SPONSORS

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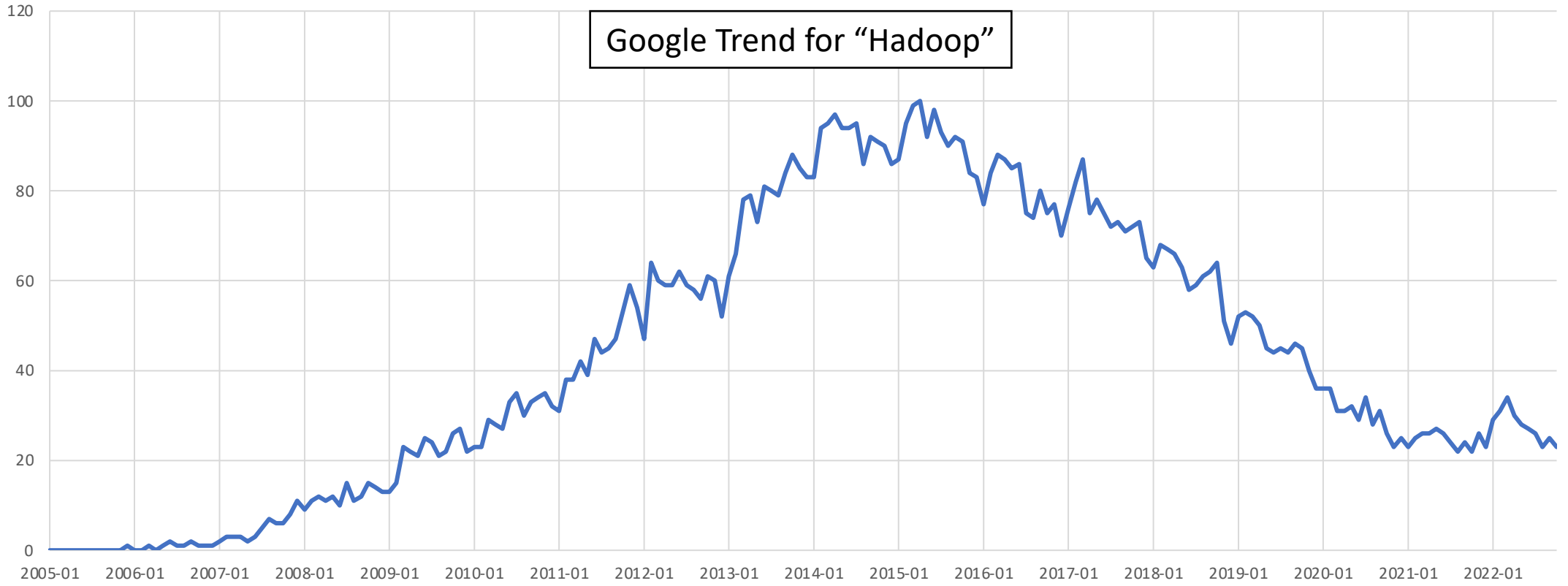
Running Big Data Pipelines on Kubernetes *without Crashing the Cluster*

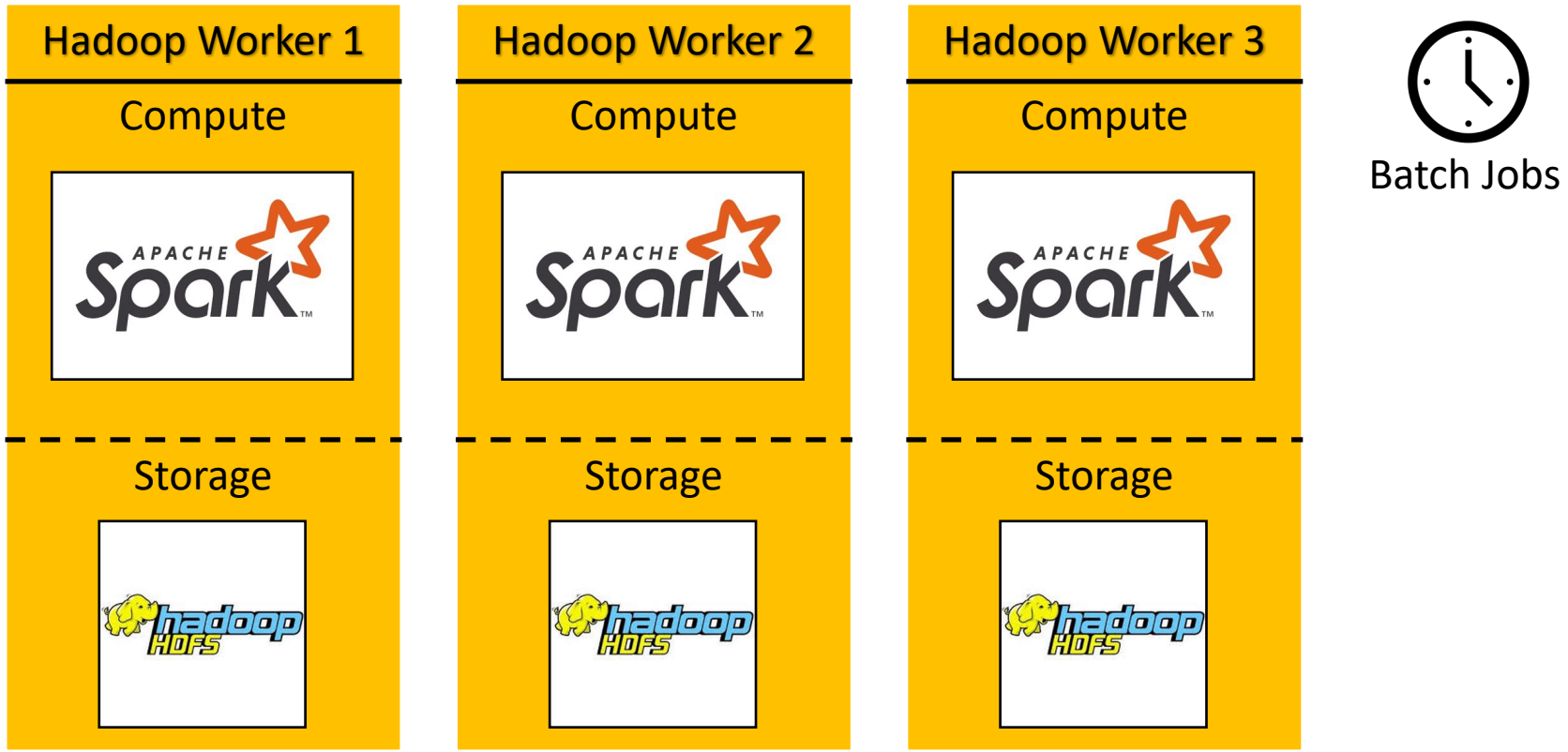
On-premise Hadoop clusters are legacy and need to be migrated.



Public clouds have managed Hadoop Services. There is no easy solution for Kubernetes.

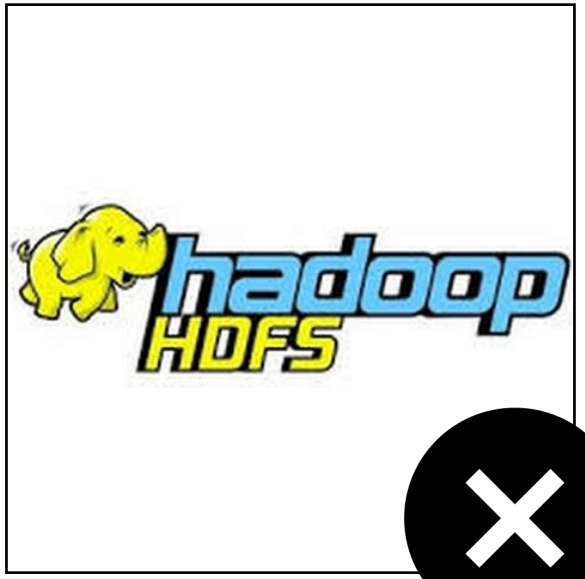
Cloud Dataproc

Hadoop clusters provide co-located compute and storage resources.



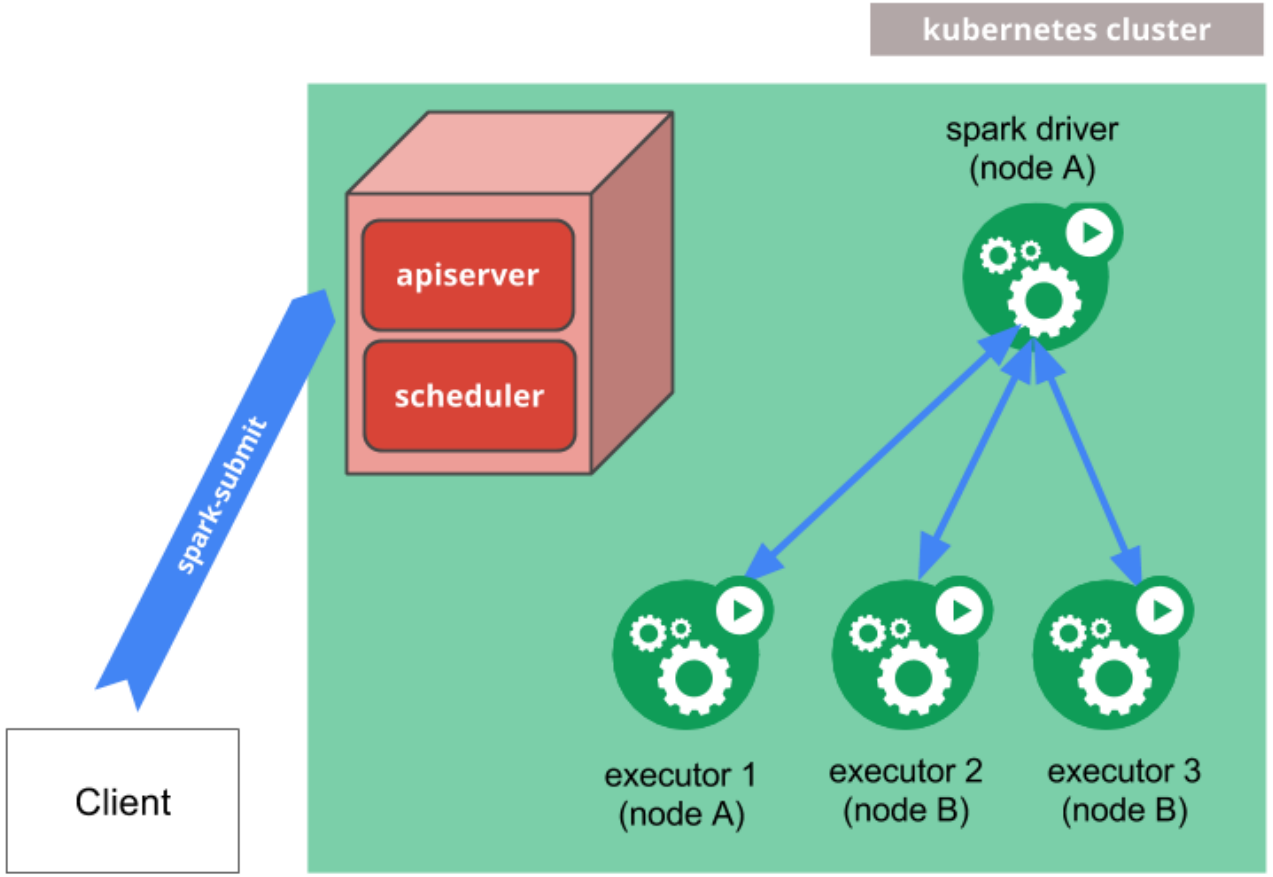
Using non-local object storage instead of HDFS works *fine*.

Storage on Kubernetes



Spark natively supports running on k8s.
But it wants to submit itself from somewhere.

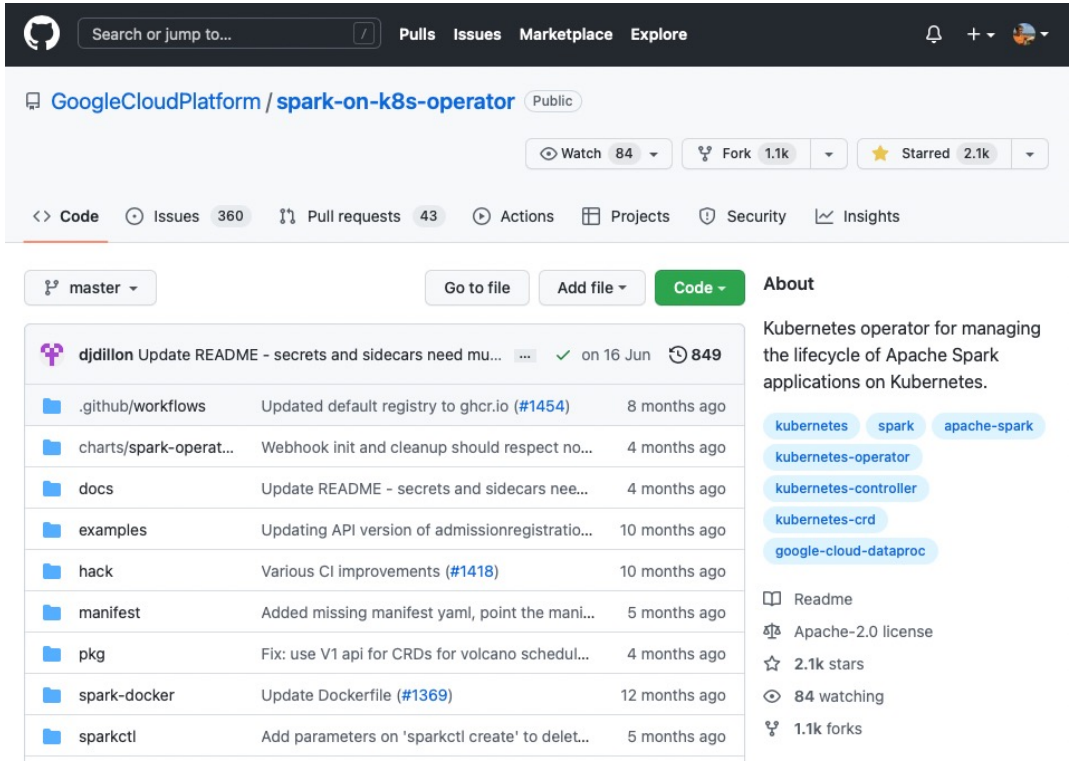
Compute on Kubernetes



Source: Official Apache Spark Documentation

GCP created an operator so that we can submit YAMLs instead.

Compute on Kubernetes



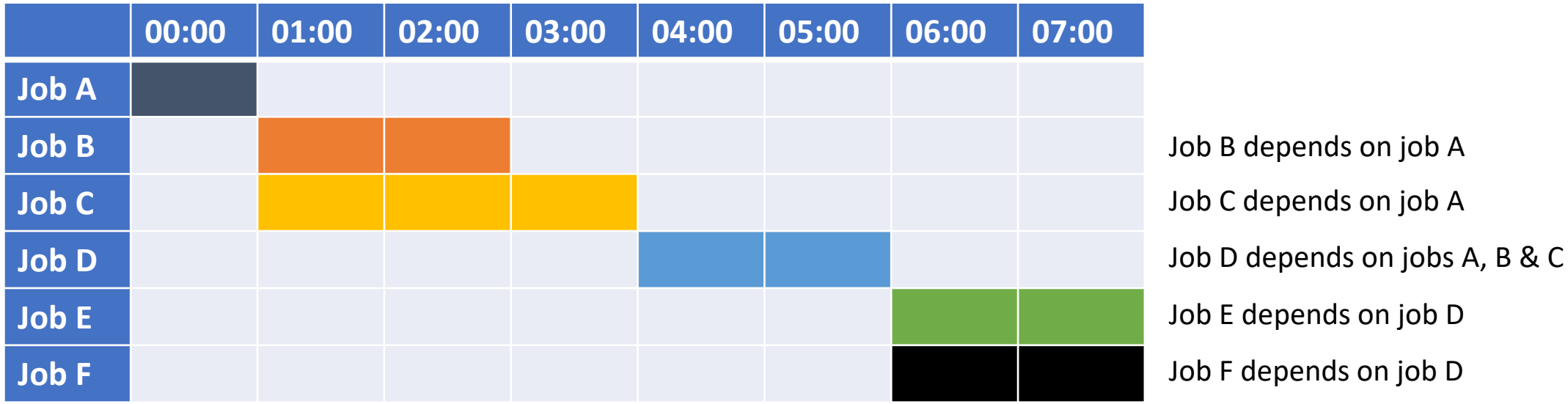
example-spark-application.yaml > ...

```yaml
---
apiVersion: sparkoperator.k8s.io/v1beta2
kind: SparkApplication
metadata:
  # ...
spec:
  driver:
    cores: 1
    memory: 1g
    serviceAccount: spark
  executor:
    cores: 1
    instances: 20
    memory: 5g
  image: gcr.io/ynli-k8s/spark:v3.1.1
  type: Python
  pythonVersion: 3
  mainApplicationFile: local:///opt/my-big-big-data-application.py
  # ...
---
```

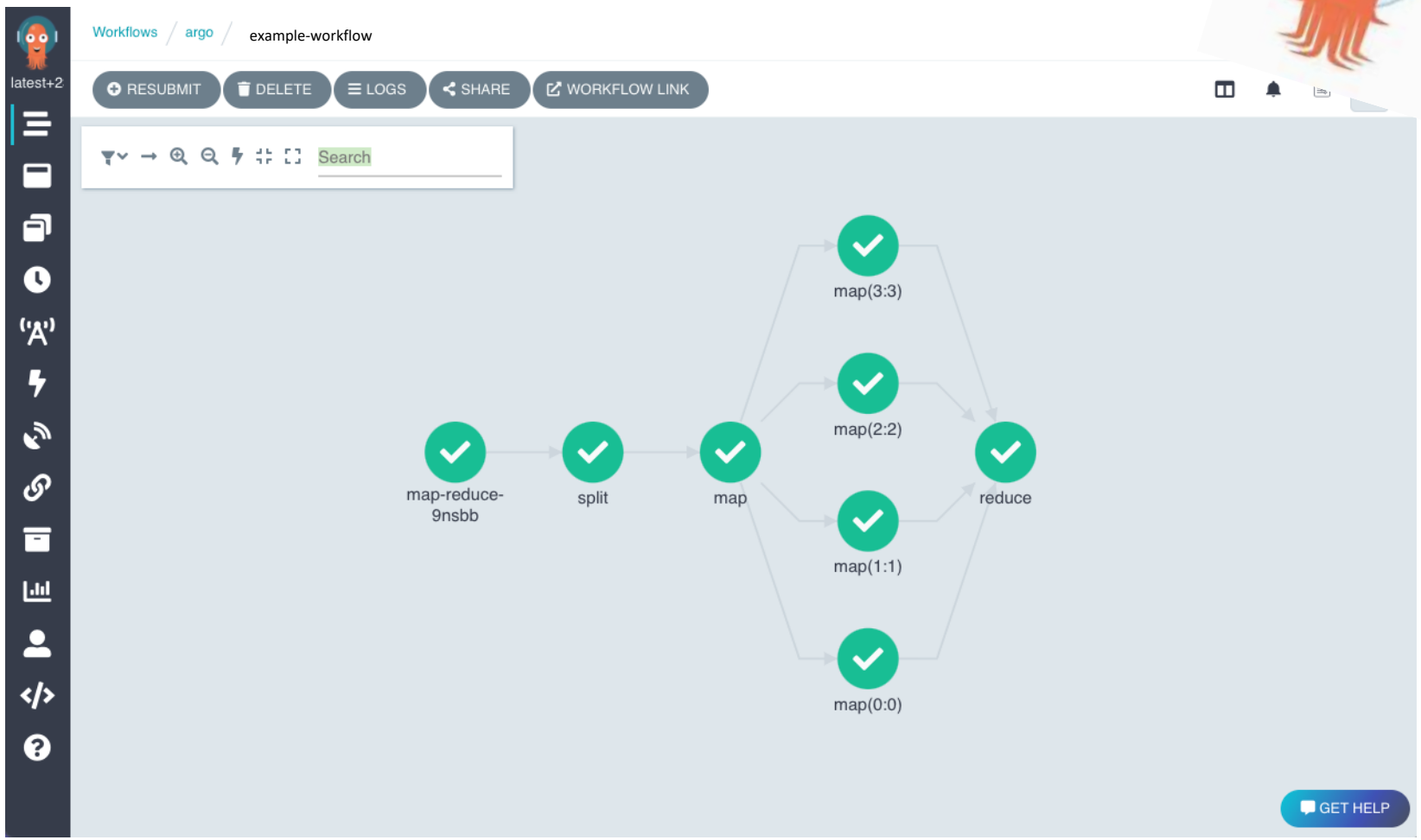
Lessons Learned

- We were too optimistic. Expect failures, do load testing, limit the blast radius and do not optimize too early.
- Try to keep pods small and run more of them. This makes scheduling easier and more reliable and avoids many problems (e.g., PIDs).
- Cluster auto scaling and priority classes are a good idea when running batch jobs.

Once we get more batch jobs, we need more sophisticated scheduling.



Argo Workflows is a cloud-native orchestrator for batch **pipelines**.

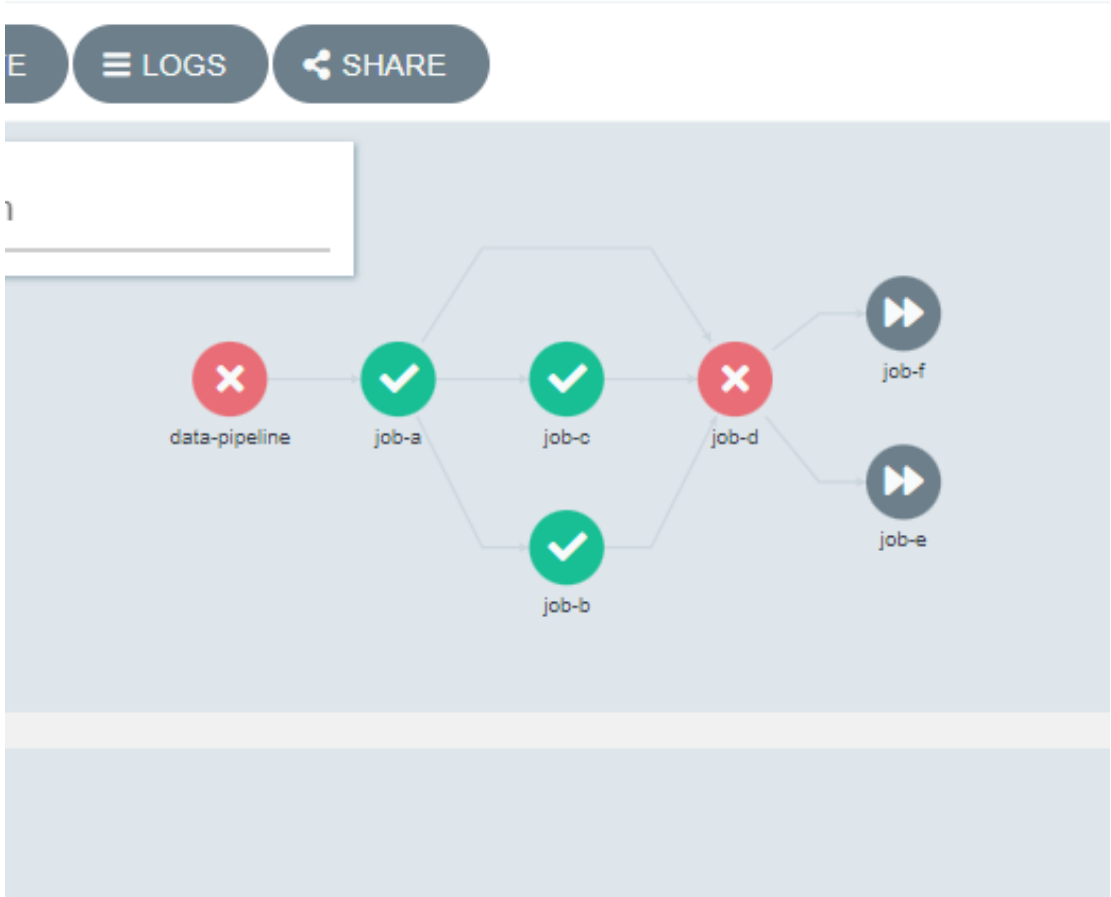


With Argo Workflows we can define complex batch pipelines.

example-argo-workflow.yaml > ...

```yaml
---
apiVersion: argoproj.io/v1alpha1
kind: Workflow
metadata:
  name: data-pipeline
spec:
  entrypoint: run-data-pipeline
  templates:
    - name: run-data-pipeline
      dag:
        tasks:
        - name: job-a
          template: python-job-a
        - name: job-b
          depends: "job-a"
          template: spark-job-b
        - name: job-c
          depends: "job-a"
          template: sql-query-c
        - name: job-d
          depends: "job-a & job-b & job-c"
          template: python-job-d
        - name: job-e
          depends: "job-d"
          template: sql-query-e
        - name: job-f
          depends: "job-d"
          template: sql-query-f
    - name: python-job-a
      container:
        name: main
        image: 'python:3.9'
        command:
          - python
        args:
          - etl_a.py
    # [...]
---

```



Take Away Messages

- Migrating a Hadoop cluster to Kubernetes is possible, but not easy. Spark on Kubernetes is still in an early stage.
- Argo Workflows is fantastic for orchestrating complex batch pipelines and integrates well with existing Kubernetes tooling.
- Expect failure initially, limit your blast radius and only optimize cost when everything is stable.