance even more than for start
- Self-service, conventions and processes pay off
- Shared environment(s) - worth considering but definitely not a silver bullet

Thank you!

Questions?

https://allegro.tech/