AWS re:Invent

NOV. 29 – DEC. 3, 2021 | LAS VEGAS, NV

DAT301

Amazon DocumentDB deep dive

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Product Manager – Amazon DocumentDB
AWS

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Head of Data Platform
Rappi

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Agenda

What is Amazon DocumentDB (with MongoDB compatibility)?

What is unique about Amazon DocumentDB's architecture?

What's new?

Case study: Rappi

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What is Amazon DocumentDB?

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Amazon DocumentDB

FAST, SCALABLE, AND FULLY MANAGED MONGODB-COMPATIBLE DATABASE SERVICE



Fast and scalable

- Scale compute in minutes
- Storage and I/O autoscaling
- Storage scales to 64 TB
- Scale out to 15 replicas for millions of reads
- Globally distributed



Fully managed

- Built-in high availability
- Backups enabled by default
- Durable by default
- Security best practices by default
- Automatic patching
- Monitoring and alerting



MongoDB compatible

- Applications, drivers, and tools can be used with little or no change
- Supports hundreds of APIs, operators, and stages
- Continually working backward from customers to deliver the capabilities they need

aws

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Amazon DocumentDB

FAST, SCALABLE, AND FULLY MANAGED MONGODB-COMPATIBLE DATABASE SERVICE



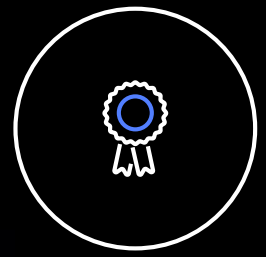
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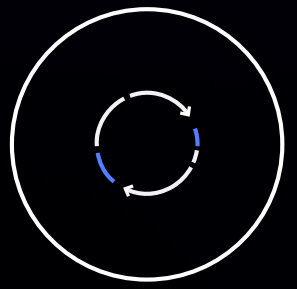
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When should you use a document database?



JSON data



Flexible schema for fast iteration



Ad-hoc query capabilities



Flexible indexing



Operational and analytics workloads

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When should you use a document database?



Document use case: gaming user profiles

```
{
  userid: 181276,
  username: "sue1942",
  name: {first: "Susan",
         last: "Benoit"}
}
```



```
{
  userid: 181276,
  username: "sue1942",
  name: {first: "Susan",
         last: "Benoit"},
  ExplodingSnails: {
    hi_score: 3185400,
    global_rank: 5139,
    bonus_levels: true
  },
} promotions: ["new user","5%","snail lover"]
}
```

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DFL

ODX

Zulily

woot!

monkey

SAMSUNG

hudl

HABBY

freshop
Easy Online Groceries

DOW JONES

ENKIDOO ai

Iron

sportradar

Rappi

amazon

Plume

smartsheet

朝日新聞

zipwhip

The
Washington
Post

FINRA

CapitalOne

freshworks

BBC

digital

sandstone
TECHNOLOGY

punchh

Homage

knotion
knowledge in action

How is DocumentDB architected for NoSQL workloads at scale?

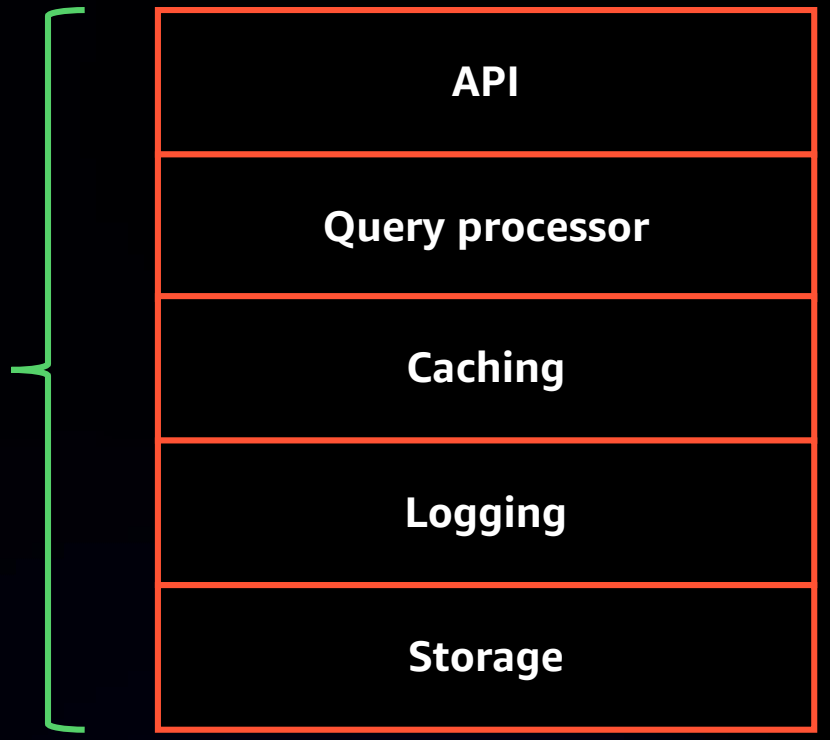
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Architecture

TRADITIONAL DATABASE ARCHITECTURE

Single monolithic architecture

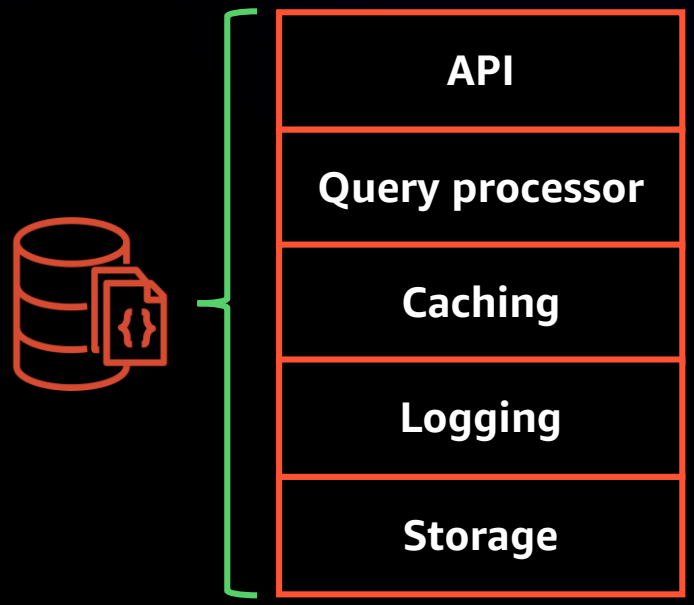




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Architecture

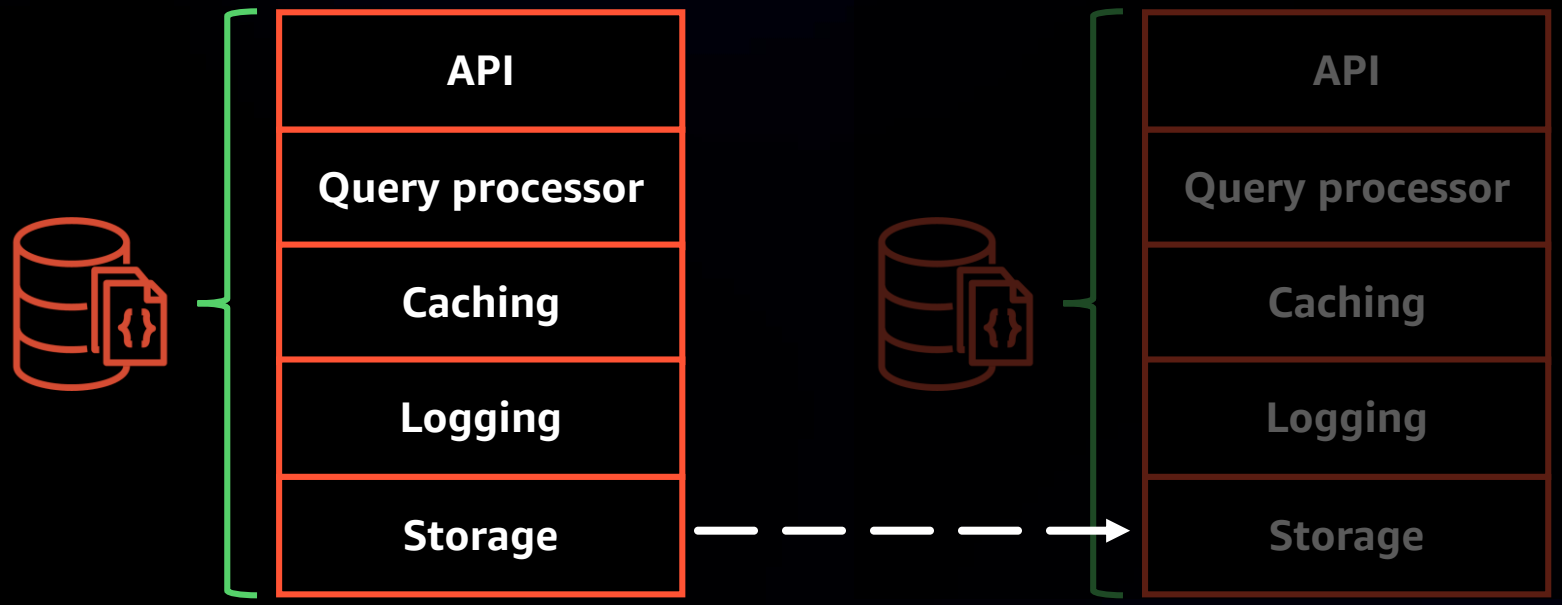
CHALLENGE: ADDING READ CAPACITY ON DEMAND



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Architecture

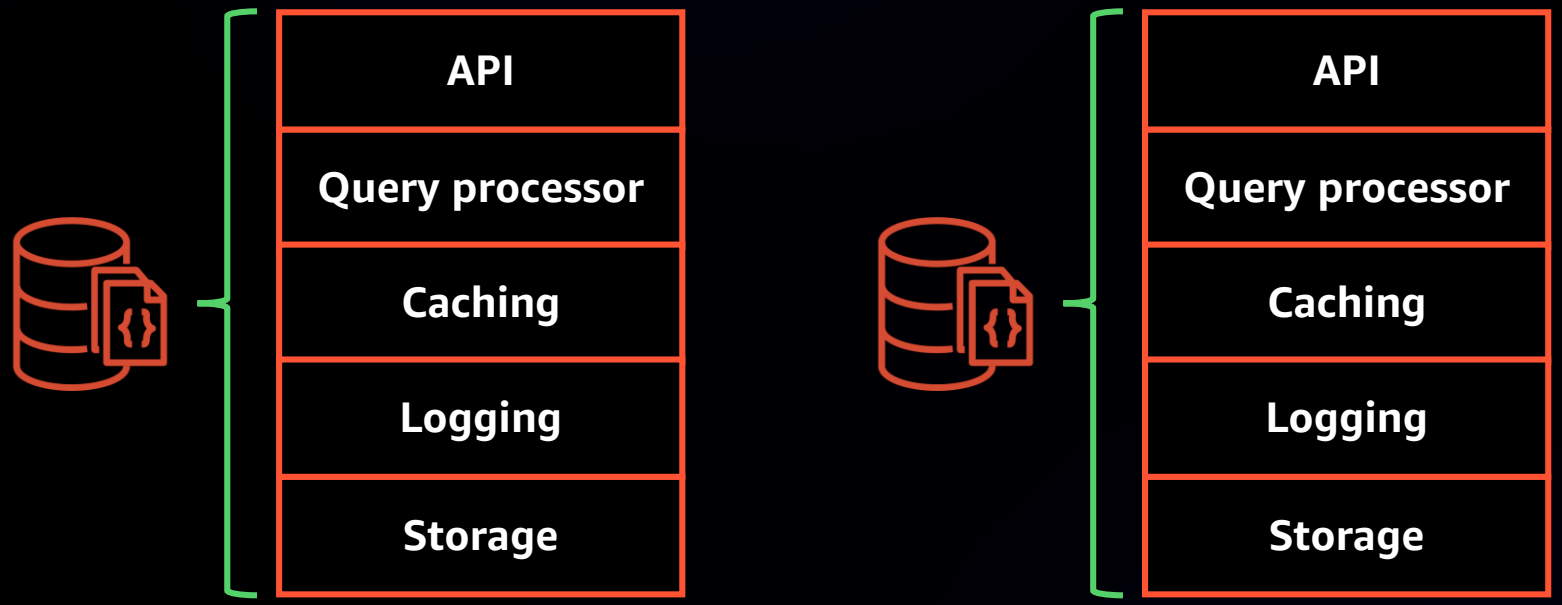
CHALLENGE: ADDING READ CAPACITY ON DEMAND



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Architecture

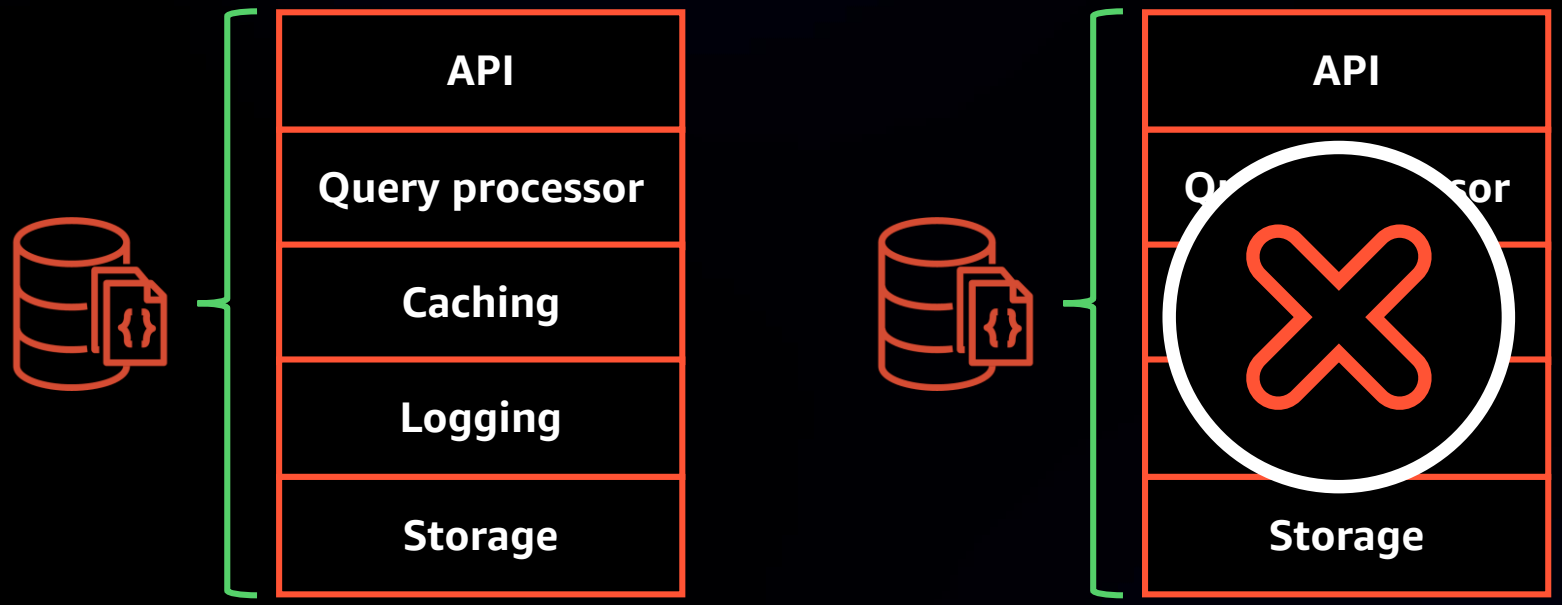
CHALLENGE: RECOVERING FROM NODE FAILURE



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Architecture

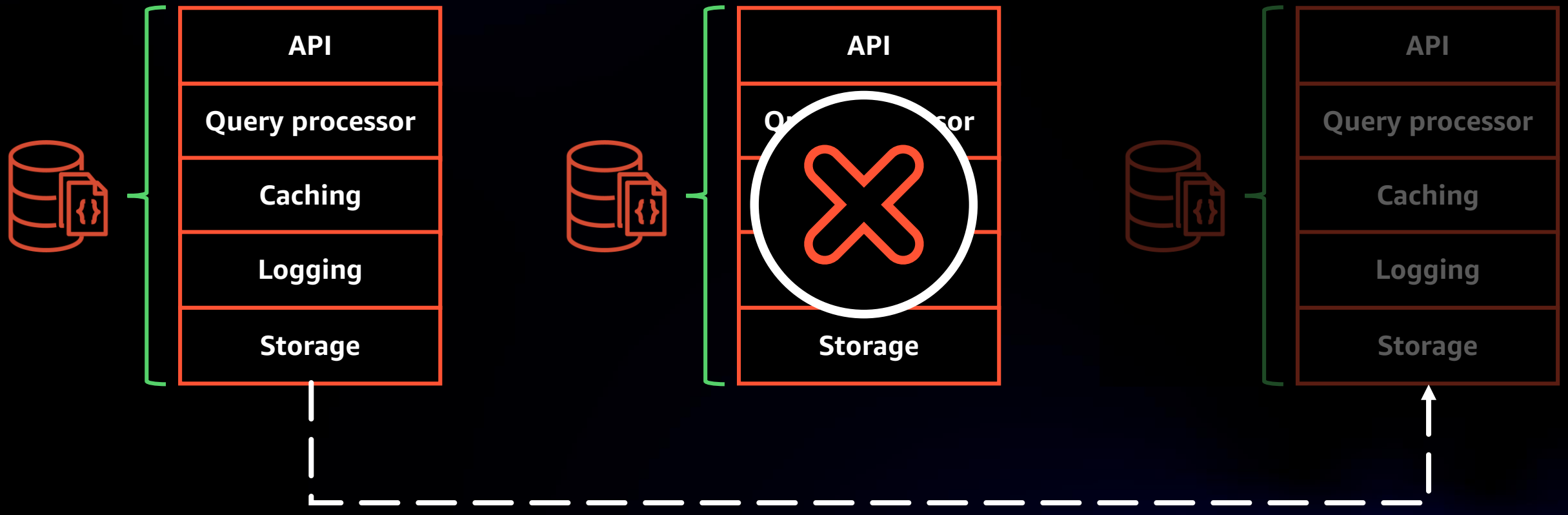
CHALLENGE: RECOVERING FROM NODE FAILURE



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Architecture

CHALLENGE: RECOVERING FROM NODE FAILURE

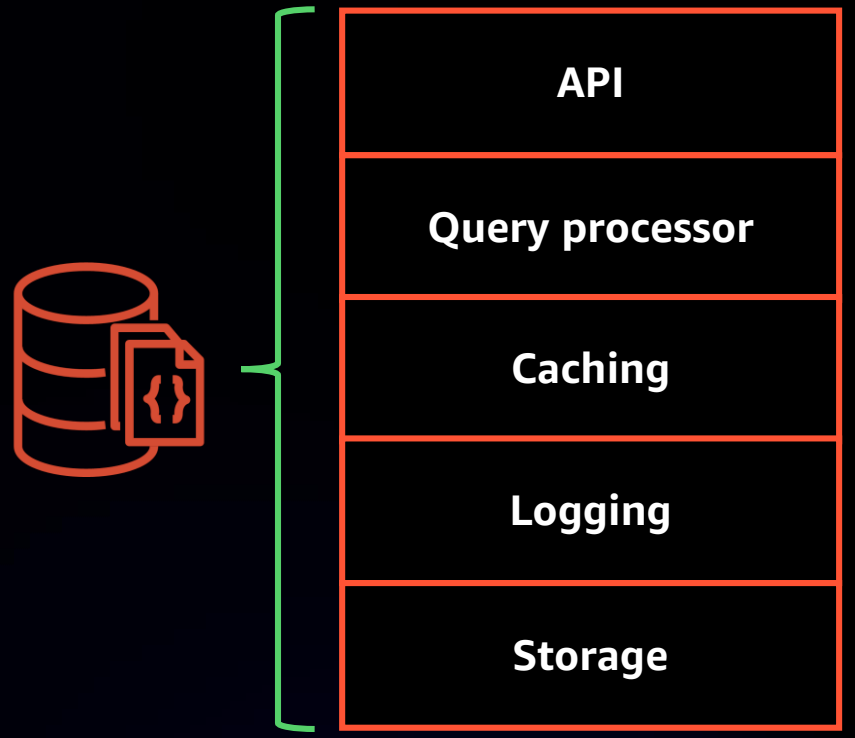


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Architecture

SCALING REQUIRES COPYING THE WHOLE STACK

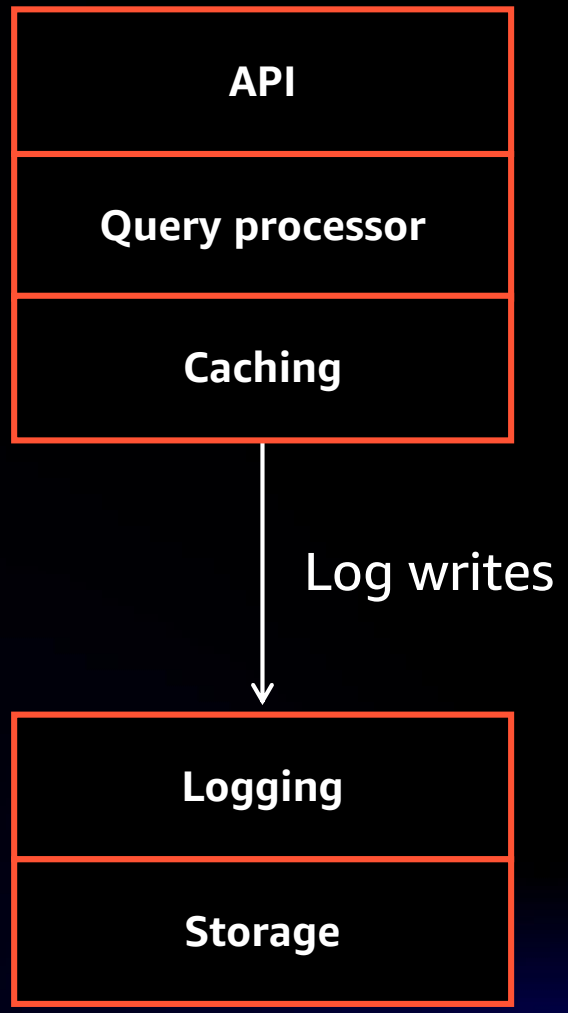
Single monolithic architecture



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Architecture

SEPARATION OF STORAGE AND COMPUTE



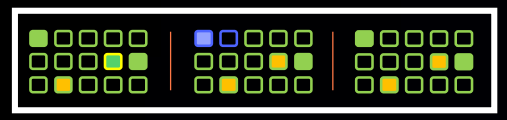
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Architecture

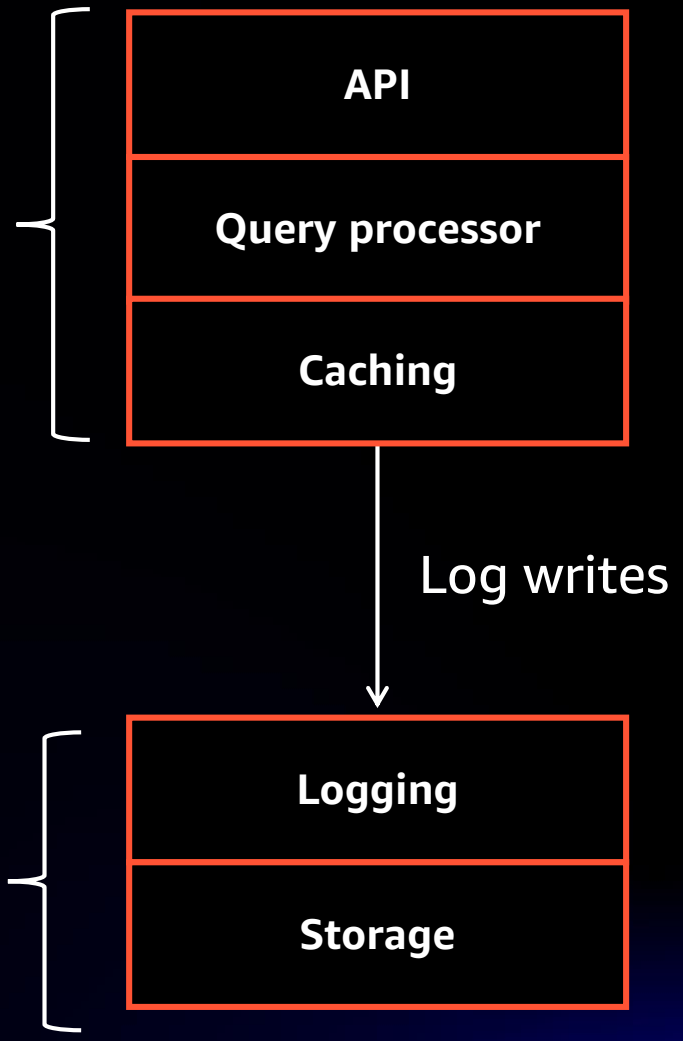
SEPARATION OF STORAGE AND COMPUTE



Compute layer



Storage layer



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Architecture

SEPARATION OF STORAGE AND COMPUTE



Compute layer

API

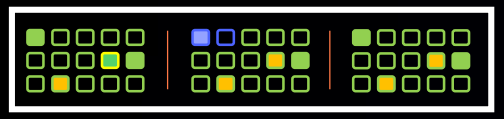
Query processor

Caching

Scale compute

Decouple compute and storage

Log writes



Storage layer

Logging

Storage

Scale storage

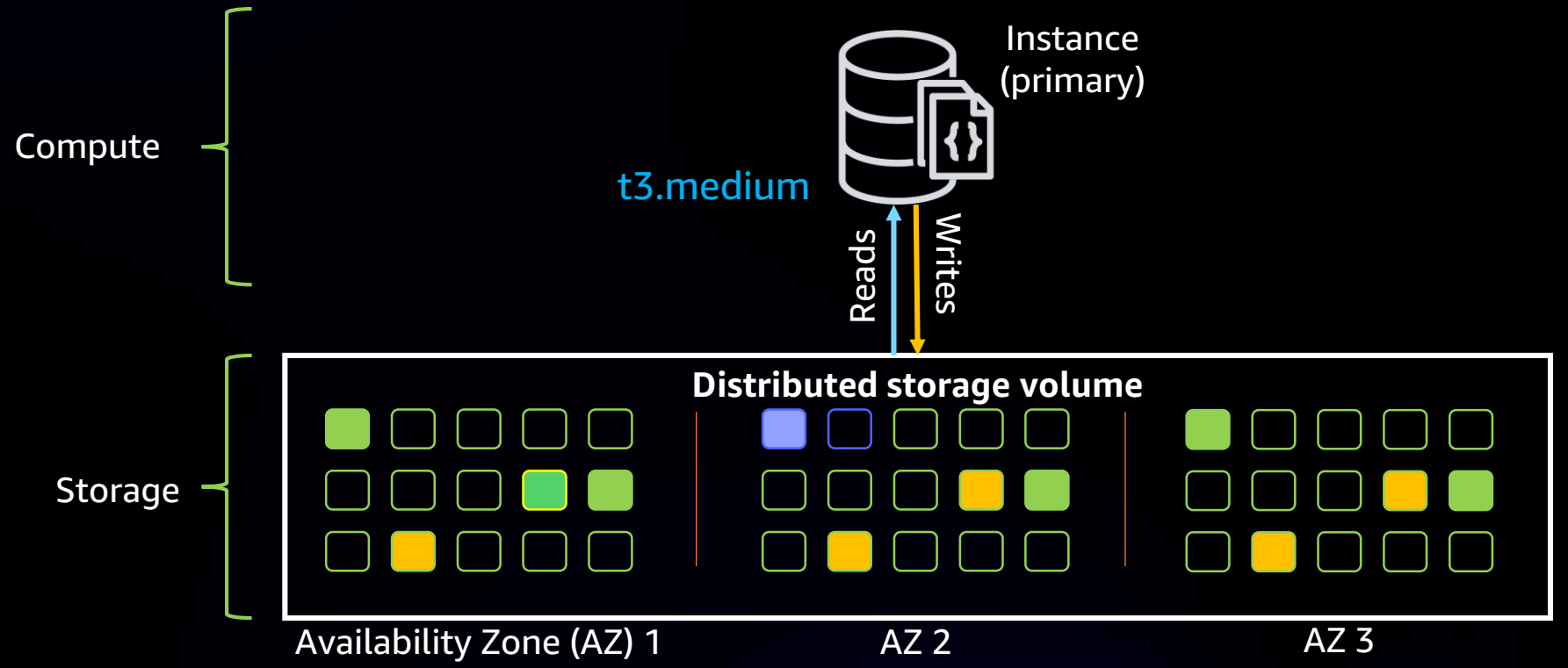
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Architecture

SEPARATION OF STORAGE AND COMPUTE

t3.medium: Dedicated, single-instance cluster for dev/test ($0.08/hr)

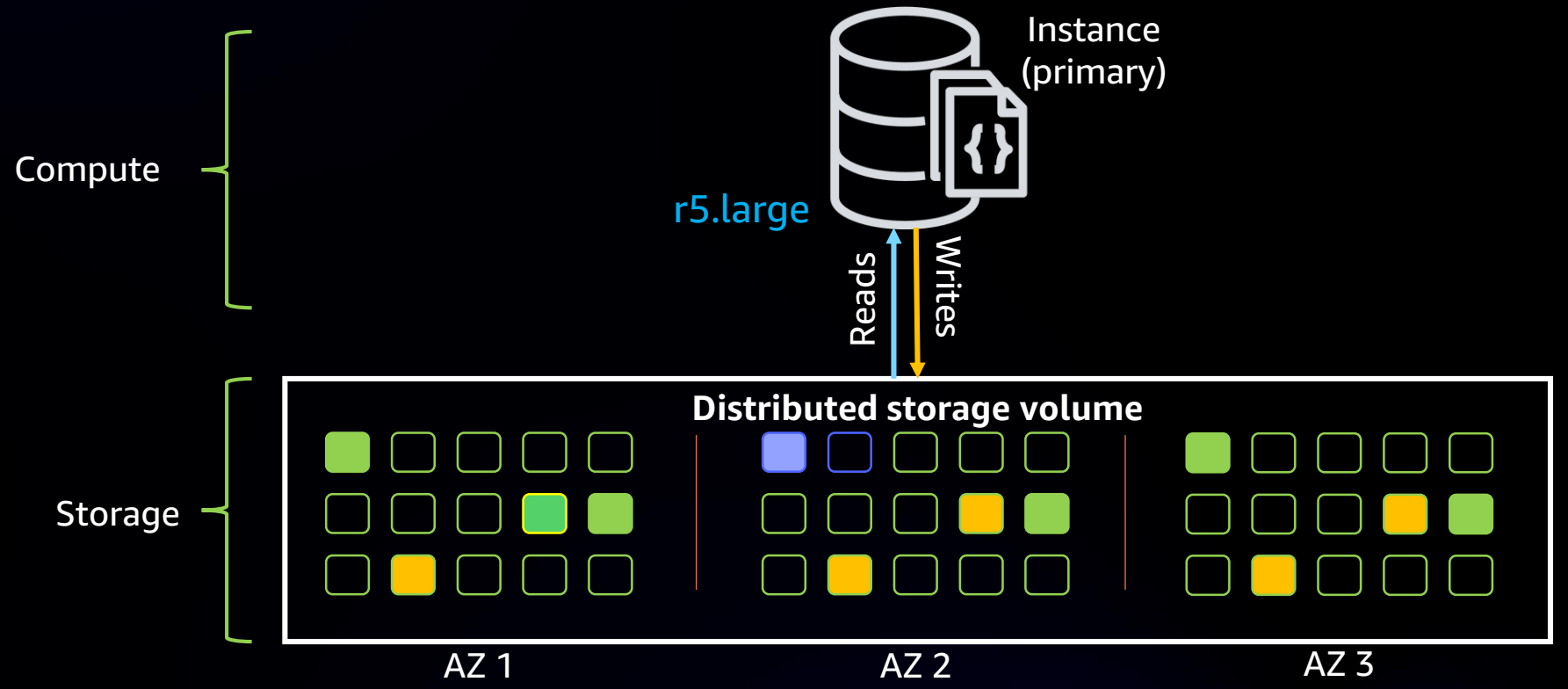


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Architecture

SEPARATION OF STORAGE AND COMPUTE

Scale up your existing instance in minutes, regardless of storage size

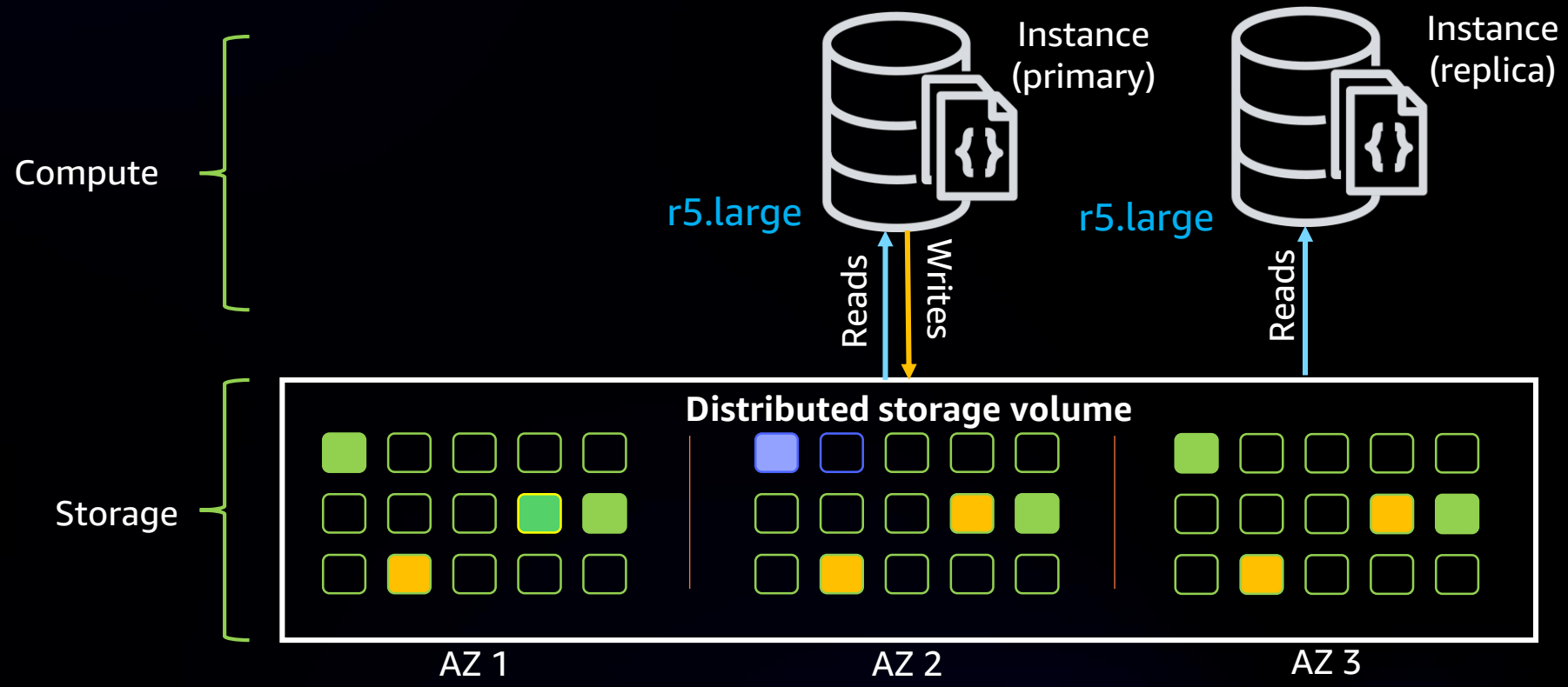


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Architecture

SEPARATION OF STORAGE AND COMPUTE

Add new instances in minutes, regardless of storage size

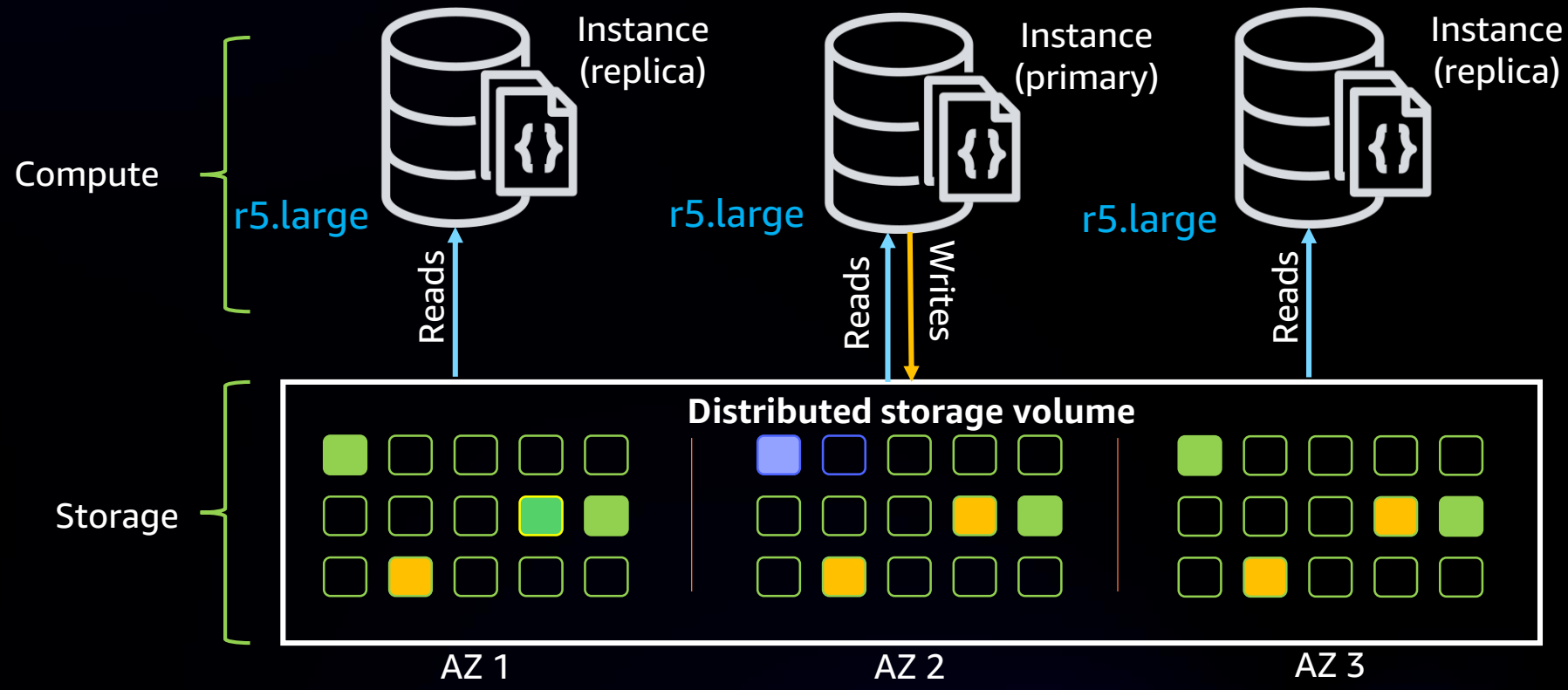


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Architecture

SEPARATION OF STORAGE AND COMPUTE

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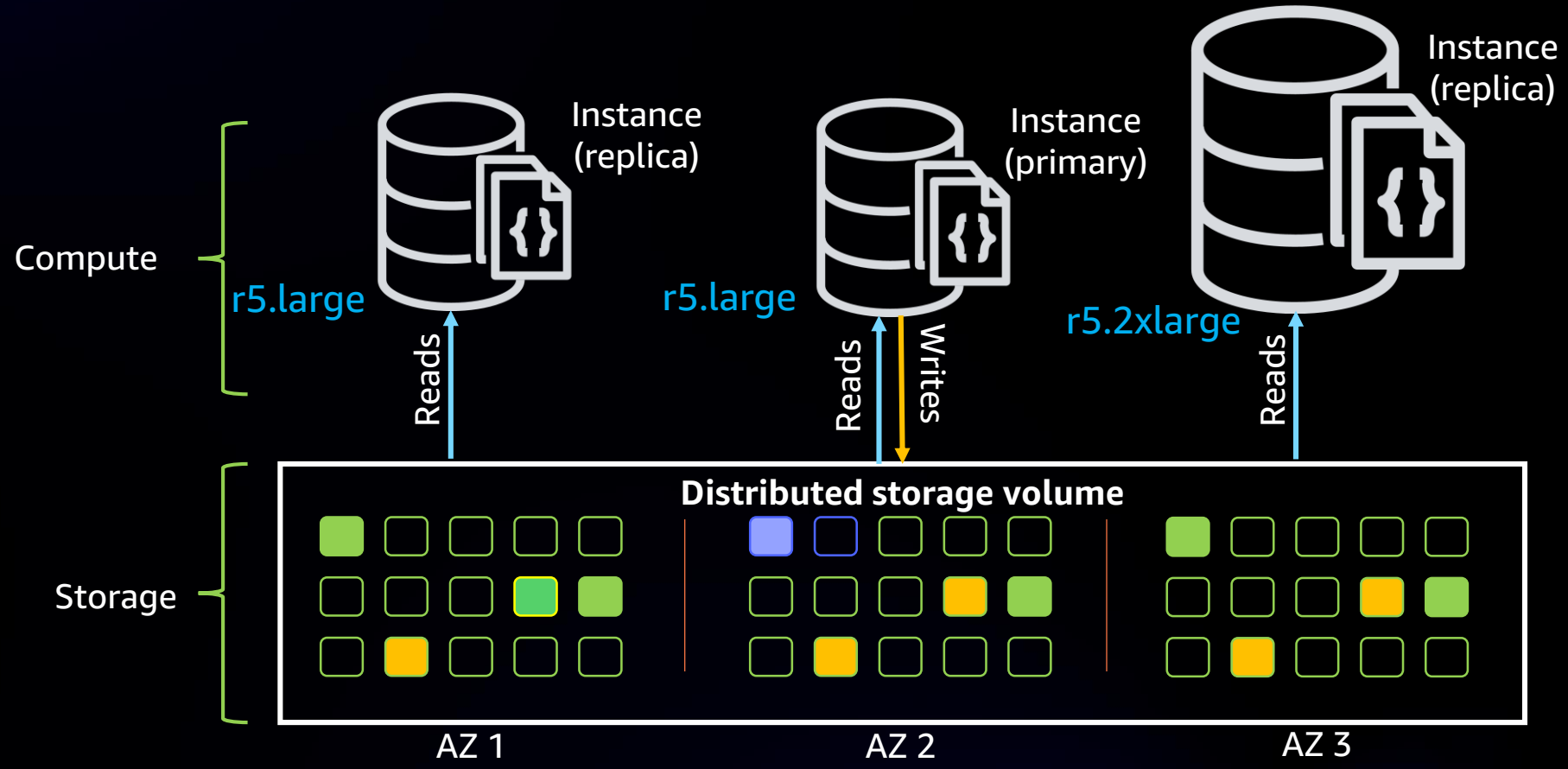


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Architecture

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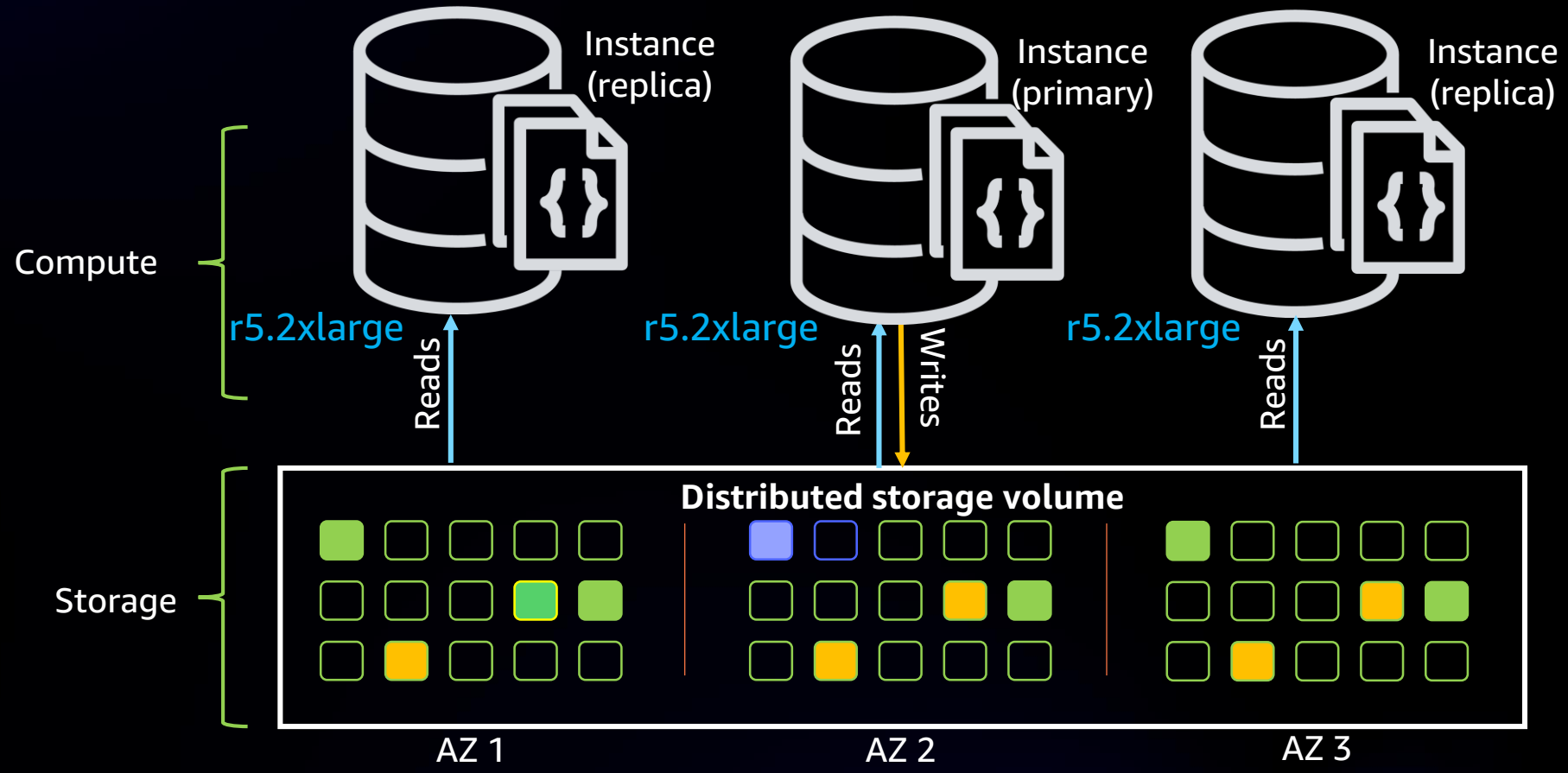


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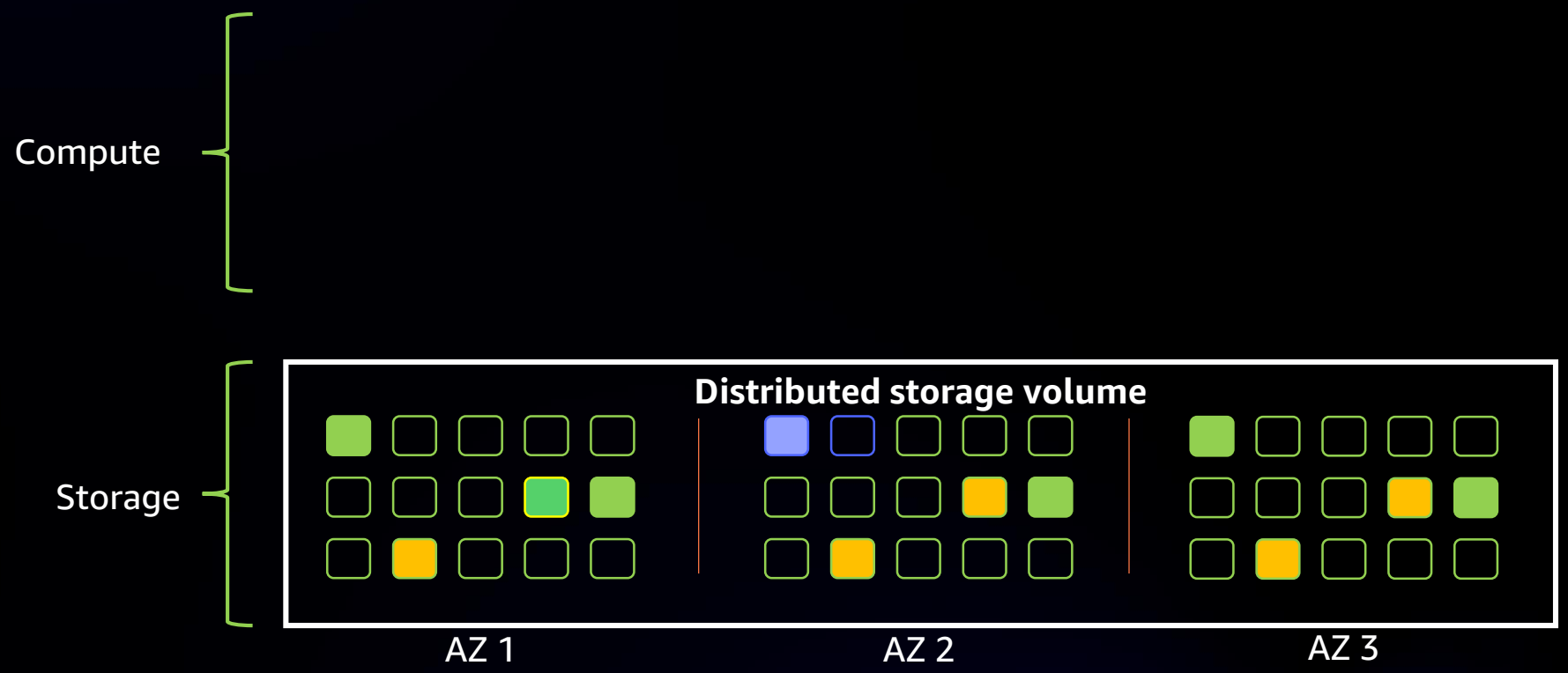


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Architecture

SEPARATION OF STORAGE AND COMPUTE

Compute and storage are separated to the degree that you can delete all compute and your data is still highly durable

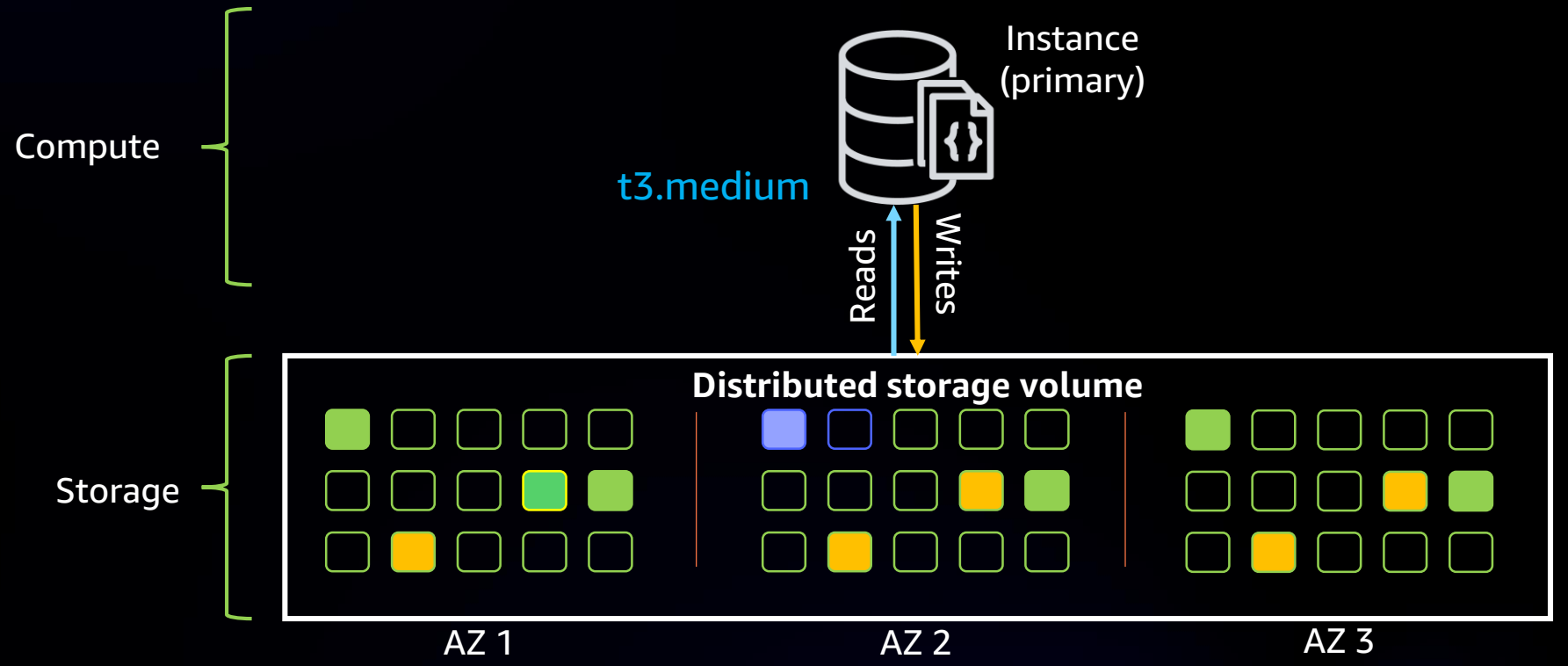


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Architecture

SEPARATION OF STORAGE AND COMPUTE

Single-node cluster is still highly durable



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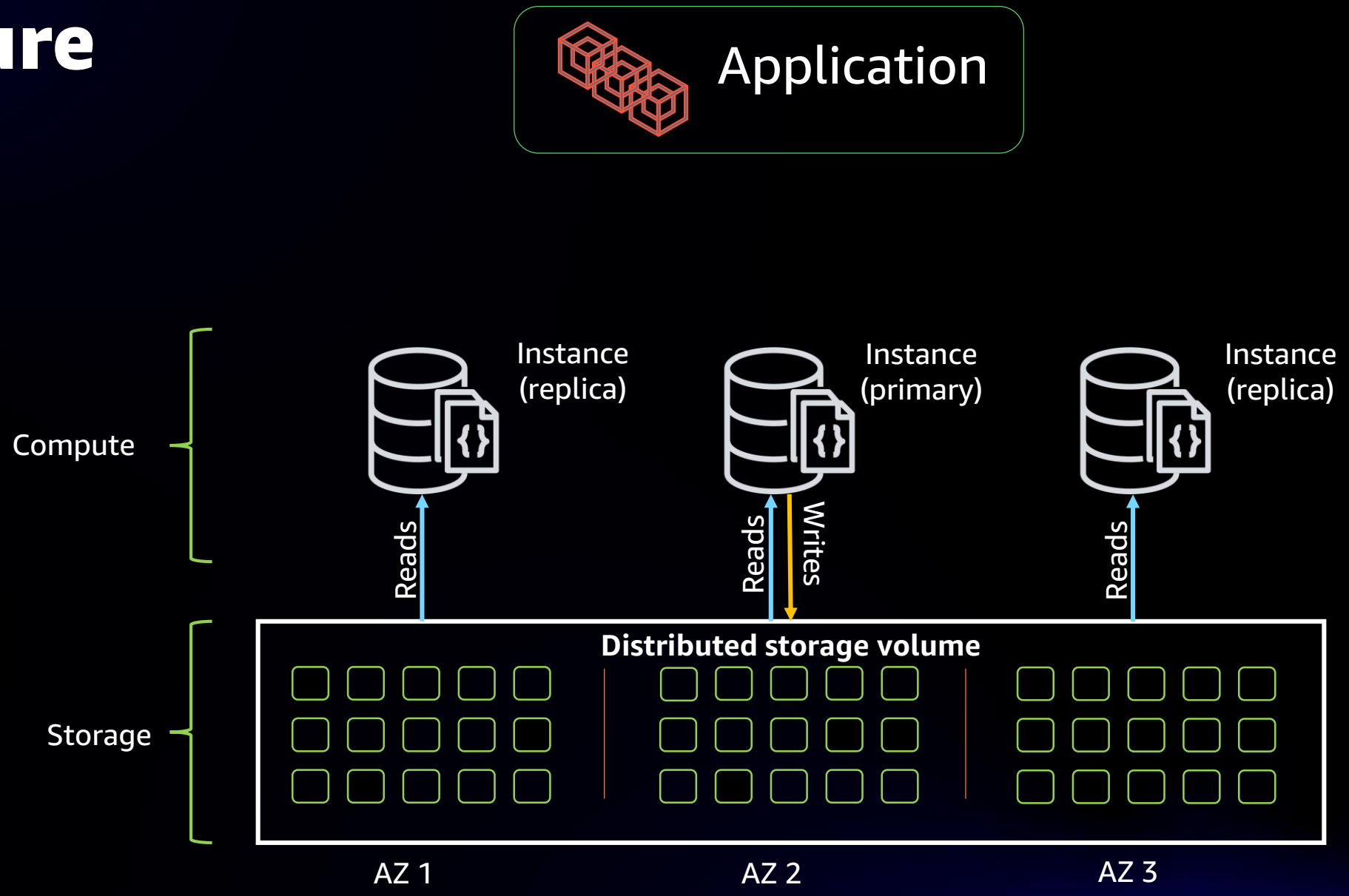
Replication

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Architecture

REPLICATION

Default write concern is w:4 and j:true

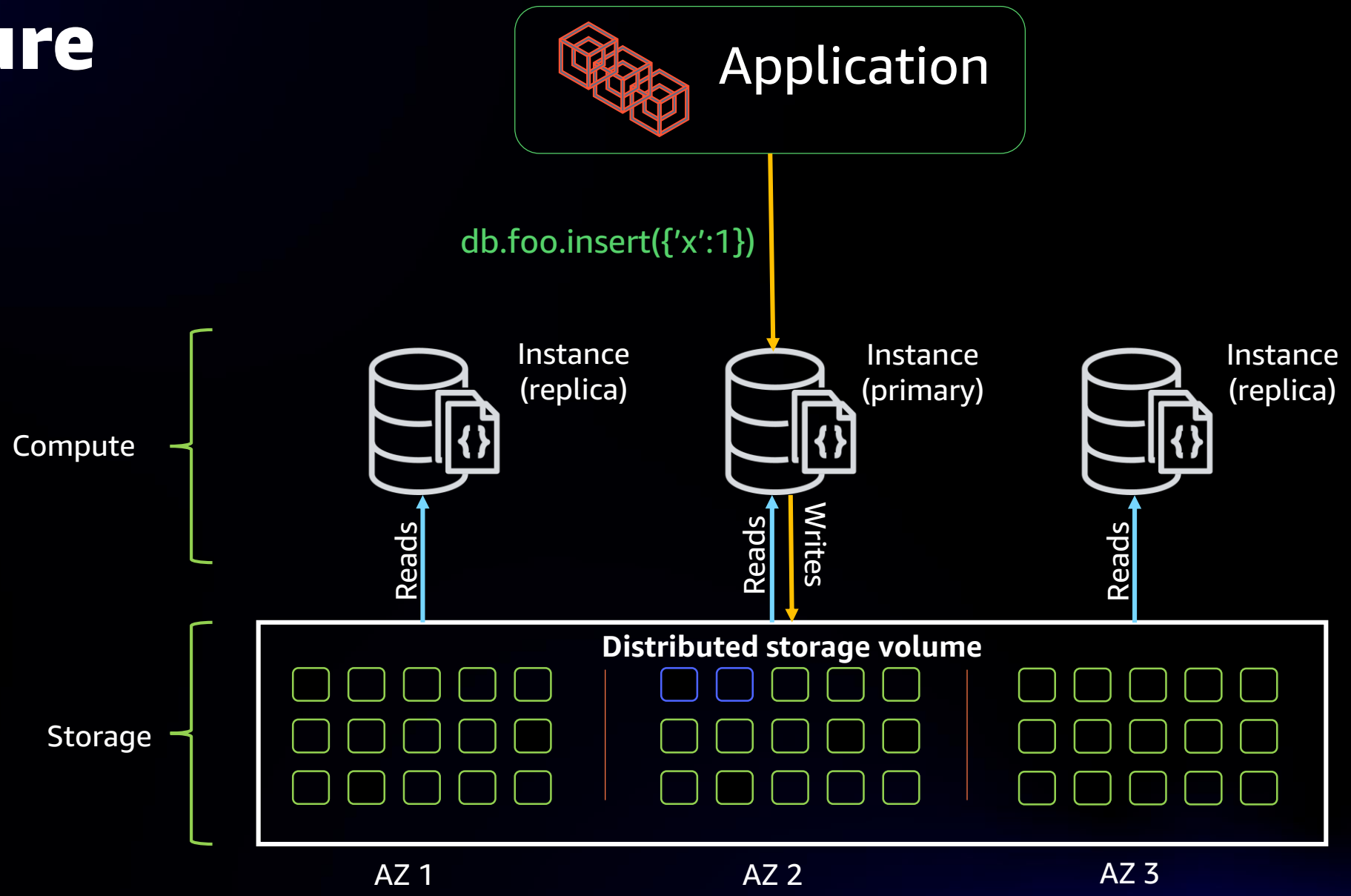


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Architecture

REPLICATION

Writes are acknowledged after a quorum if ($V_w = 4$)

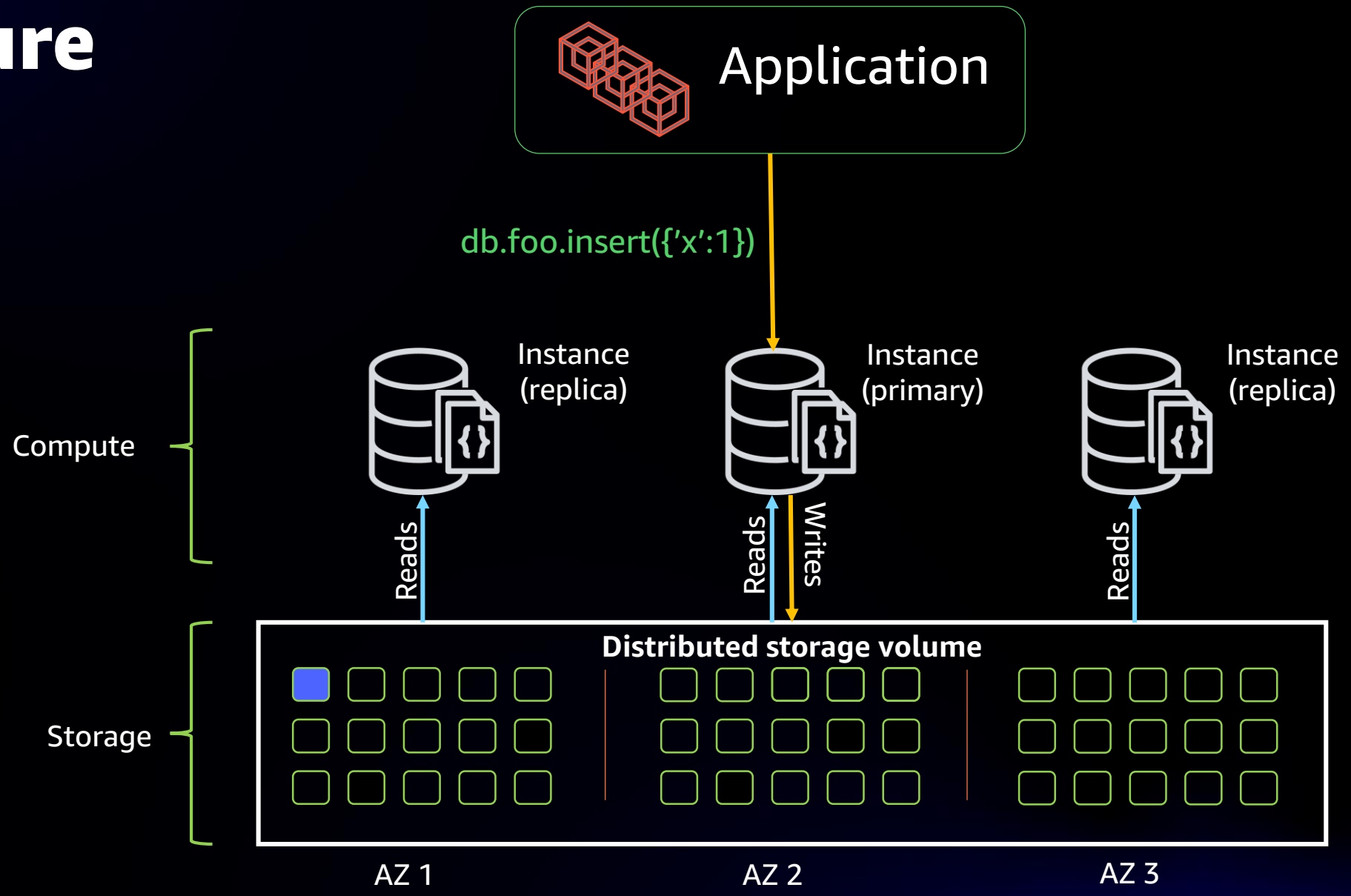


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Architecture

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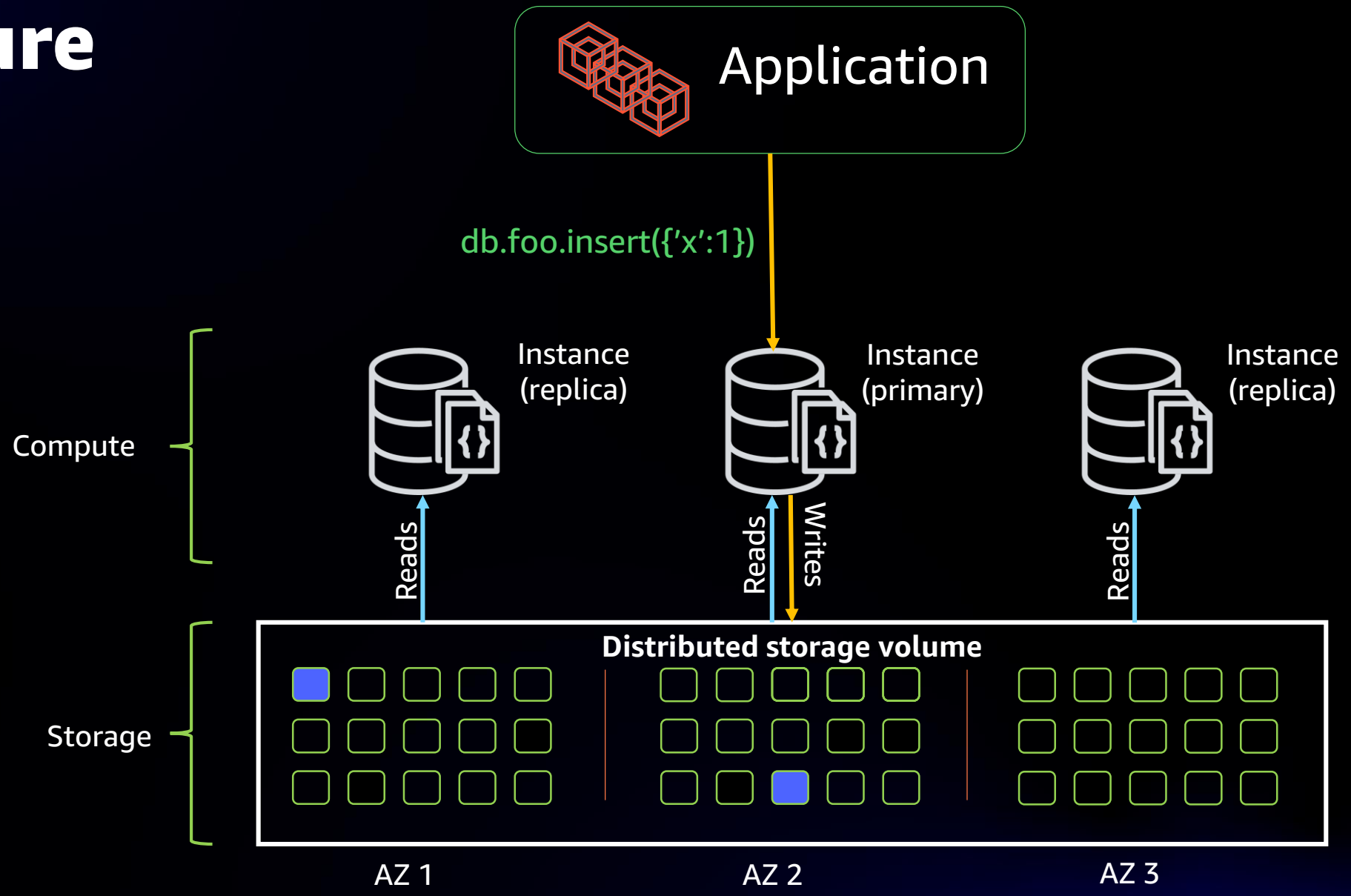
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Architecture

REPLICATION

Writes are acknowledged after a quorum if ($V_w = 4$)

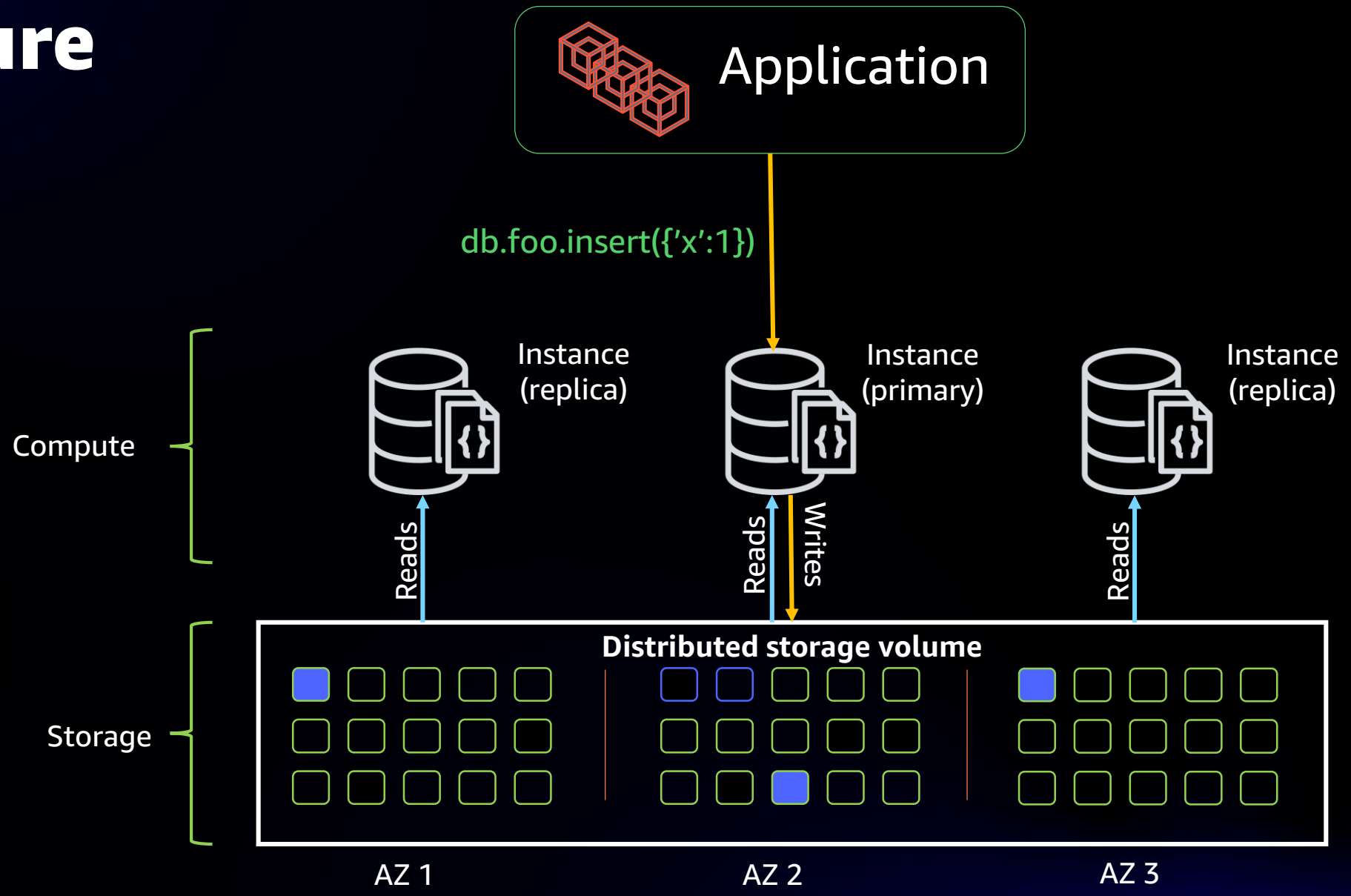


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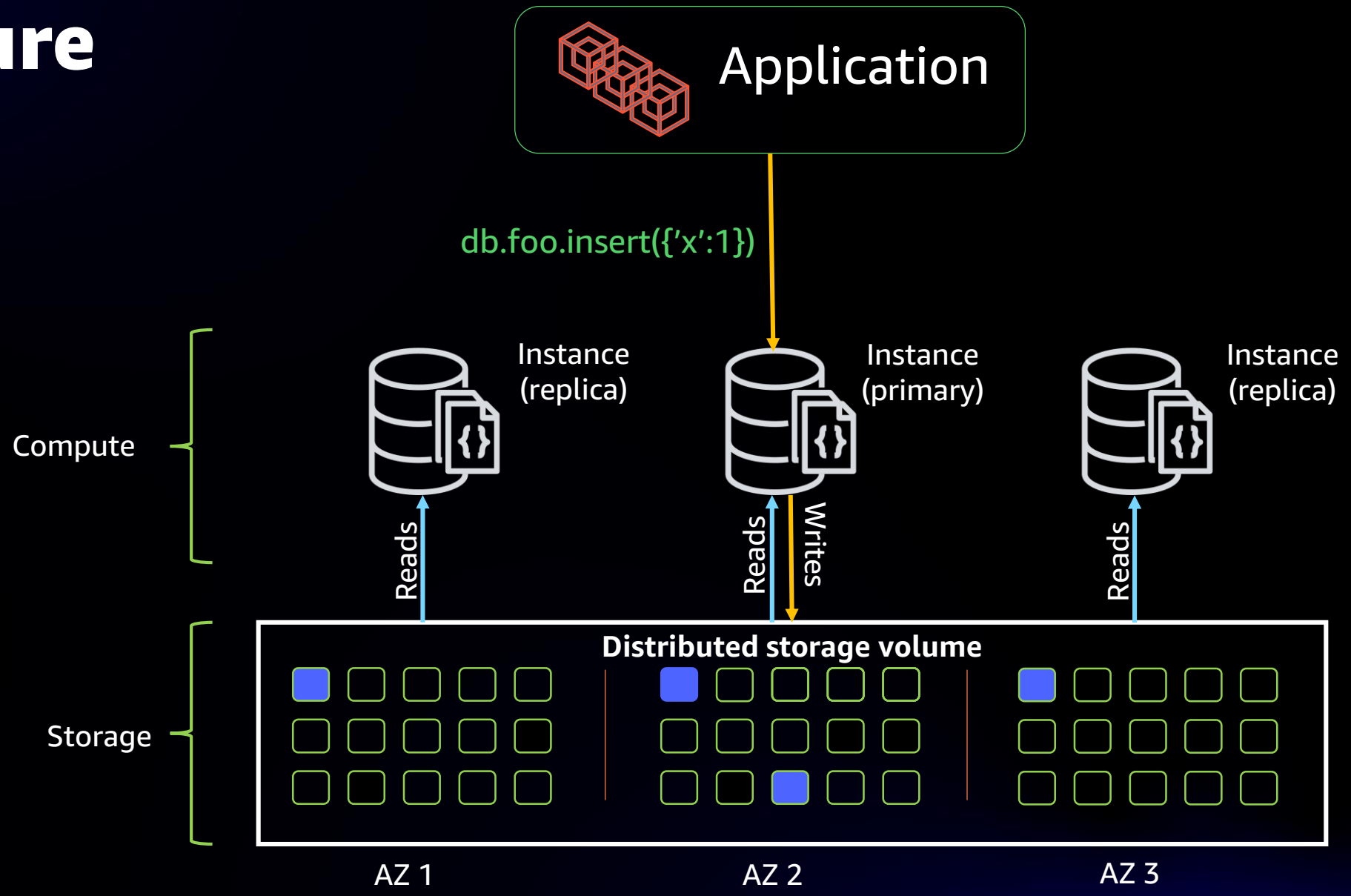


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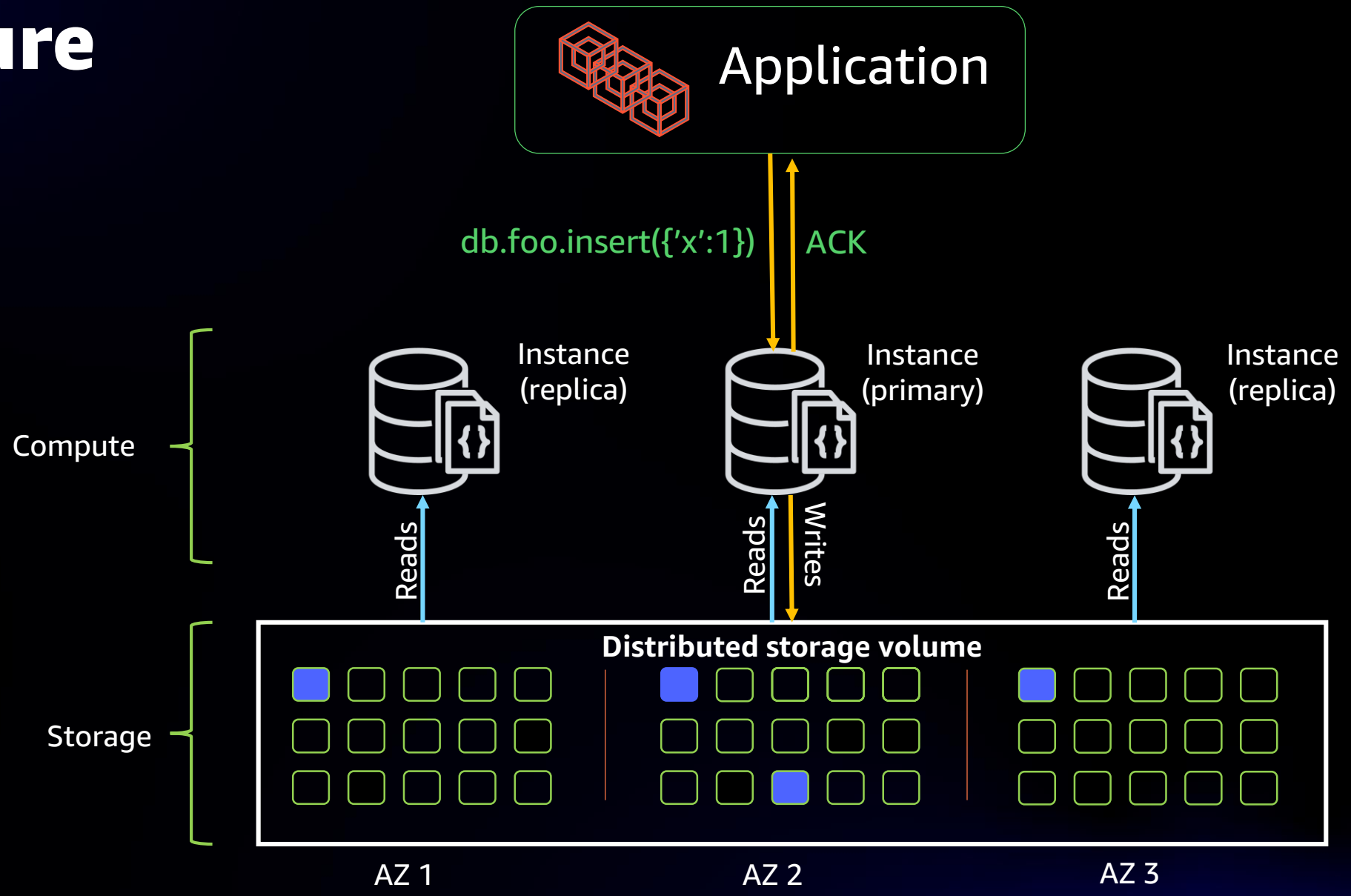


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Architecture

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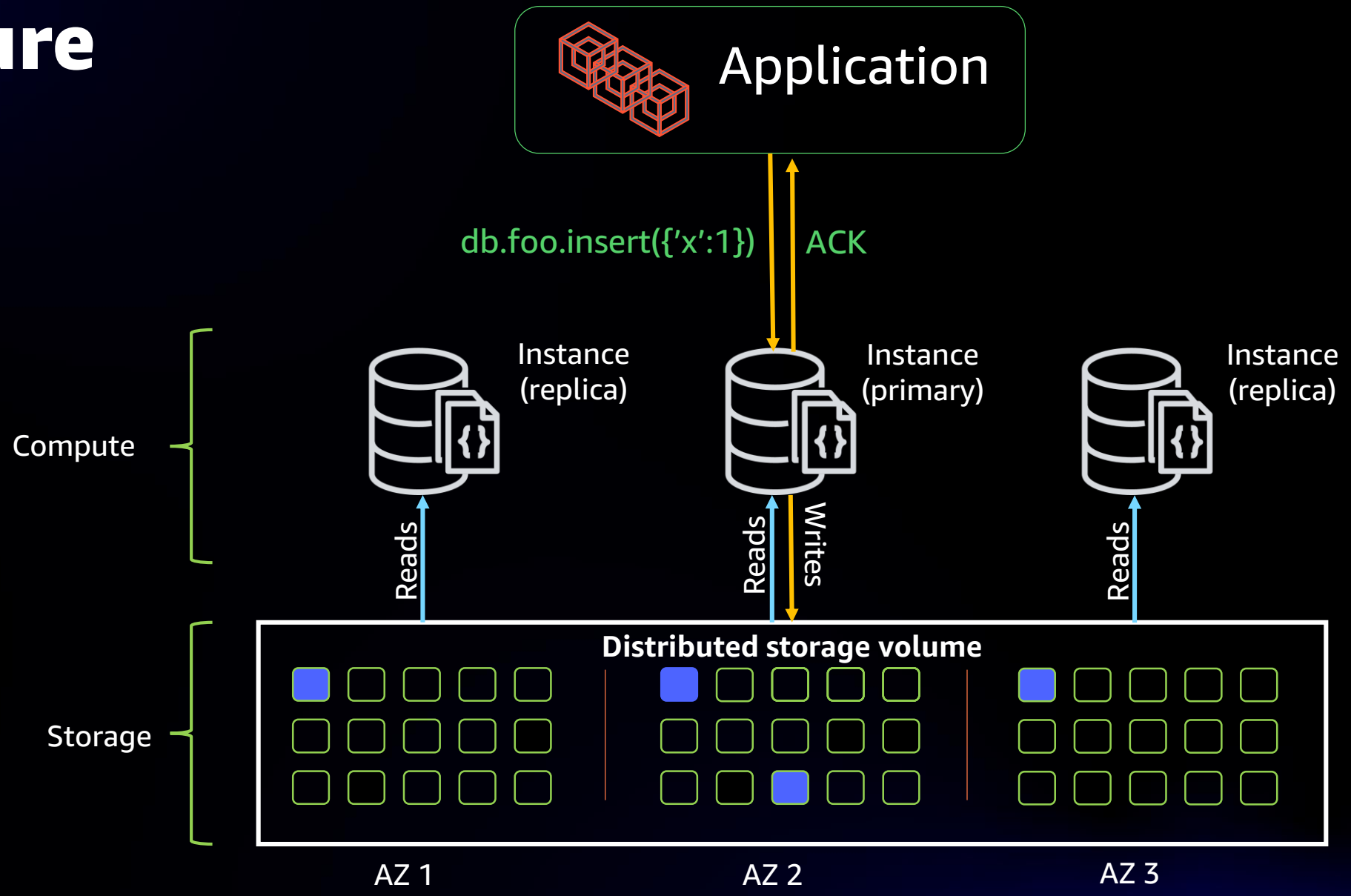


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Architecture

REPLICATION

Data is further replicated to achieve 6 copies across 3 AZs (V = 6)



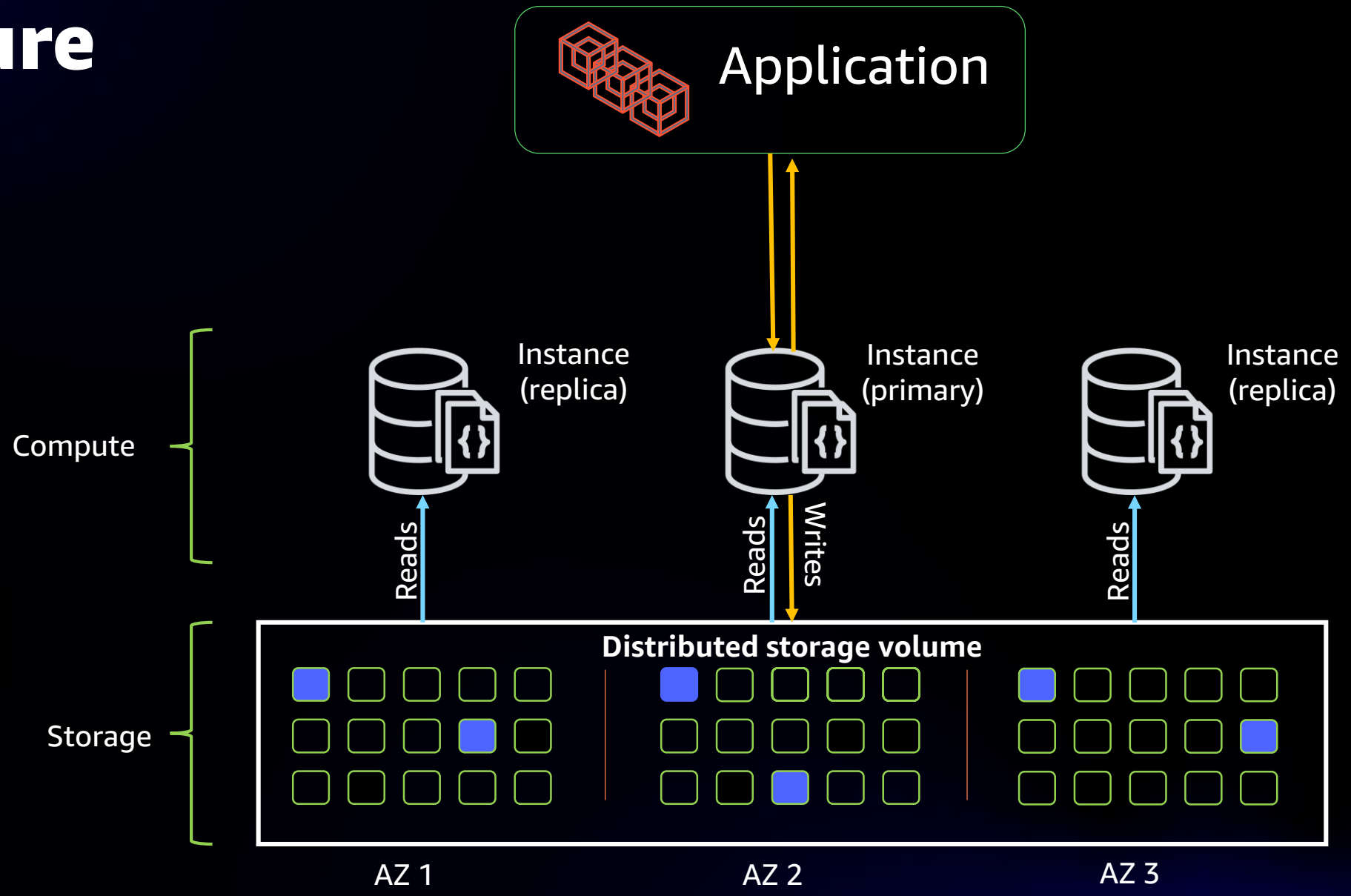
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Architecture

REPLICATION

Data is not replicating across instances

Replicas do not participate in data replication, freeing them up for reads



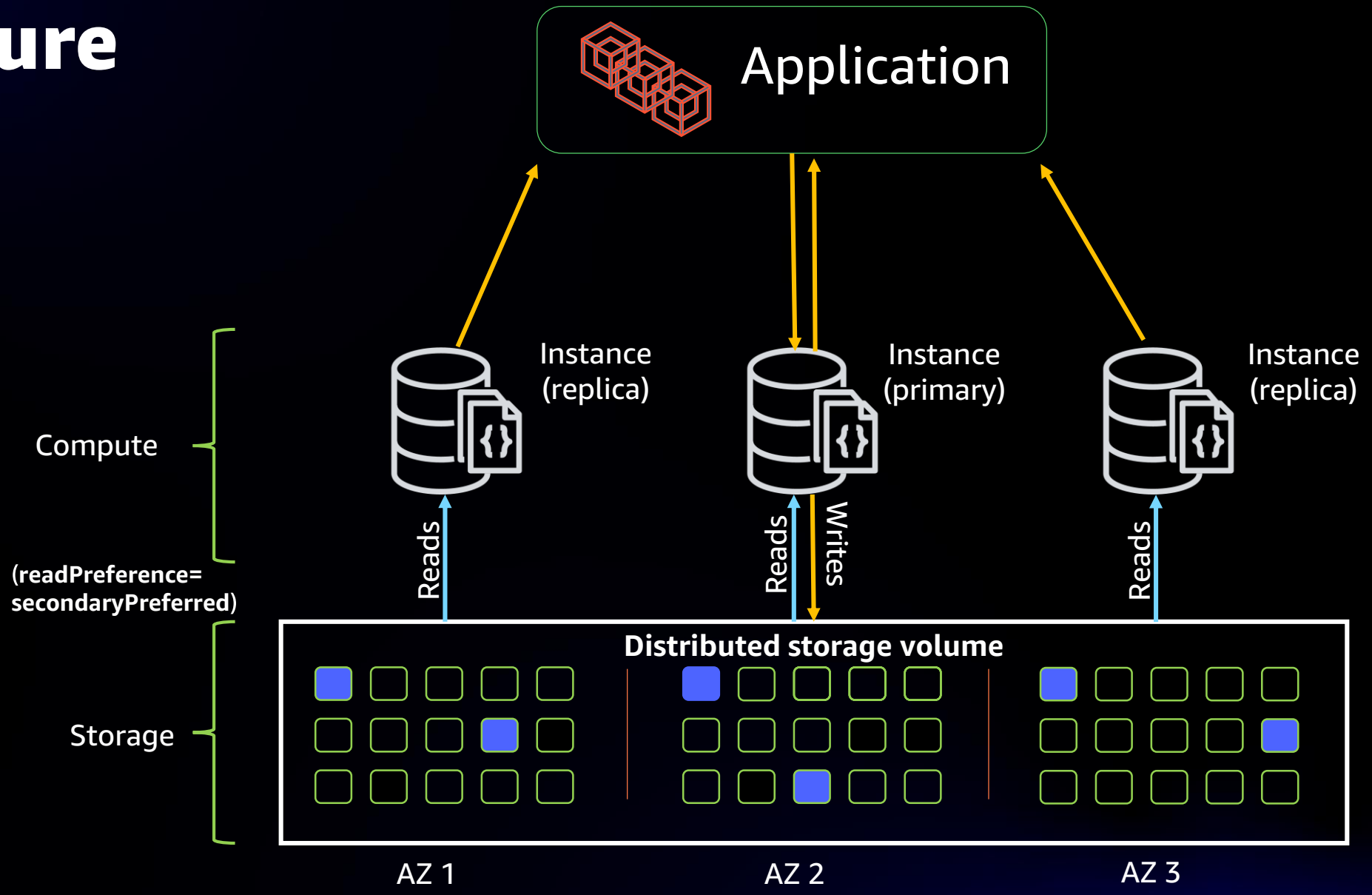
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Architecture

REPLICATION

As a best practice, we recommend connecting as a replica set

Connection string specifies read preference



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Durability

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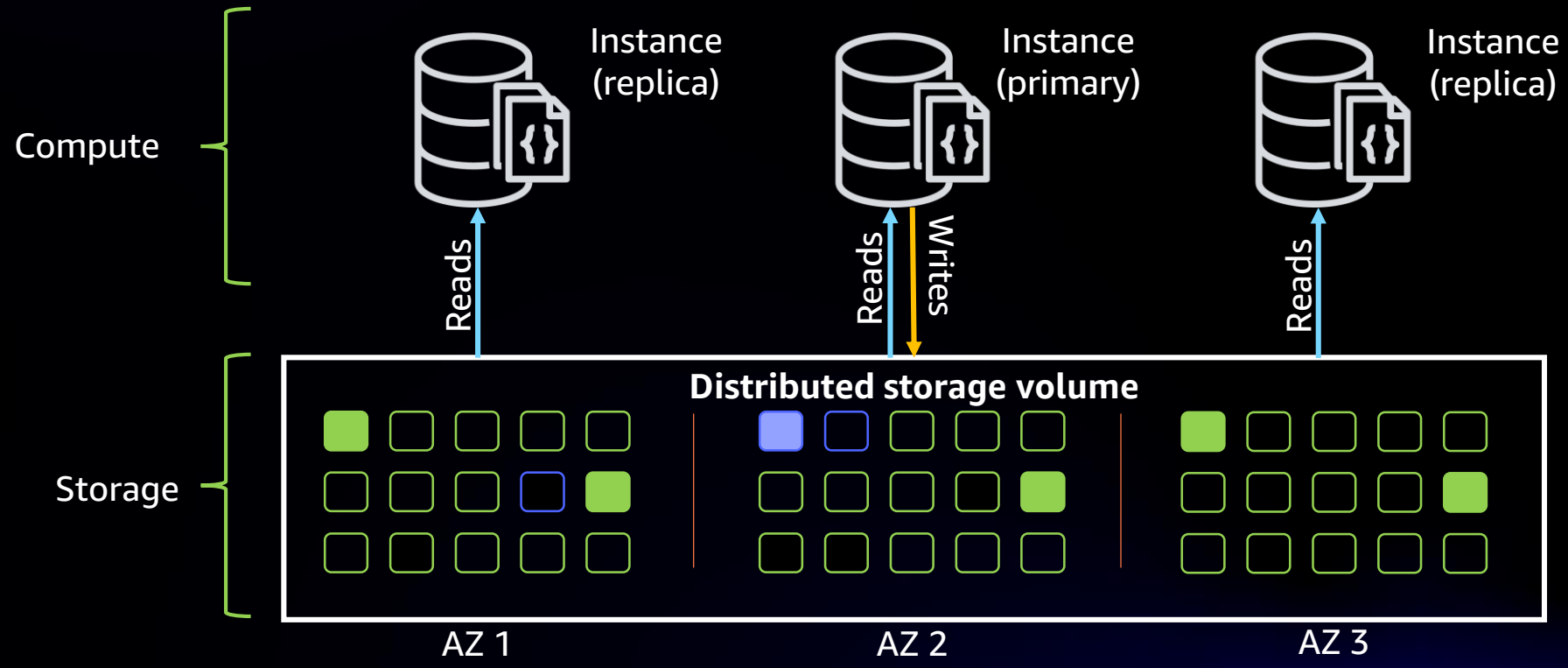
Architecture

DURABILITY

Storage is replicated 6 ways across 3 AZs (10 GB partitions)

Highly durable by default

AZ + 1 resilient



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Architecture

DURABILITY

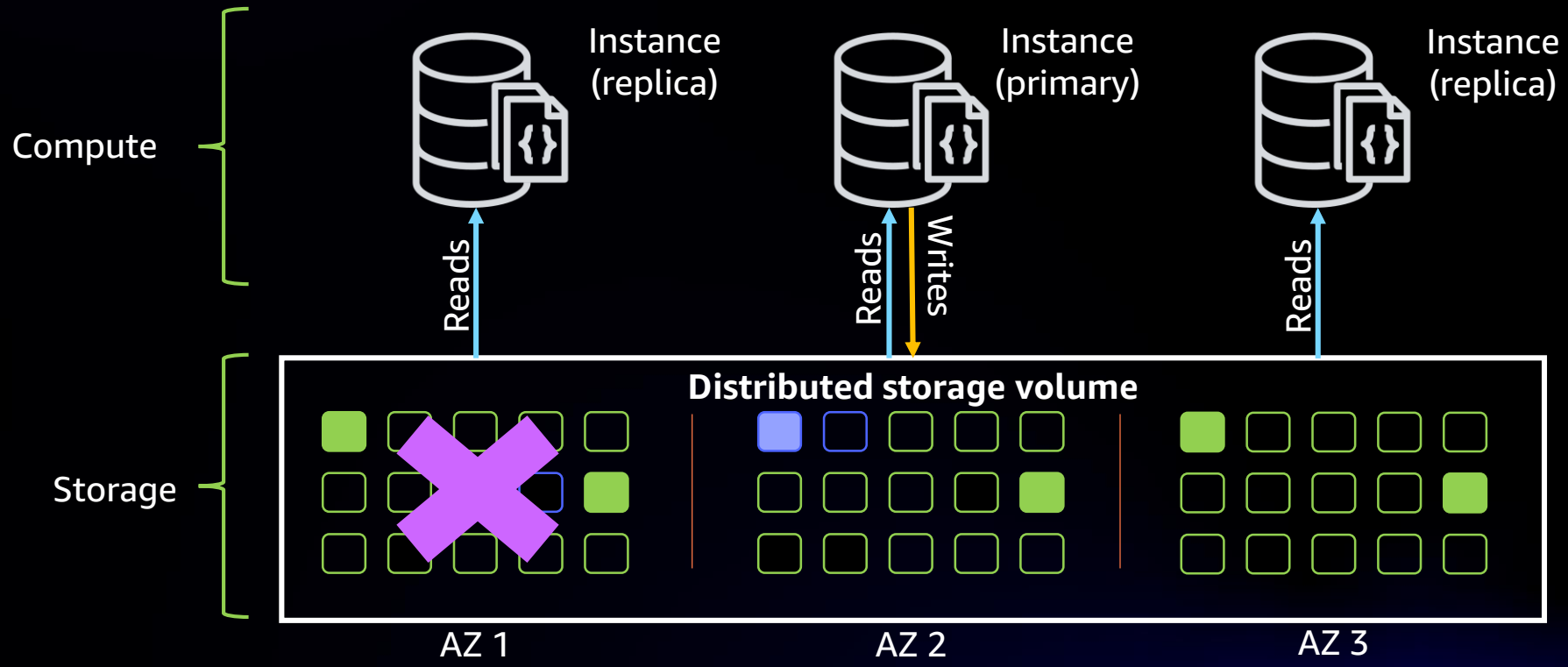
Loss of an AZ:
Write quorum is still achieved with the loss of an AZ

$V_w = 4$

$V_r = 3$

Highly durable by default

AZ + 1 resilient



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Architecture

DURABILITY

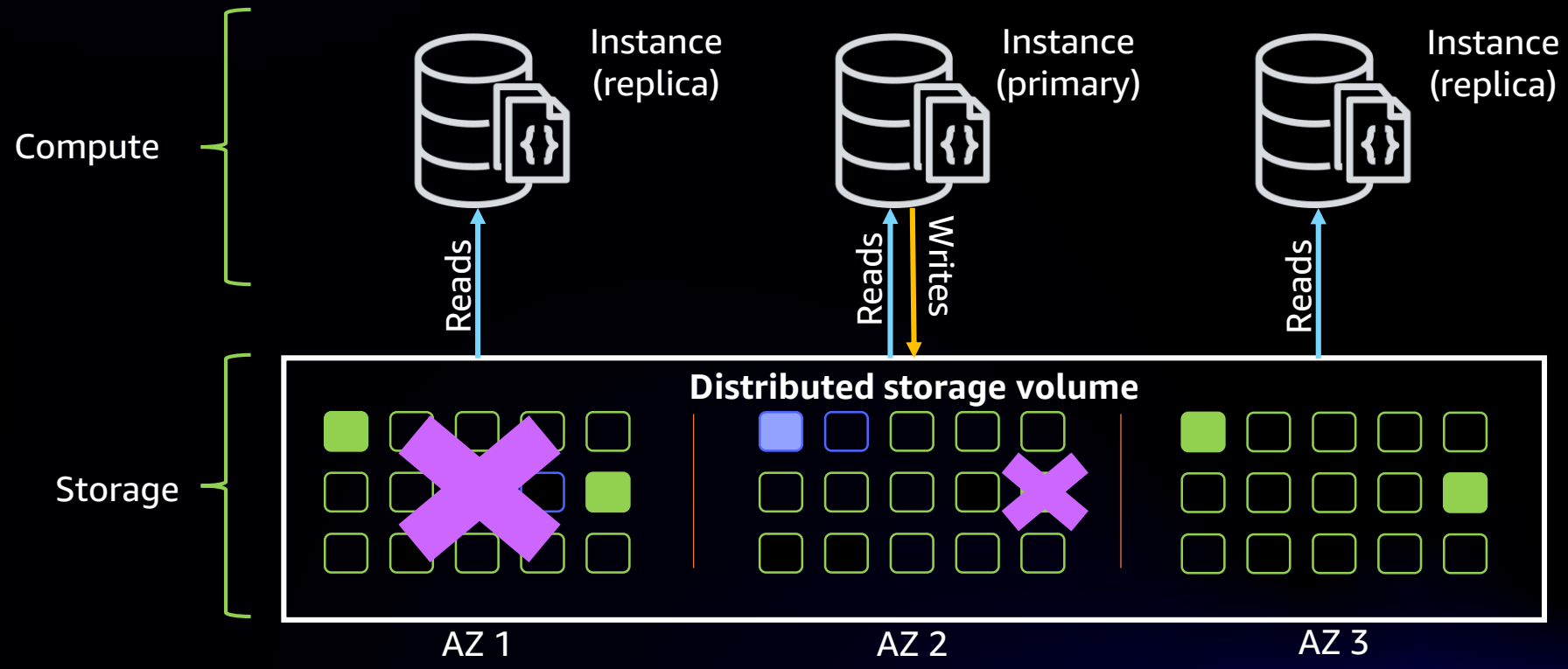
Loss of an AZ + 1: Read quorum is still achieved with the loss of an AZ

$V_w = 4$

$V_r = 3$

Highly durable by default

AZ + 1 resilient



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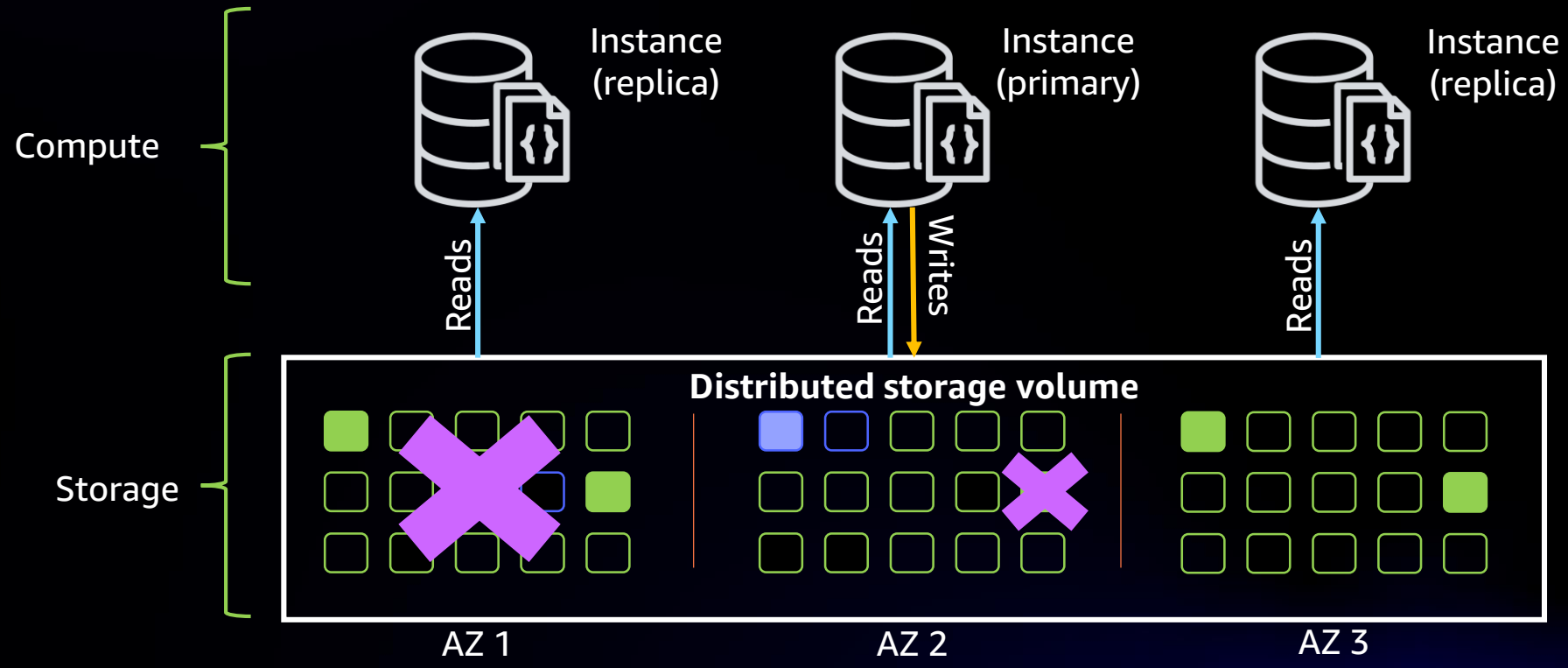
Architecture

DURABILITY

Mean time to recovery is a function of replicating 10 GB

Highly durable by default

AZ + 1 resilient



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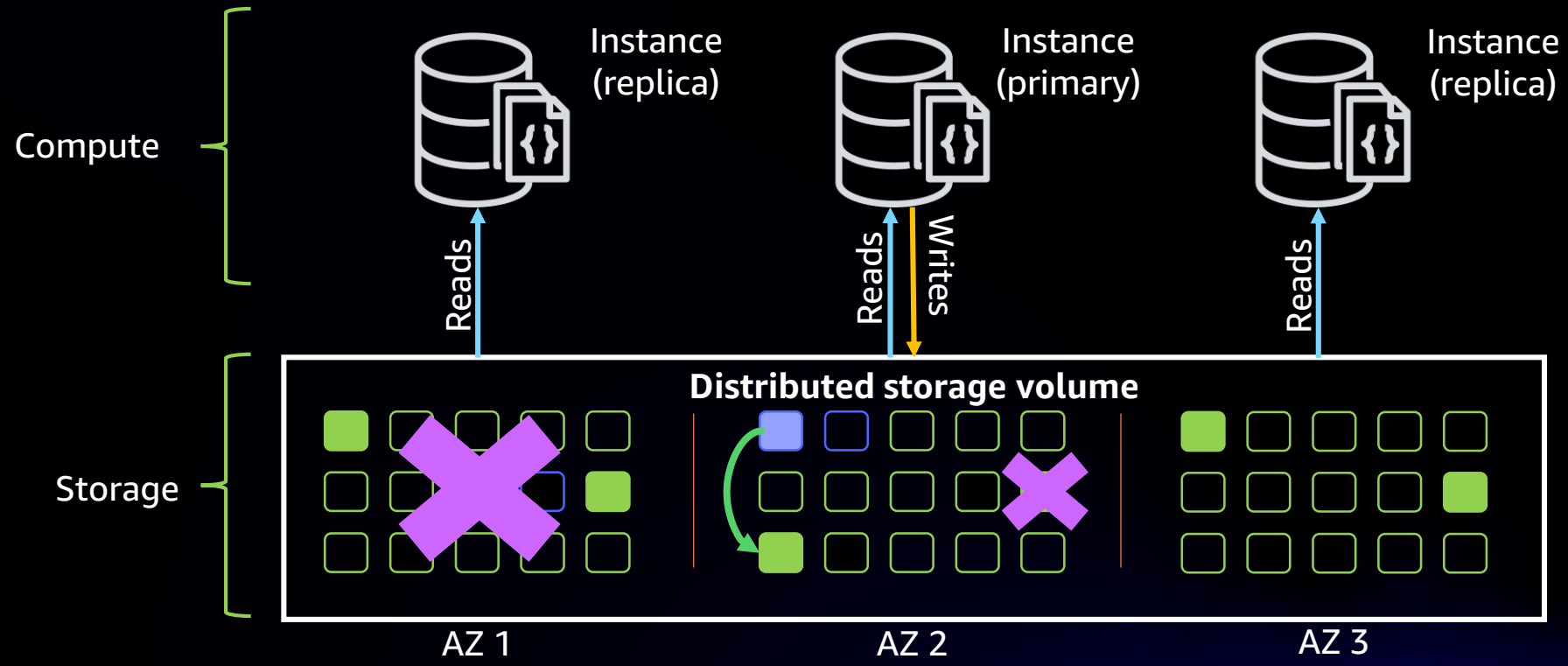
Architecture

DURABILITY

Mean time to recovery is a function of replicating 10 GB

Highly durable by default

AZ + 1 resilient



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What’s new

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A few highlights from the past year



AWS Graviton instances with up to 30% better performance

Cross-Region Replication (Global Clusters)

Role-based access control (user-defined roles)

JDBC driver for SQL interface and analytics

Geospatial query capabilities and additional MongoDB APIs

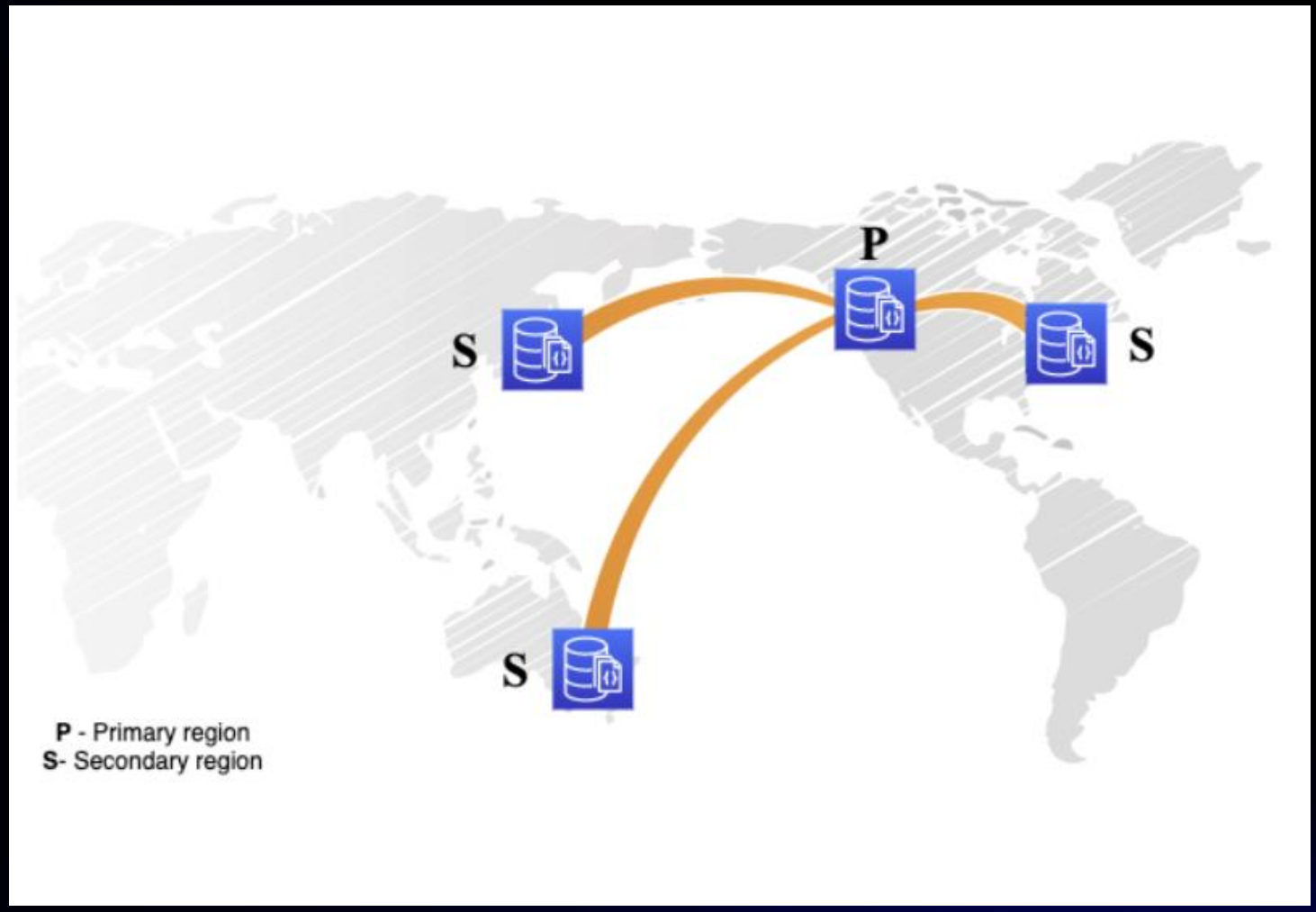
And so much more!

aws

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Global clusters

- Replicates your data to clusters in up to 5 AWS regions
- Up to 16 replicas per cluster per Region
- Storage-based replication with latencies of less than one second
- Secondaries can be promoted to primary in minutes



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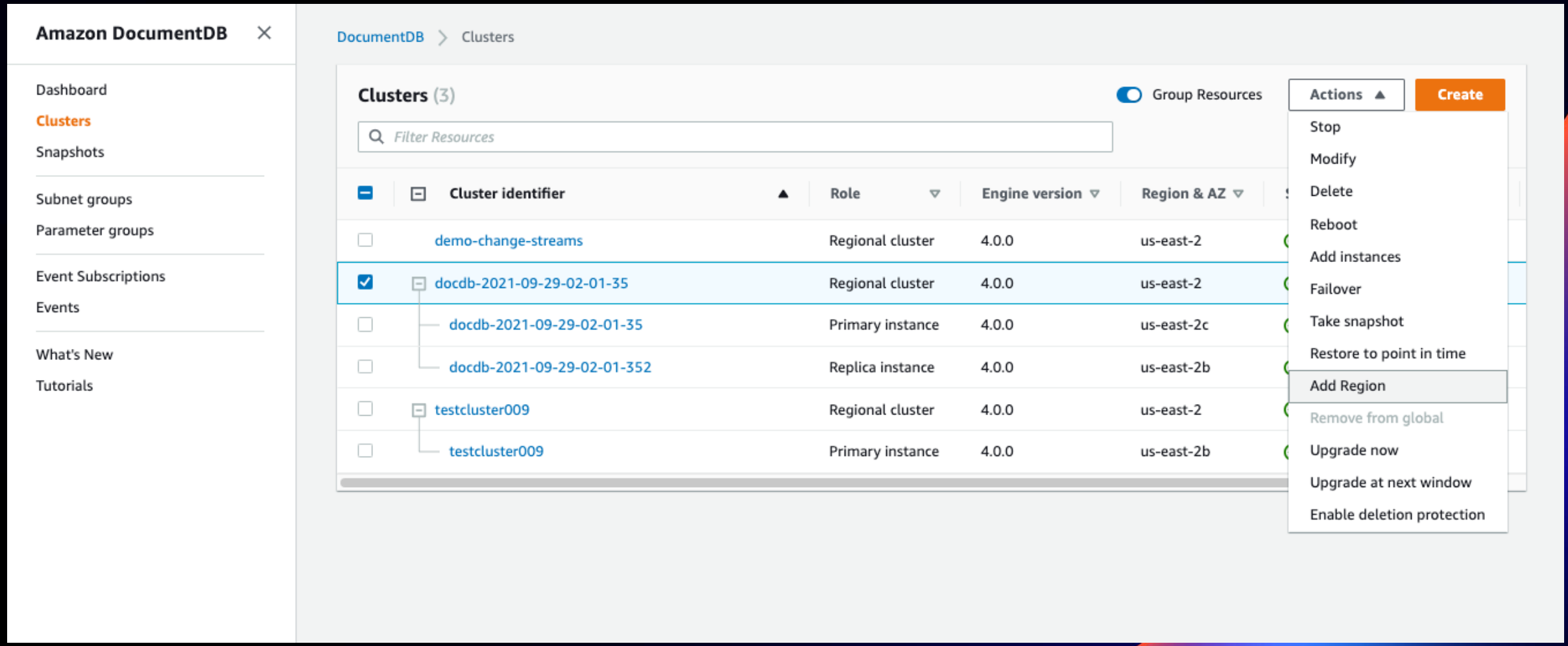
Global clusters

- Recovery from Region-wide outages – promote a secondary cluster to a primary in minutes

- Global reads with local latency – add multiple instances to a secondary Region for read scale with local latency

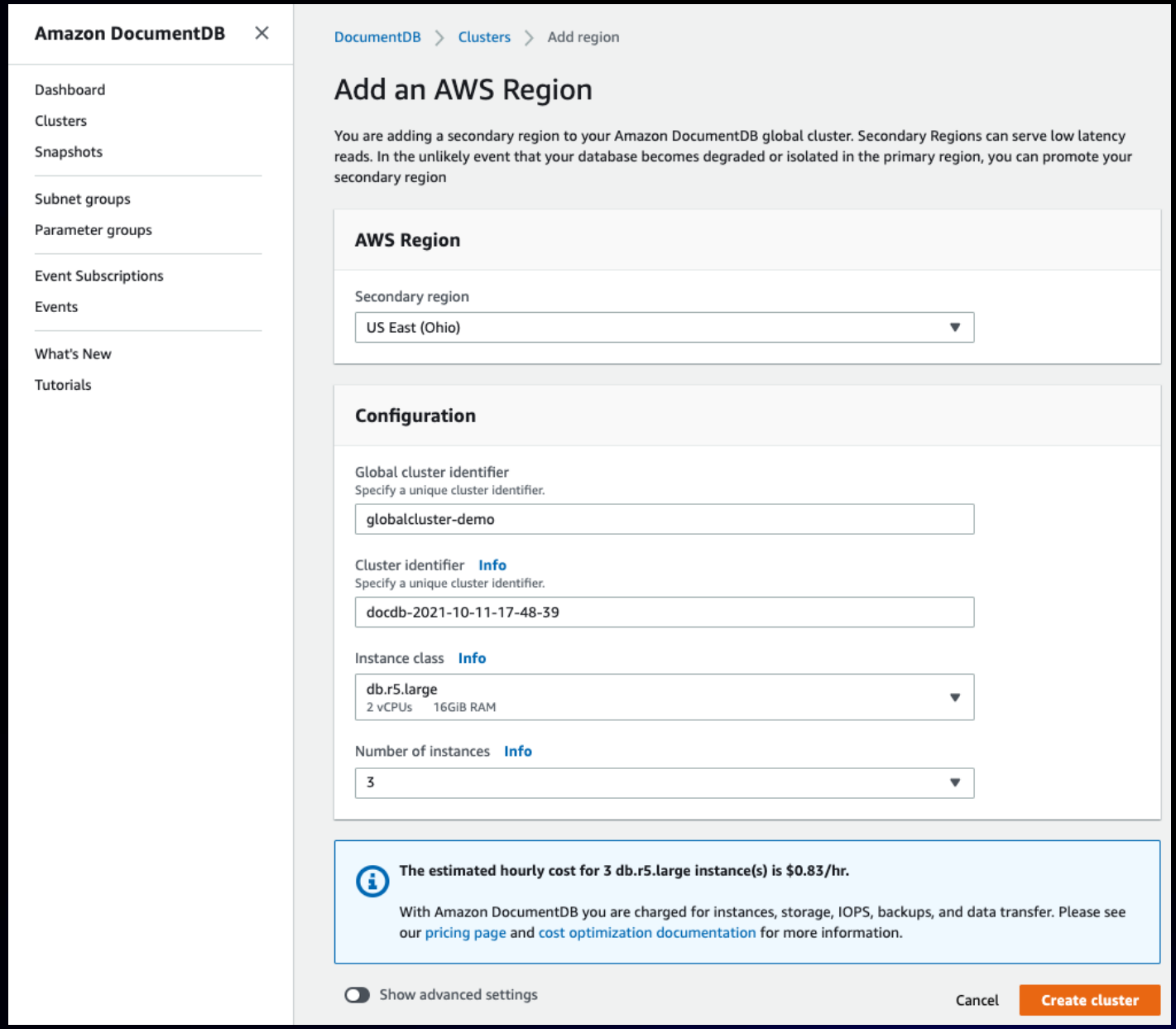
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Global clusters



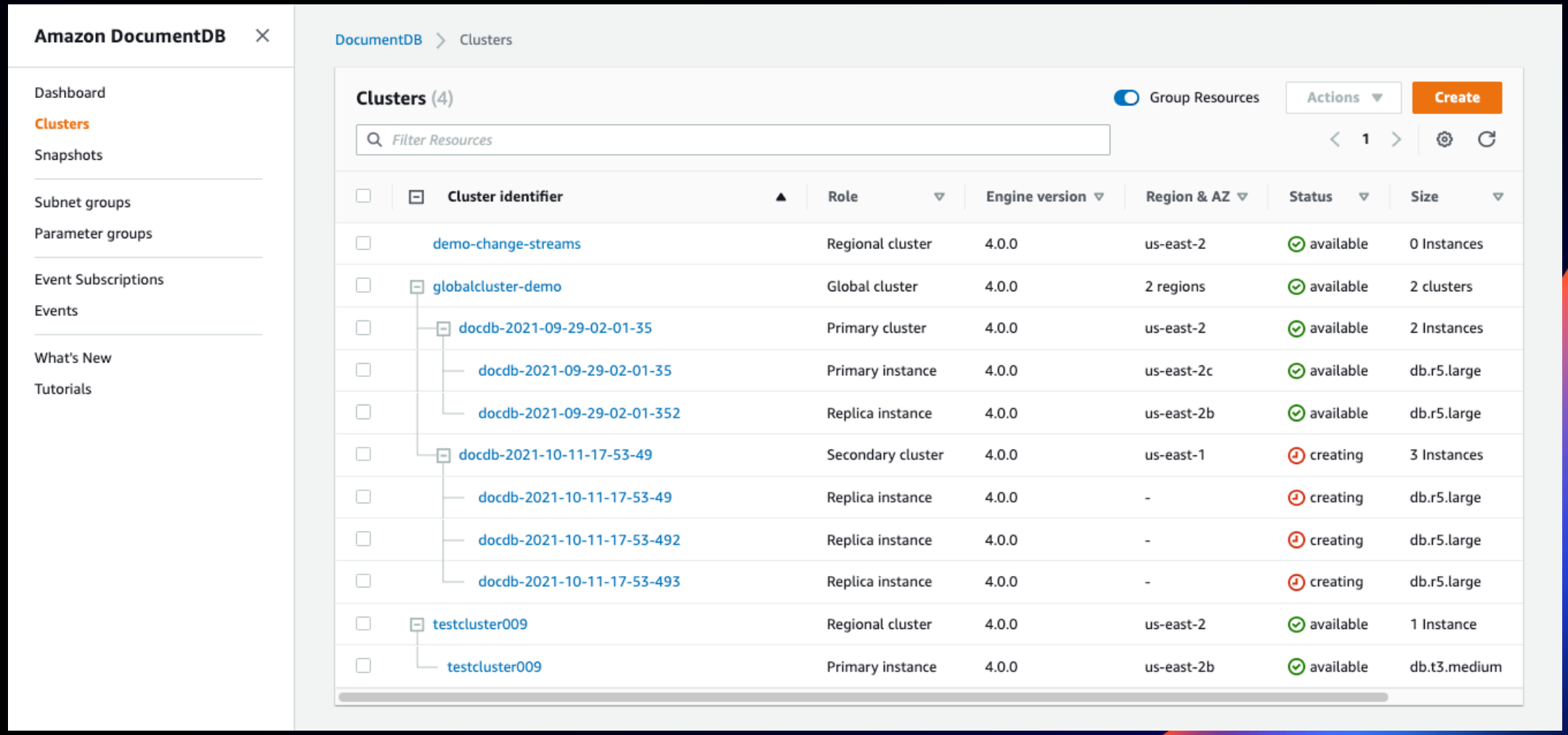
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Global clusters



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Global clusters



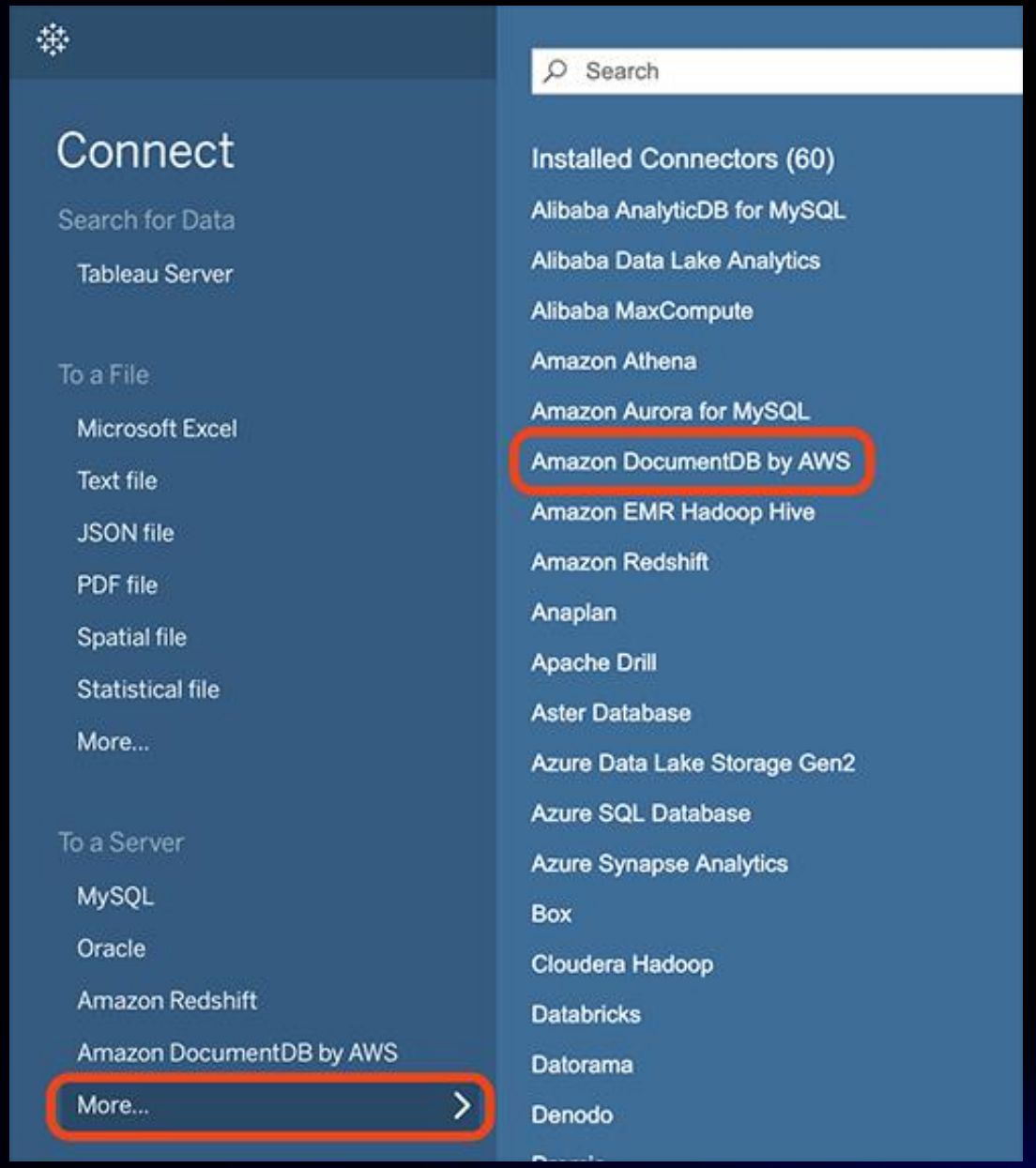
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JDBC driver

- Connect to BI tools such as Tableau, MicroStrategy, and QlikView
- Run SQL queries against DocumentDB from tools such as SQL Workbench
- Open source

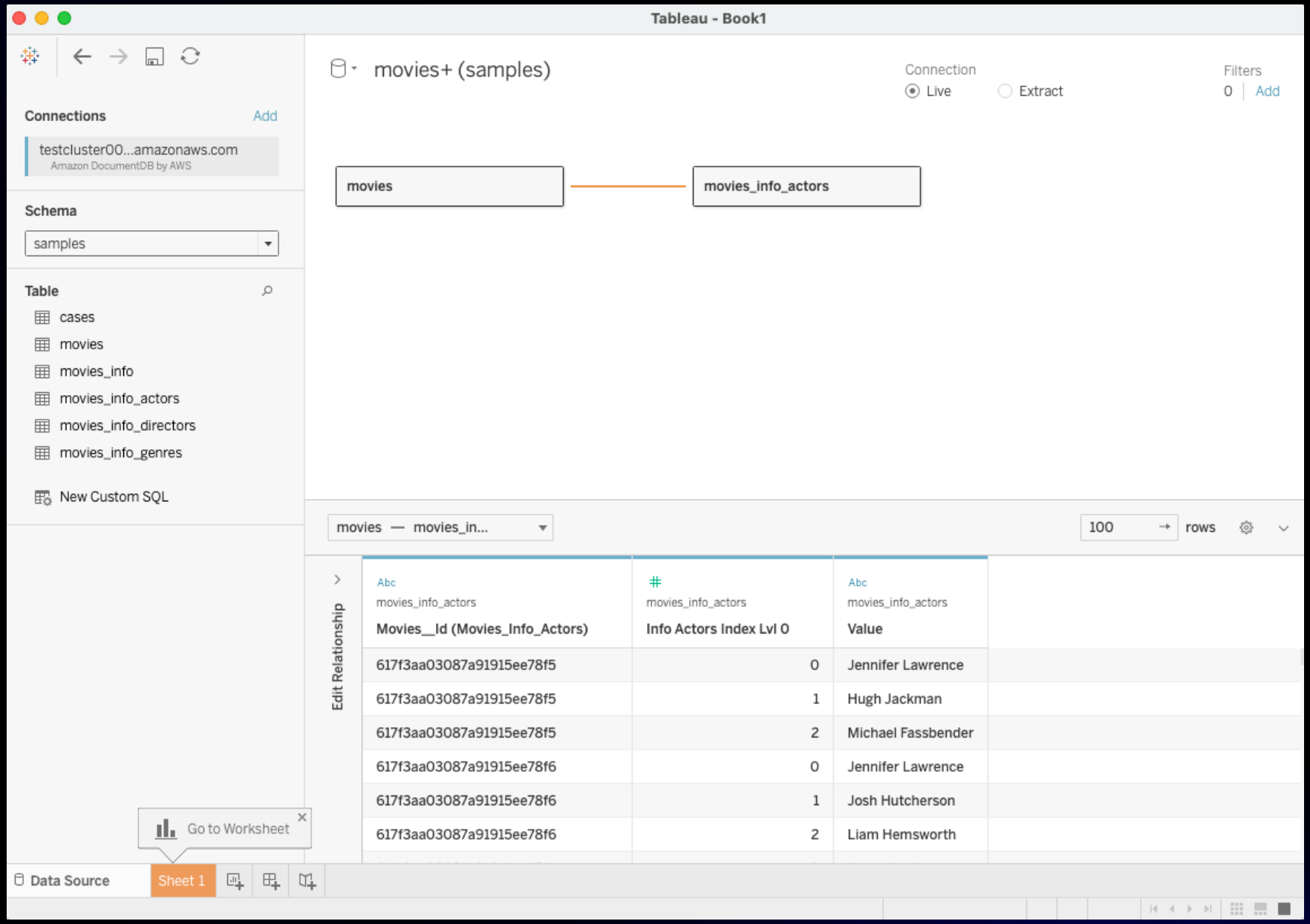
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JDBC driver



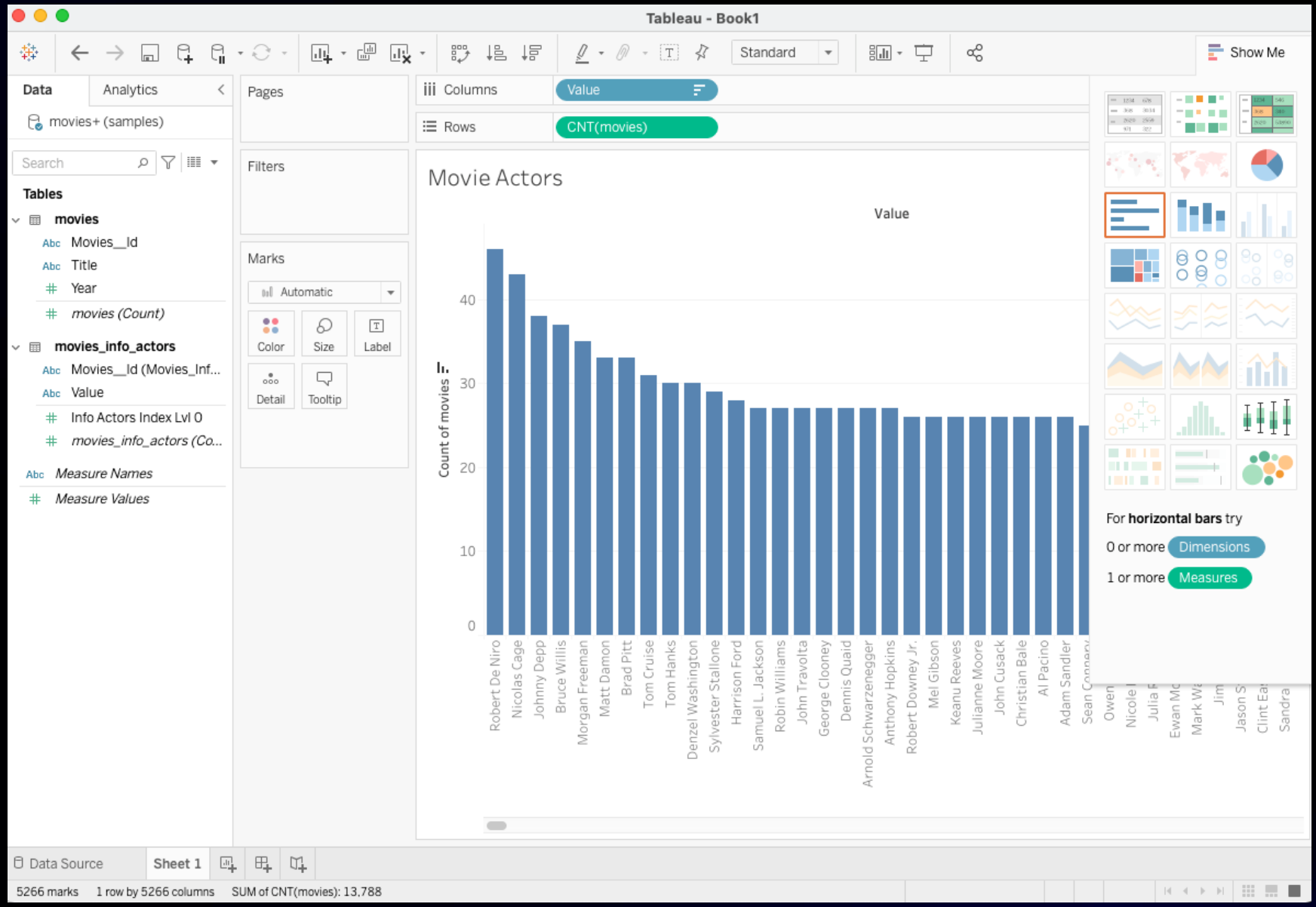
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JDBC driver



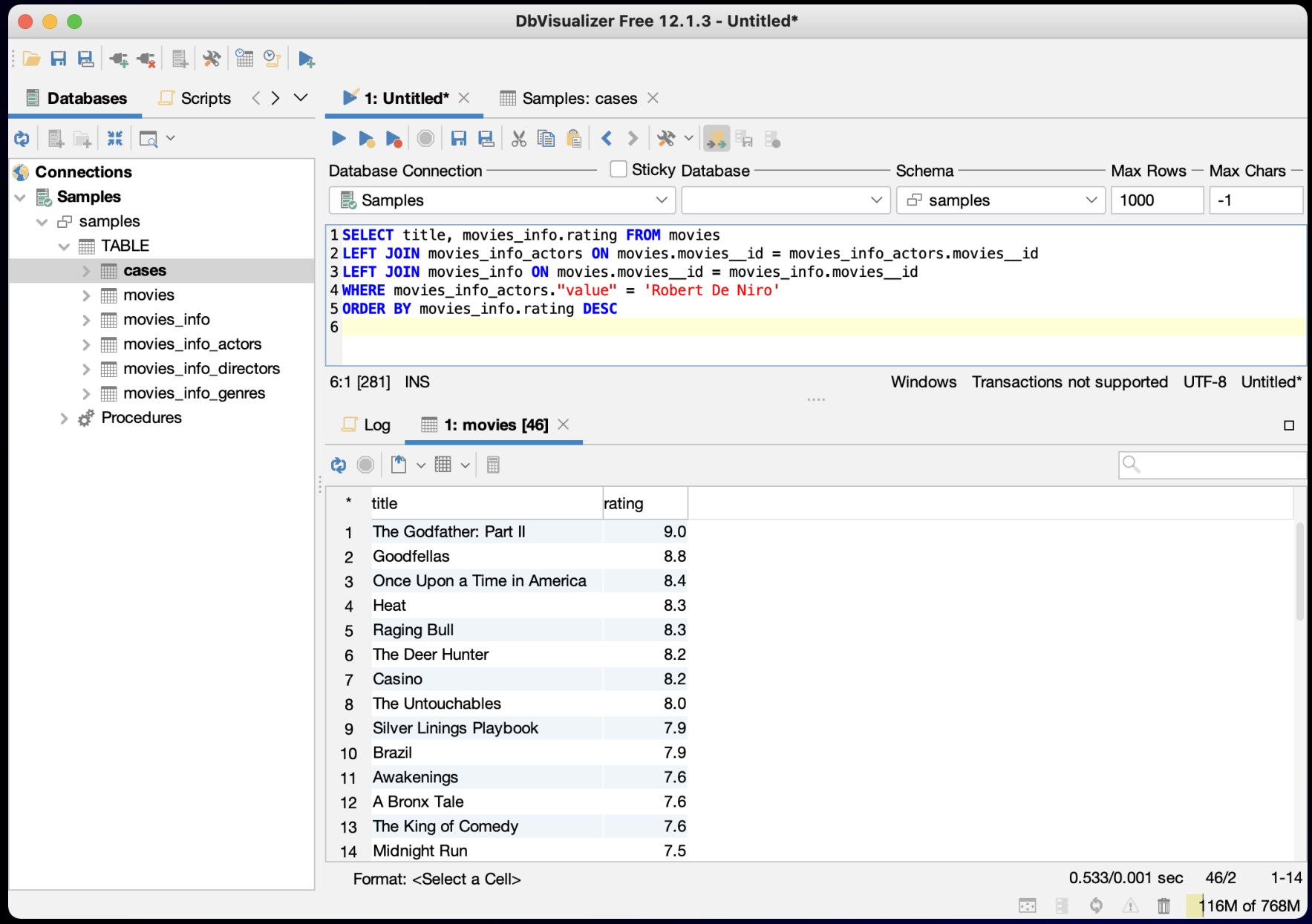
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JDBC driver



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JDBC driver



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A few highlights from the past year



AWS Graviton instances with up to 30% better performance

Cross-Region Replication (Global Clusters)

Role-based access control (user-defined roles)

JDBC driver for SQL interface and analytics

Geospatial query capabilities and additional MongoDB APIs

And so much more!

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Case study: Rappi



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Story of Rappi

Founded in 2015, Rappi is Colombia's first tech startup to be valued at over $5.25 billion

Rappi is a multi-vertical technological platform that connects commerce, consumers, and couriers, allowing the delivery of almost anything – from food and clothing, to insurance and financial services – in 9 Latin American countries in more than 250 cities



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Business problems and data system requirements

Data solution needs to support multiple business applications across multiple countries without single points of failures – **flexibility**

Data solution needs to scale independently; different business units can peak at different times – **scalability and performance**

With a small team be able to manage hundreds of databases – **fully managed**

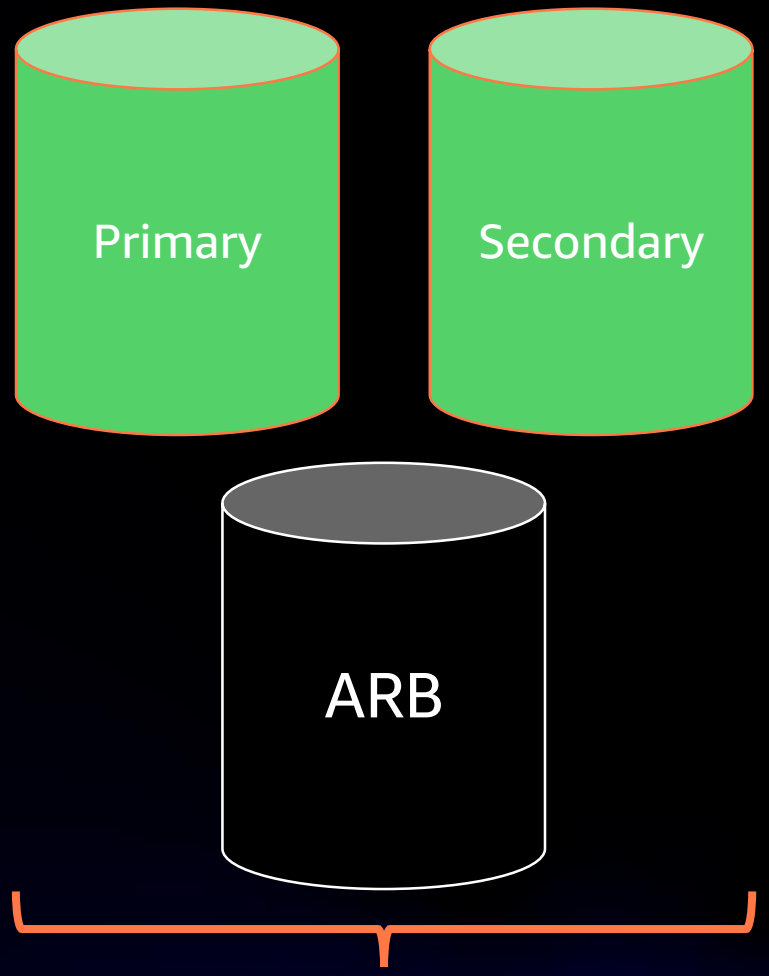


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Rappi before Amazon DocumentDB

Use of ReplicaSets

- On 16X large Amazon EC2 instances
- Managed Amazon EBS snapshots
- No logical backups
- Amazon CloudWatch for instance-level monitoring
- No internal monitoring
- LOG profile ad hoc

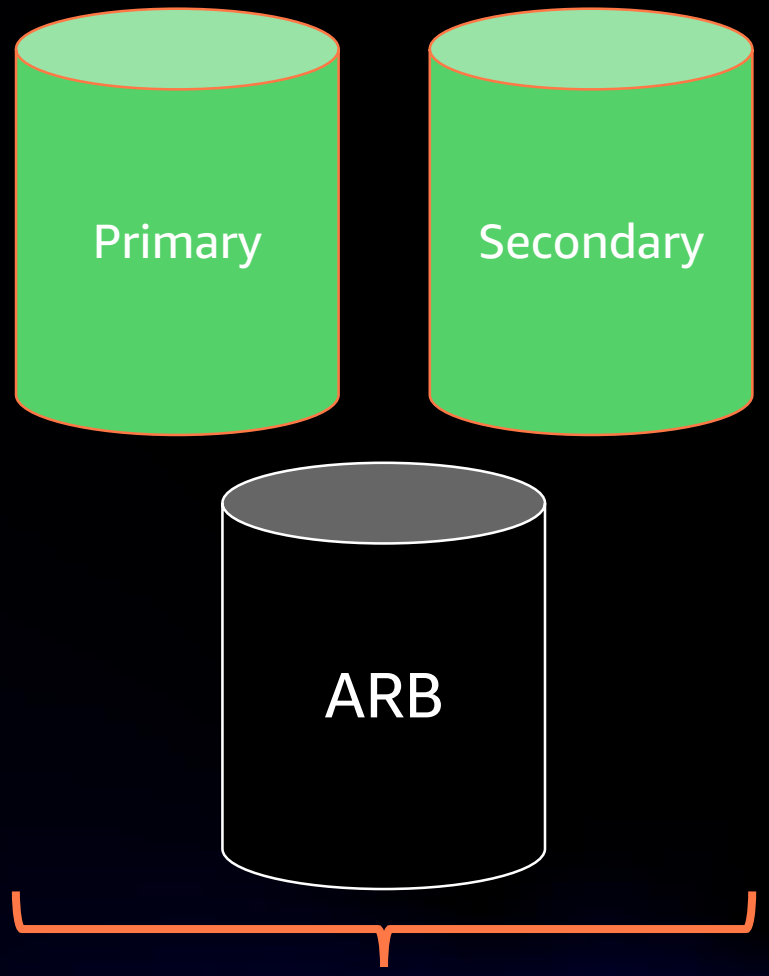


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Rappi before Amazon DocumentDB

Challenges

- Small team and many databases
- Lack of MongoDB knowledge
- Lack of Linux knowledge
- Other priorities
- $$$$



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Finding the right database on AWS

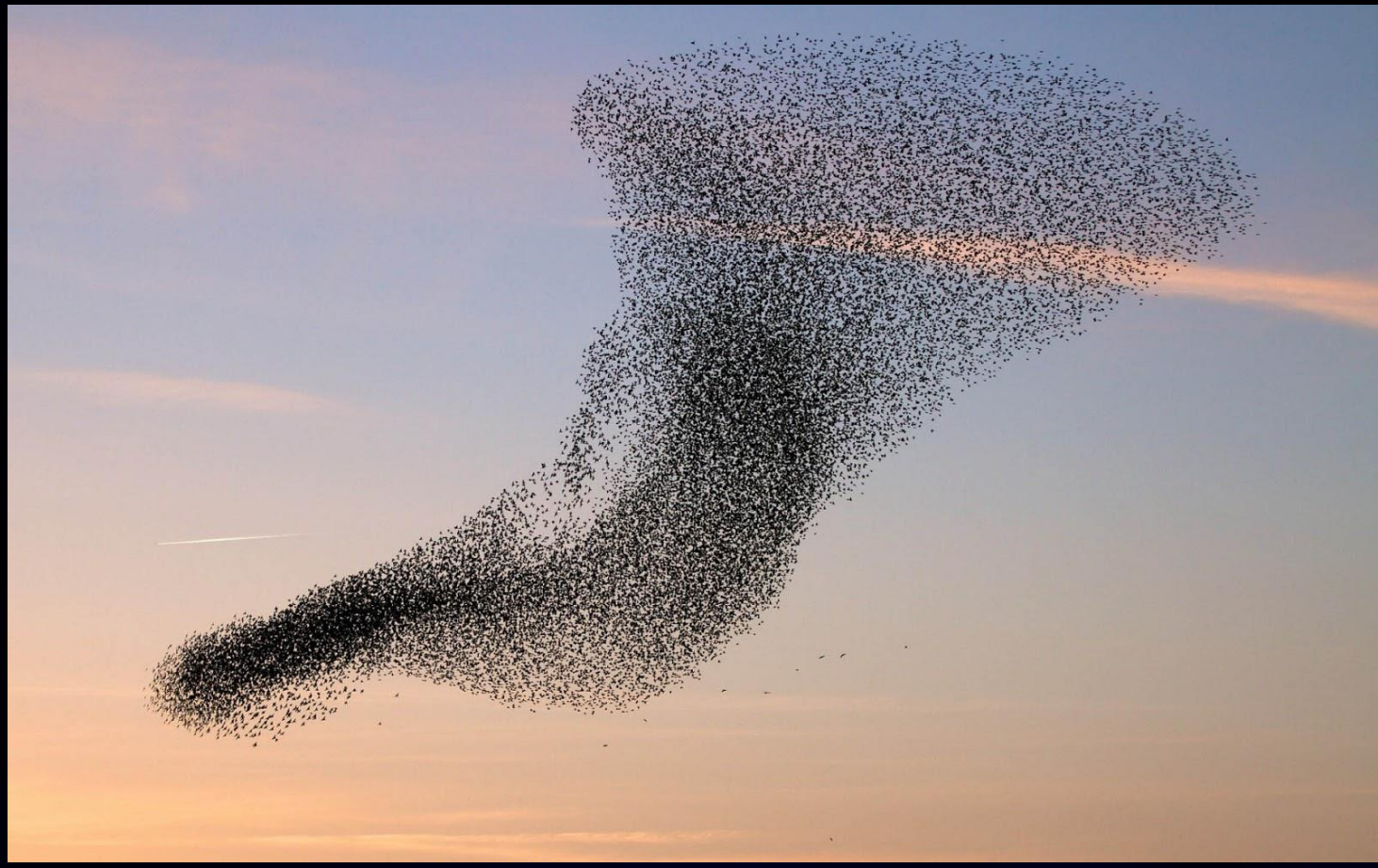


- To drastically improve performance, Rappi determined that part of its microservices workloads needed to be supported by a document store
- Started to move from Elasticsearch to MongoDB, but maintaining infrastructure for so many MongoDB clusters was a challenge
- Rappi found in Amazon DocumentDB a fully managed document database, compatible with MongoDB, that allowed migration with few code changes

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Migration to Amazon DocumentDB

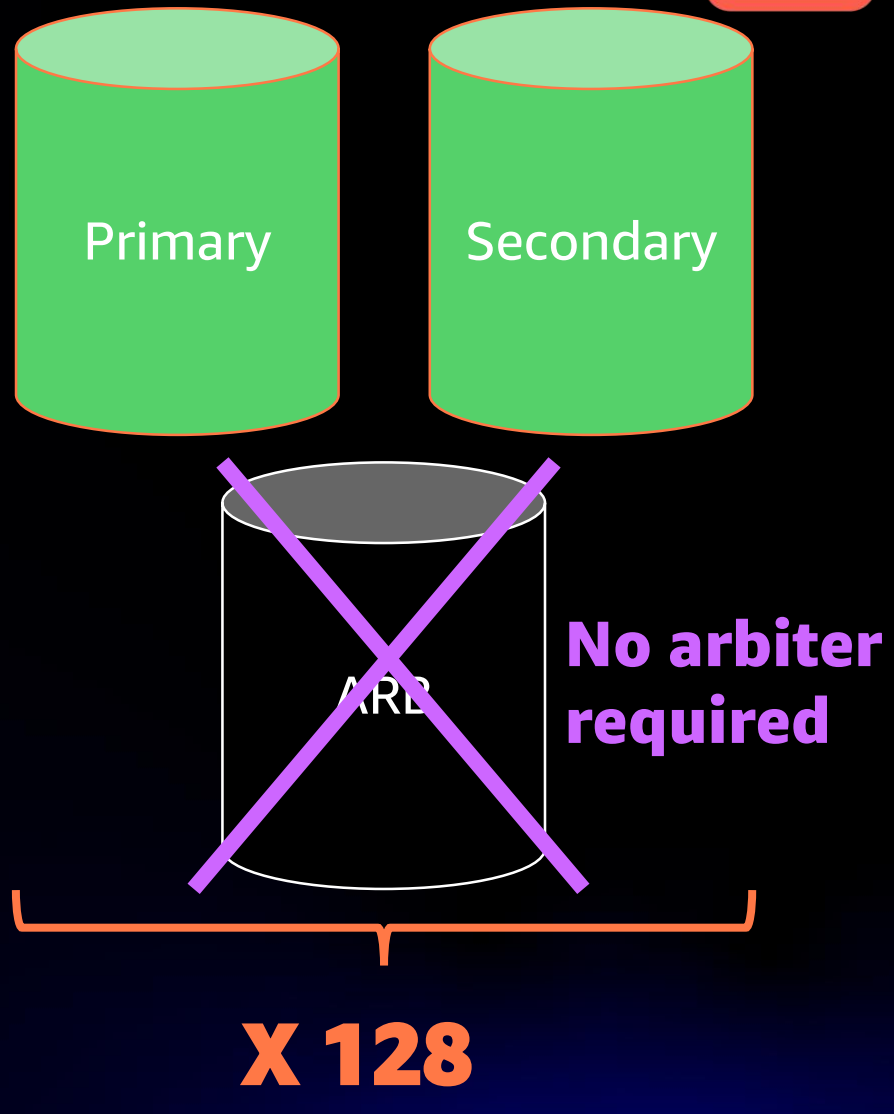
- Took weeks!
- No need for code rewrite
- Latency dropped to 80 ms in the 99th percentile
- Amazon DocumentDB already supported the Mongo Features we used
- **No outages!**



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Rappi on Amazon DocumentDB

- Managed services
- Instance size accordingly
- No need for arbiter
- Easy failovers
- Easy to scale up and down
- Log insights
- More integrated CloudWatch Metrics

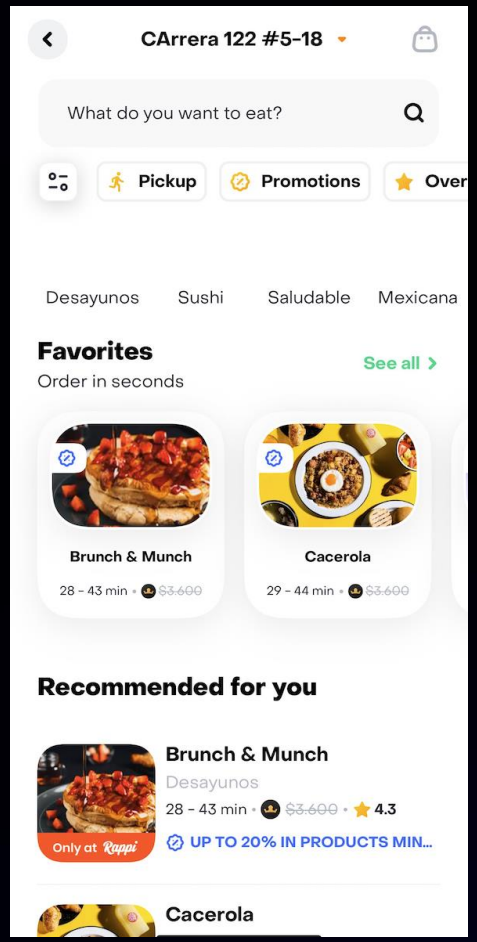


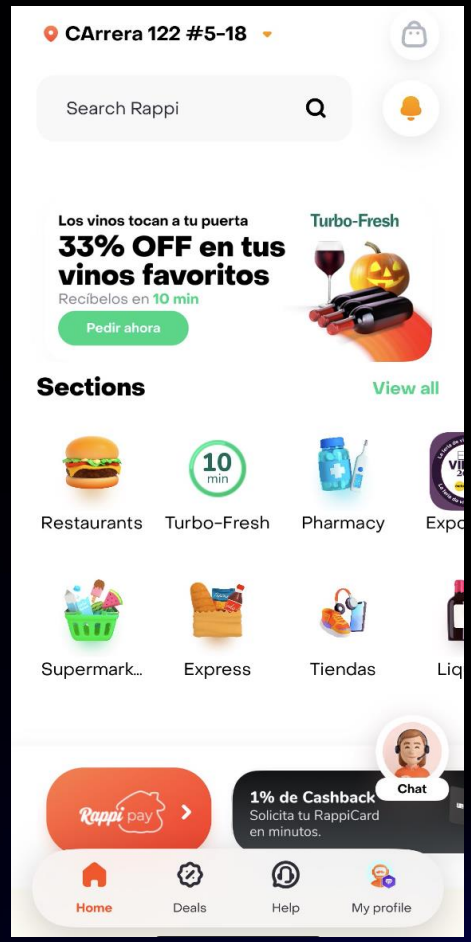
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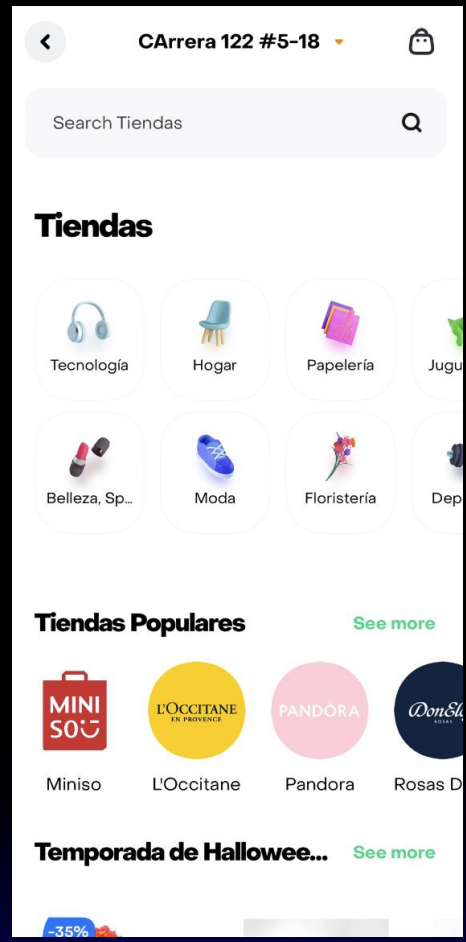
Rappi on Amazon DocumentDB

Amazon DocumentDB backs key business, such as

- Restaurant catalog
- App home
- Store catalog

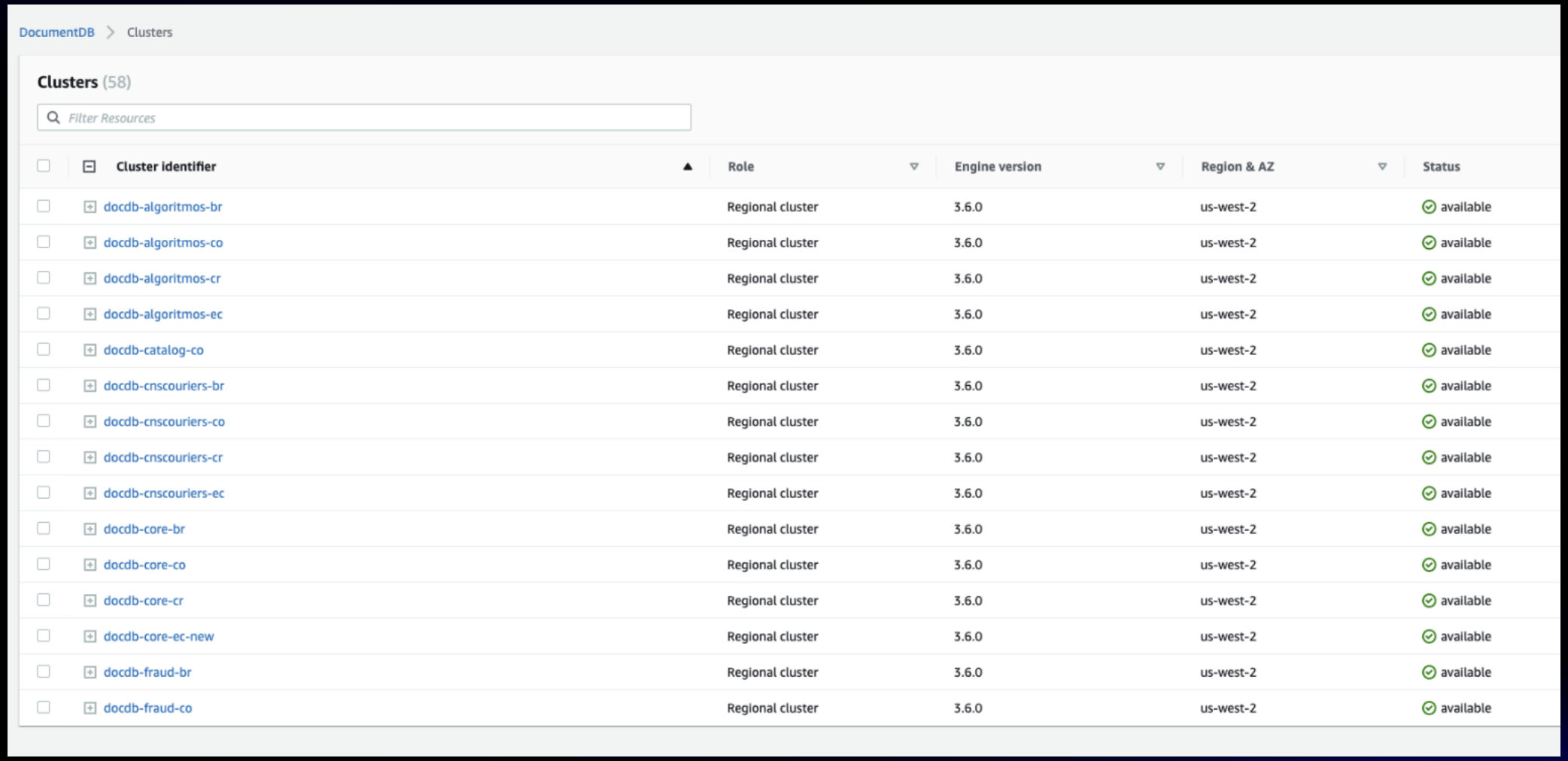






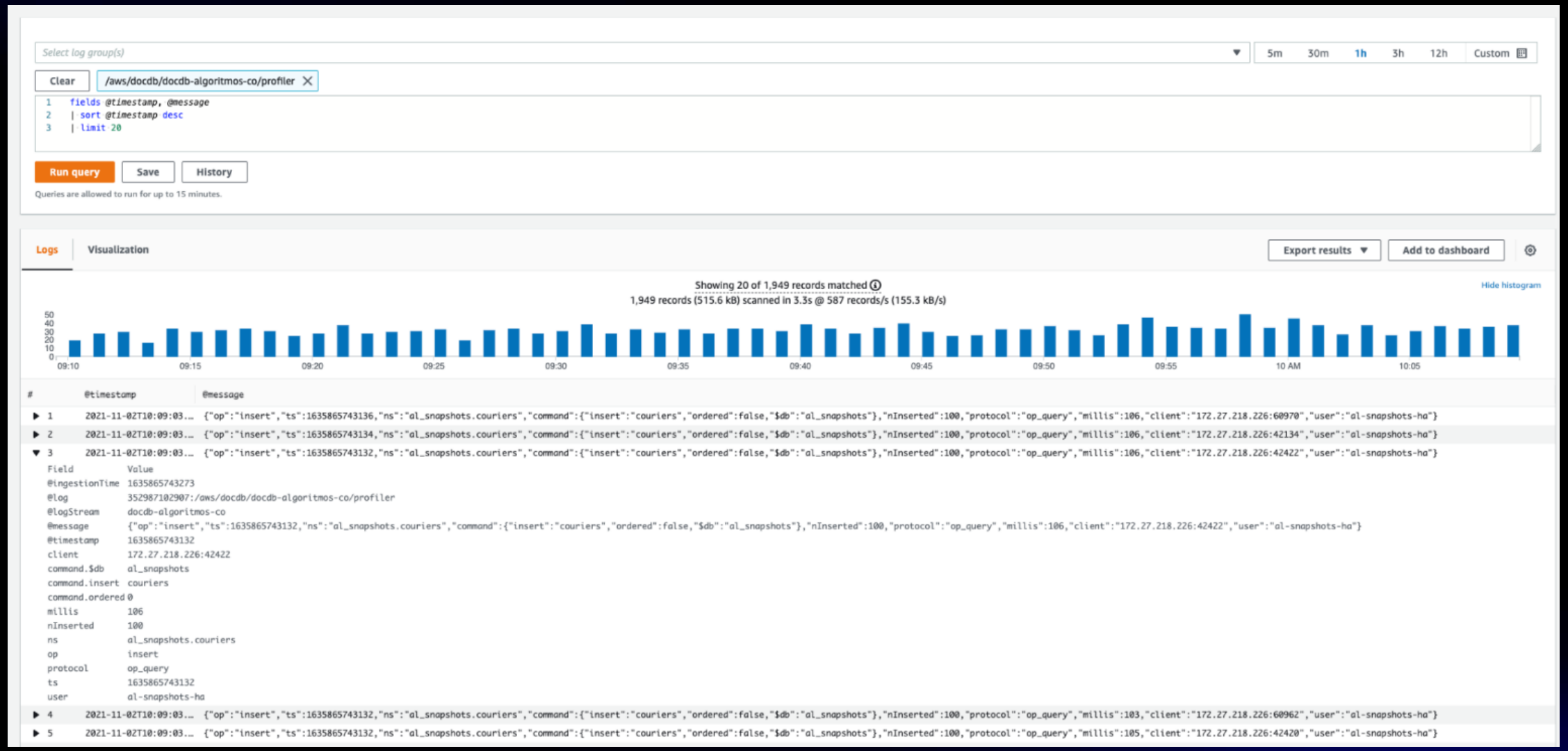
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Rappi on Amazon DocumentDB



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Rappi on Amazon DocumentDB: Monitoring



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Rappi on Amazon DocumentDB: Monitoring



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Results



Dropped number of outages from frequent to zero

Migrated over 100 live MongoDB databases to Amazon DocumentDB in 3 months

Decreased latency from up to 500 ms to 80 ms on average for the restaurants ranking query (from the main restaurant application)

Decreased management/operational overhead by more than 50%

Achieved greater stability with less code

Ongoing engagement with service team and ability to address growing needs

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Thank you!

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