bigdata

Challenges faced and lessons learnt while building a multi-cloud Data platform

Antonio Murgia – Big Data conference EU 2023

Who am I

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👨‍💻 Data Architect at AgileLab.
I spent the last 7 years first implementing, then leading teams and ultimately designing from the ground-up scalable streaming and batch data solutions.

I'm an open source contributor 👨‍🎓
(Apache Spark ✨ and Project Nessie 🦕)

In my free time I love to hike 🥾 and climb 🧗 mountains 🏔️ and I'm up for playing any kind of sport 🏐

Great place to work 😎

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witboost

Born as a Data management consultancy company in 2013, based in Turin (Italy)
Focused on scalable technologies and data practices - which is a way to scale too

We are now 150 engineers all over europe!

In recent years we started to develop witboost, a product that helps big organizations build their internal data development platform based on their own needs, processes, practices and policies

Great Place To Work.®

⚠️ DISCLAIMER ⚠️

This is not a guide on «how to» implement a multi-cloud data platform.

We were NOT implementing a «greenfield» data platform.

This is the story of how we managed to transform an AWS centric platform to a multi-cloud one.

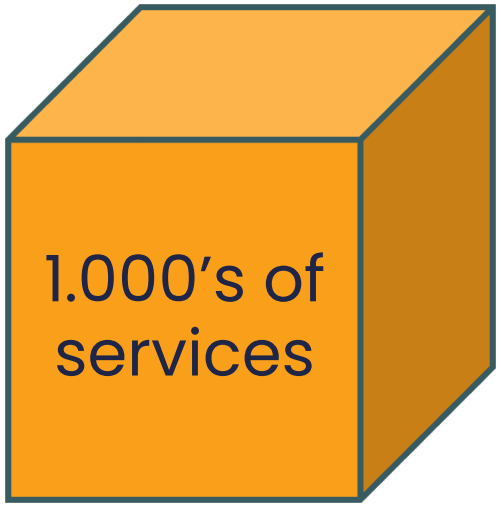
Once upon a time

We started building a service + data platform on AWS in 2019
The platform follows an “holistic” approach:

domain teams 🔨 build, 📦 deploy and 👷 operate
in the same platform both operational and data services/products

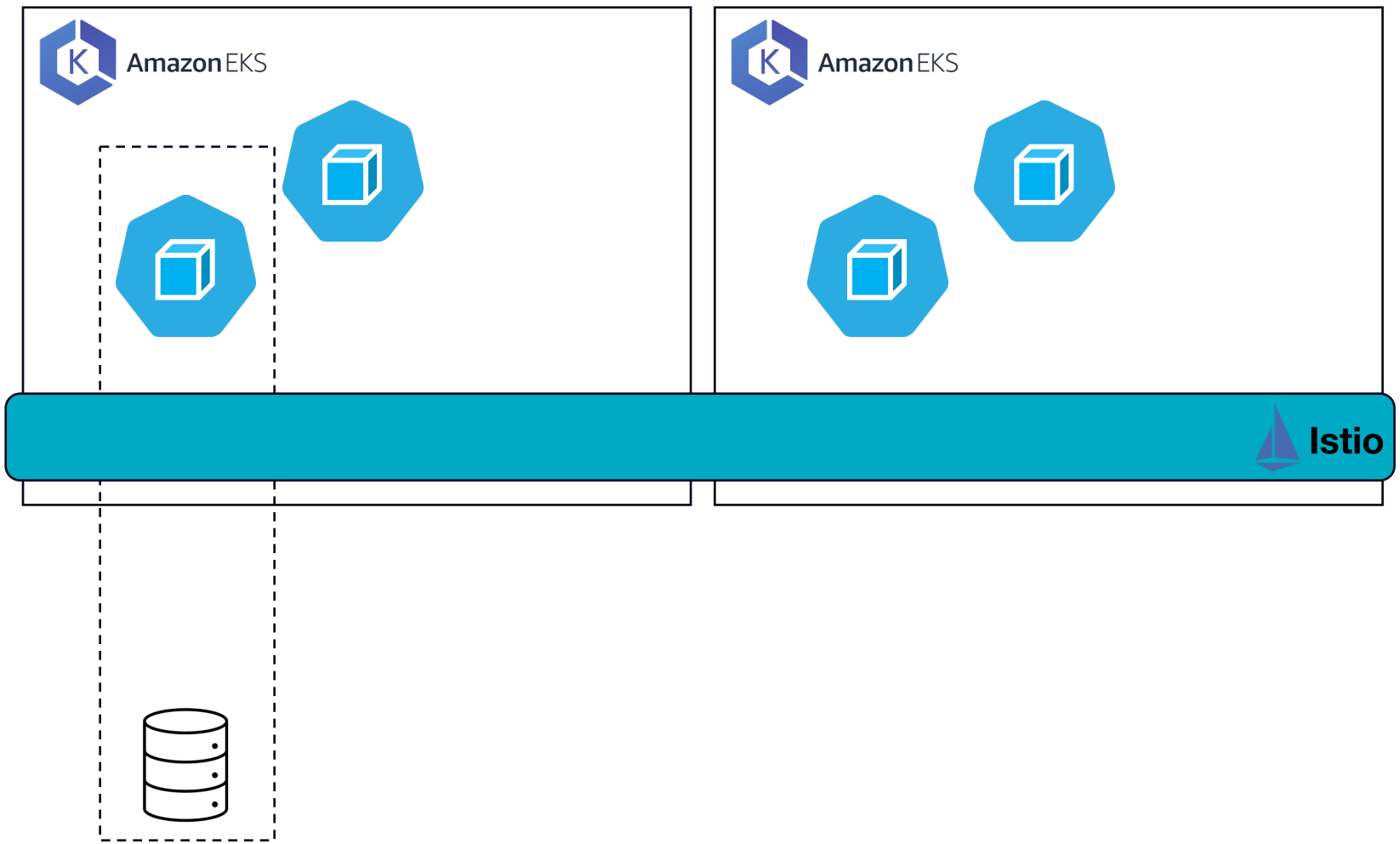
In retrospective we were building a very prehistoric kind of Data Mesh +1 year before Zhamak blogged about it on Martin Fowler website

Context



Technology Stack

Technology Stack



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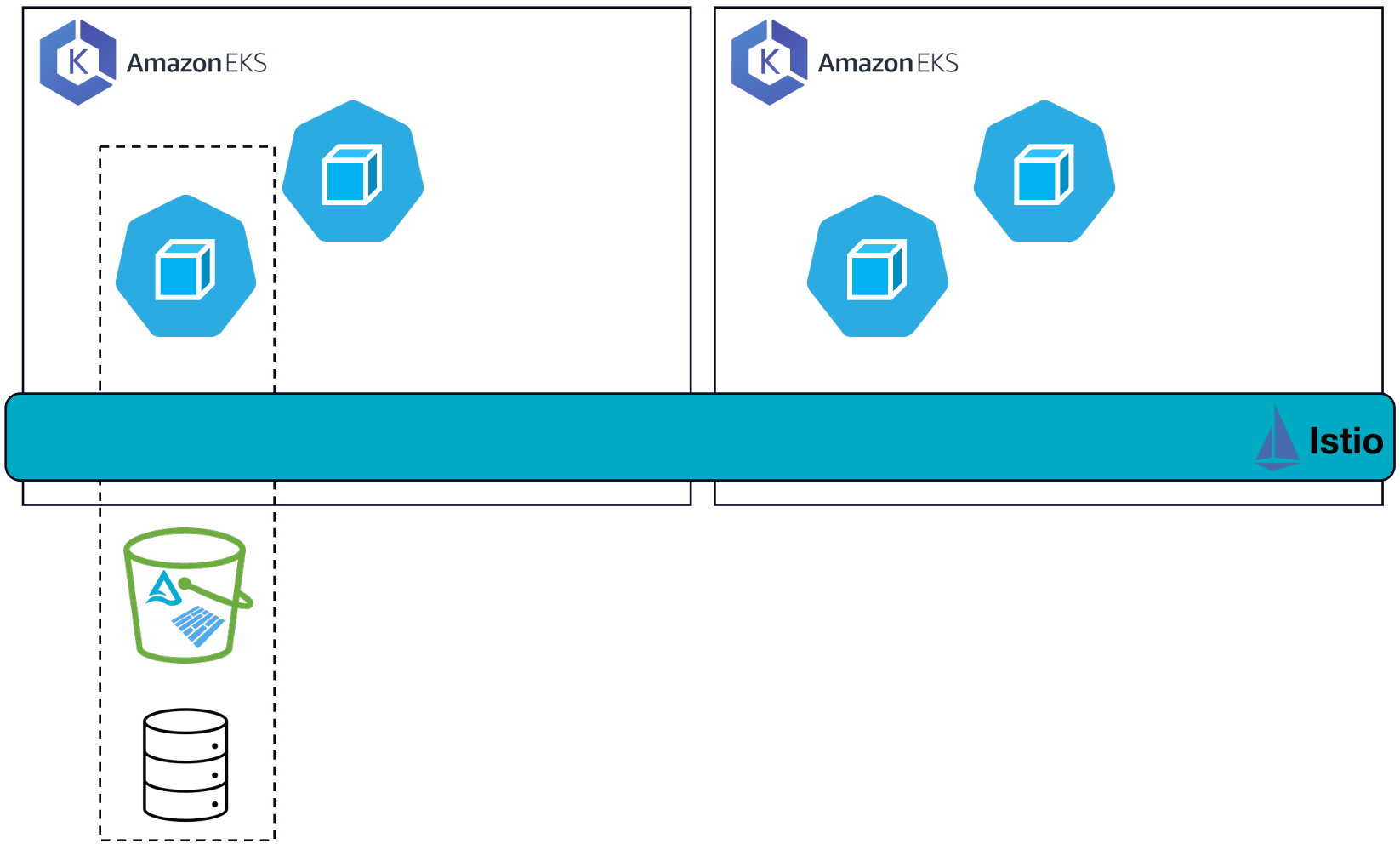
Technology Stack



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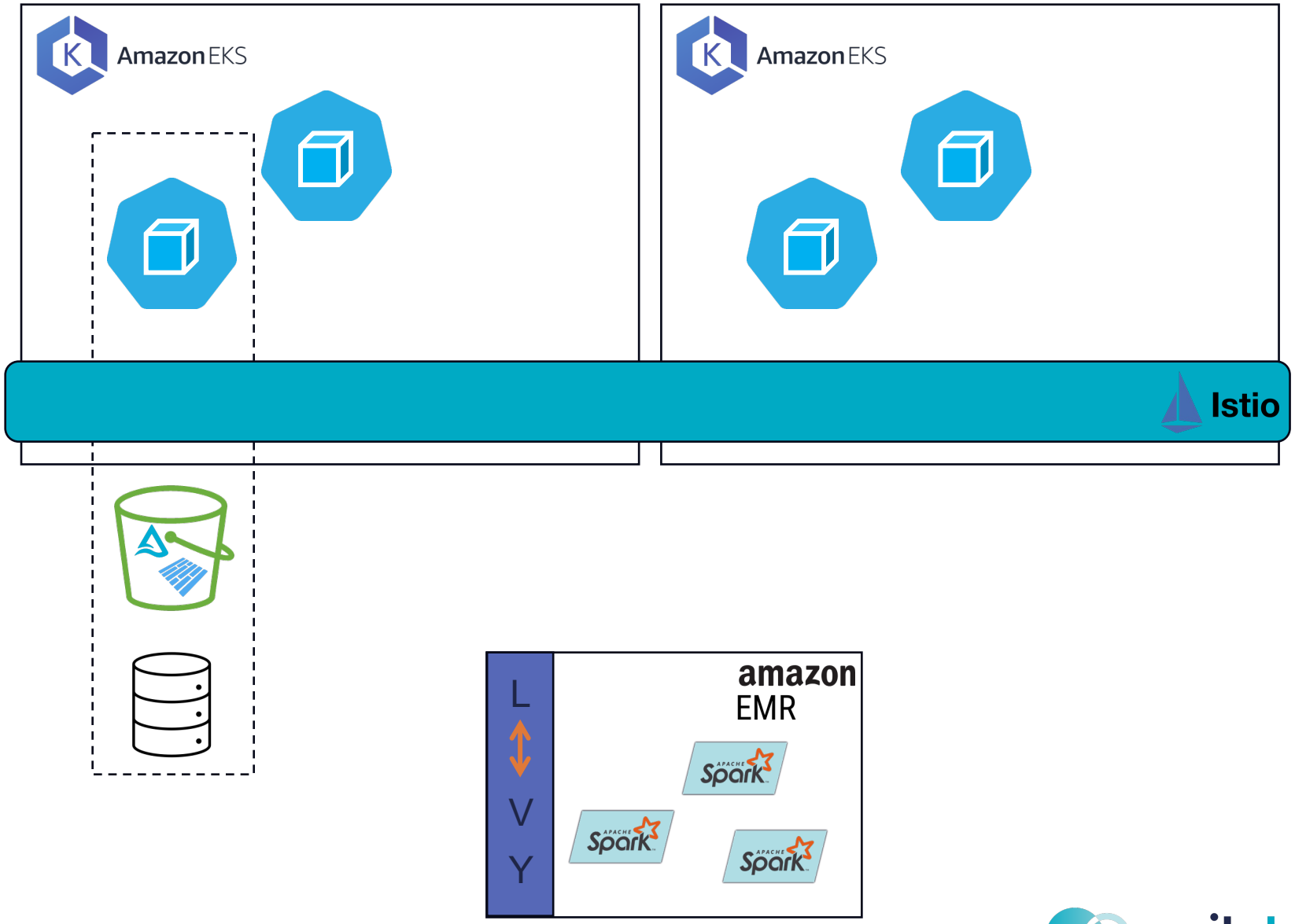

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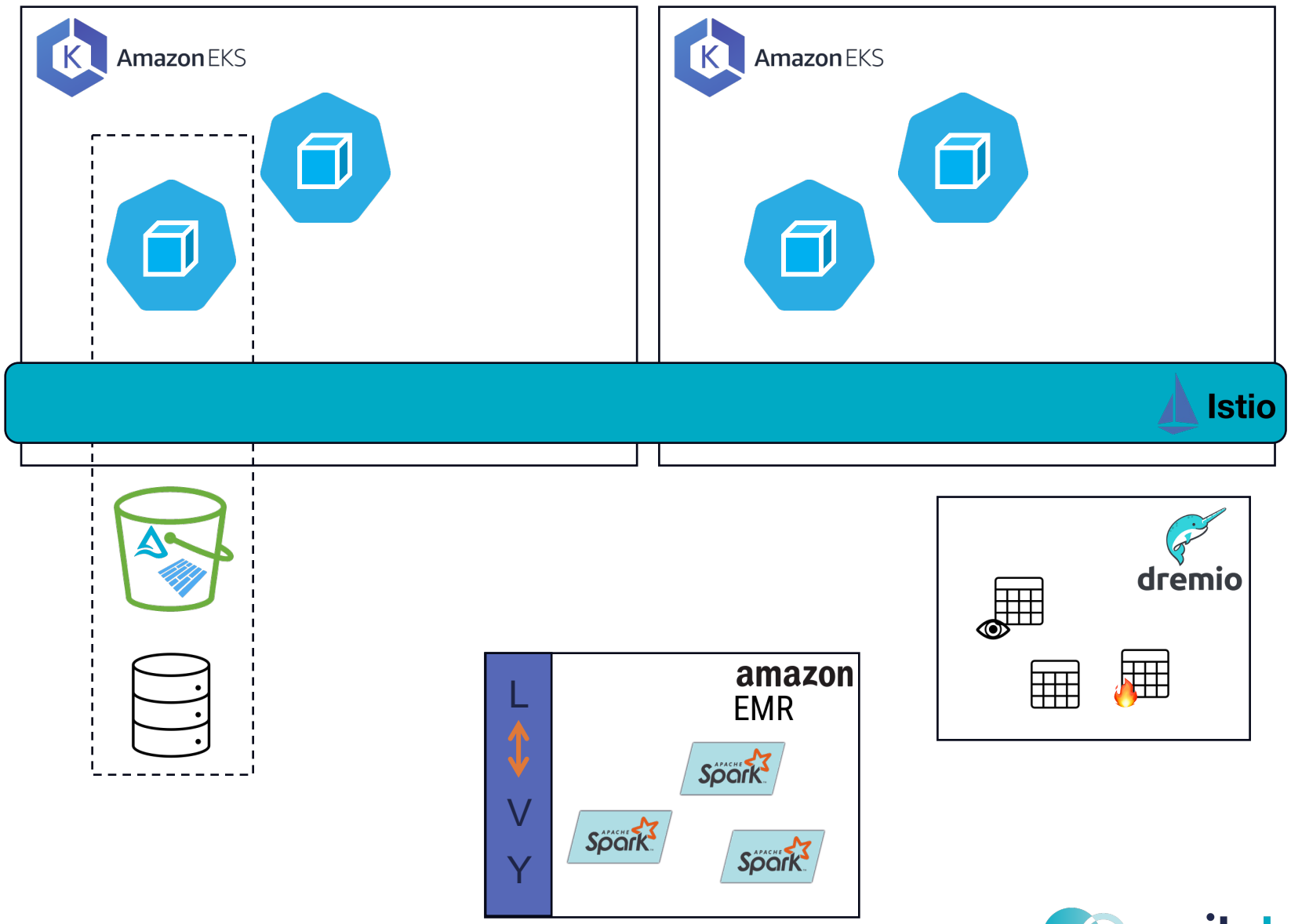

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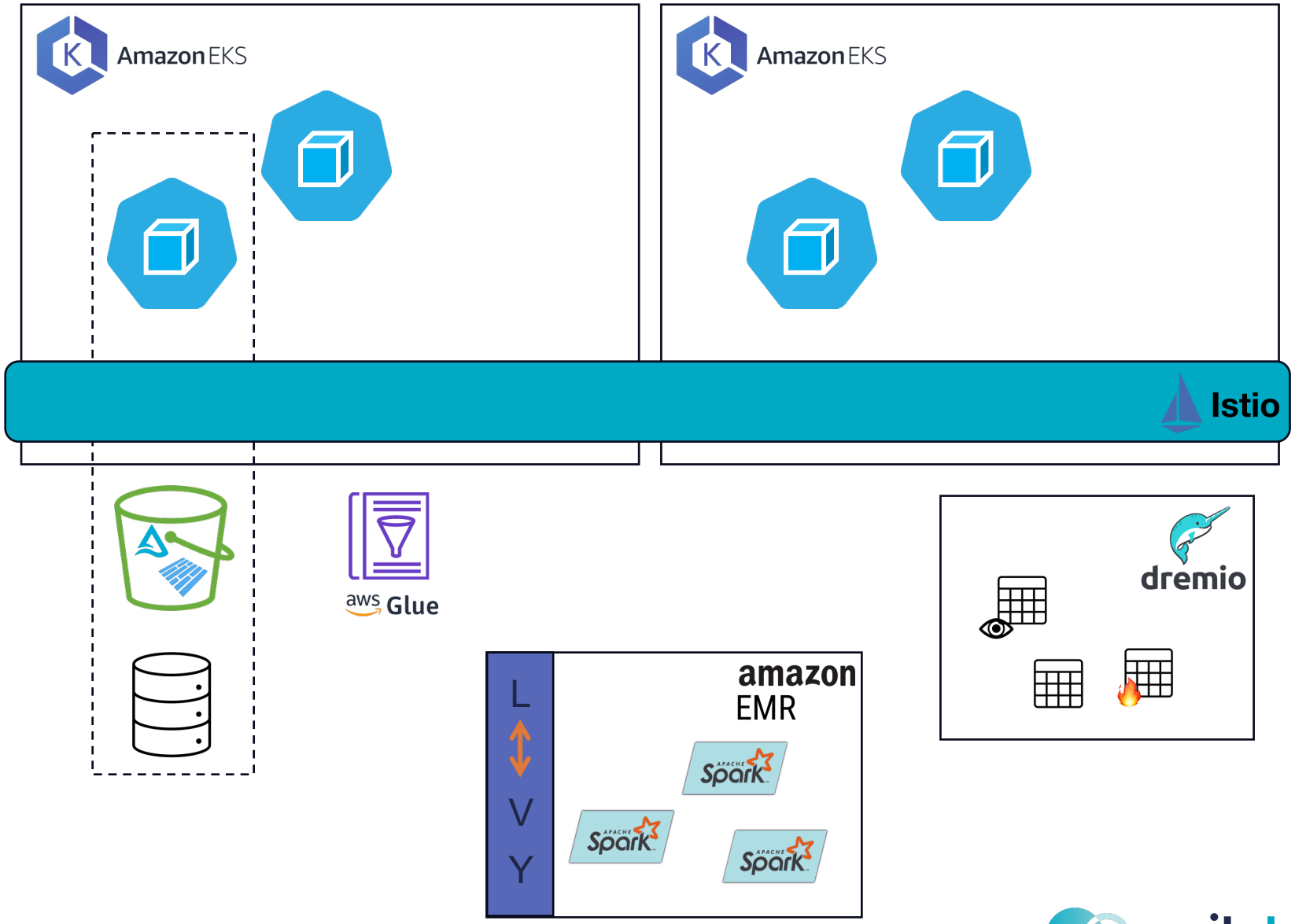

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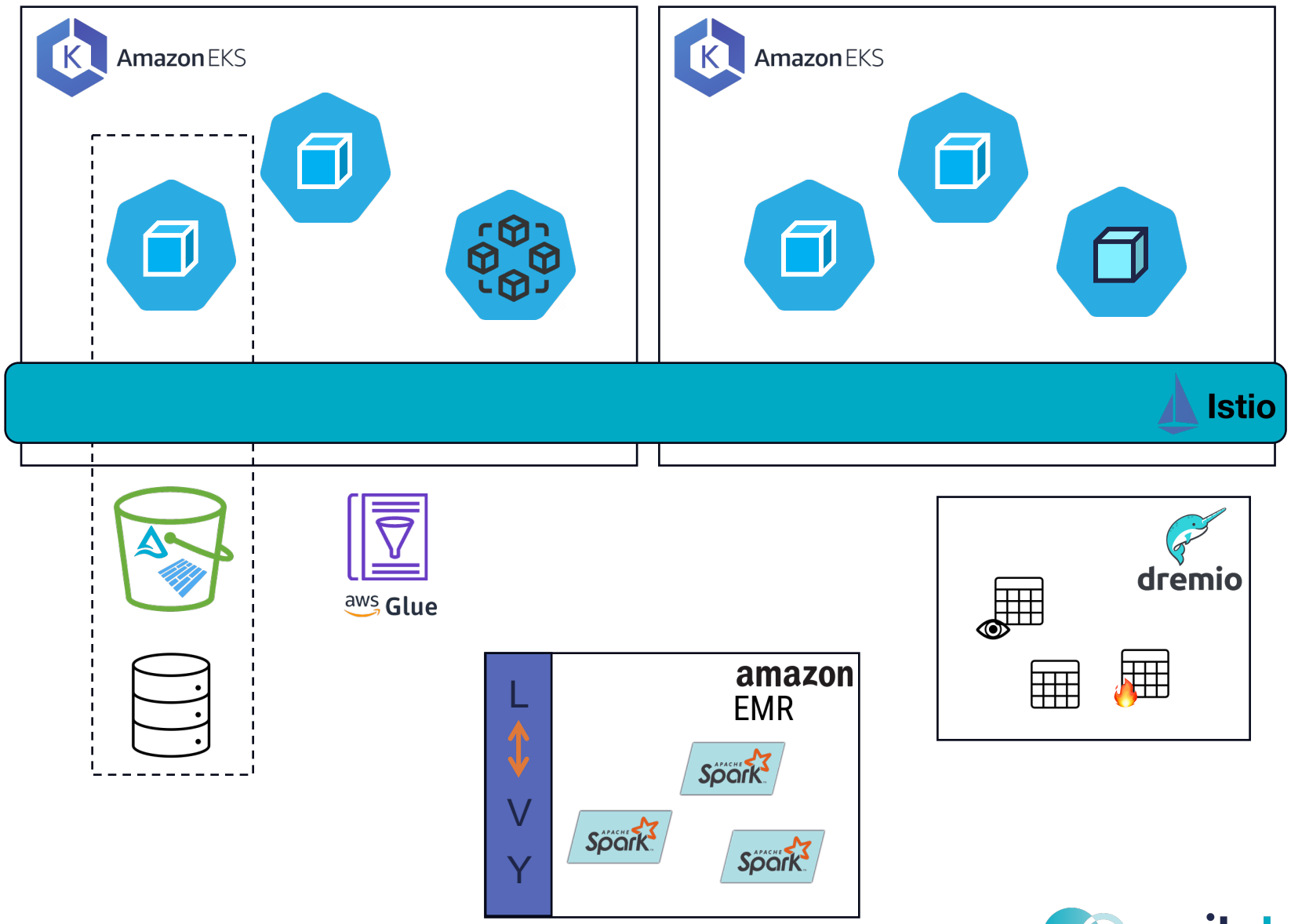

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Organization

Each domain team has an associated AWS IAM Role for each environment (dev/test/prod)

Each service has its own s3 bucket and operational DB

A central catalog is the entry-point for governance

Datasets are declared as Glue tables

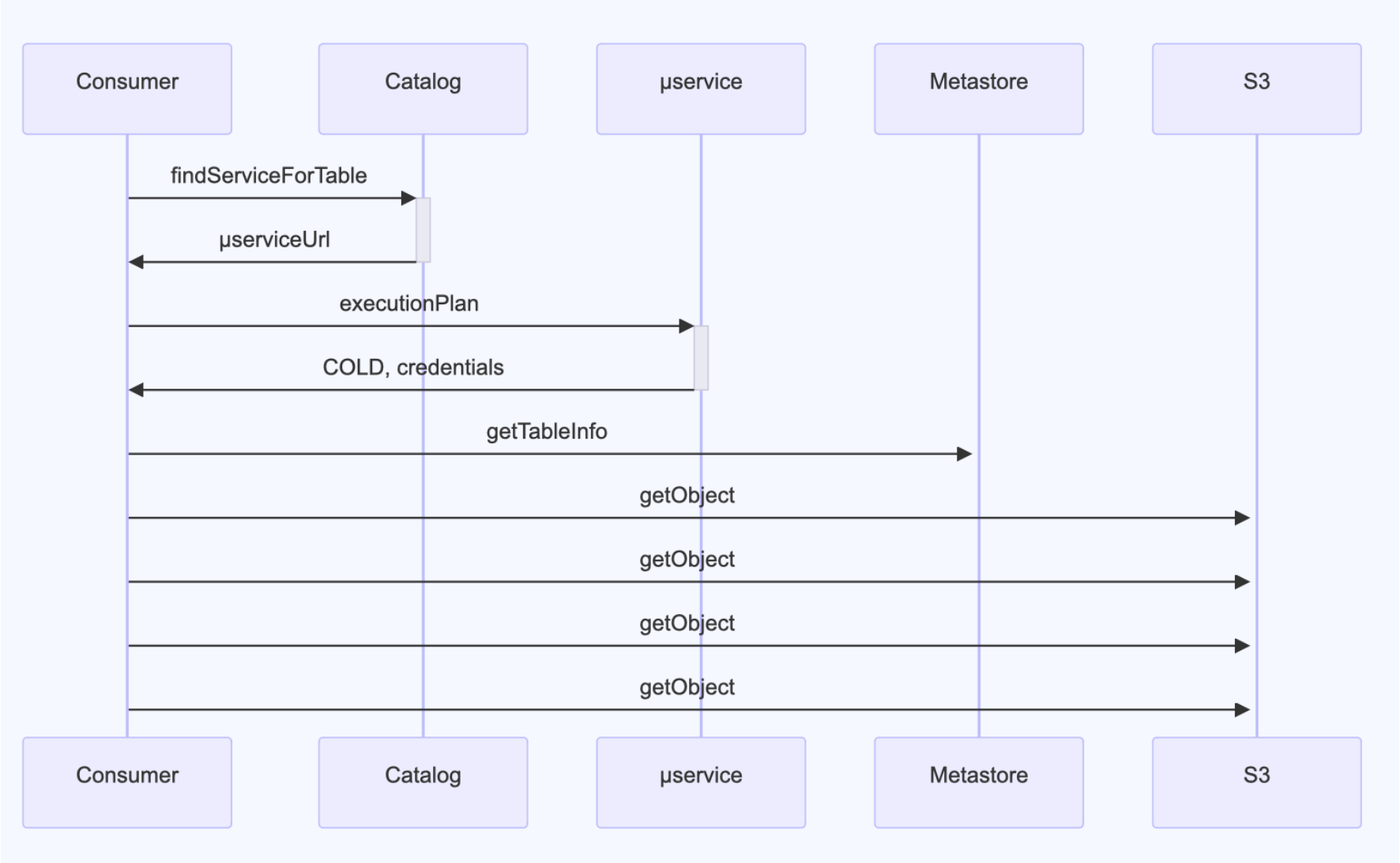
Data for analytical purposes can be exposed in one of 3 ways:

- ❄️ Parquet or Delta Lake tables on s3
- 🔥 json/http with a custom pre-defined protocol

Everything is provisioned through CloudFormation

Everything is API-first

Cold Data *(Parquet/Delta Lake on s3)*



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Hot 🔥 Data *(http/json)*

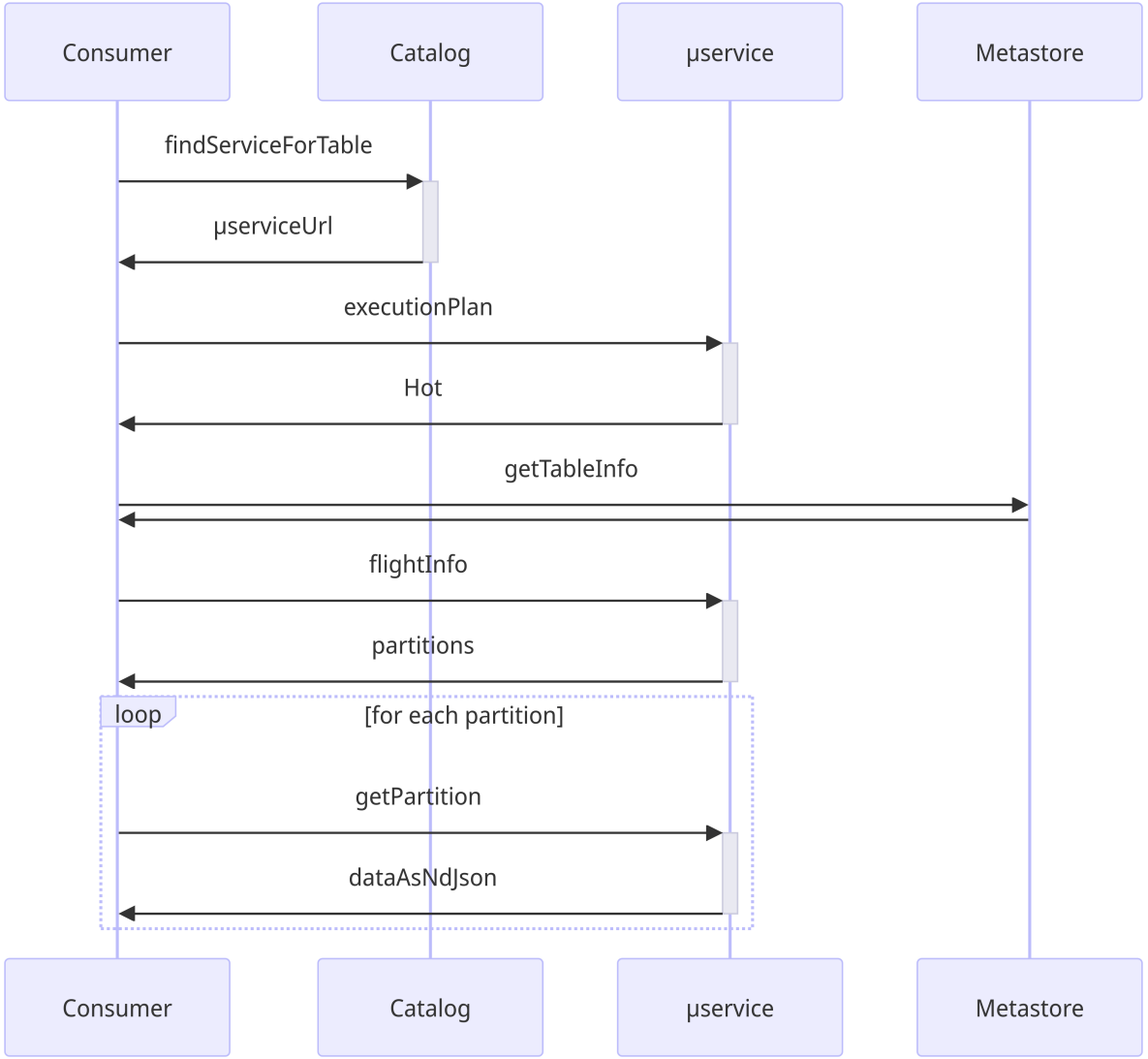

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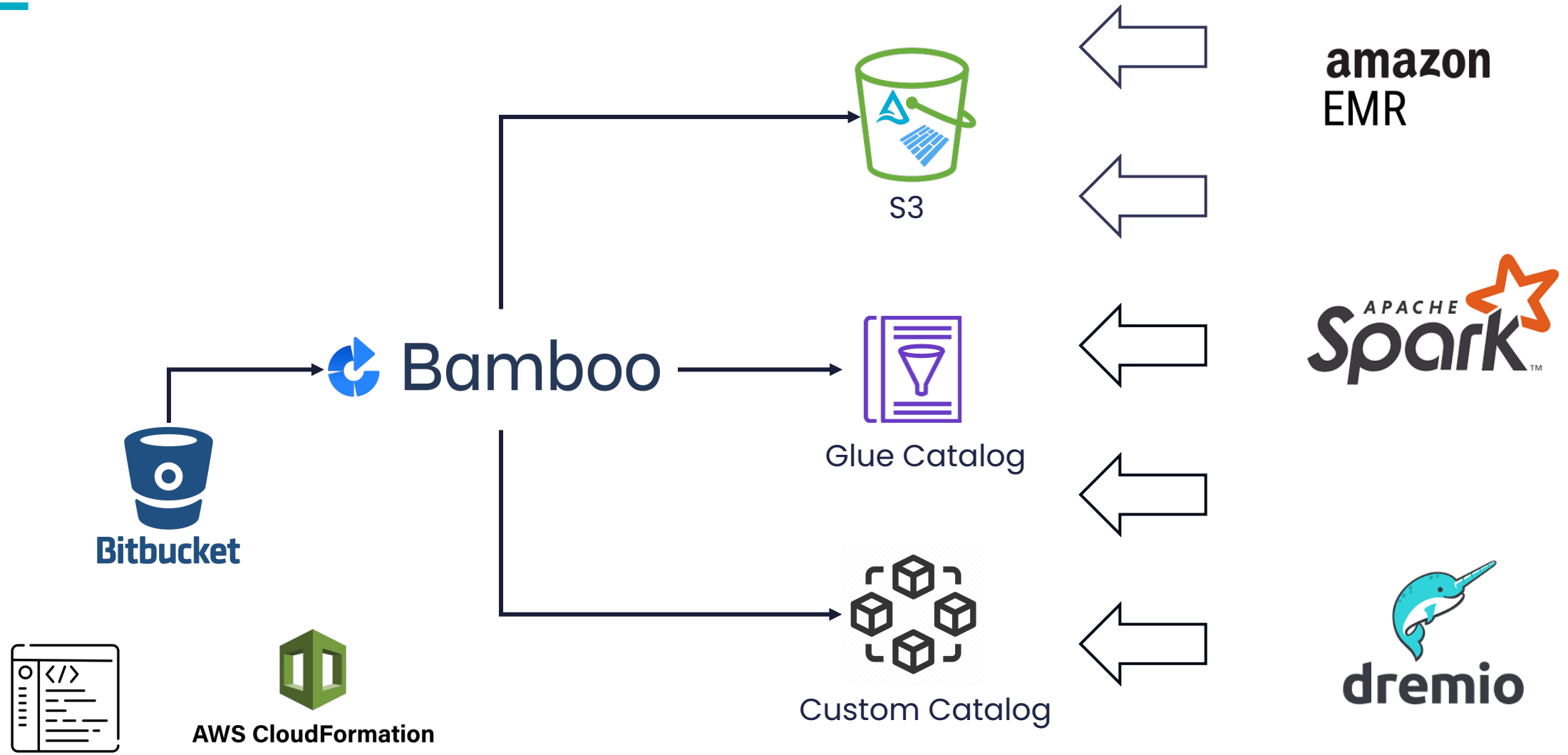
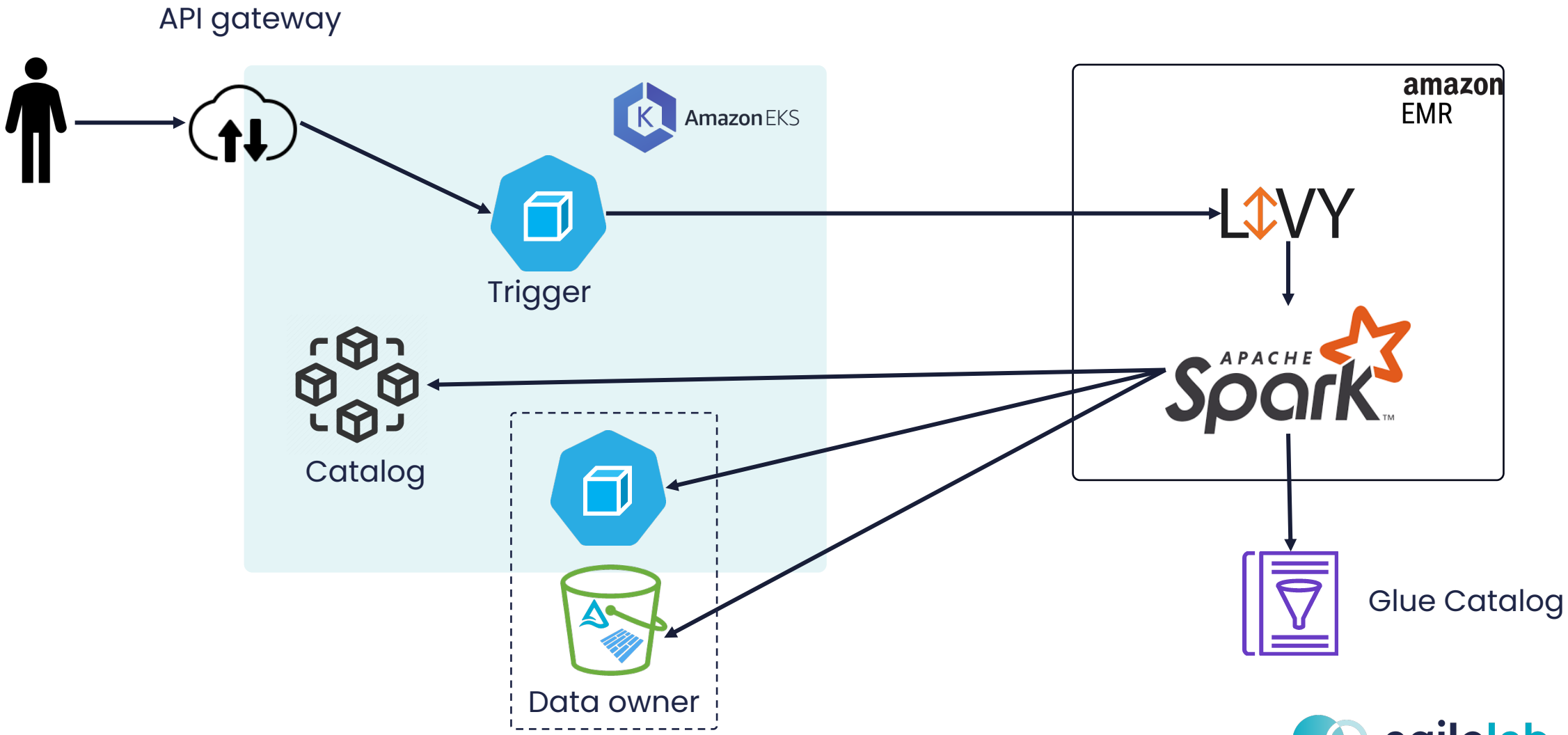
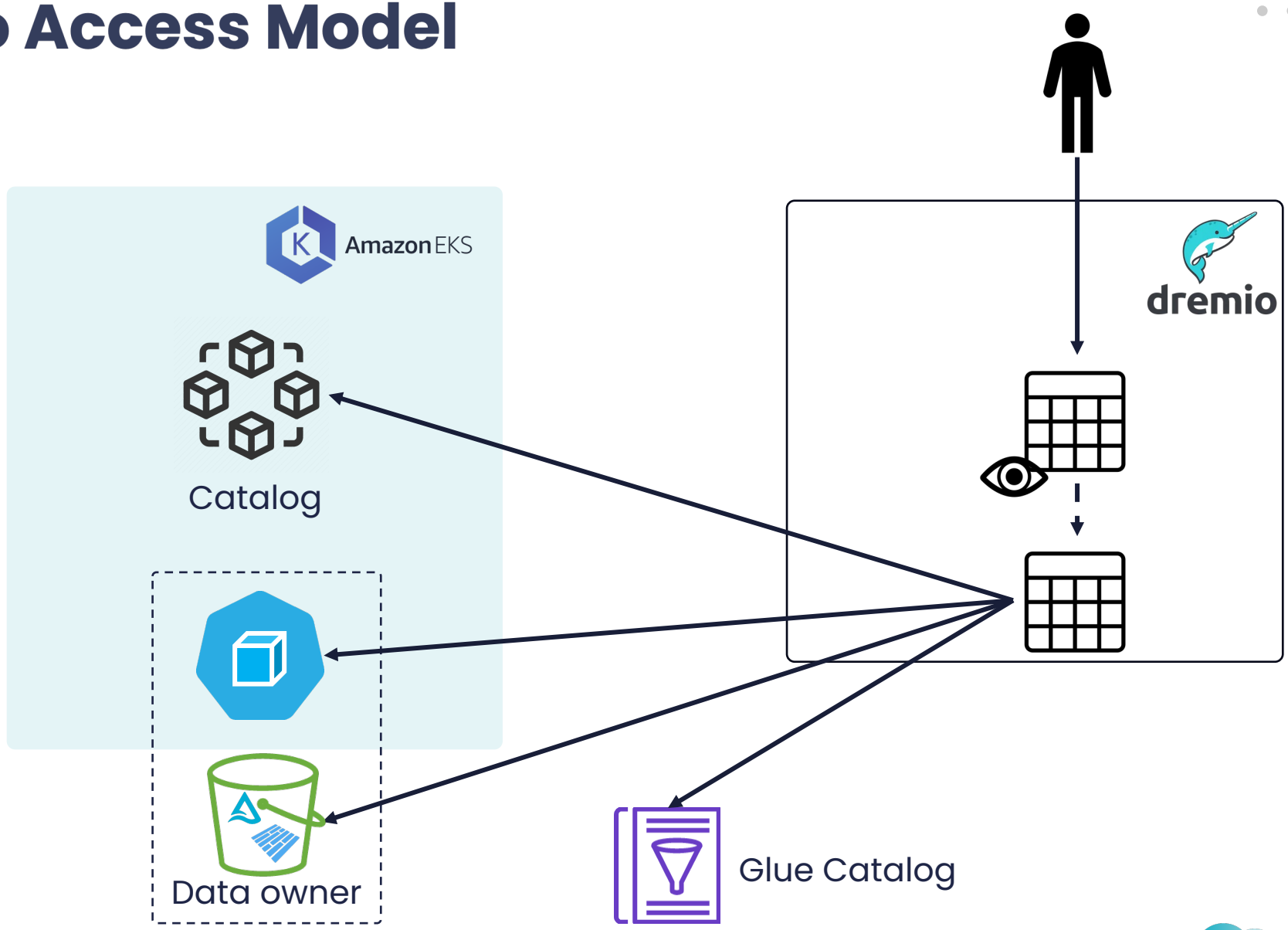
Table creation



Job submission



Dremio Access Model



Let’s dive into Multi-cloud

What's multicloud?

Definition

multiple **cloud** computing services in a single architecture

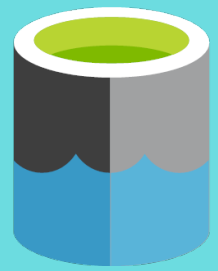
Key Points

Goals

Transparent allocation on aws and Azure of:

Compute

Storage



Already sorted out

«If I have seen further it is by standing on the shoulders of giants»

Isaac Newton

Http communication across different Kubernetes clusters on different cloud providers (backbone on on-premise data center)

Challenges

No open source Spark Glue connector

EMR is not available out of aws

amazon
EMR

Provide a non-breaking upgrade

Metastore

Challenges:

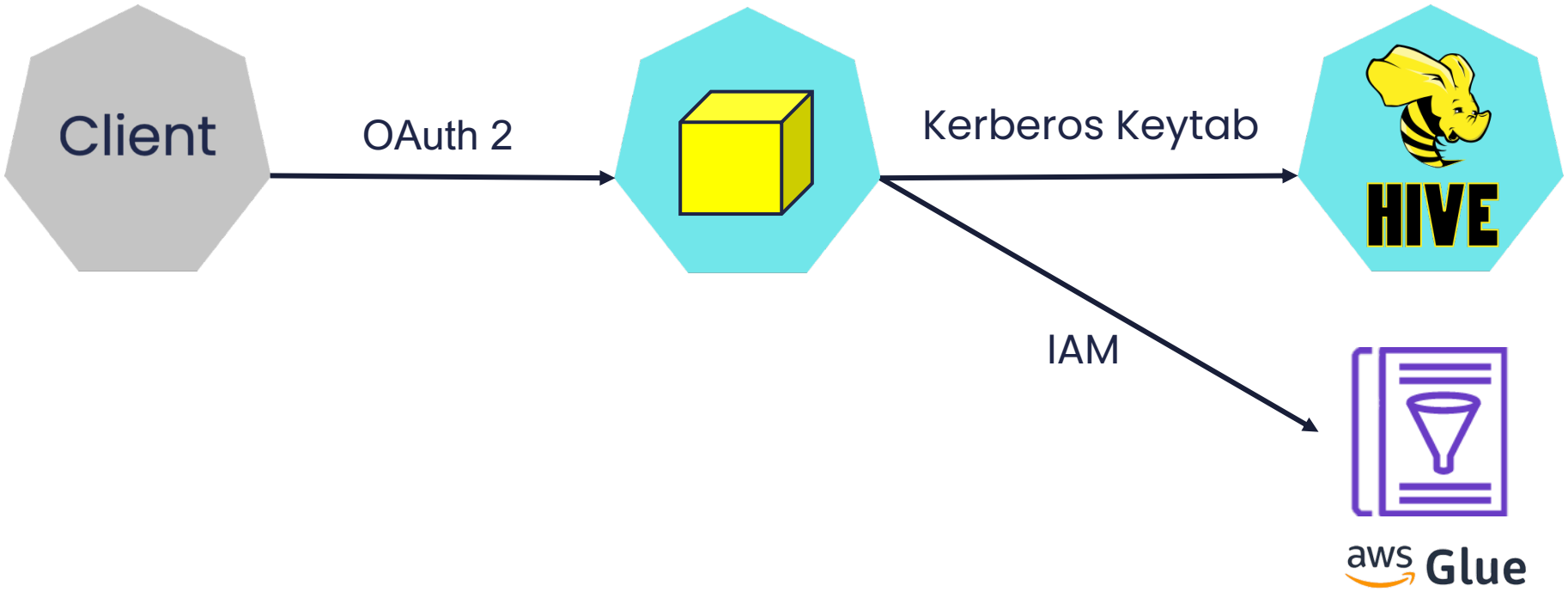
💀 Authentication is based on Kerberos

✨Spark 2 can’t easily switch between catalogs

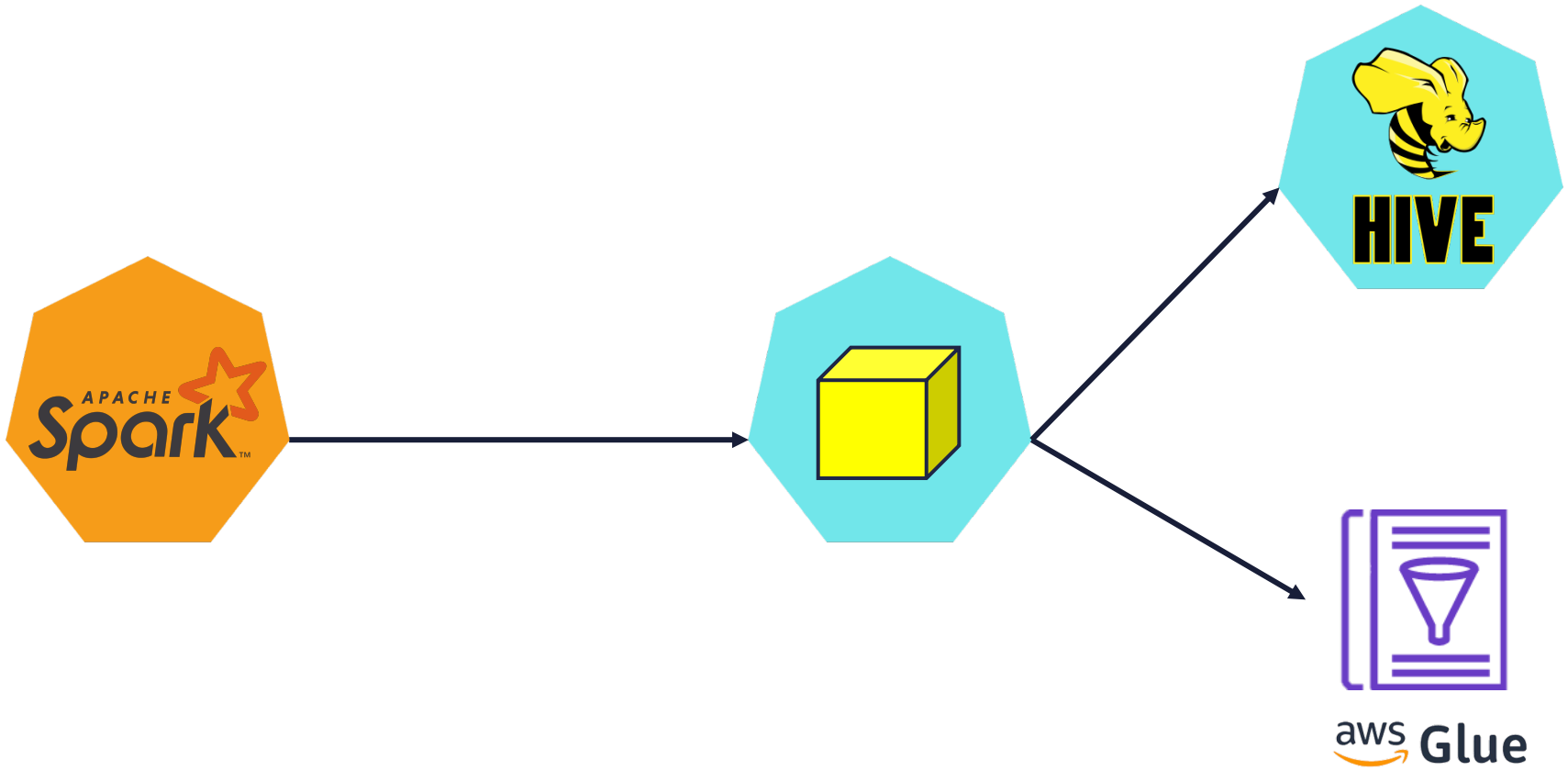
Kerberos

Hundreds of developers struggling with Kerberos?

Not on my watch



Spark single catalog limitation



Resource Manager for Spark

✅ Deployable in any cloud

❌ Huge pain to operationalise

Resource Manager for Spark

CLOUDERA

✅ Deployable in any cloud
✅ Easier to operationalise

❌ Quite hard to integrate across instances

Resource Manager for Spark

✅ Deployable in any cloud
✅ Easier to operationalise
✅ Federation ease integration

❌ Vendor lock-in

Resource Manager for Spark

✅ Deployable in any cloud
✅ No vendor lock-in
✅ Good isolation
✅ Huge configurability

❌ Huge pain to operationalise
❌ Maintain your Spark “distro”

Resource Manager for Spark

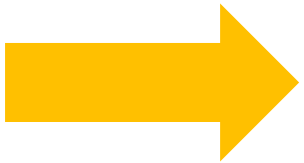
- ✅ Deployable in any cloud
- ✅ Easier to operationalise
- ✅ No vendor lock-in
- ✅ Good isolation
- ✅ Huge configurability

- ❌ Maintain your Spark “distro”

Smooth migration – evil master plan

1. Hide low level details
2. Introduce concept of deployment options
3. Build multi-cloud support
4. Add Azure deployment options
5. Gently roll out upgrades
6. Profit🤞

Step 1.1 – Hide storage and table provisioning

Cloudformation  Cloud agnostic descriptor

Step 1.1 – Hide storage and table provisioning

```yaml
version: v3
type: parallelread
entityName: customer
entityVersion: v1
description: customer data from the financial system
coldStorage:
  format: parquet
  location:
    bucket: finance_customer_${}
    prefix: bronze
    provider: aws|azure
  hasHistory: false
  partitioningColumns: [country]
columns:
  - name: fullName
    type: string
          - dgItaly1
  - name: address
    type: string
    optional: true
```

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Step 1.2 – hide Spark low level details

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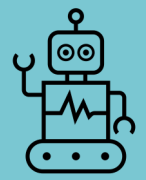
pre-built Templates

Step 2.1 – Deployment options

Introduce batch job deployment descriptor with deployment target

The project skeleton/template is auto-configured from the deployment descriptor



The CI/CD pipeline takes care of setting everything up

Step 2.1 – Deployment options

```yaml
specVersion: v1
name: "helloworld"
sources:
  - domain: "Finance"
    name: "customer"
    version: "v1"
  - domain: "Ecommerce"
    name: "orders"
    version: "v2"
sink:
  domain: "Marketing"
  name: "most_spending_customers"
  version: "v1"
framework: #technology specific configuration
  kind: spark-2.4.4-emr6-livy-scala
  cluster: emr1
  entrypointClass: "io.contoso.app.HelloWorld"
  dependencies: []
  configurations:
    spark.task.maxFailures: 6
    spark.dynamicAllocation.enabled: false
```

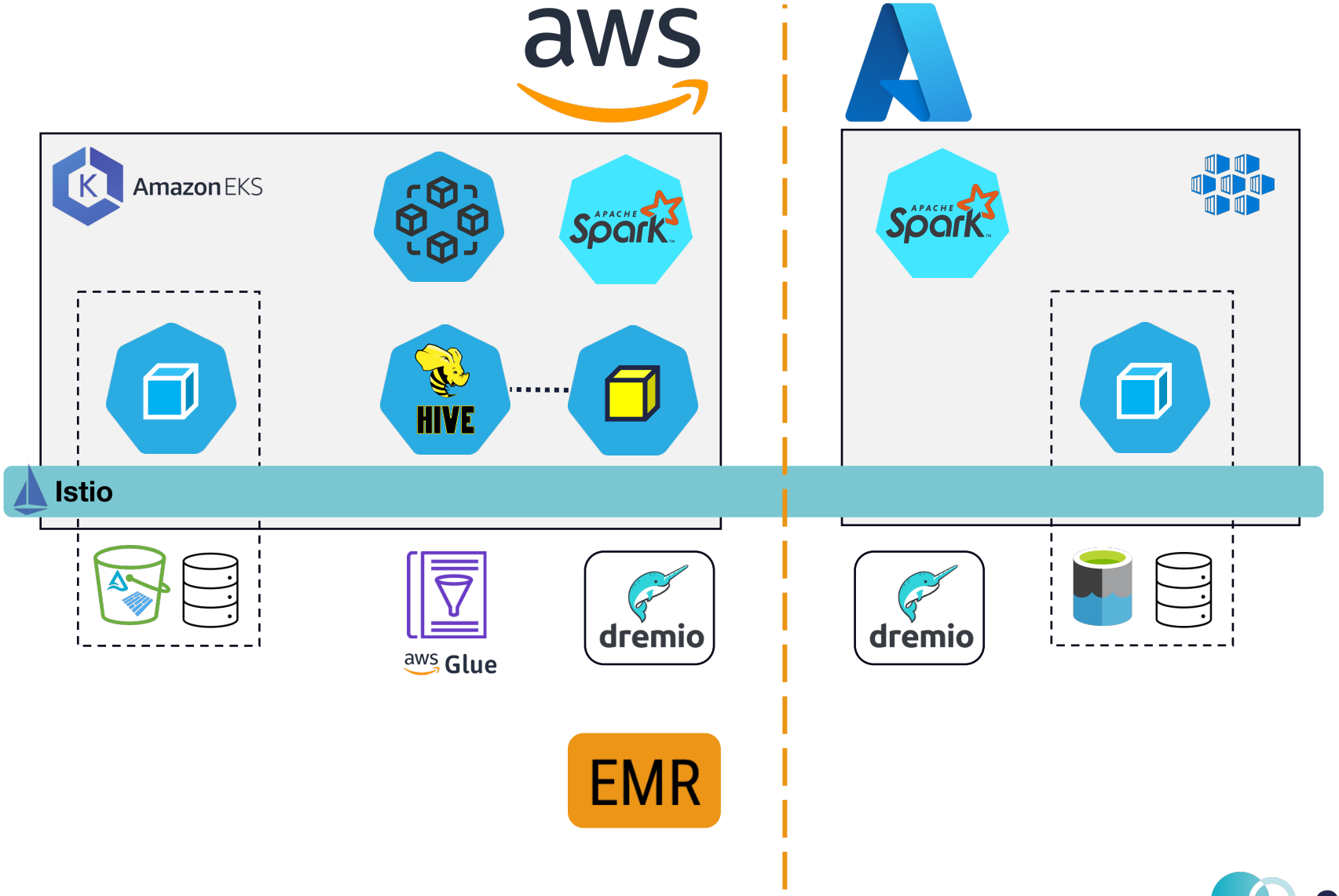
Step 3 – Build azure support

- Extend our sdk to support Azure/ADLS
- Prepare base container images
- Hide s3/adls setup on SDK side
- Setup spark context with custom catalog

Step 4 – Add azure support

```yaml
specVersion: v1
name: "helloworld"
sources:
  - domain: Finance
    name: customer
    version: v1
  - domain: Ecommerce
    name: orders
    version: v2
sink:
  domain: Marketing
  name: most_spending_customer
  version: v1
framework: # technologyspecific configuration
  kind: spark-3.4.1-k8s-livy-scala
  cluster: azure1
  entrypointClass: io.contoso.app.HelloWorld
  dependencies: [ ]
```

Full picture



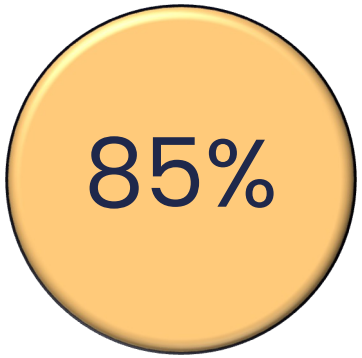
Gently roll-out

- We don’t FORCE anyone to update to Spark newest version
- New applications run on Kubernetes by default
- Applications running on EMR can’t access datasets stored on Azure
- So we give them a good reason to update!

Roll out status – 6 months in

Thanks to the platform custom catalog we know that:

multi-cloud



upgraded

New app on Azure
(3% overall)

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Lessons learnt

Abstracting infra is good way of handling a transition

Truly open standards are there and help a lot

You can/should create your internal standards (when needed)

You **need** a Platform Team

Data has gravity (egress traffic is expensive)

Next steps – caching

There are only two hard things in Computer Science: cache invalidation and naming things.

Phil Karlton

Next steps – smart scheduler

My favourite subject at school was avoiding unnecessary work

Prince Philip

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Next steps – true independence

Independence is not freedom, it's a responsibility

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Thank you!

Questions?

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