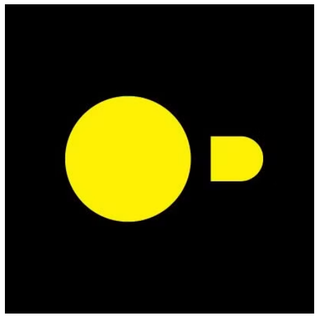
A quack at building Scalable Data Pipelines with DuckDB 🦆



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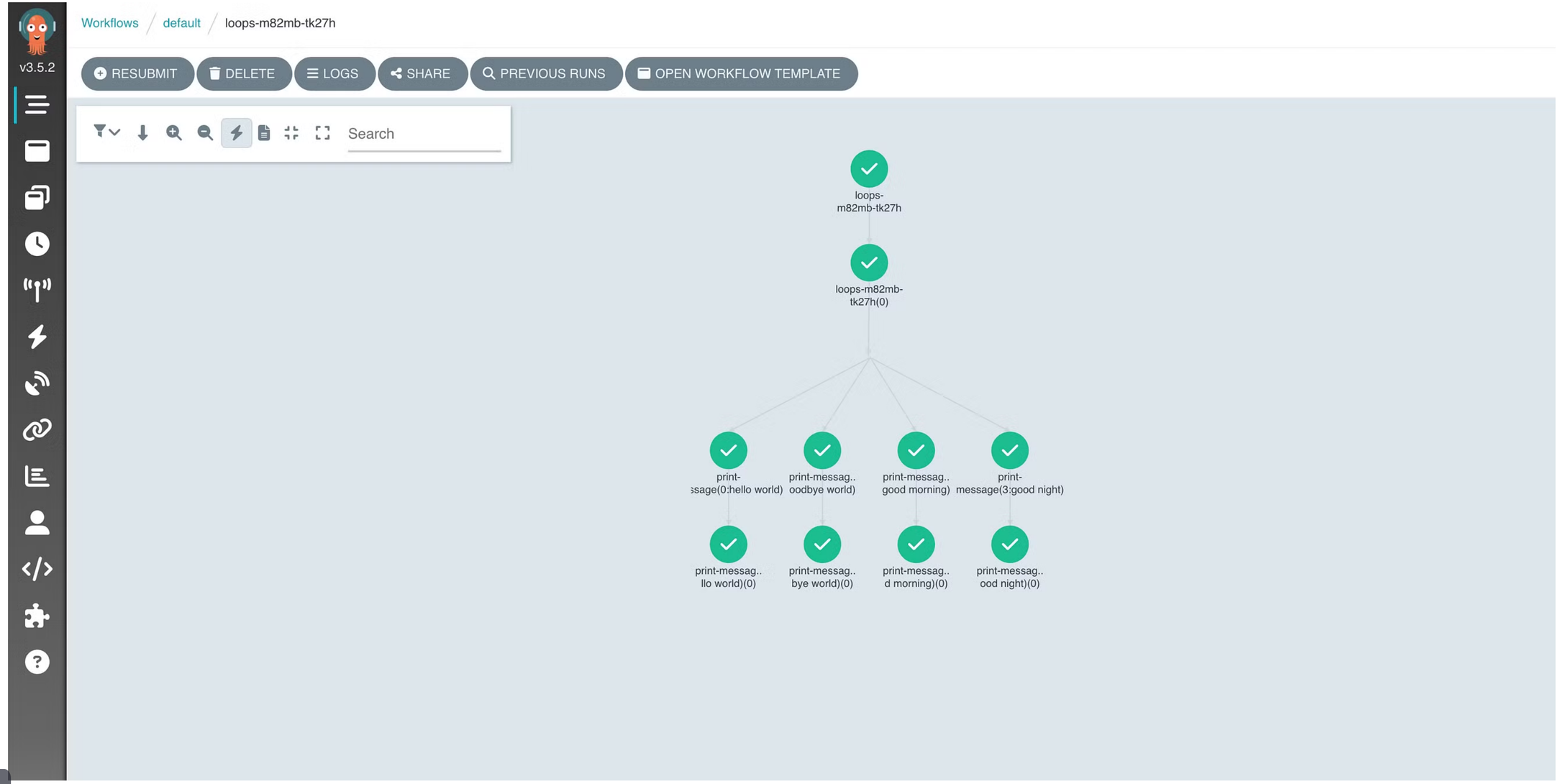
A short Intro to Argo Workflows



YAML based DSL to define K8s Native DAGs

```yaml
apiVersion: argoproj.io/v1alpha1
kind: Workflow
metadata:
  generateName: loops-
spec:
  entrypoint: loop-example
  templates:
  - name: loop-example
    steps:
    - - name: print-message
        template: whalesay
        arguments:
          parameters:
          - name: message
            value: "{{item}}"
        withItems: ["hello world","goodbye world","good morning","good night"]

  - name: whalesay
    inputs:
      parameters:
        - name: message
    container:
      image: docker/whalesay:latest
      command: [cowsay]
      args: ["{{inputs.parameters.message}}"]
```

Workflow Artifacts on S3

- Argo workflows can use major cloud object stores as artifactories
- Artifacts can be inputs to or outputs from workflow steps
- Artifacts on S3 are very versatile
  - Storing large datasets
  - Sharing data between workflow steps
  - Persisting results for later analysis
- DuckDB + Parquet + S3 is very ergonomic

```
- name: process
  outputs:
    artifacts:
      - name: orders_summary
        path: /tmp/orders_summary.parquet
        s3:
          key: "some/s3/prefix/orders_summary.parquet"
  container:
    image: junaidrahim/duckdb-with-argo:latest
    ...
```

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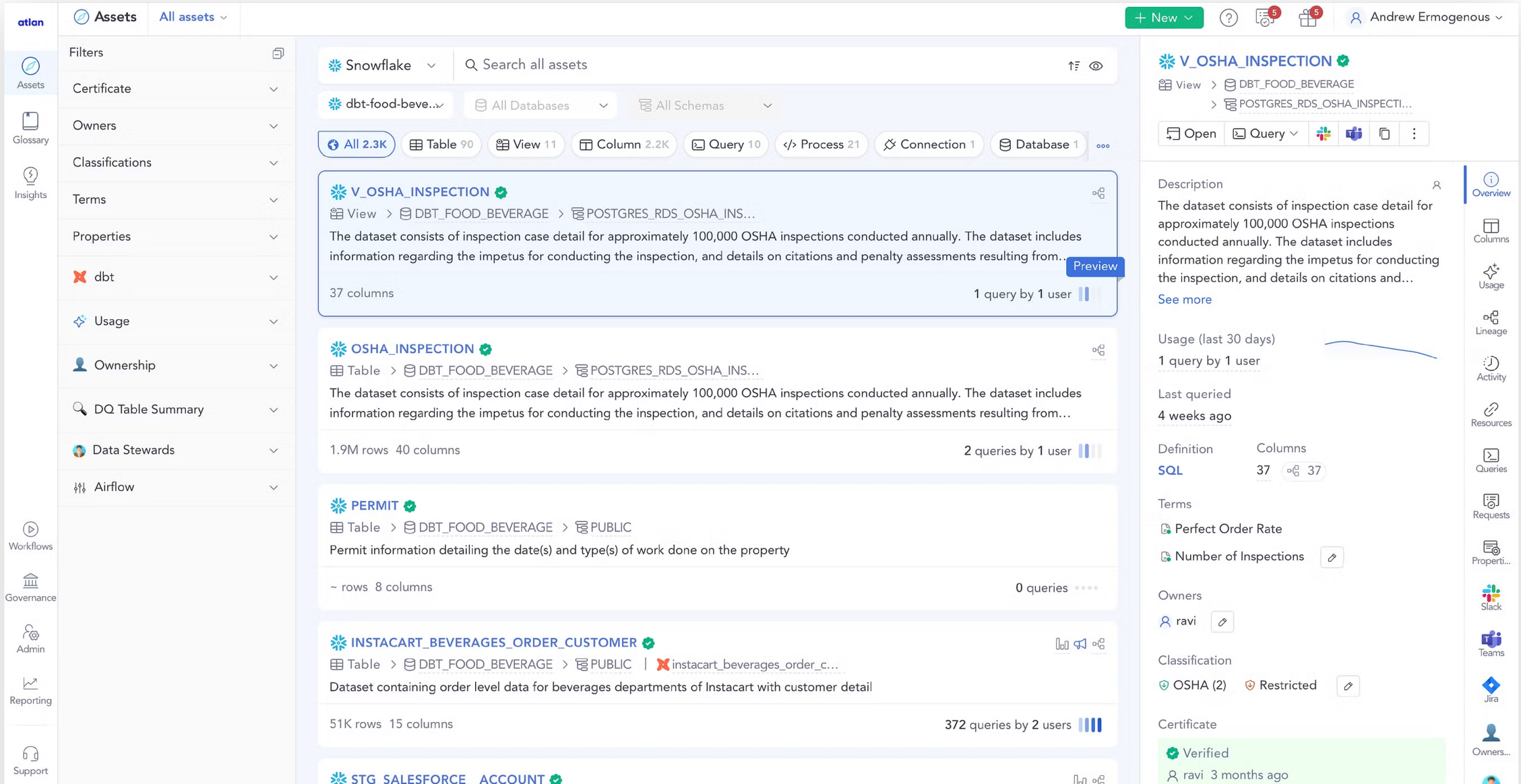
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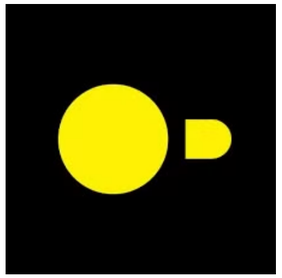
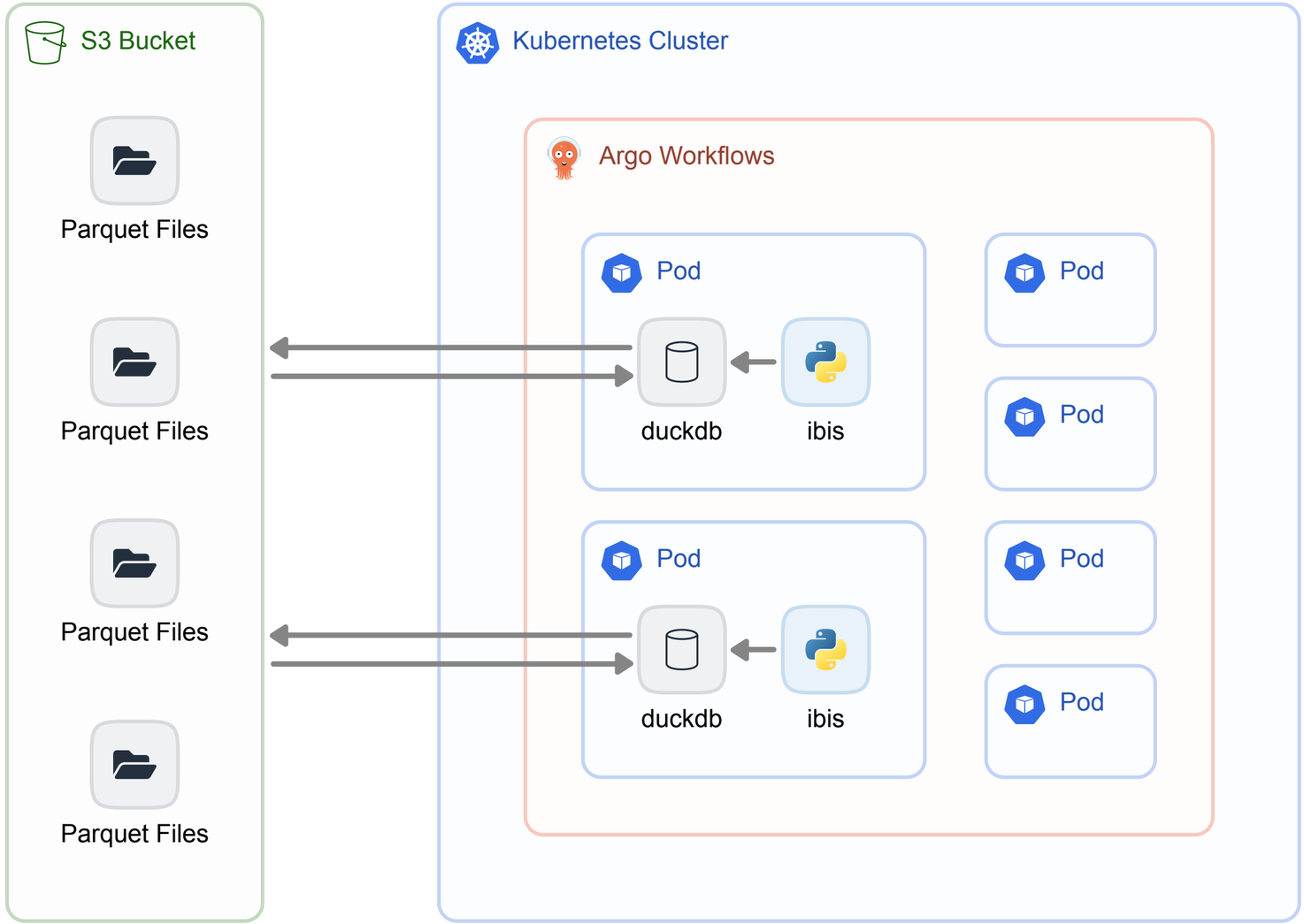
Assets
All assets
New
Andrew Ermogenous
Filters
Certificate
Owners
Classifications
Terms
Properties
dbt
Usage
Ownership
DQ Table Summary
Data Stewards
Airflow
Snowflake
Search all assets
dbt-food-beve...
All Databases
All Schemas
All 2.3K
Table 90
View 11
Column 2.2K
Query 10
Process 21
Connection 1
Database 1
V_OSHA_INSPECTION
View > DBT_FOOD_BEVERAGE > POSTGRES_RDS_OSHA_INS...
The dataset consists of inspection case detail for approximately 100,000 OSHA inspections conducted annually. The dataset includes information regarding the impetus for conducting the inspection, and details on citations and penalty assessments resulting from...
Preview
37 columns
1 query by 1 user
OSHA_INSPECTION
Table > DBT_FOOD_BEVERAGE > POSTGRES_RDS_OSHA_INS...
The dataset consists of inspection case detail for approximately 100,000 OSHA inspections conducted annually. The dataset includes information regarding the impetus for conducting the inspection, and details on citations and penalty assessments resulting from...
1.9M rows 40 columns
2 queries by 1 user
PERMIT
Table > DBT_FOOD_BEVERAGE > PUBLIC
Permit information detailing the date(s) and type(s) of work done on the property
~ rows 8 columns
0 queries
INSTACART_BEVERAGES_ORDER_CUSTOMER
Table > DBT_FOOD_BEVERAGE > PUBLIC | instacart_beverages_order_c...
Dataset containing order level data for beverages departments of Instacart with customer detail
51K rows 15 columns
372 queries by 2 users
STG_SALESFORCE_ACCOUNT
Workflows
Governance
Admin
Reporting
Support
Try Pitch
V_OSHA_INSPECTION
View > DBT_FOOD_BEVERAGE > POSTGRES_RDS_OSHA_INSPECTI...
Open
Query
Description
The dataset consists of inspection case detail for approximately 100,000 OSHA inspections conducted annually. The dataset includes information regarding the impetus for conducting the inspection, and details on citations and...
See more
Usage (last 30 days)
1 query by 1 user
Last queried
4 weeks ago
Definition
SQL
Columns
37
37
Terms
Perfect Order Rate
Number of Inspections
Owners
ravi
Classification
OSHA (2)
Restricted
Certificate
Verified
ravi 3 months ago
Overview
Columns
Usage
Lineage
Activity
Resources
Queries
Requests
Properti...
Slack
Teams
Jira
Owners...

atlan ♥ 

DuckDB Pipelines with Argo Workflows

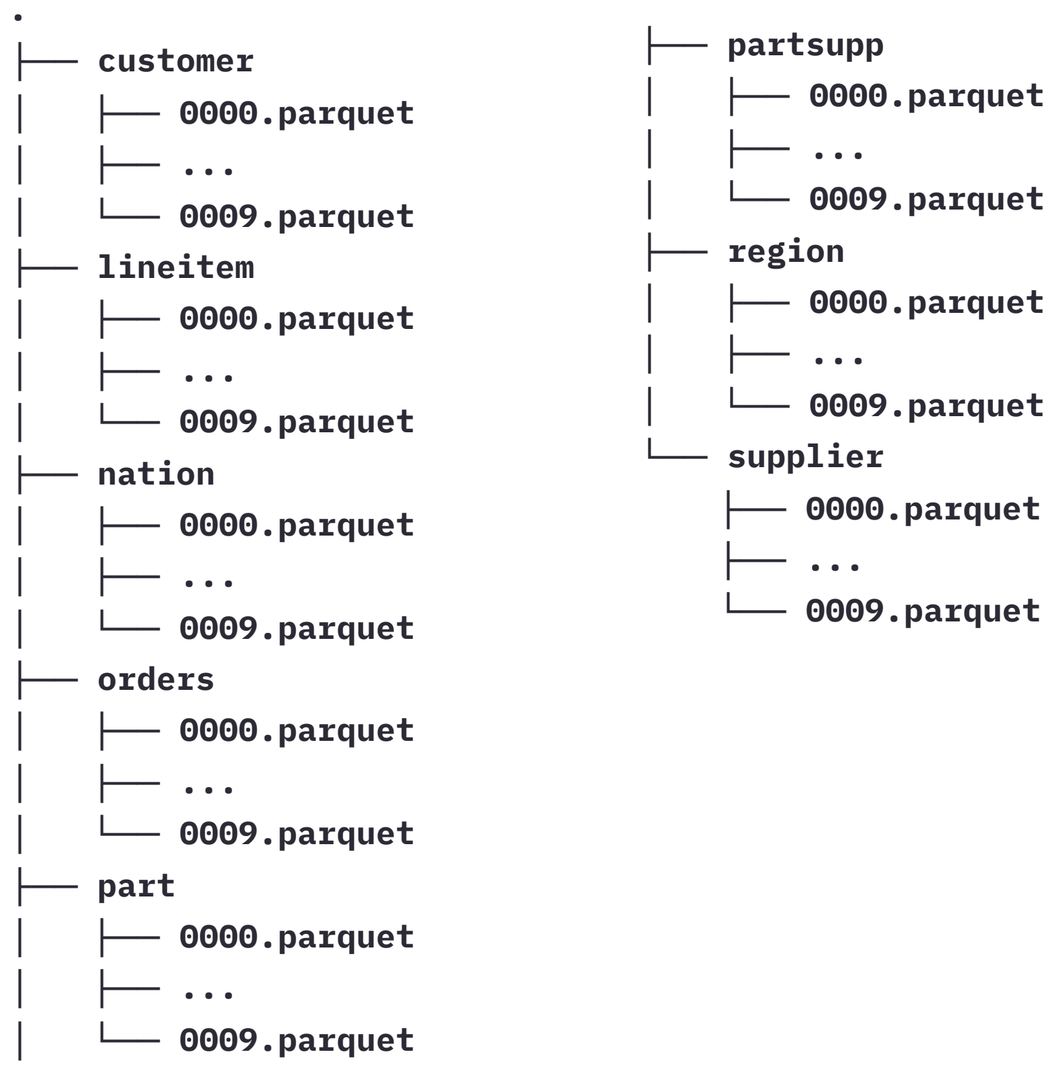


Example

Code available at github.com/junaidrahim/duckdb-with-argo-wf

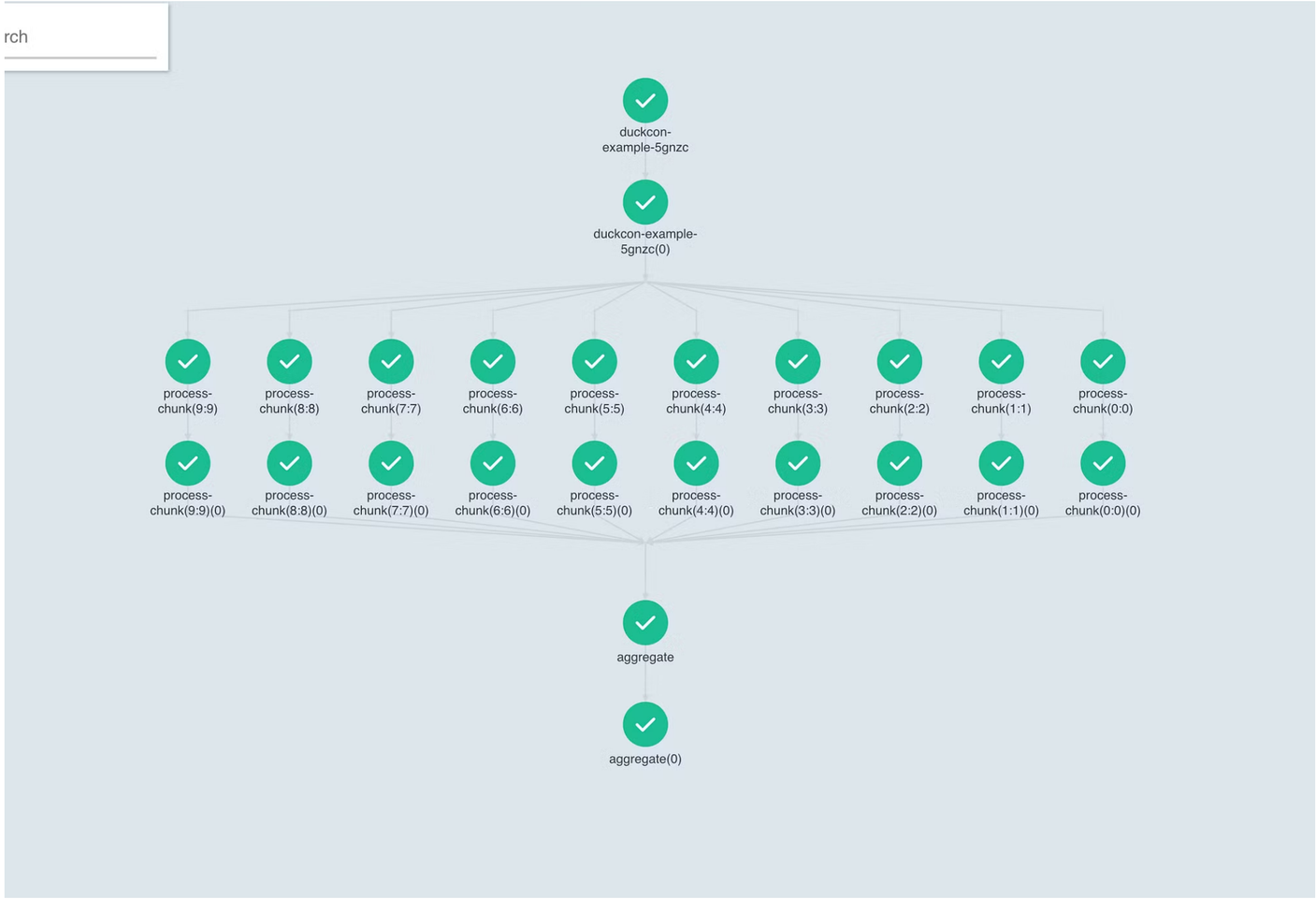
TPC-DS Sample Data

- Generated using ibis-bench
- 100 GB in memory
- 39 GB on disk



Workflow with Aggregate Queries

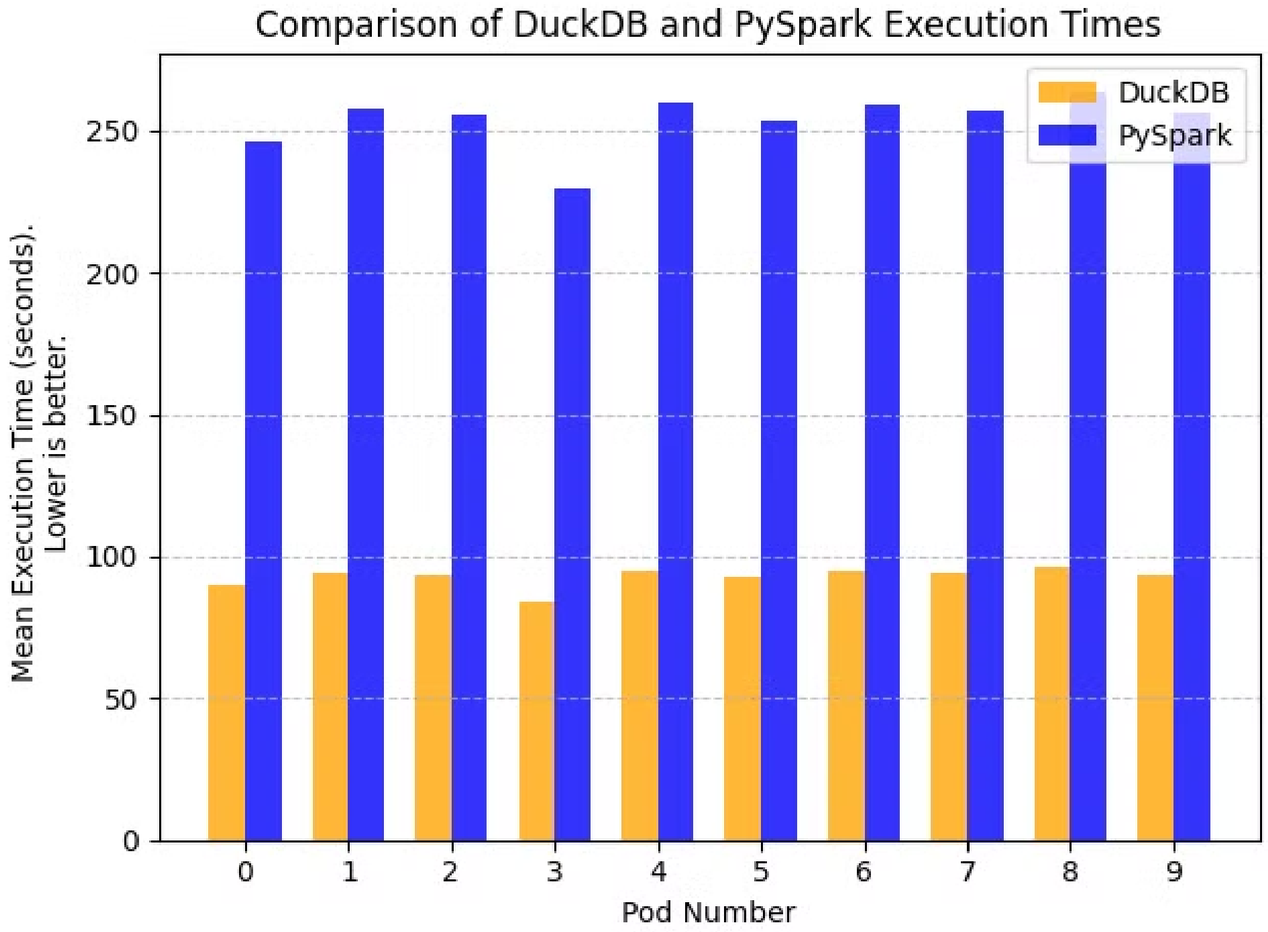
- A pod processing a chunk each
  - ~3.3 GB compressed parquet
- DuckDB
  - memory_limit="2GB"
  - threads="2"
- 2 queries to aggregate on **lineitem** and **orders** table



Performance

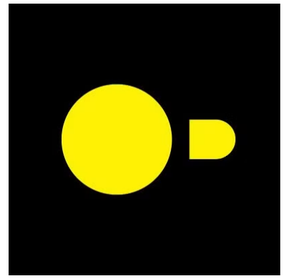
- DuckDB runs the aggregate queries **~2.3x** faster than PySpark at the pod level.

- Specs
  - Argo workflows on a single node EKS cluster
  - t3a.2xlarge (8 vCPU, 32GB mem)
- Execution time is mean over 5 runs
- github.com/junaidrahim/duckdb-with-argo-wf



Horizontal Scaling, Dynamic Resources, Retries and much more

- Argo workflows are full of features you would expect from a battle-tested job orchestrator
  - Fan-in, Fan-out DAGs
  - Dynamic resource allocation using podSpecPatch
  - Robust retry mechanisms
  - Recursive DAGs
- Simpler further reporting and dashboarding
  - evidence.dev
  - observablehq.com
  - rilldata.com
  - motherduck.com
  - etc.



Thank You.

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