OpenLineage

An open standard for data lineage

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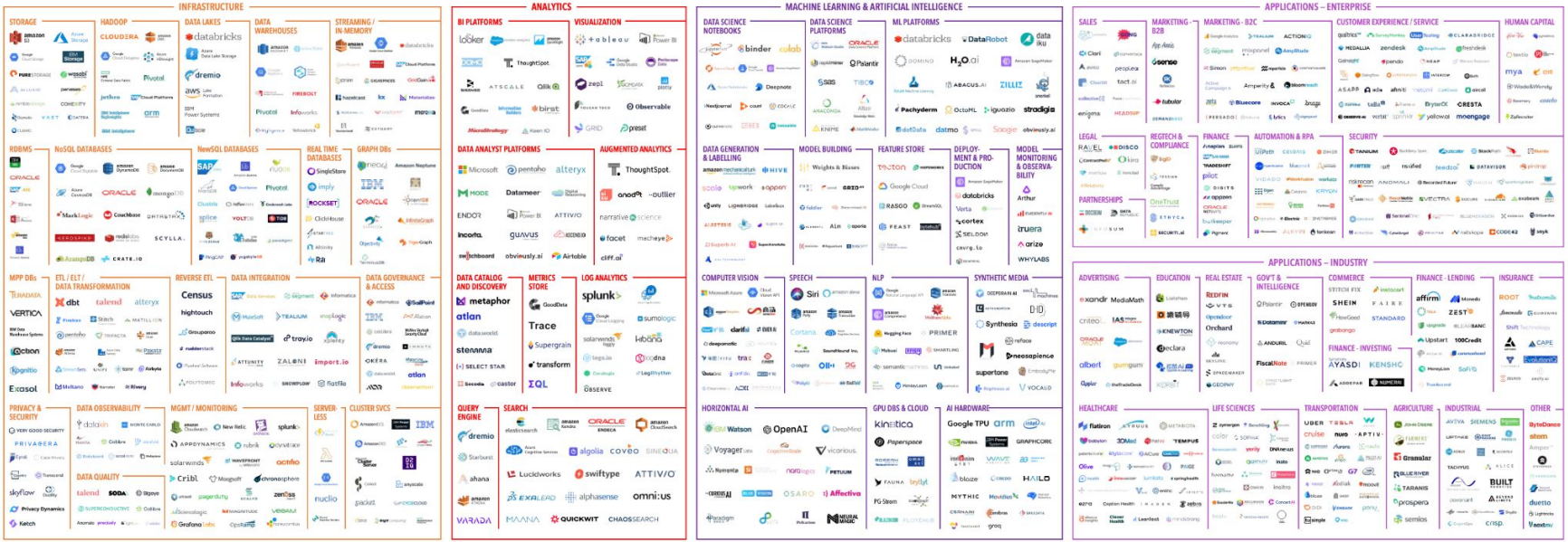
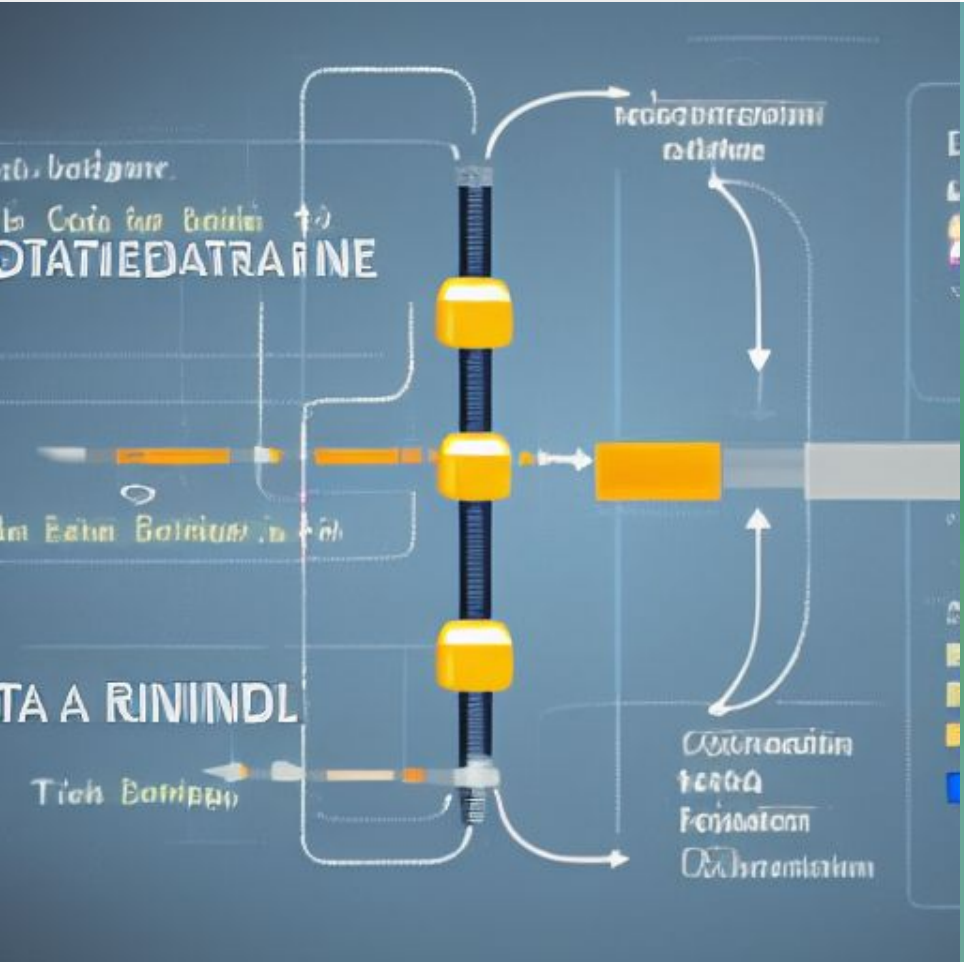
Why now?

MACHINE LEARNING, ARTIFICIAL INTELLIGENCE, AND DATA (MAD) LANDSCAPE 2021

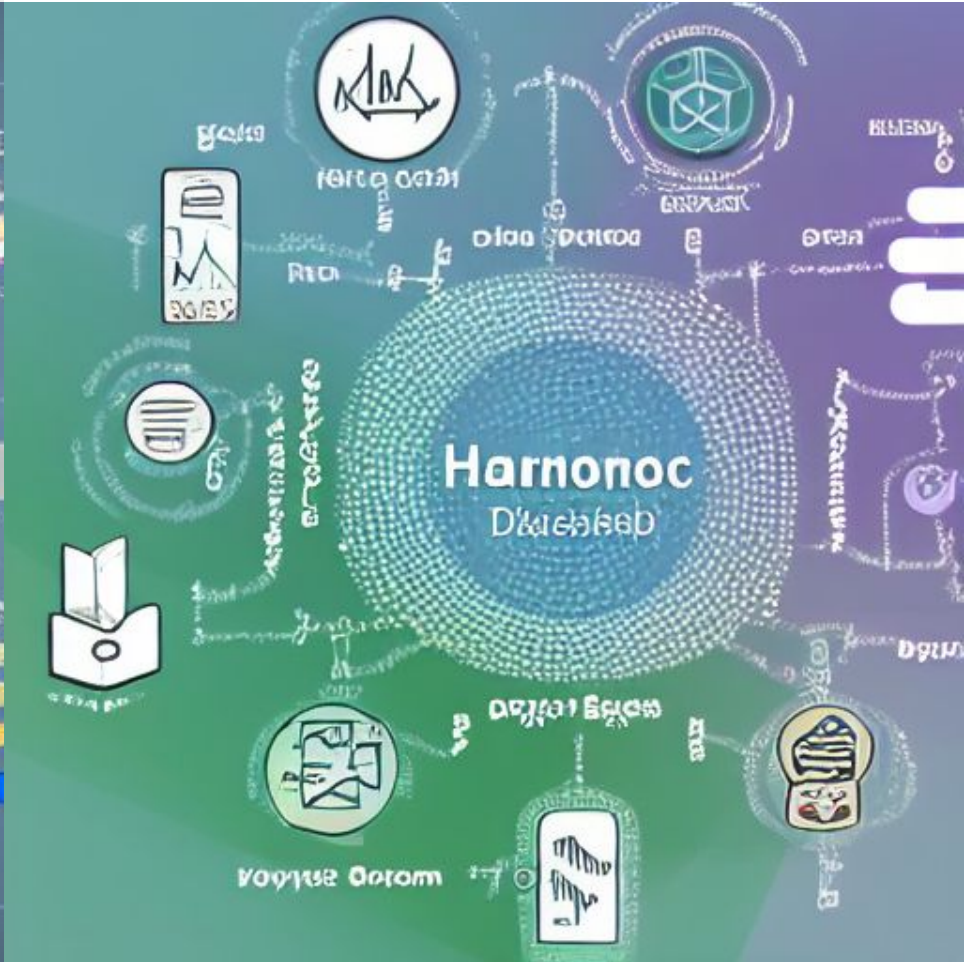


FIRSTMARK
EARLY STAGE VENTURE CAPITAL

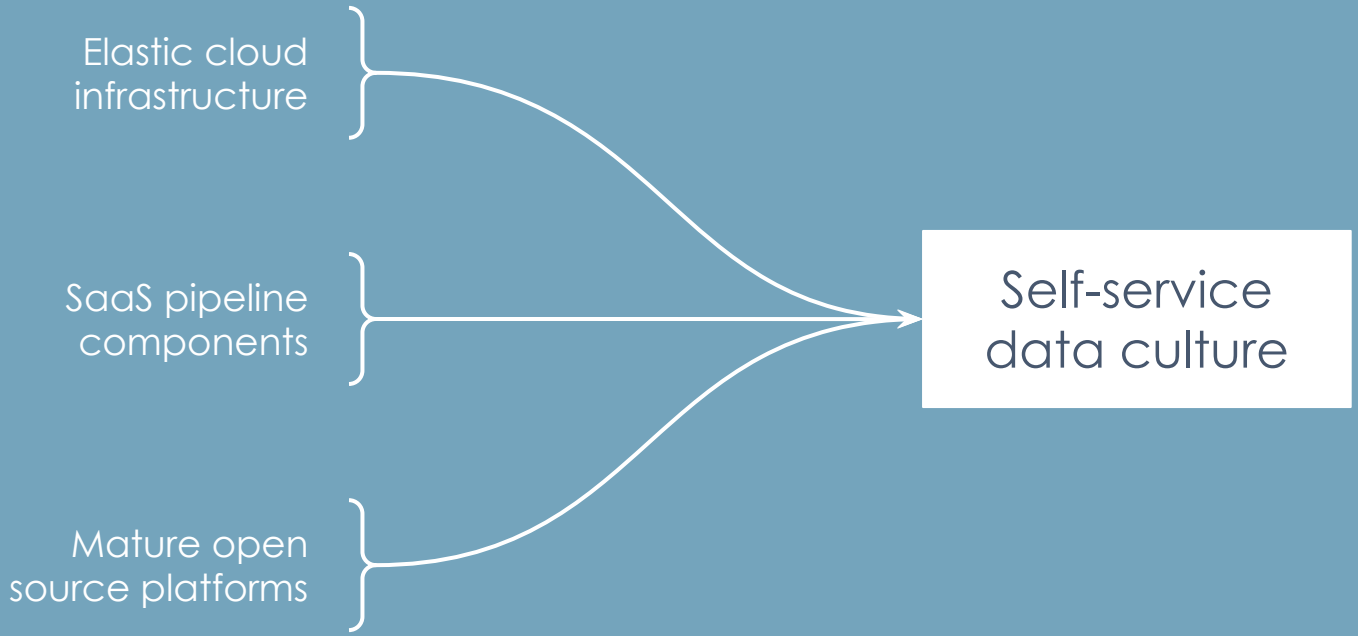
a data pipeline



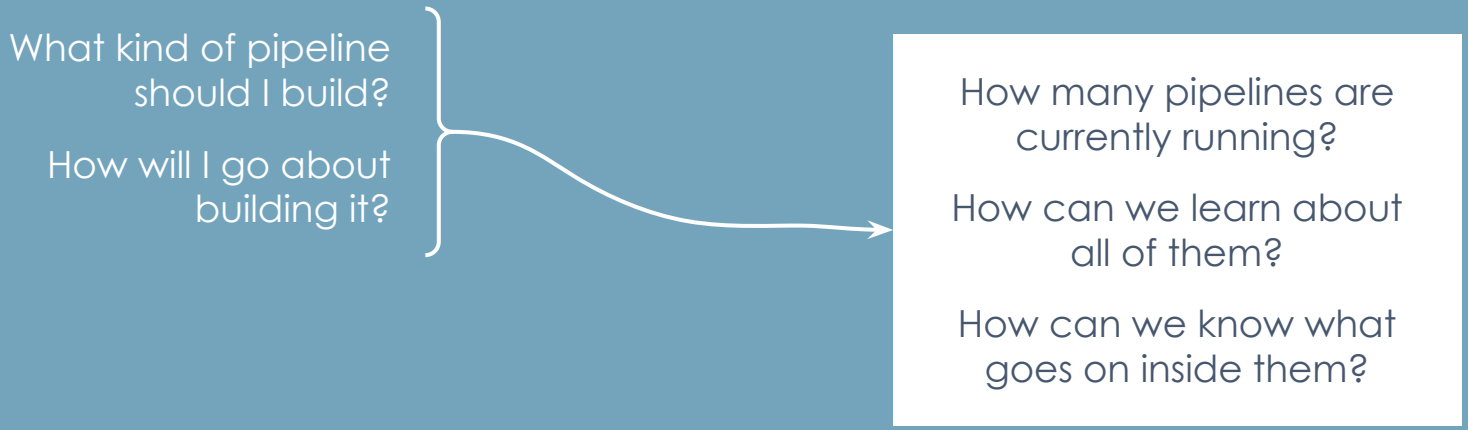
a harmonious data ecosystem



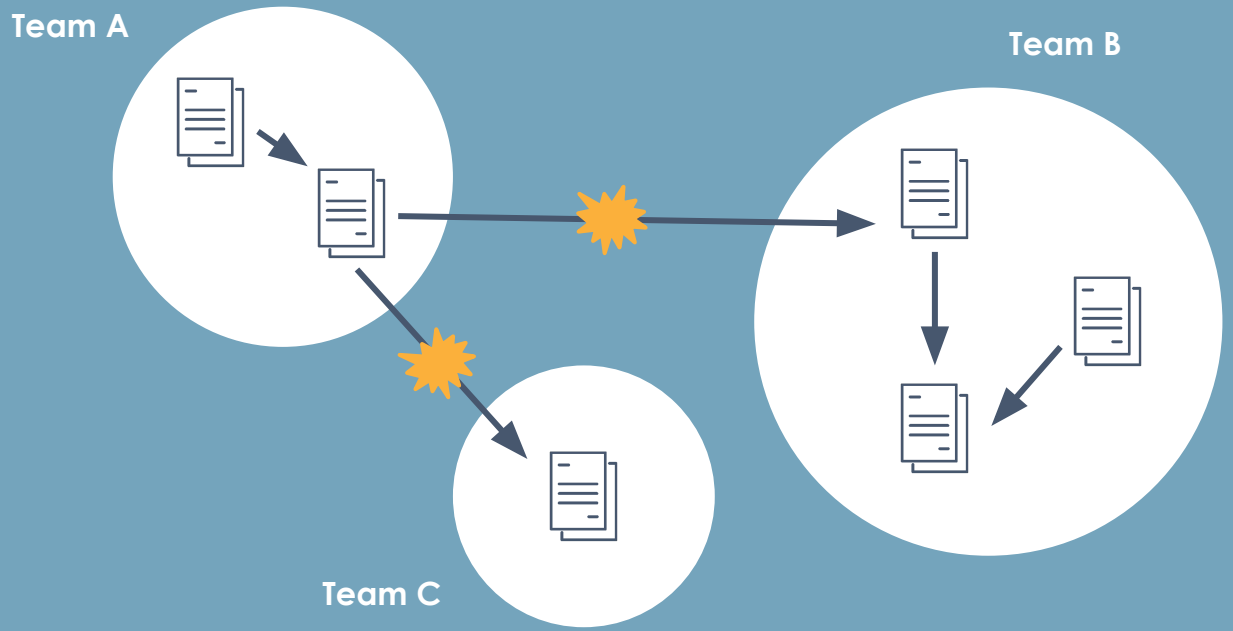
What else changed?



The defining dilemma



Building a healthy data ecosystem



Ecosystems form around shared understanding

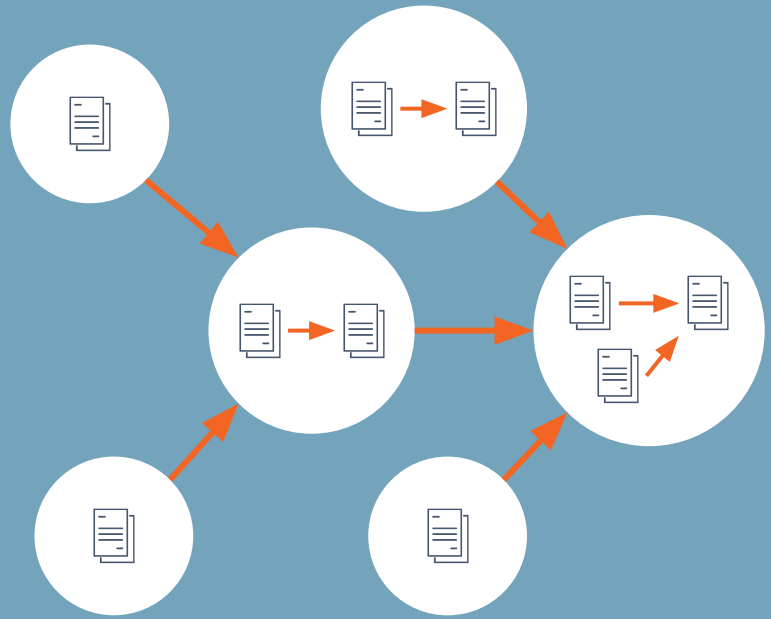
What is the data source?
What is the schema?
Who is the owner?
How often is it updated?
Where does it come from?
Who is using it?
What has changed?

What is data lineage?

What is data lineage?

Data lineage contains what we need to know to solve our most complicated problems.

- Producers & consumers of each dataset
- Inputs and outputs of each job

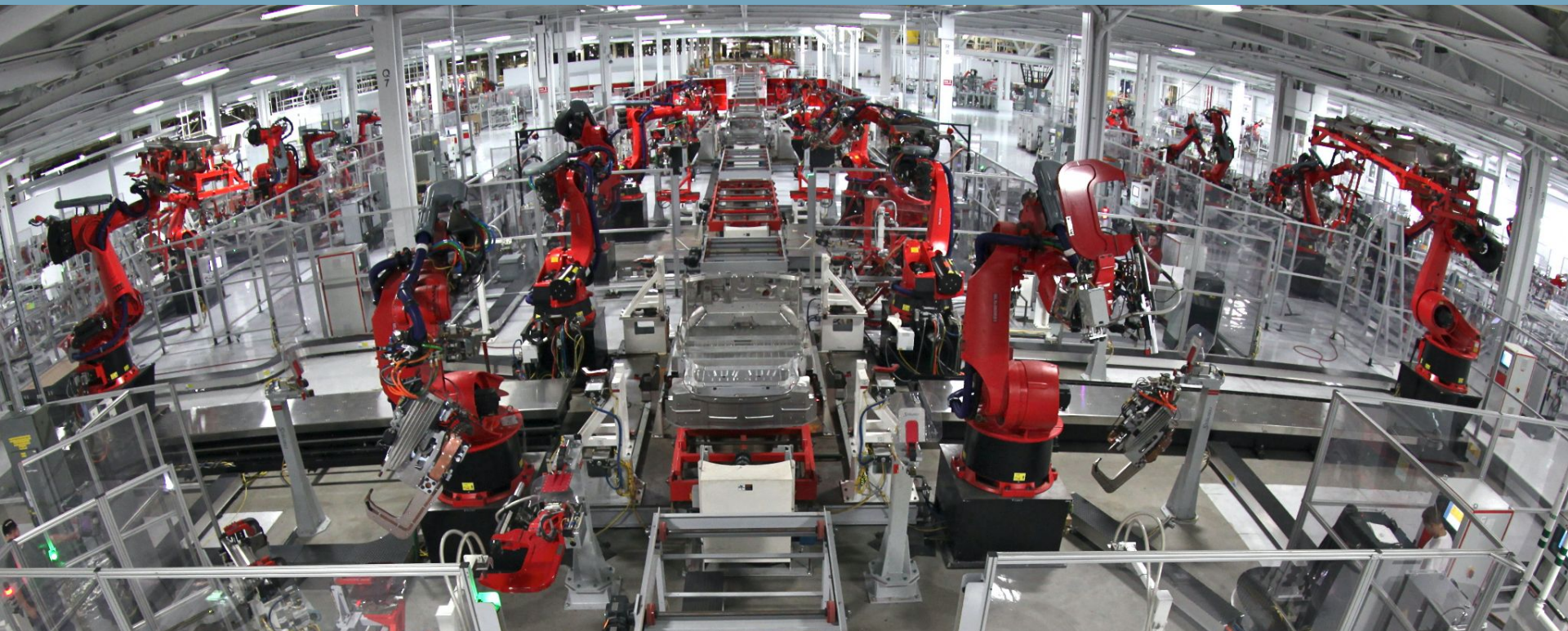


That’s it 

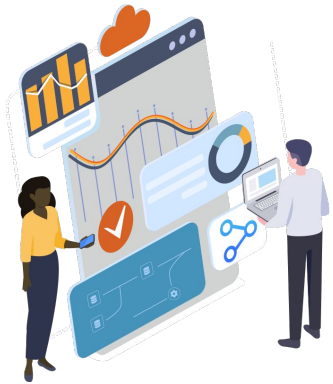
Just know everything, right?

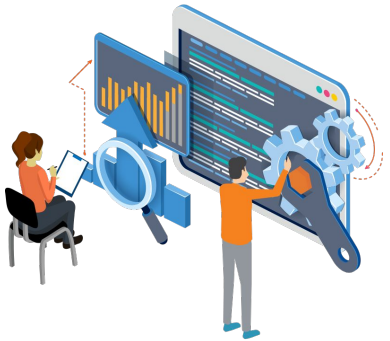
Verifying compliance

Optimizing data operations



Establishing context & language





OMG the possibilities are endless

Dependency tracing
Root cause identification
Issue prioritization
Impact mapping
Precision backfills
Anomaly detection
Change management
Historical analysis
Automated audits

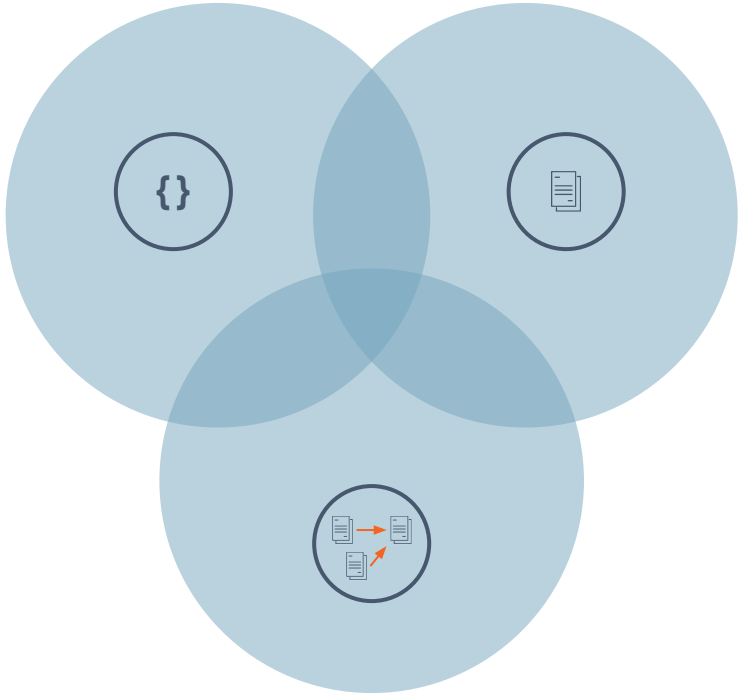
Ok, sounds great.
So how?

The best time to collect metadata

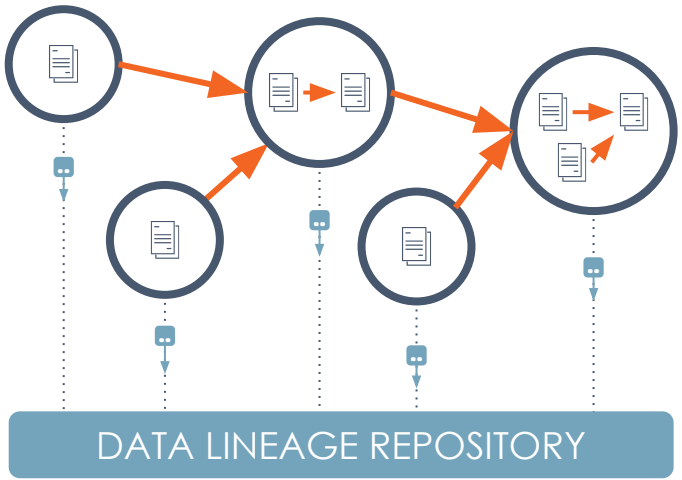
You can try to infer the date and location of an image after the fact…

…or you can capture it when the image is originally created!

Comparing approaches

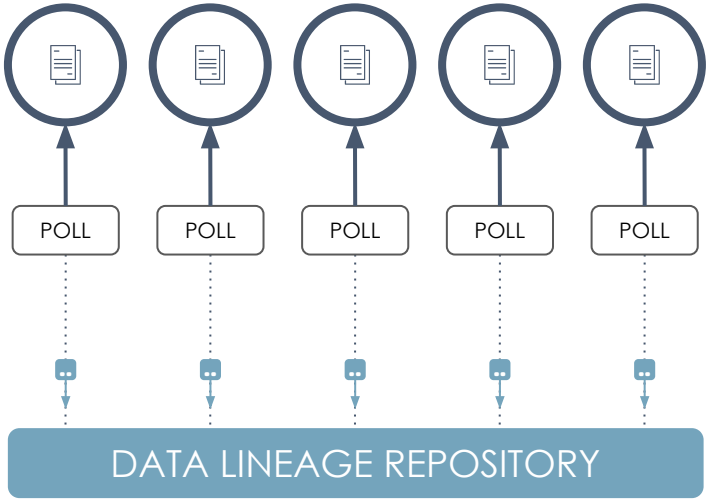


Observe the pipeline



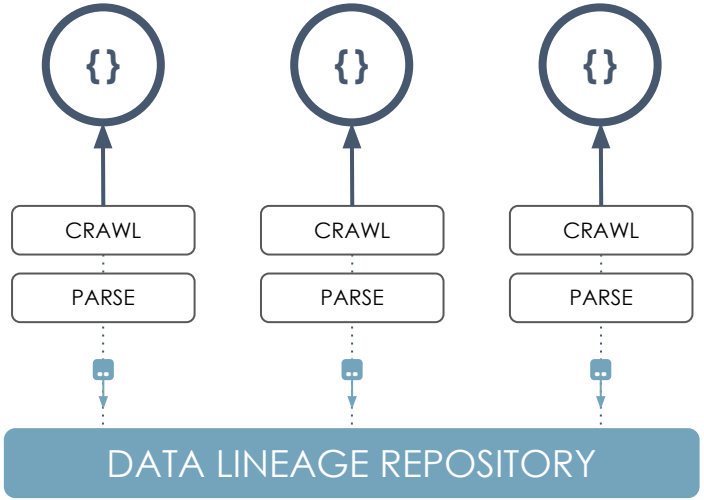
- Integrate with data orchestration systems
- As jobs run, observe the way they affect data
- Report to a lineage metadata repository

Process query / activity logs



- Integrate with data stores and warehouses
- Regularly process query logs to trace lineage
- Report to a lineage metadata repository

Analyze source code



- Integrate with source code repositories
- Look for queries and parse them for lineage
- Report to a lineage metadata repository

It’s a patchwork

Non-malicious (yet common) lineage lies

Fully-automated

Real-time

End-to-end

360° visibility

Easy

AI/ML enhanced

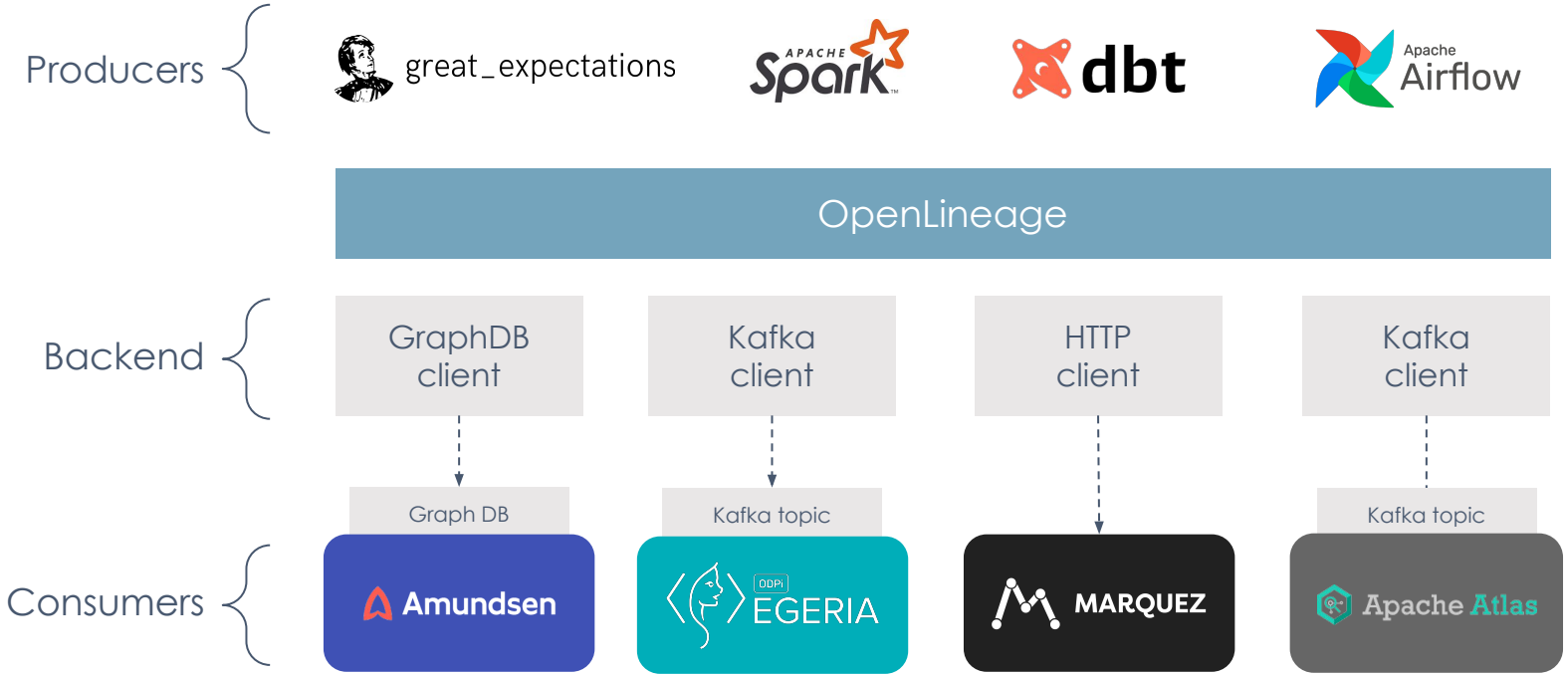
OpenLineage

Mission

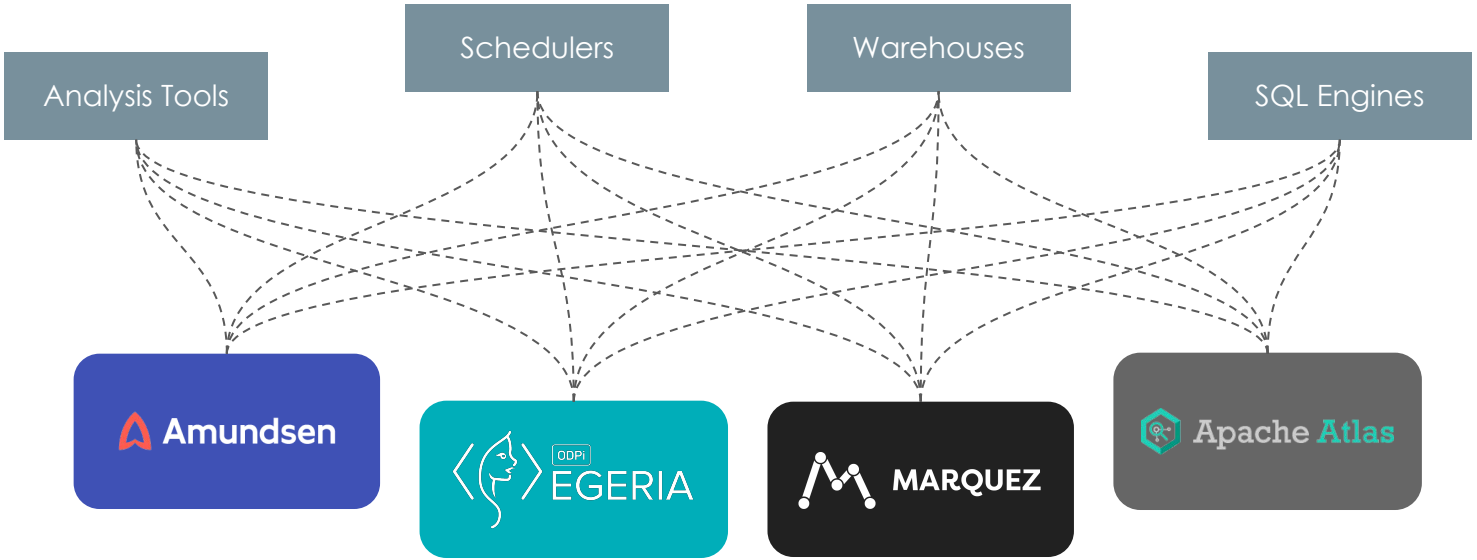
To define an **open standard** for the collection of lineage metadata from pipelines **as they are running**.

Stone Soup, a fable about community

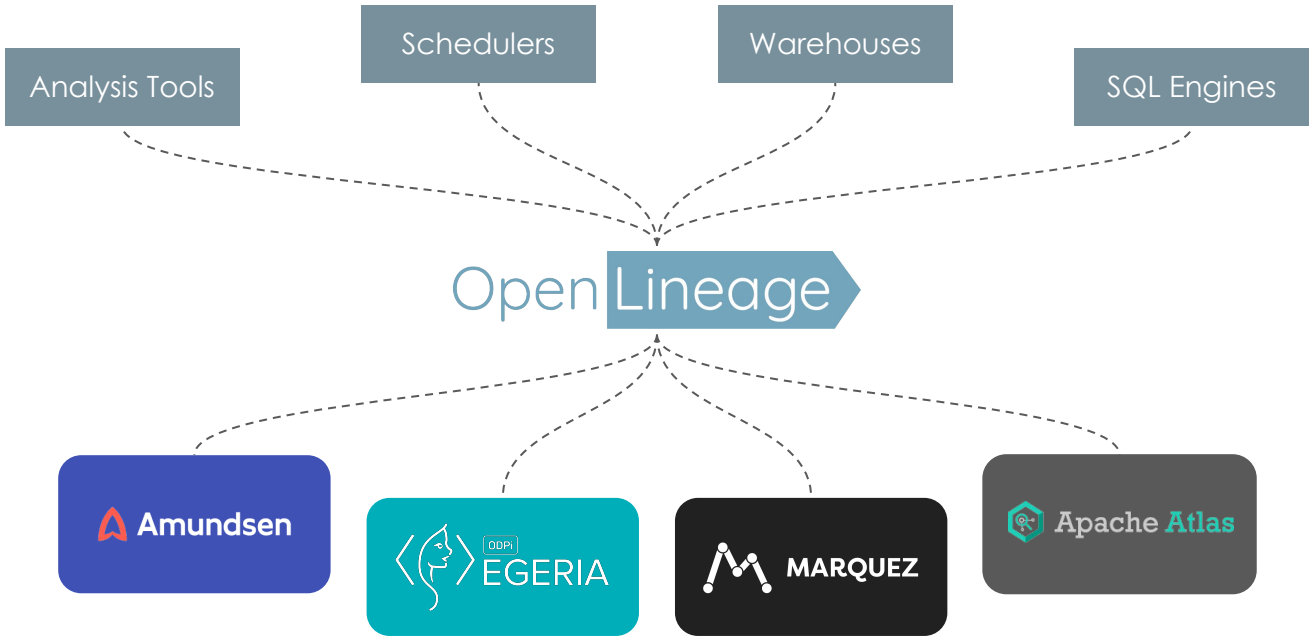
Where OpenLineage potentially fits



Before OpenLineage

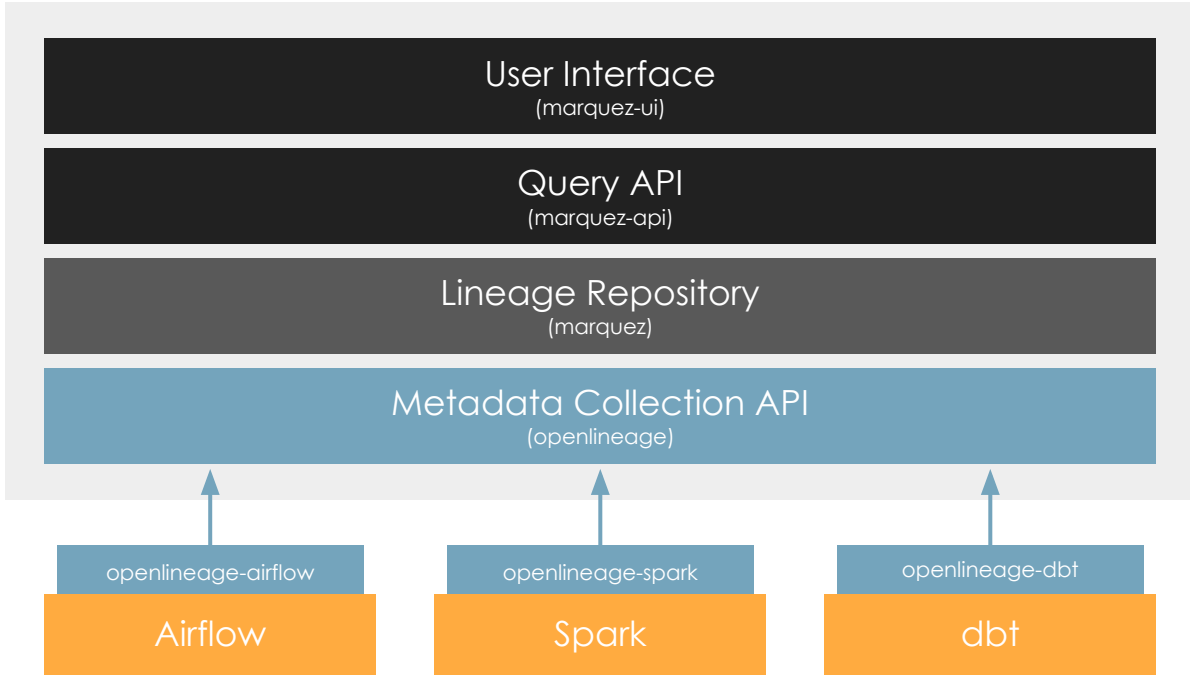


With OpenLineage

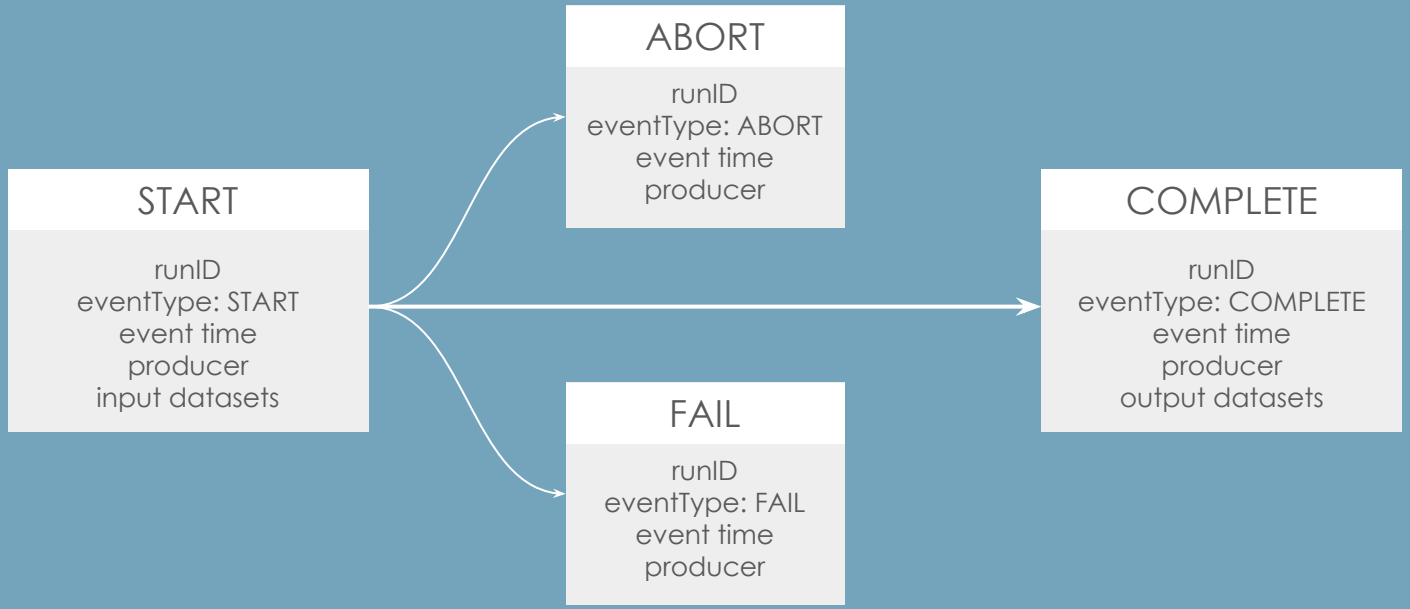


How does OpenLineage work?

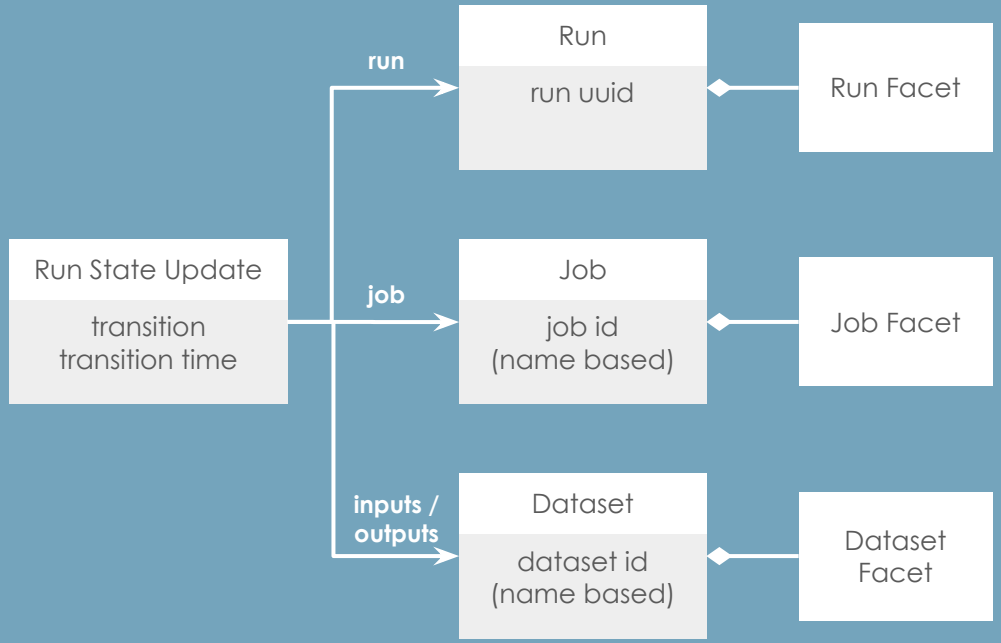
The OpenLineage Stack



Lifecycle of a job run



Data model



Built around core entities: Datasets, Jobs, and Runs

Defined as a JSON Schema spec

Consistent naming for:
Jobs (*scheduler.job.task*)
Datasets (*instance.schema.table*)

Facet examples

Dataset:

- Stats
- Schema
- Version

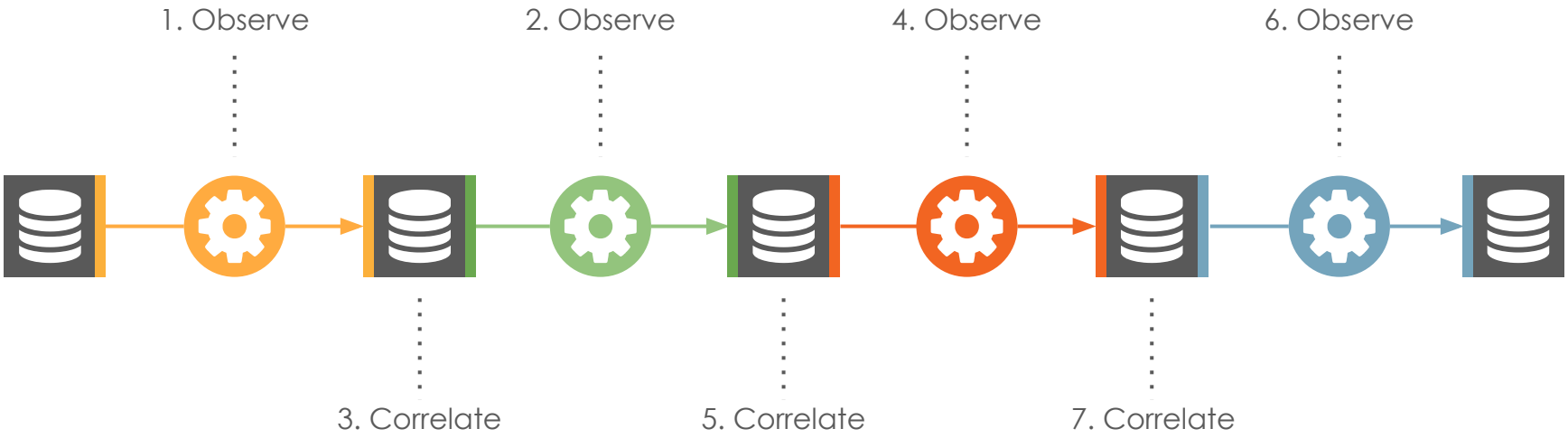
Job:

- Source code
- Dependencies
- Source control
- Query plan

Run:

- Scheduled time
- Batch ID
- Query profile
- Params

Lineage is built on correlations



Dataset names are used to stitch together observations of job runs into a lineage graph.

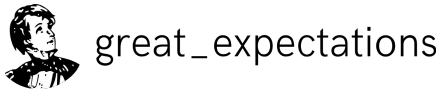
Naming conventions

	Formulae	Examples
Datasets	host + database + table bucket + path host + port + path project + dataset + table	postgres://db.foo.com/metrics.salesorders s3://sales-metrics/orders.csv hdfs://stg.foo.com:salesorders.csv bigquery:metrics.sales.orders
Jobs	namespace + name namespace + project + name	staging.load_orders_from_csv prod.orders_etl.count_orders
Runs	Client-provided UUID	1c0386aa-0979-41e3-9861-3a330623effa

The snowball effect

OpenLineage Integrations

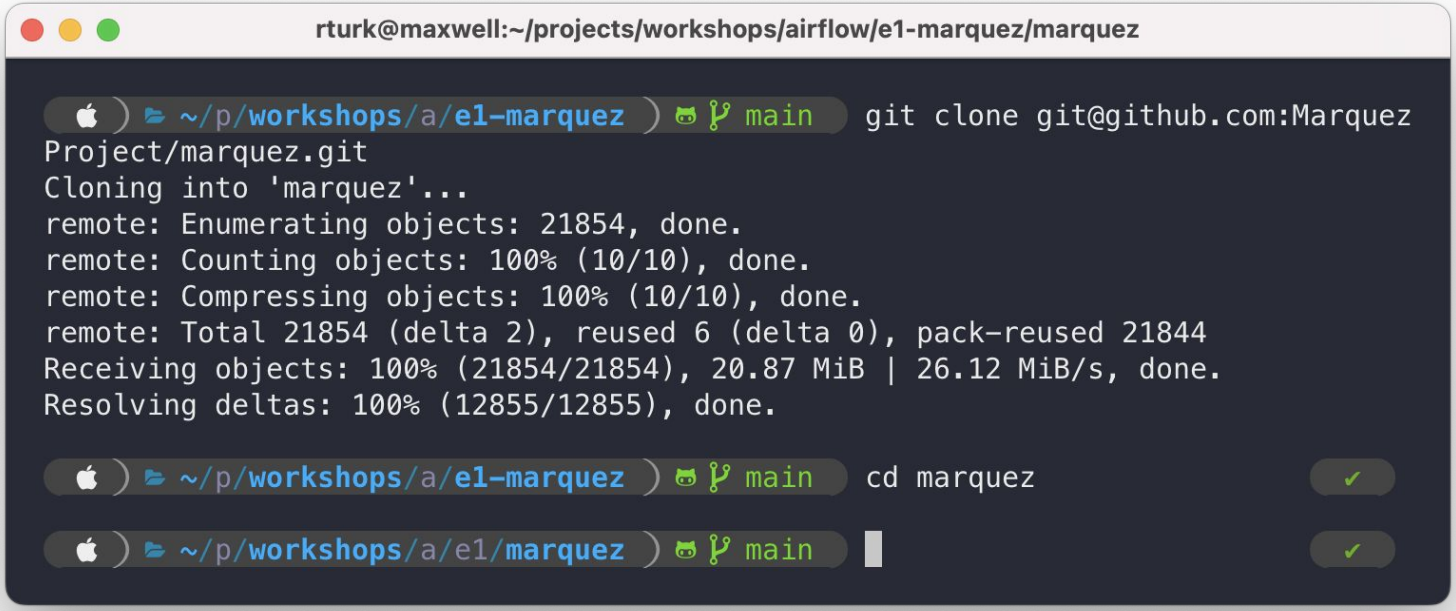
Metadata producers



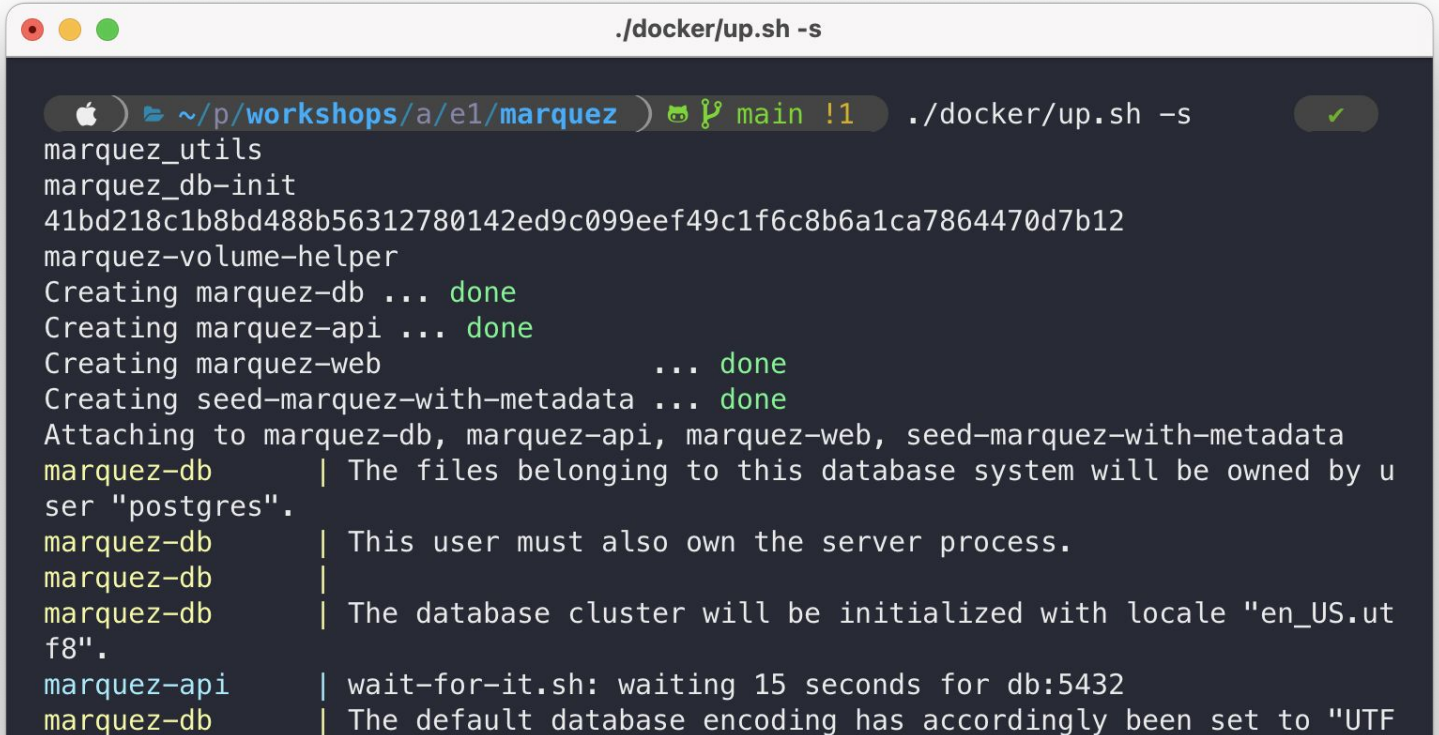
Metadata consumers

Marquez: open source metadata

Checking out the Marquez project



Starting up Marquez



About the Marquez start script

```
docker/up.sh --seed
```

Load the database with seed data

After starting Marquez, simulate a series of lineage events for a fictional food delivery service pipeline. Good for exploring the Marquez UI + the OpenLineage data model and API.

```
docker/up.sh --detach
```

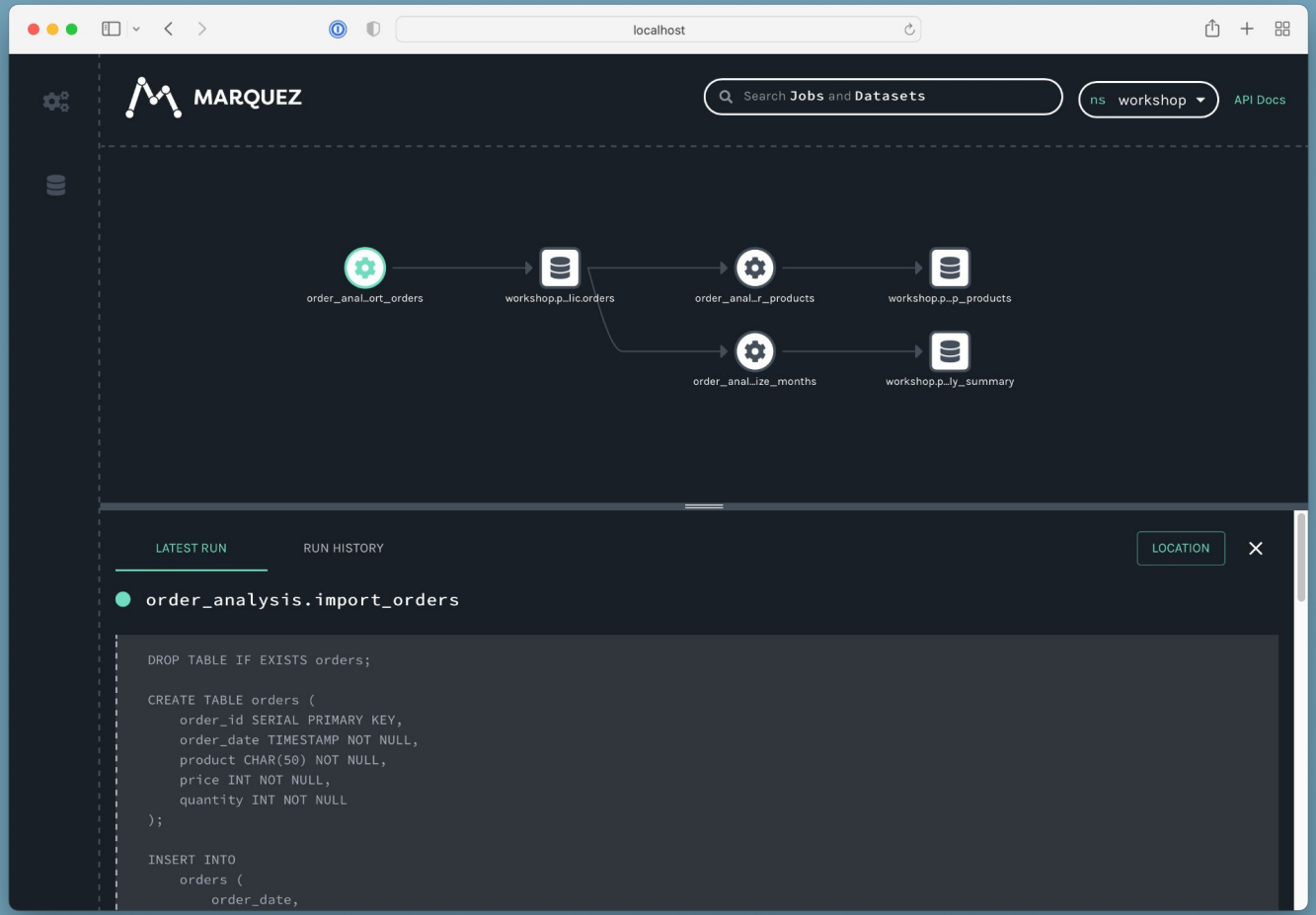
Run in detached mode

This will cause everything to run in the background (cool!) but also it won't show logs (aww!)

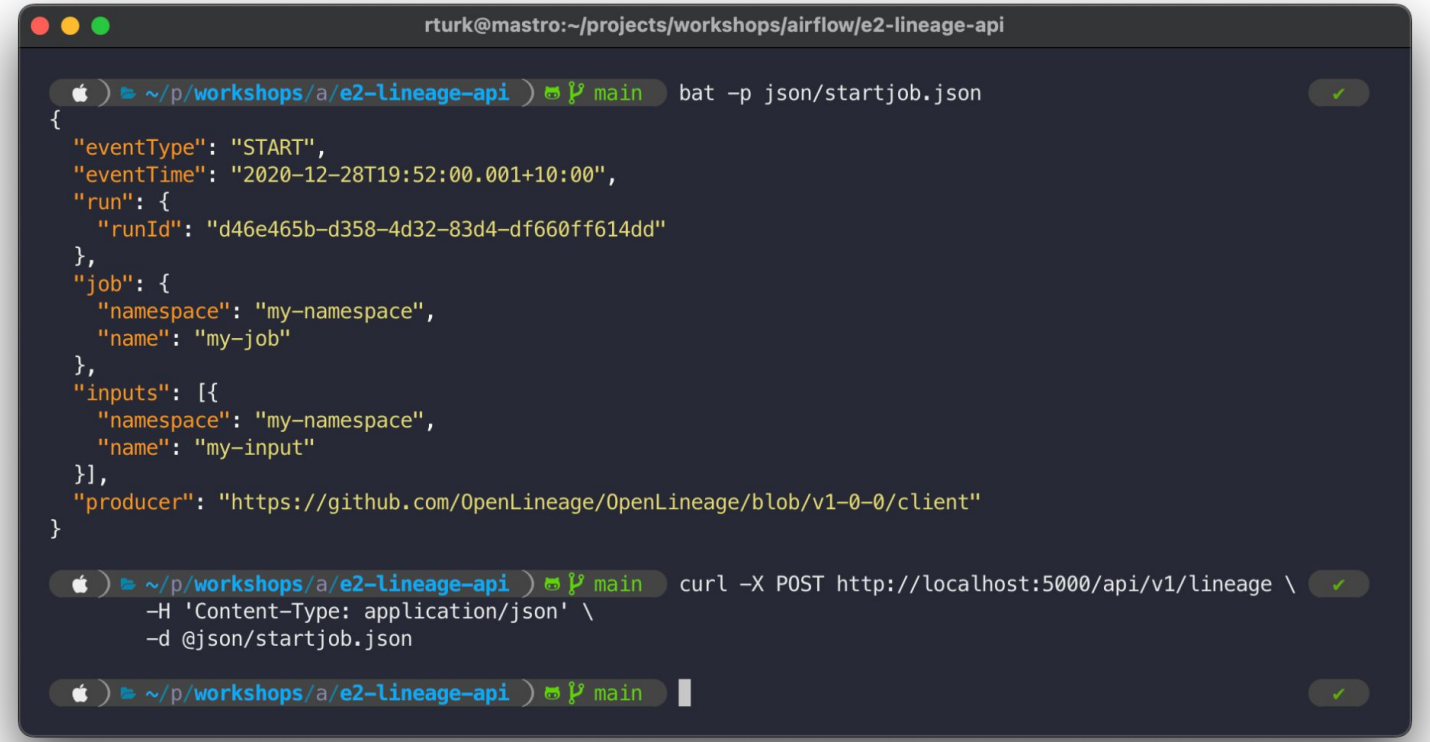
```
docker/up.sh --build
```

Build from source

Build everything, instead of grabbing the latest images from Docker Hub. For development.


localhost
MARQUEZ
Search Jobs and Datasets
ns workshop
API Docs
order_anal...ort_orders
workshop.p...lic.orders
order_anal...r_products
workshop.p...p_products
order_anal...ize_months
workshop.p...ly_summary
LATEST RUN
RUN HISTORY
LOCATION
order_analysis.import_orders
DROP TABLE IF EXISTS orders;
CREATE TABLE orders (
order_id SERIAL PRIMARY KEY,
order_date TIMESTAMP NOT NULL,
product CHAR(50) NOT NULL,
price INT NOT NULL,
quantity INT NOT NULL
);
INSERT INTO
orders (
order_date,

Starting a job run



Completing a job run

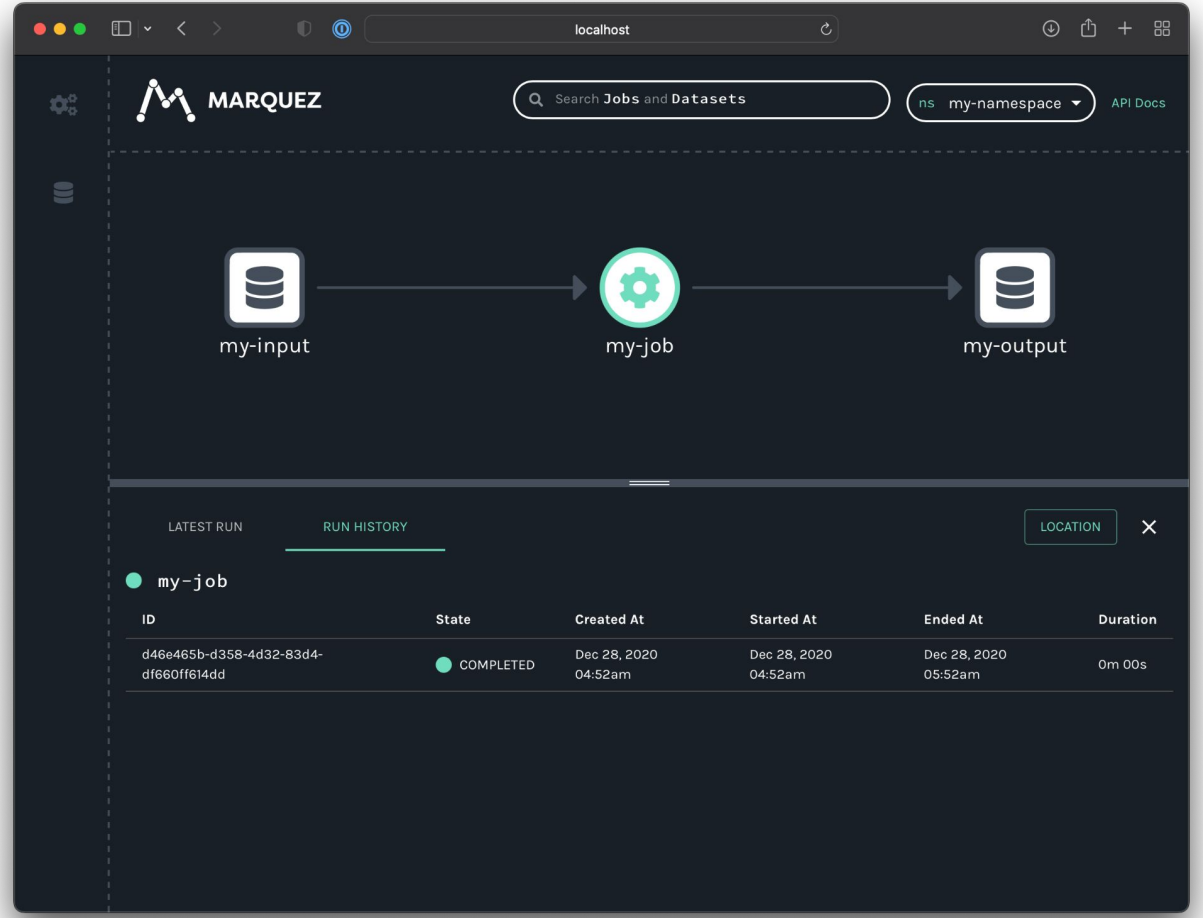
rturk@mastro:~/projects/workshops/airflow/e2-lineage-api

```
~/p/workshops/a/e2-lineage-api main bat -p json/completejob.json
{
  "eventType": "COMPLETE",
  "eventTime": "2020-12-28T20:52:00.001+10:00",
  "run": {
    "runId": "d46e465b-d358-4d32-83d4-df660ff614dd"
  },
  "job": {
    "namespace": "my-namespace",
    "name": "my-job"
  },
  "outputs": [{
    "namespace": "my-namespace",
    "name": "my-output"
  }],
  "producer": "https://github.com/OpenLineage/OpenLineage/blob/v1-0-0/client"
}

~/p/workshops/a/e2-lineage-api main curl -X POST http://localhost:5000/api/v1/lineage \
       -H 'Content-Type: application/json' \
       -d @json/completejob.json

~/p/workshops/a/e2-lineage-api main
```

Example: viewing a job run



```python
#!/usr/bin/env python3

from openlineage.client.run import RunEvent, RunState, Run, Job, Dataset
from openlineage.client.client import OpenLineageClient
from datetime import datetime
from uuid import uuid4

# Initialize the OpenLineage client
client = OpenLineageClient.from_environment()

# Specify the producer of this lineage metadata
producer = "https://github.com/OpenLineage/workshops"

# Create some basic Dataset objects for our fictional pipeline
online_orders = Dataset(namespace="workshop", name="online_orders")
mail_orders = Dataset(namespace="workshop", name="mail_orders")
orders = Dataset(namespace="workshop", name="orders")

# Create a Run object with a unique ID
run = Run(str(uuid4()))

# Create a Job object
job = Job(namespace="workshop", name="process_orders")

# Emit a START run event
client.emit(
    RunEvent(
        RunState.START,
        datetime.now().isoformat(),
        run, job, producer
    )
)

#
# This is where our application would do the actual work :)
#

# Emit a COMPLETE run event
client.emit(
    RunEvent(
        RunState.COMPLETE,
        datetime.now().isoformat(),
        run, job, producer,
        inputs=[online_orders, mail_orders],
        outputs=[orders],
    )
)
```

Using the Python client

Thanks :)