#MDBlocal

Global Clusters Topologies

Sig Narvaez
Principal Solution Architect, MongoDB

3.15 Billion

new internet users since the first MongoDB code commit

Every year a US-sized population is coming online for the first time

You don’t have to be a household name to meaningfully reach them

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Yes, a CDN can *reach* but users expect *more*

Global Operational Data

Your users want…

Interactive experiences

Personalization

Instant gratification

Global Operational Data

Your users want…

Interactive experiences

Personalization

Instant gratification

You want…

Happy users

To stay ahead of competition

Global awareness

What does 100ms equate to?

What does 100ms equate to?

1% drop in sales

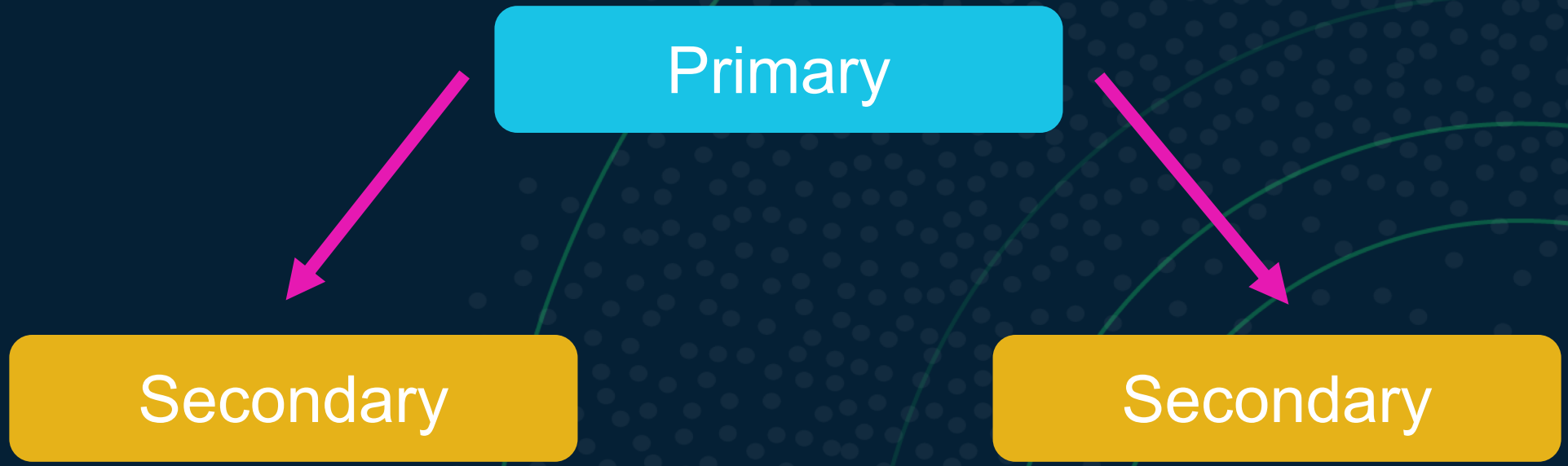
Missed chance to engage a customer meaningfully

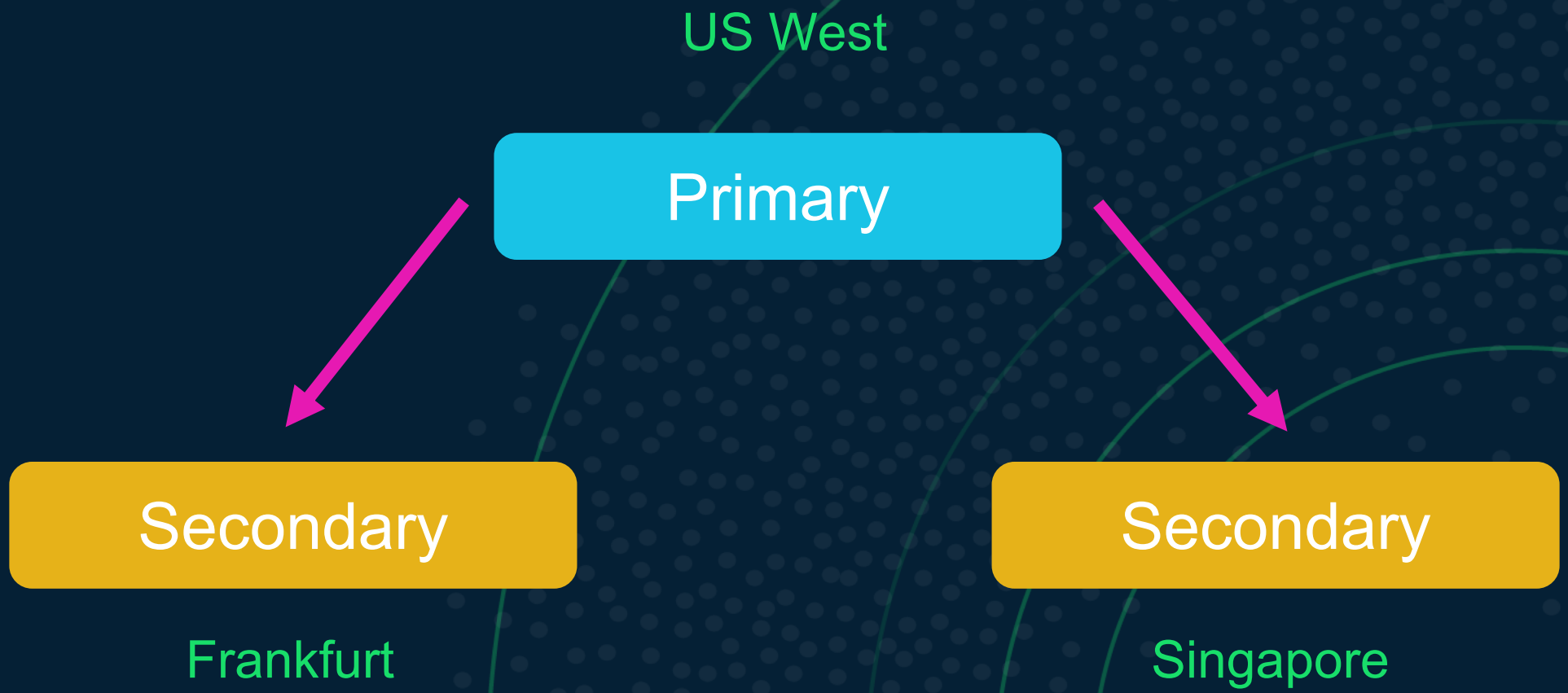
Global Latencies from AWS US West

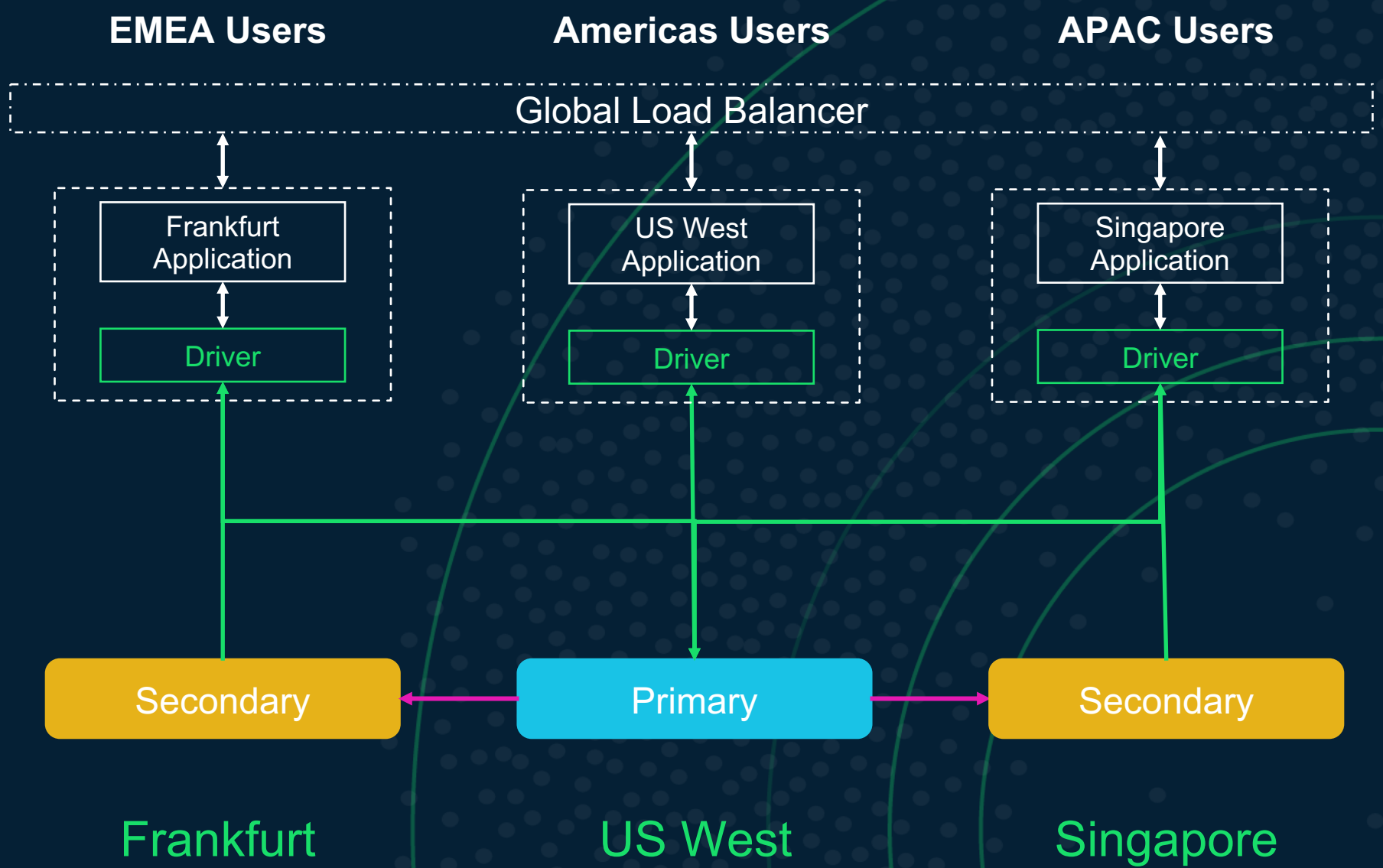
Americas	US West – US East:	**83ms**
EMEA	US West – Frankfurt:	**163ms**
LATAM	US West – Sao Paulo:	**190ms**
APAC	US West – Singapore:	**225ms**

Options

Global Multi-Region Replication


Primary
Secondary
Secondary


US West
Primary
Secondary
Secondary
Frankfurt
Singapore


EMEA Users
Americas Users
APAC Users
Global Load Balancer
Frankfurt Application
US West Application
Singapore Application
Driver
Driver
Driver
Secondary
Primary
Secondary
Frankfurt
US West
Singapore

Global Multi-Region Replication

Advantages

Single connection string globally

Cross-region high availability

Disadvantages

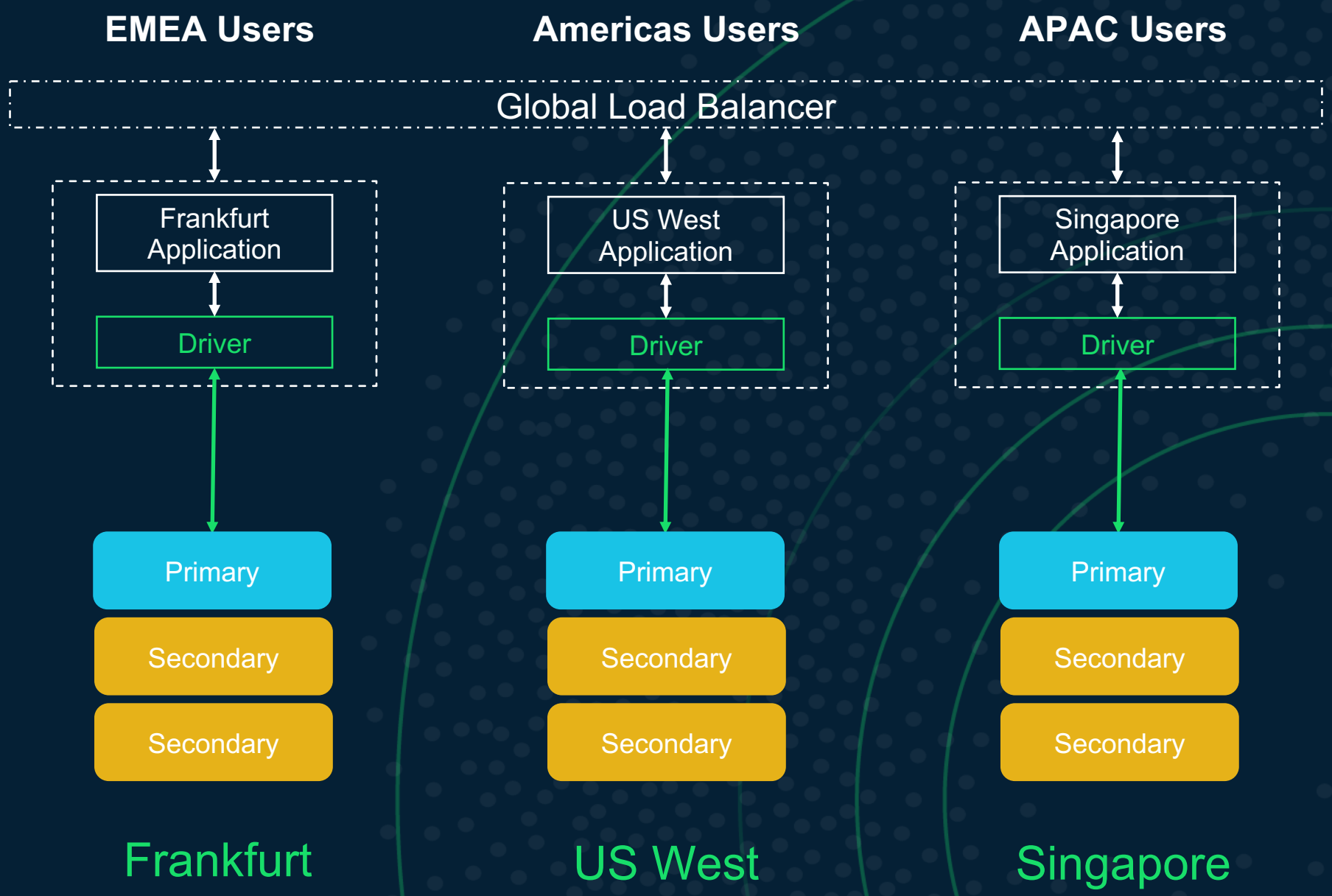
All writes go to preferred region

⅔ of users experience > 100ms

Fast reads require secondary read preference

Asymmetrical deployment

Cluster Per Region


EMEA Users
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Global Load Balancer
Frankfurt Application
Driver
US West Application
Driver
Singapore Application
Driver
Primary
Secondary
Secondary
Primary
Secondary
Secondary
Primary
Secondary
Secondary
Frankfurt
US West
Singapore

Cluster Per Region

Advantages

Easy today in MongoDB Atlas

Independently scalable

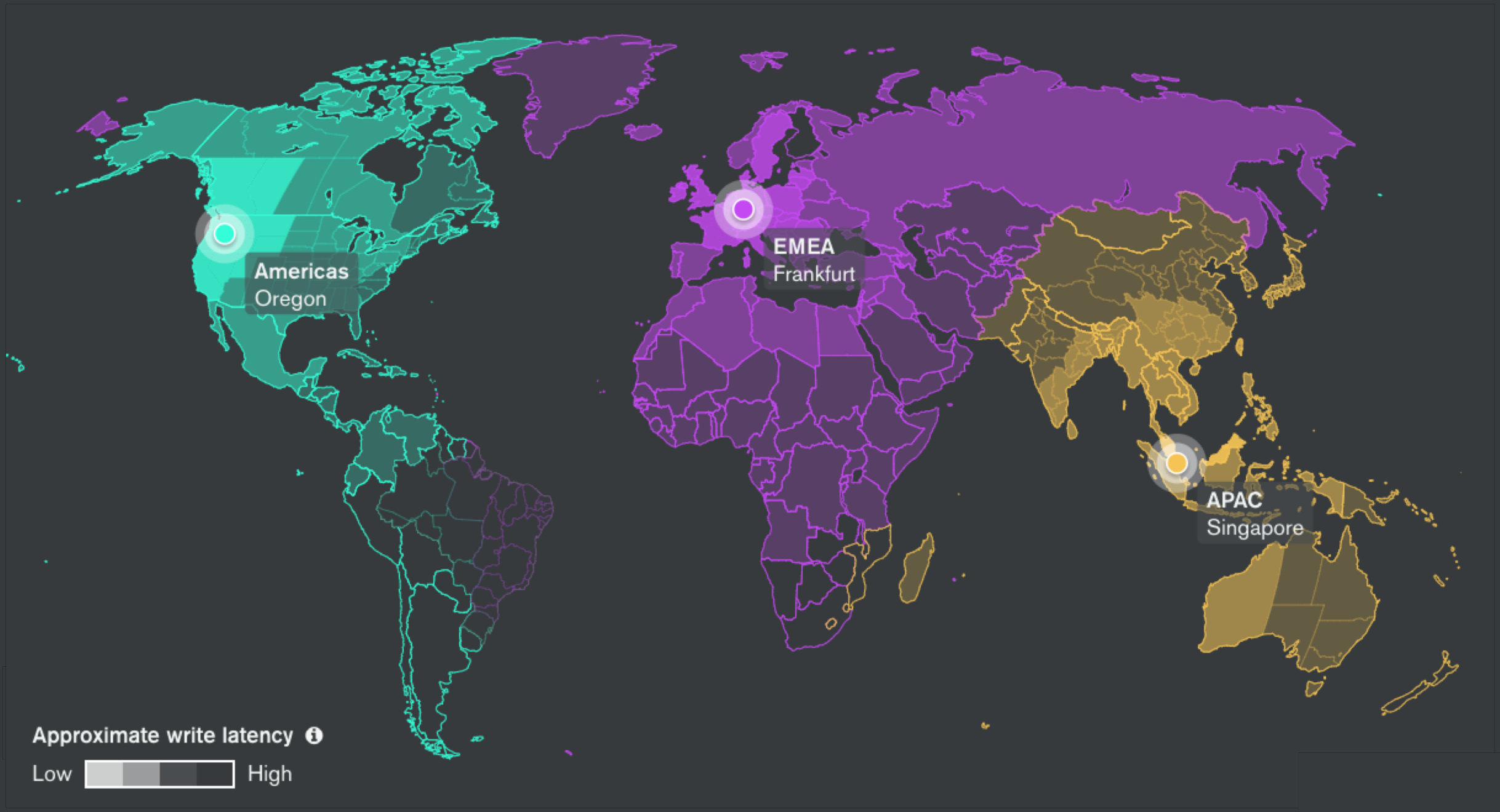
Disadvantages

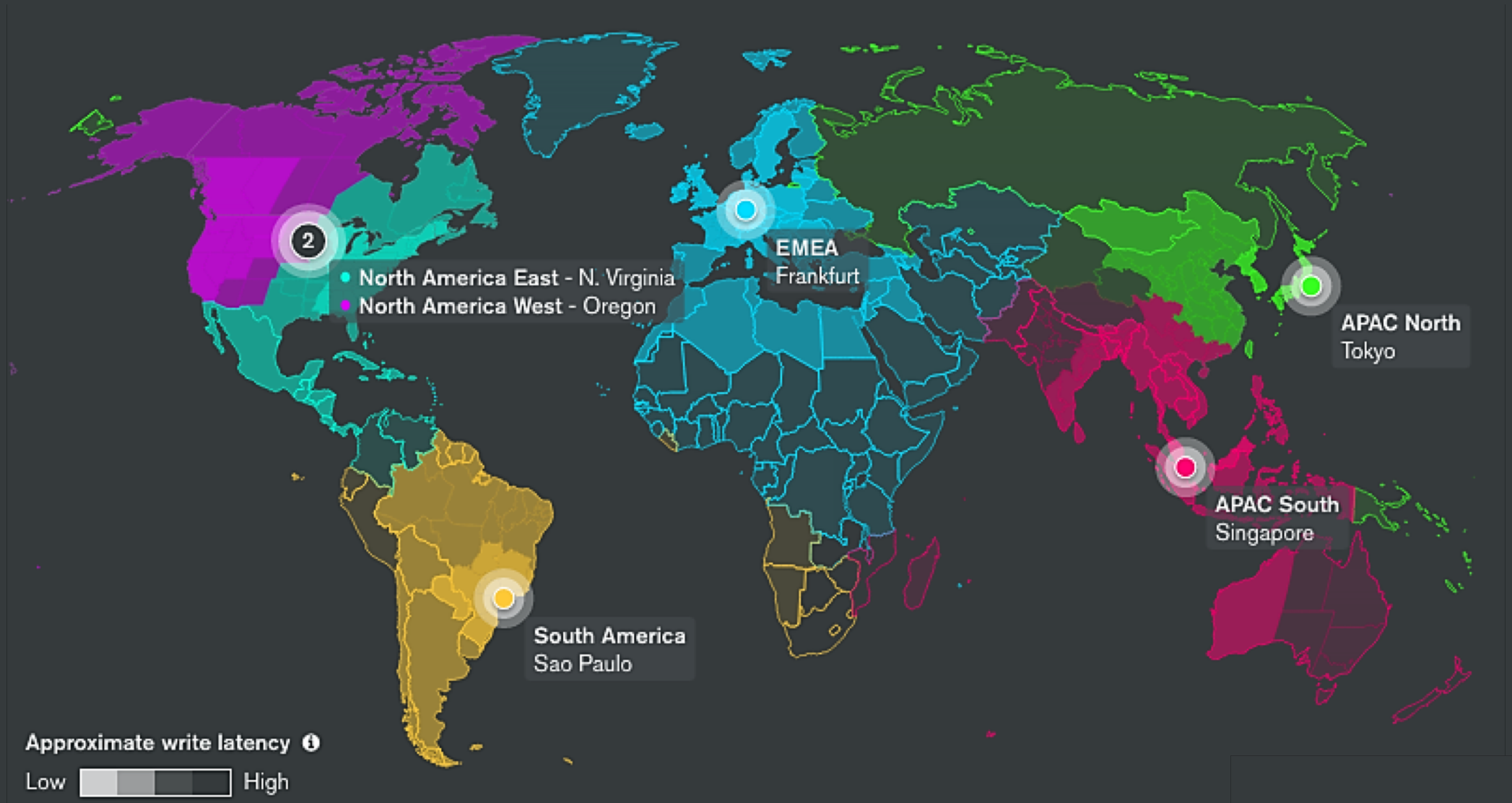
No global aggregation

Application tier manages end user to connection string affinity

Can we get the best of both worlds?

Global Clusters with Global Writes


Americas
Oregon
EMEA
Frankfurt
APAC
Singapore
Approximate write latency
Low
High


2
North America East - N. Virginia
North America West - Oregon
EMEA
Frankfurt
APAC North
Tokyo
APAC South
Singapore
South America
Sao Paulo
Approximate write latency
Low
High

How Global Writes work

Data includes location attribute

```
{
  _id: 123,
  firstName: "Johannes",
  lastName: "Doe",
  activities: [
    {
      title: "Skiing",
      attributes: ["downhill", "jumps"]
    },
    {
      title: "Coding",
      attributes: ["mongodb", "python"]
    }
  ]
}
```

```
{
  _id: 123,
  location: "DE",
  firstName: "Johannes",
  lastName: "Doe",
  activities: [
    {
      title: "Skiing",
      attributes: ["downhill", "jumps"]
    },
    {
      title: "Coding",
      attributes: ["mongodb", "python"]
    }
  ]
}
```

What is a location attribute?

Generally...

an ISO 3166-1 country code

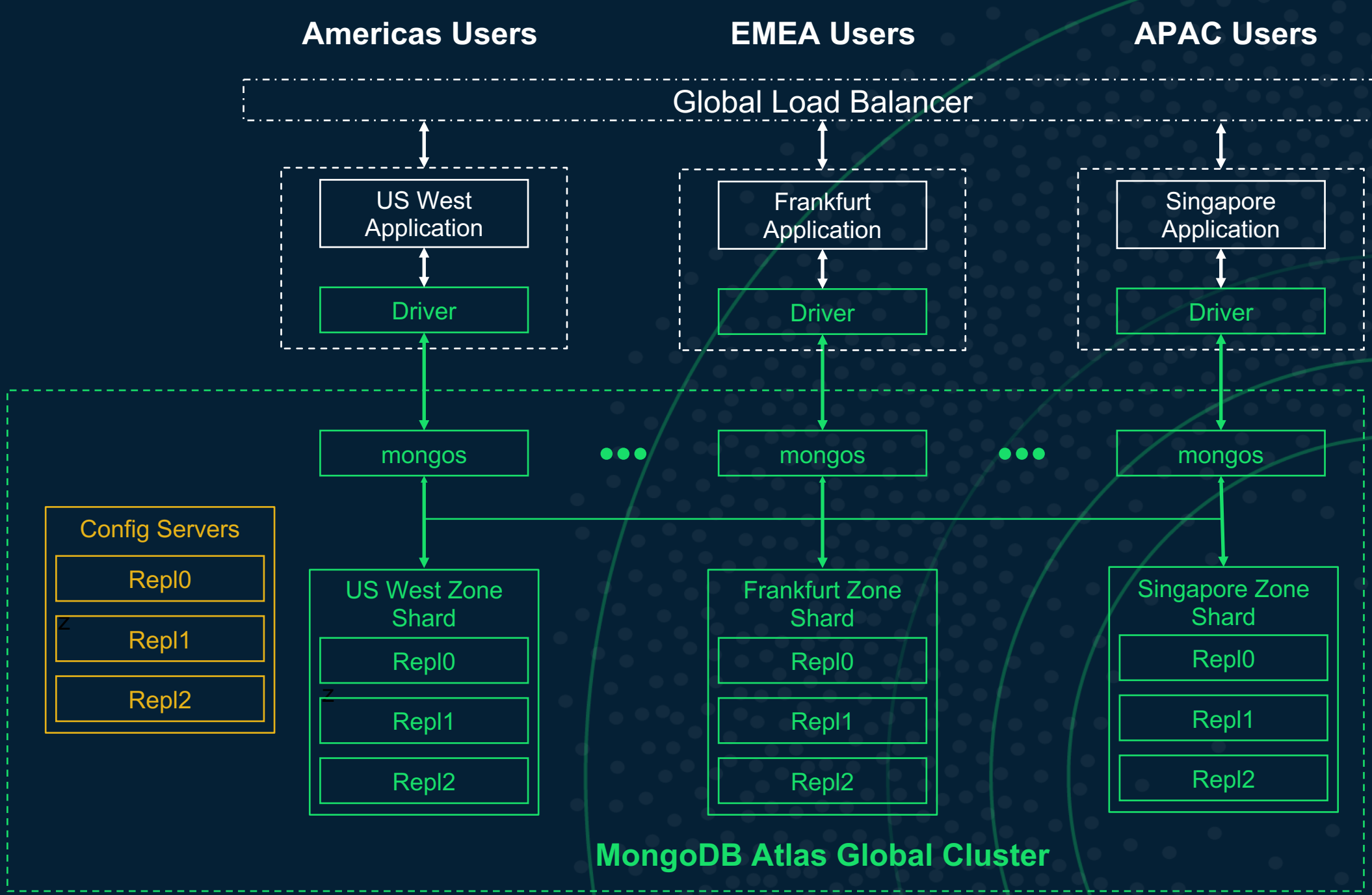
e.g., US, DE, IN, or JP

Or optionally and more specifically...

an ISO-3166-2 subdivision code

e.g., US-CA or US-NY

Examples	Description	Potential Region Affinity
US	United States	US East
DE	Germany	Frankfurt
IN	India	Mumbai
JP	Japan	Tokyo
US-CA	California	US West
US-NY	New York	US East


Americas Users
EMEA Users
APAC Users
Global Load Balancer
US West Application
Frankfurt Application
Singapore Application
Driver
Driver
Driver
mongos
mongos
mongos
Config Servers
Repl0
Repl1
Repl2
US West Zone Shard
Repl0
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Repl2
MongoDB Atlas Global Cluster

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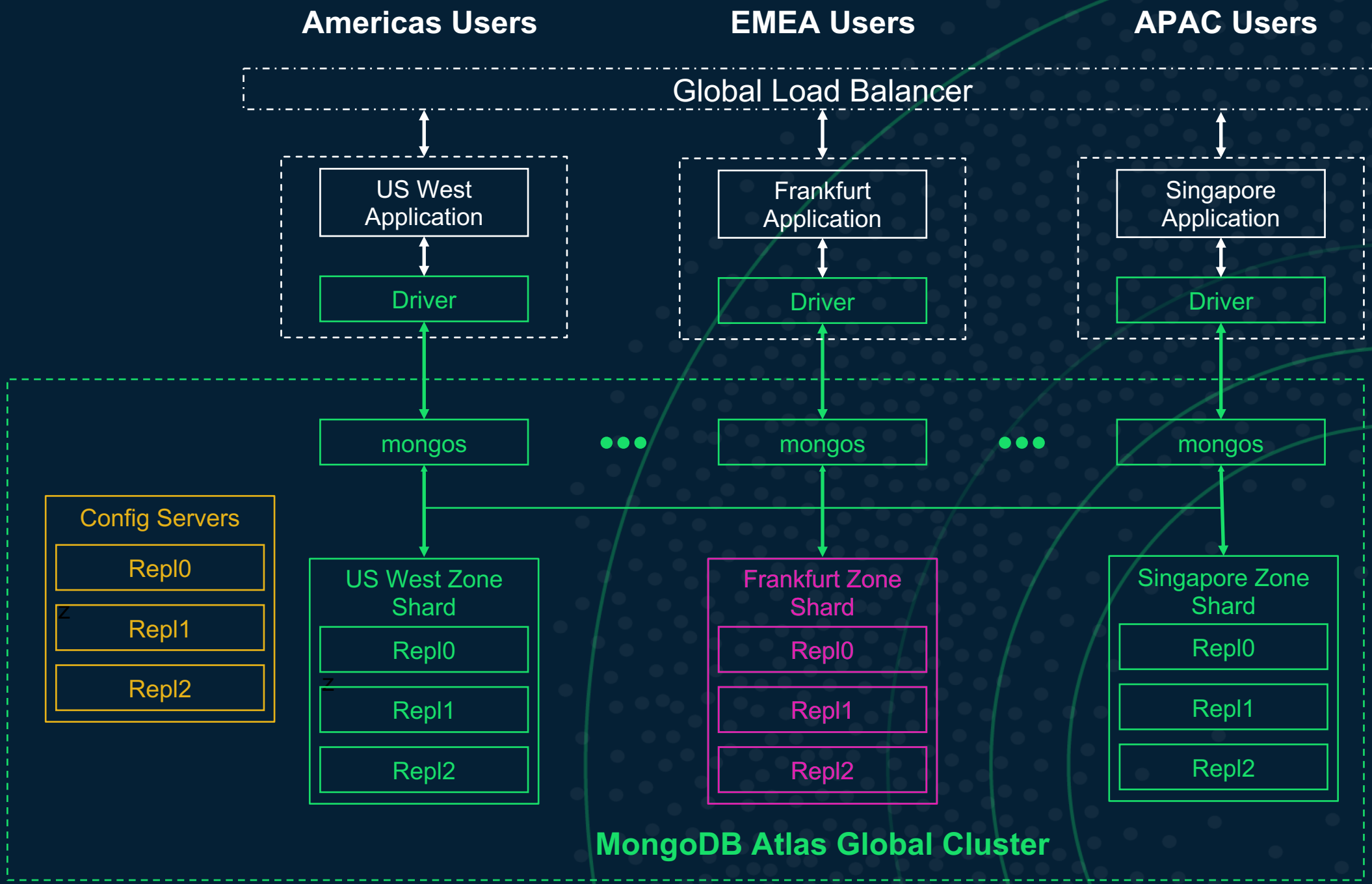
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Repl2
MongoDB Atlas Global Cluster

Define Global Collections

MongoDB Atlas will be very opinionated...

In the Data Explorer, you'll be guided to set a shard key like

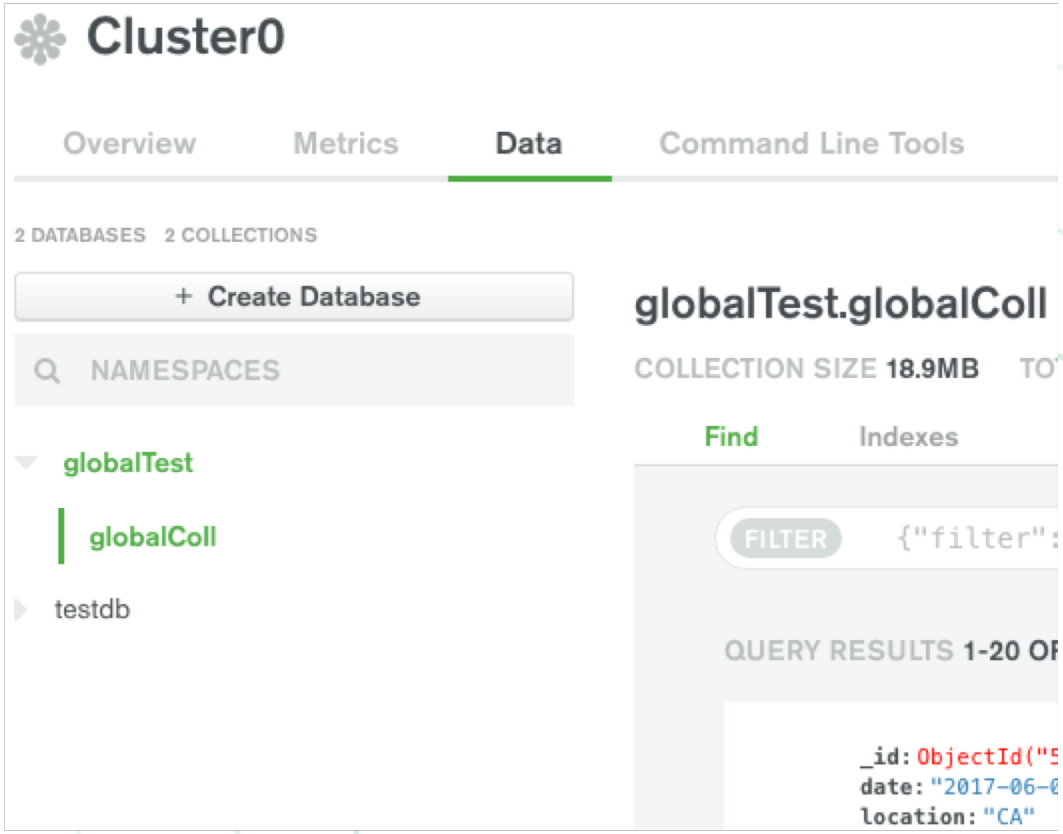
{location : 1, <identifier> : 1}

You'll receive global-targeting query examples

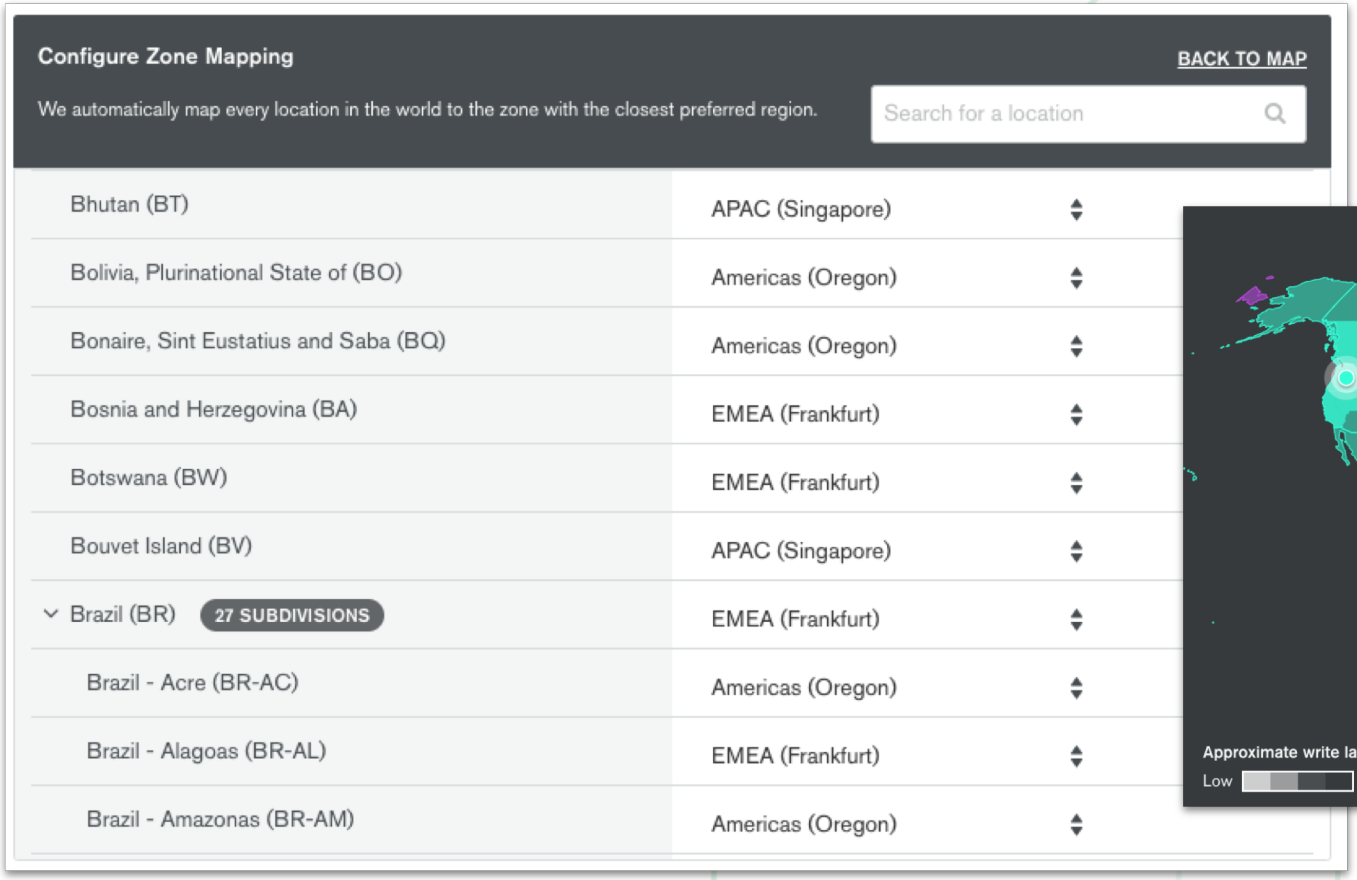
db.globalColl.findOne({ location : "XY", <identifier> : 123, ... })

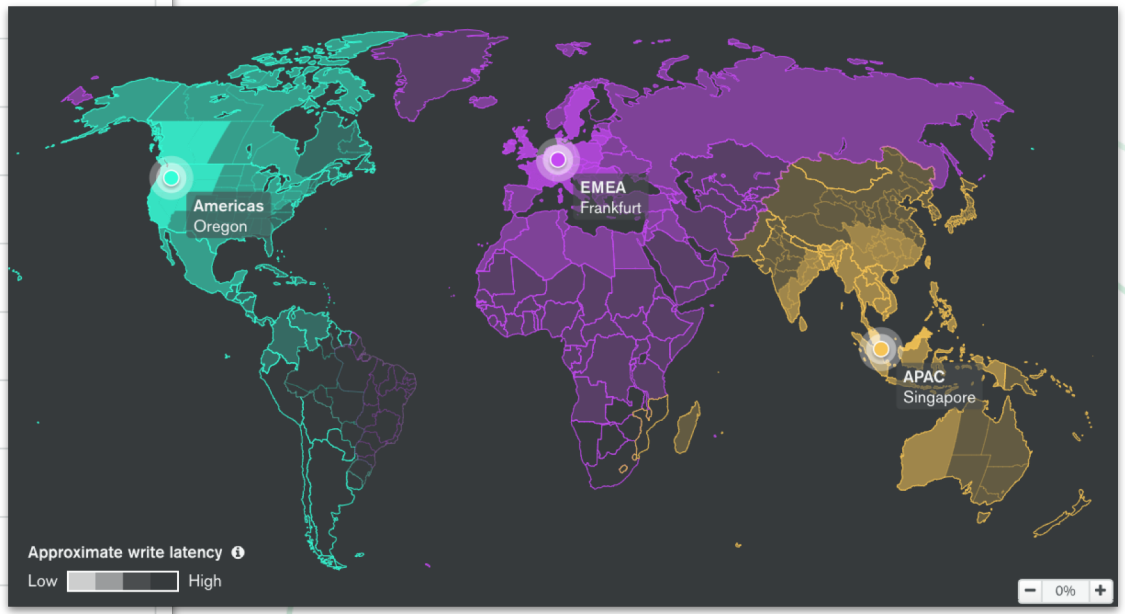
For example `location` and `_id`

```
{
  _id: 123,
  location: "CA",
  firstName: "Jane",
  lastName: "Doe",
  activities: [
    {
      title: "Mountaineering",
      attributes: ["glaciers"]
    },
    {
      title: "Coding",
      attributes: ["java", "mongodb"]
    }
  ]
}
```



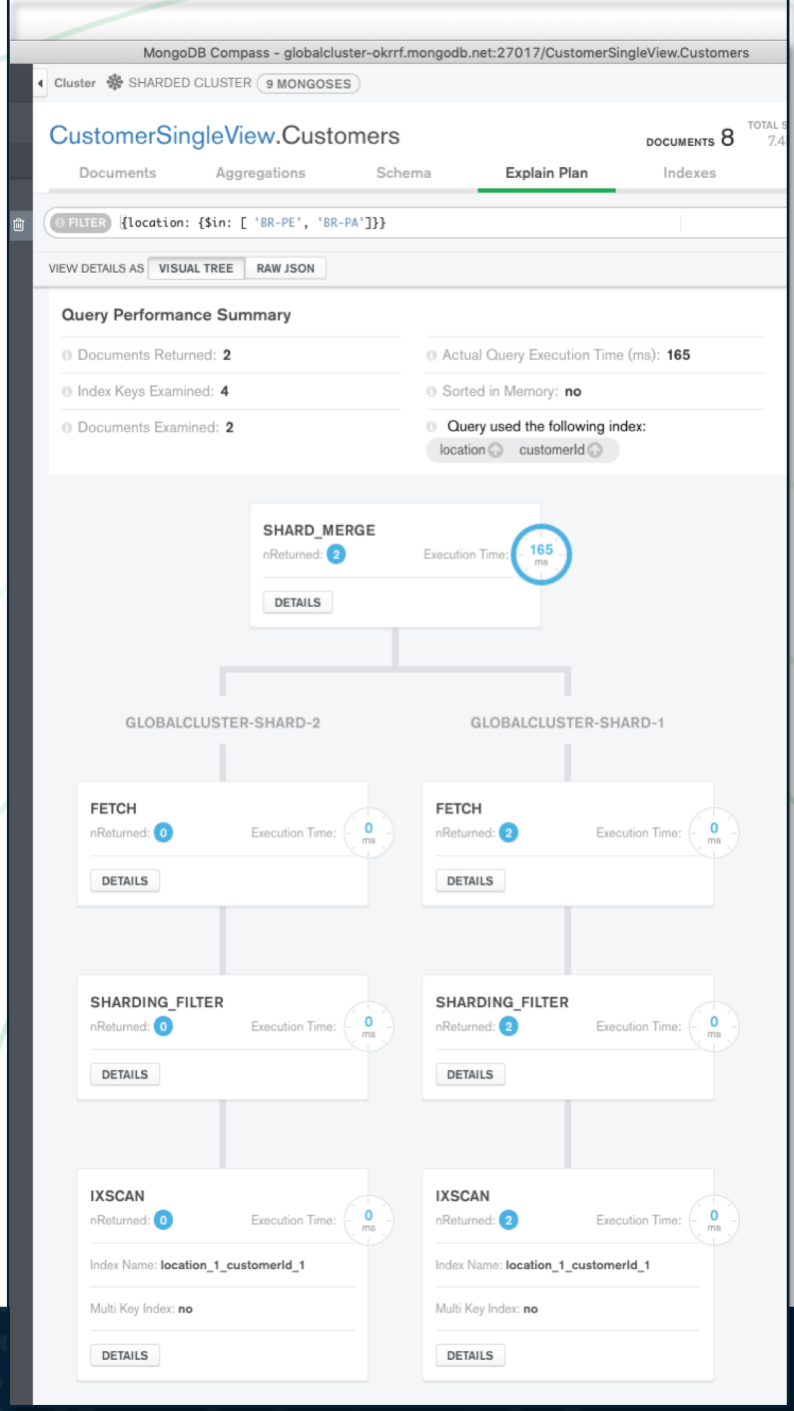
How are locations mapped to zones?





Query routing without LATAM zone

```
{
  location:
    {$in: [ 'BR-PE', 'BR-PA']}
}
```



Get ISO Country code from HTTP Request

AWS – Lambda & CloudFront

- `headers['cloudfront-viewer-country']`

*Limited to country

https://docs.aws.amazon.com/AmazonCloudFront/latest/DeveloperGuide/lambda-examples.html#lambda-examples-redirecting-examples

Google Cloud –Functions

- `country: req.headers["x-appengine-country"]`
- `region: req.headers["x-appengine-region"]`

https://cloud.google.com/appengine/docs/standard/go/reference/request-response-headers

https://medium.com/mop-developers/free-ip-based-geolocation-with-google-cloud-functions-f92e20d47651

CloudFlare – Enable IP Geolocation

- `HTTP_CF_IPCOUNTRY` header

Akamai – EdgeScape (CDN)

- `country_code` and `region_code` headers

Provide a better experience to growing markets

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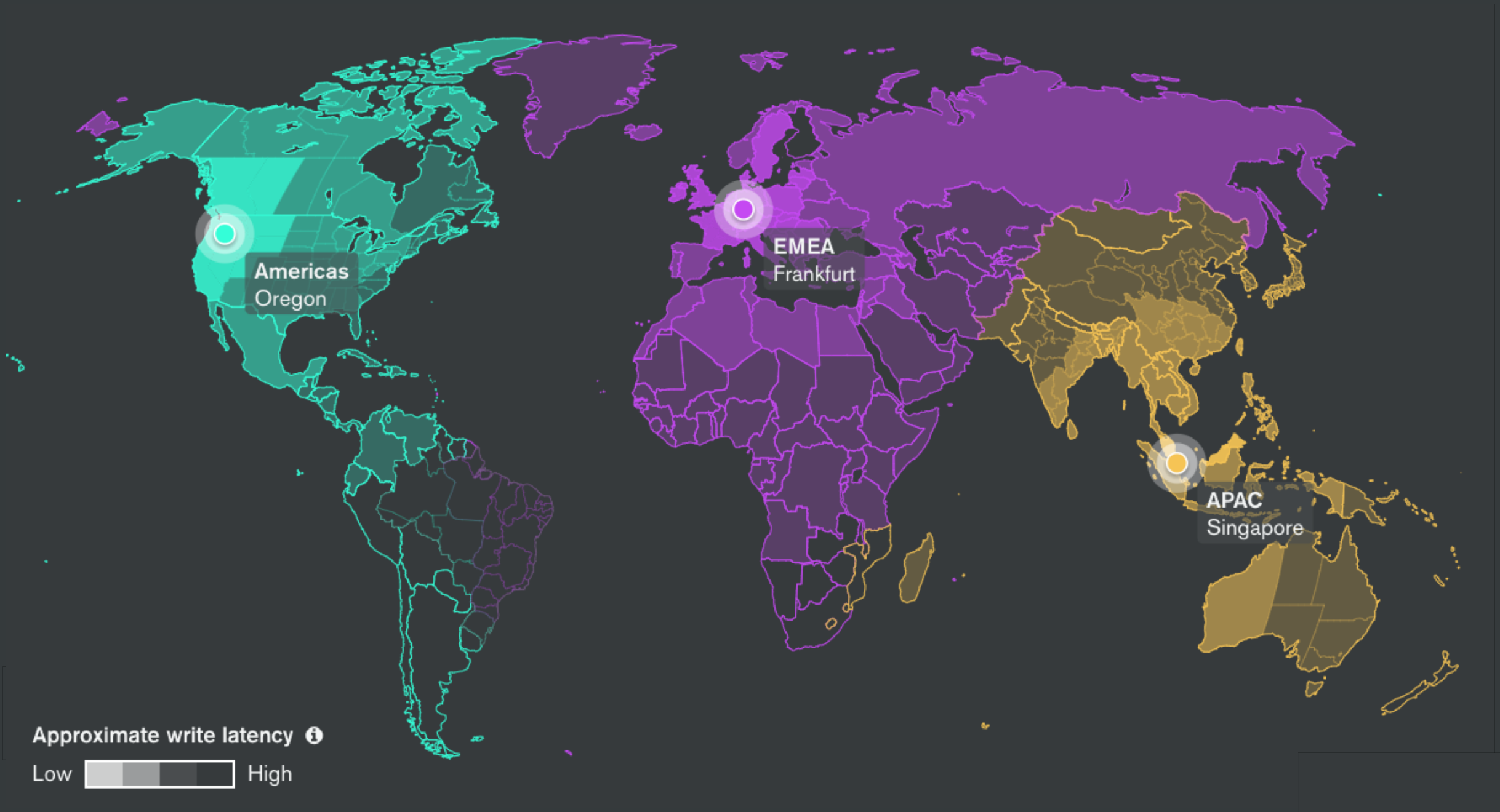

Americas
Oregon
EMEA
Frankfurt
APAC
Singapore
Approximate write latency
Low
High

When should I add a Zone?

If latency of complete request exceeds threshold?

Not really – There are many layers contributing to the latency outside of Atlas

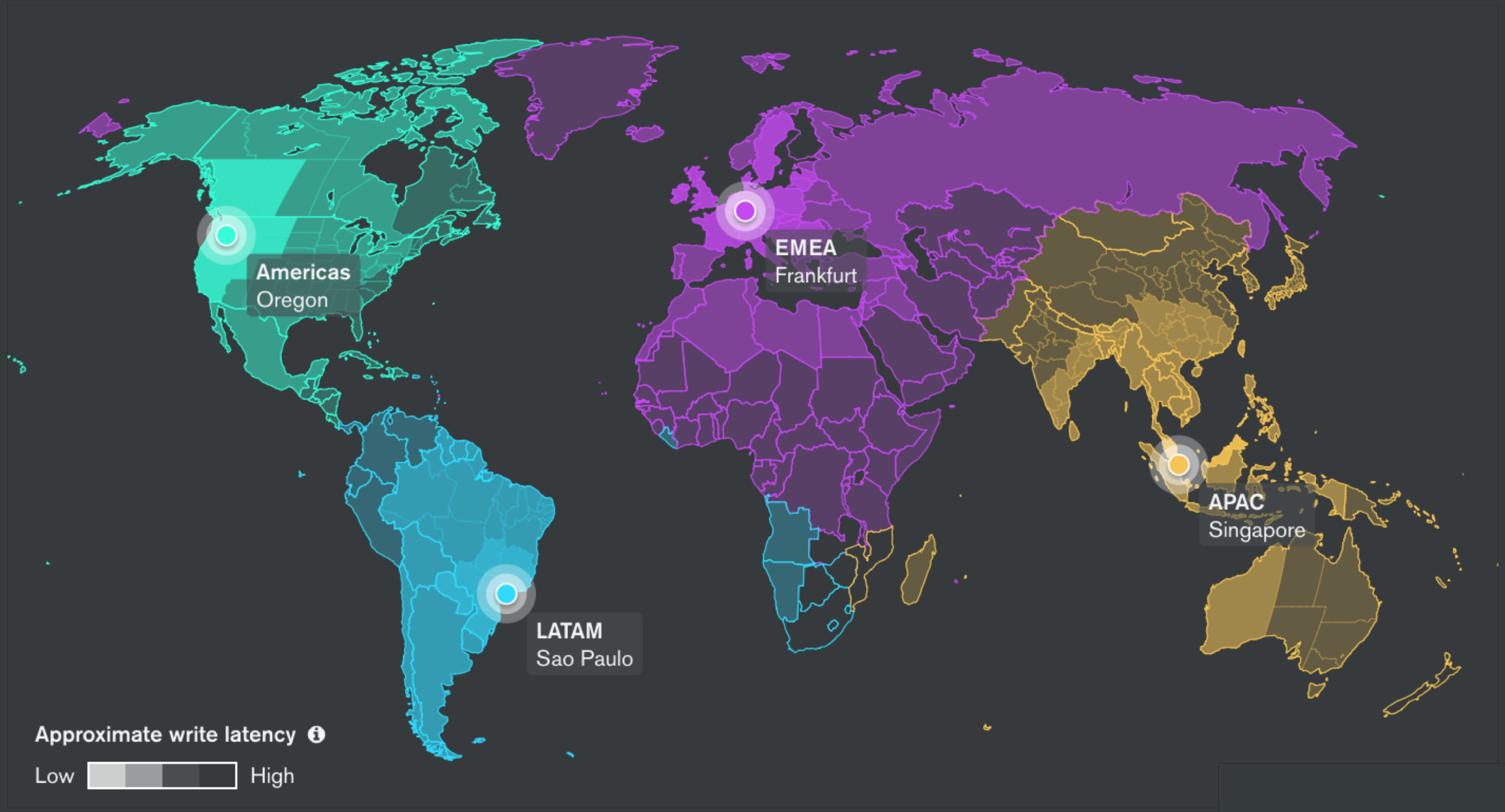
Metrics in Atlas?

Maybe – performance metrics

Maybe – mongos logs – cross-reference IP against IP-GeoLocation DB / Service

It's beyond Atlas - A combination of:

- Data Set growing from certain countries & sub-divisions
  Use Aggregation Framework, BI Connector or Spark Connector for Analytics
- CDN / API Management Metrics: AWS CloudFront / API Gateway, Akamai, etc.
- Planned Expansion: New features targeting specific markets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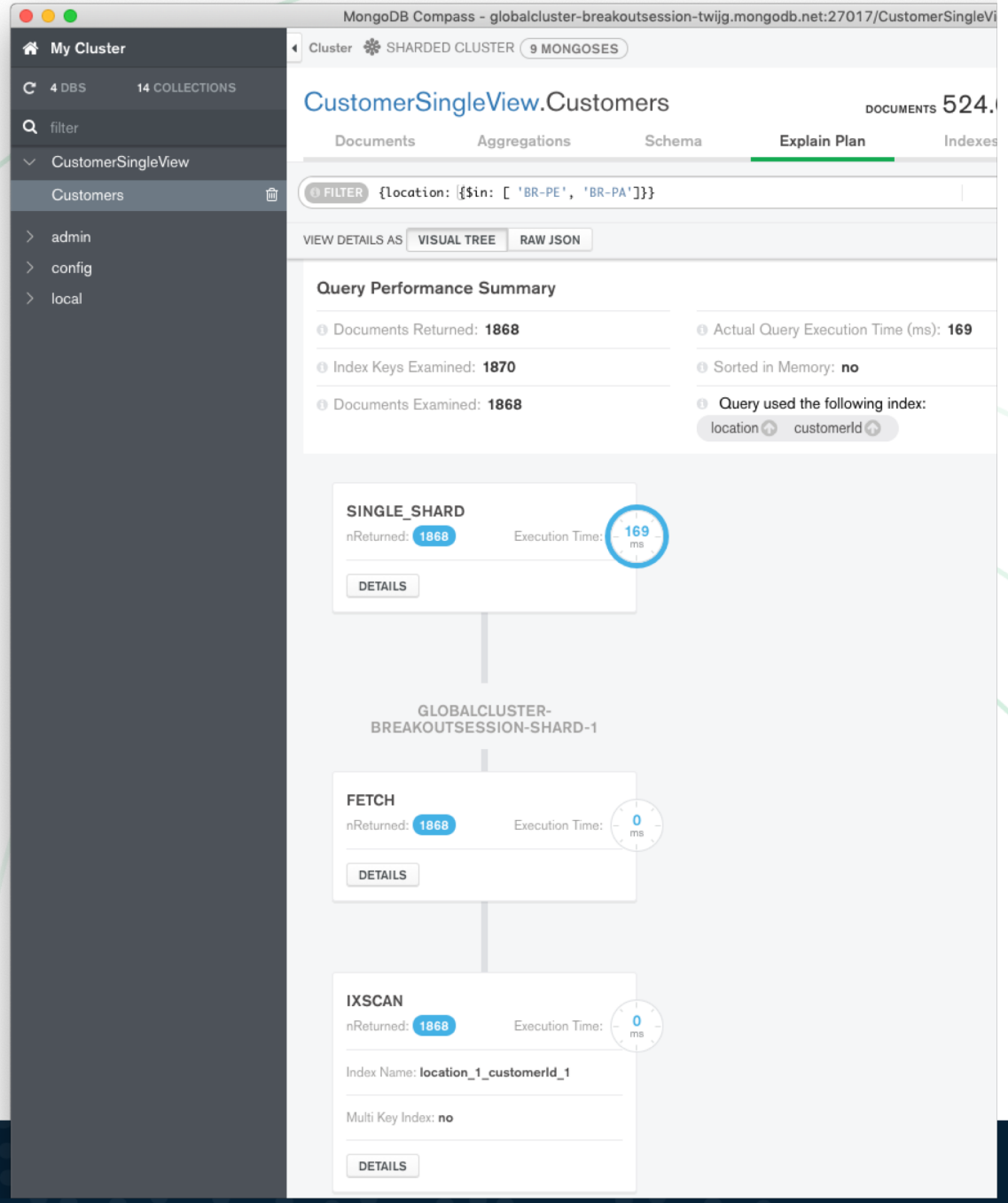
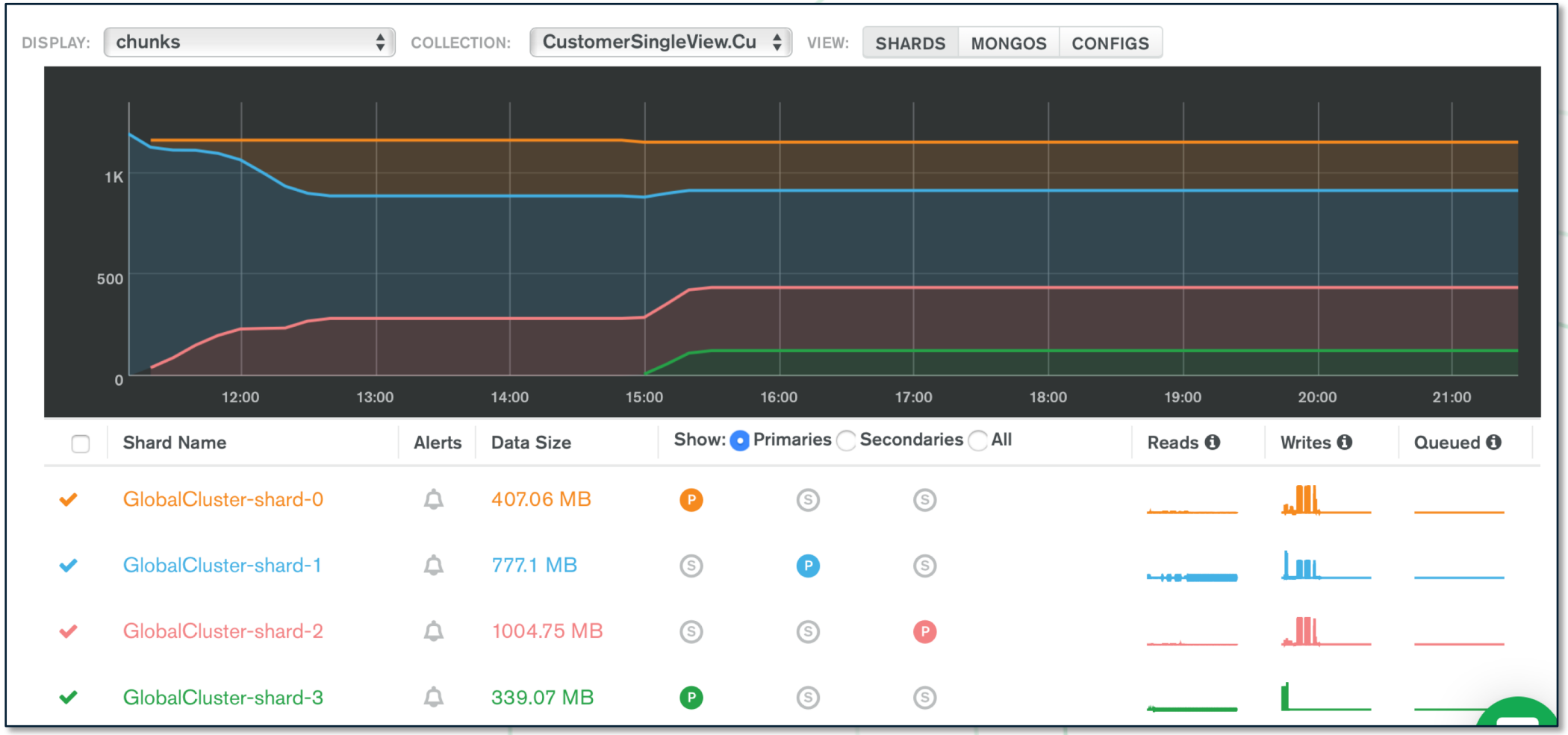
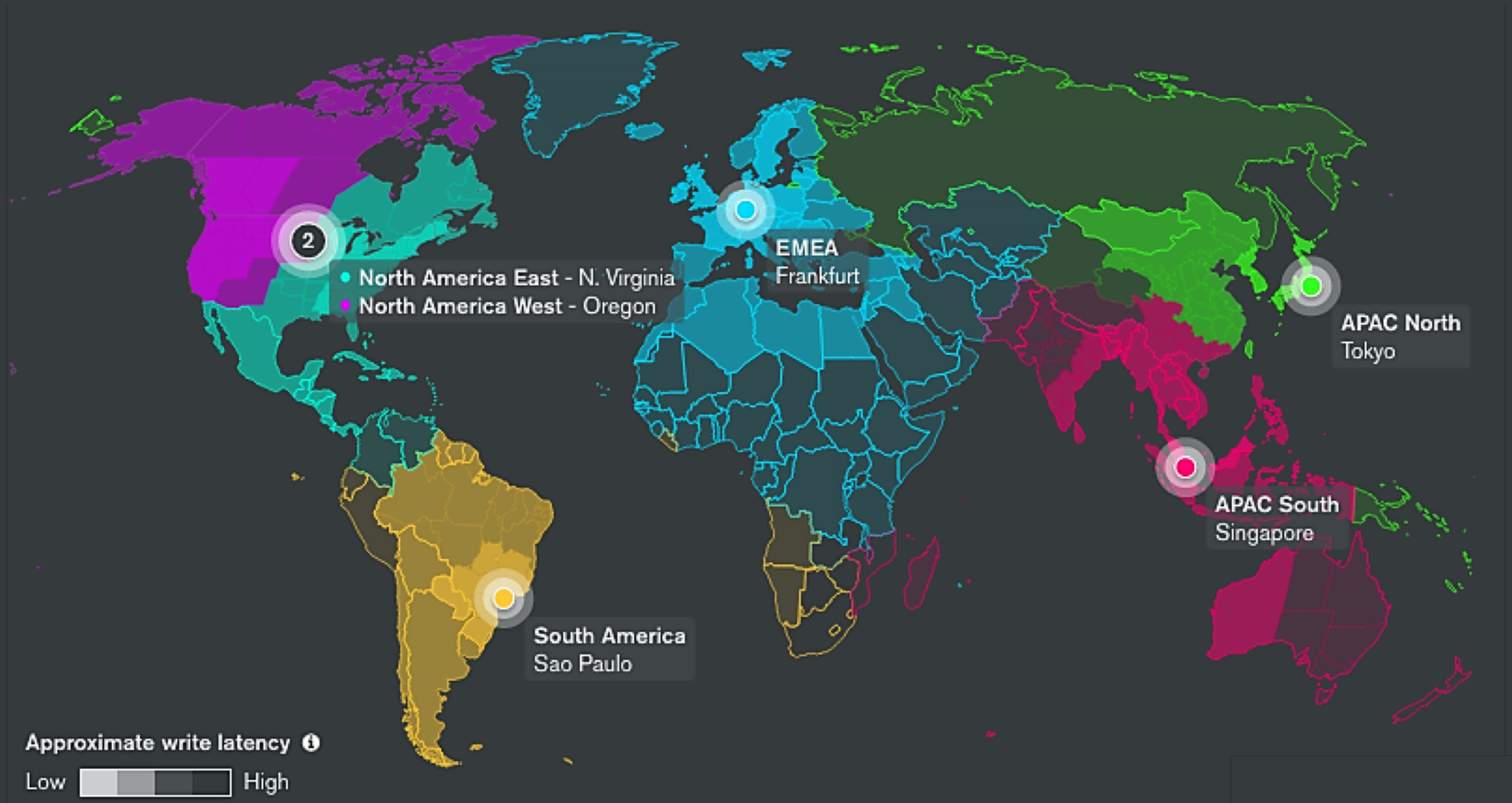


Chunk Migration – adding LATAM zone

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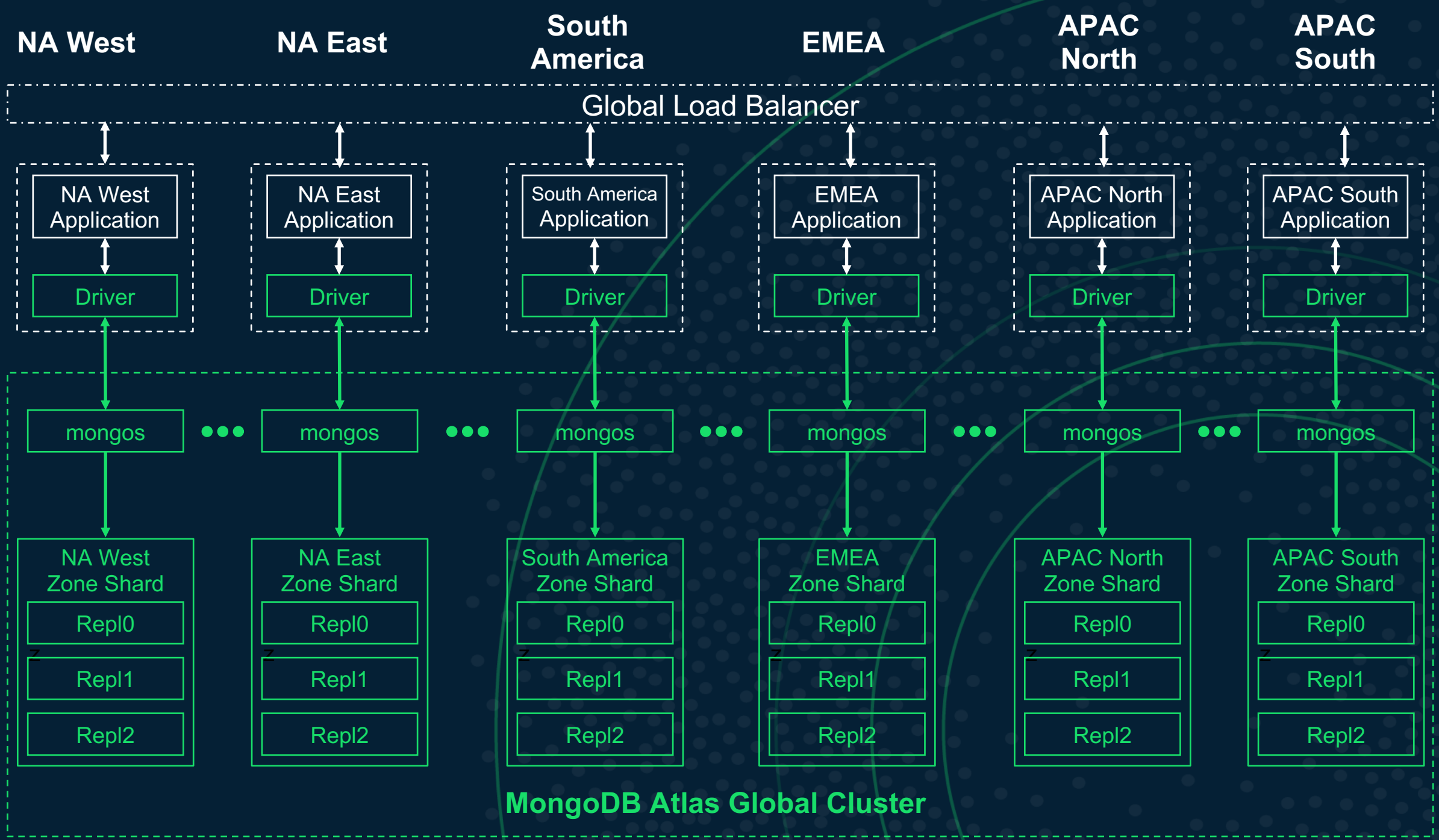
NA West
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South America Application
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APAC North Application
APAC South Application
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Driver
Driver
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NA East Zone Shard
South America Zone Shard
EMEA Zone Shard
APAC North Zone Shard
APAC South Zone Shard
Repl0
Repl1
Repl2
MongoDB Atlas Global Cluster

Simplified connectivity

Concise and global, it will look like

```
mongodb+srv://user:pass@globalCluster-rzeyq.mongodb.net
```

Your driver will use this address to discover every mongos in the cluster globally

Taking advantage of the MongoDB 3.6 driver support for SRV records

… so you can deploy the same application code everywhere - symmetrically

Resolving SRV record to mongos's

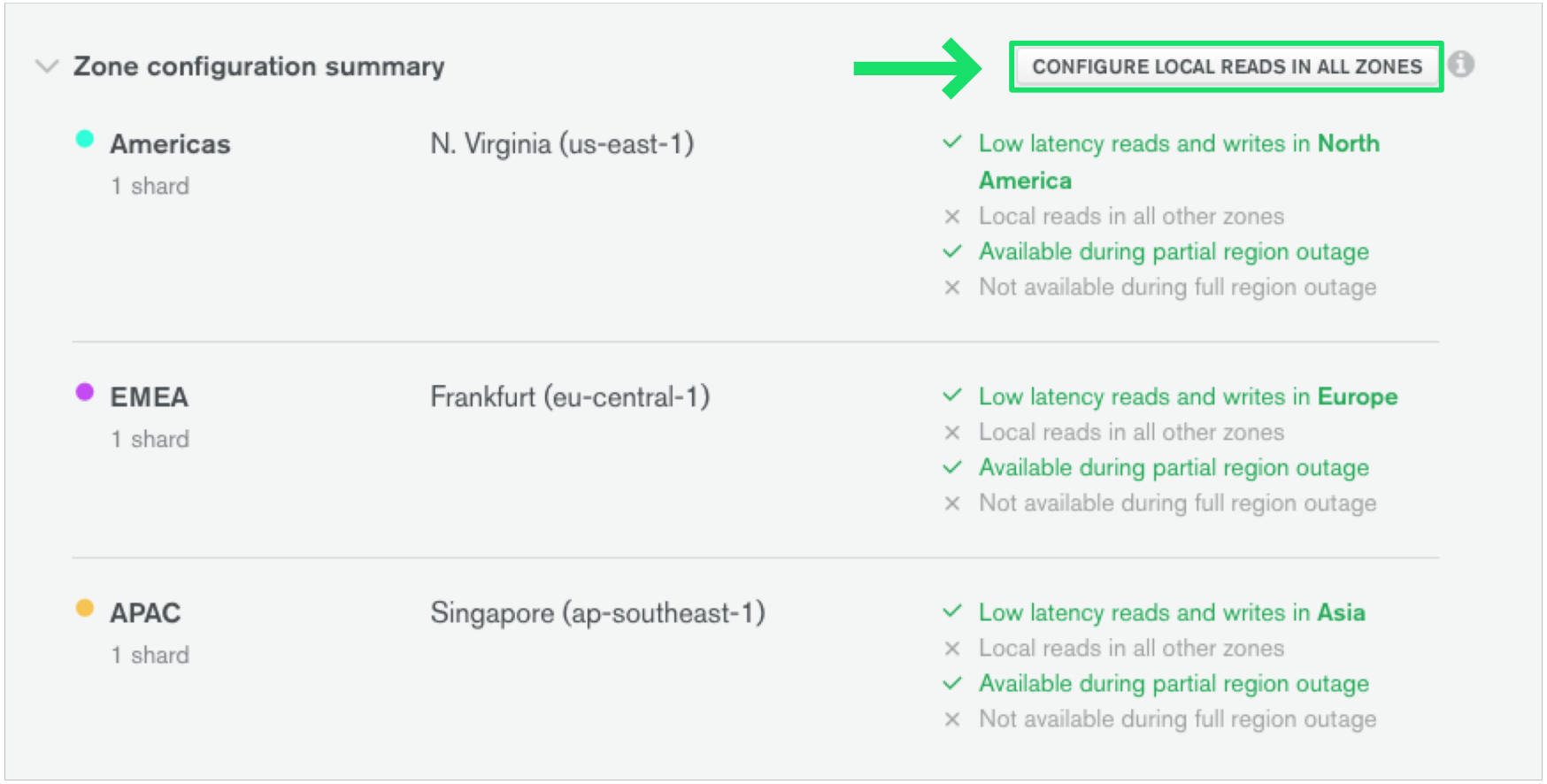
Blog Post: https://www.mongodb.com/blog/post/mongodb-3-6-here-to-SRV-you-with-easier-replica-set-connections

```
$ python mongodb_srv_records.py globalcluster-twijg.mongodb.net
globalcluster-shard-00-00-twijg.mongodb.net:27016
globalcluster-shard-00-01-twijg.mongodb.net:27016
globalcluster-shard-00-02-twijg.mongodb.net:27016
globalcluster-shard-01-00-twijg.mongodb.net:27016
globalcluster-shard-01-01-twijg.mongodb.net:27016
globalcluster-shard-01-02-twijg.mongodb.net:27016
globalcluster-shard-02-00-twijg.mongodb.net:27016
globalcluster-shard-02-01-twijg.mongodb.net:27016
globalcluster-shard-02-02-twijg.mongodb.net:27016
globalcluster-shard-03-00-twijg.mongodb.net:27016
globalcluster-shard-03-01-twijg.mongodb.net:27016
globalcluster-shard-03-02-twijg.mongodb.net:27016
globalcluster-twijg.mongodb.net: "authSource=admin"
```

An even better user experience?

What if I want low latency global reads?

What if I want low latency global reads?



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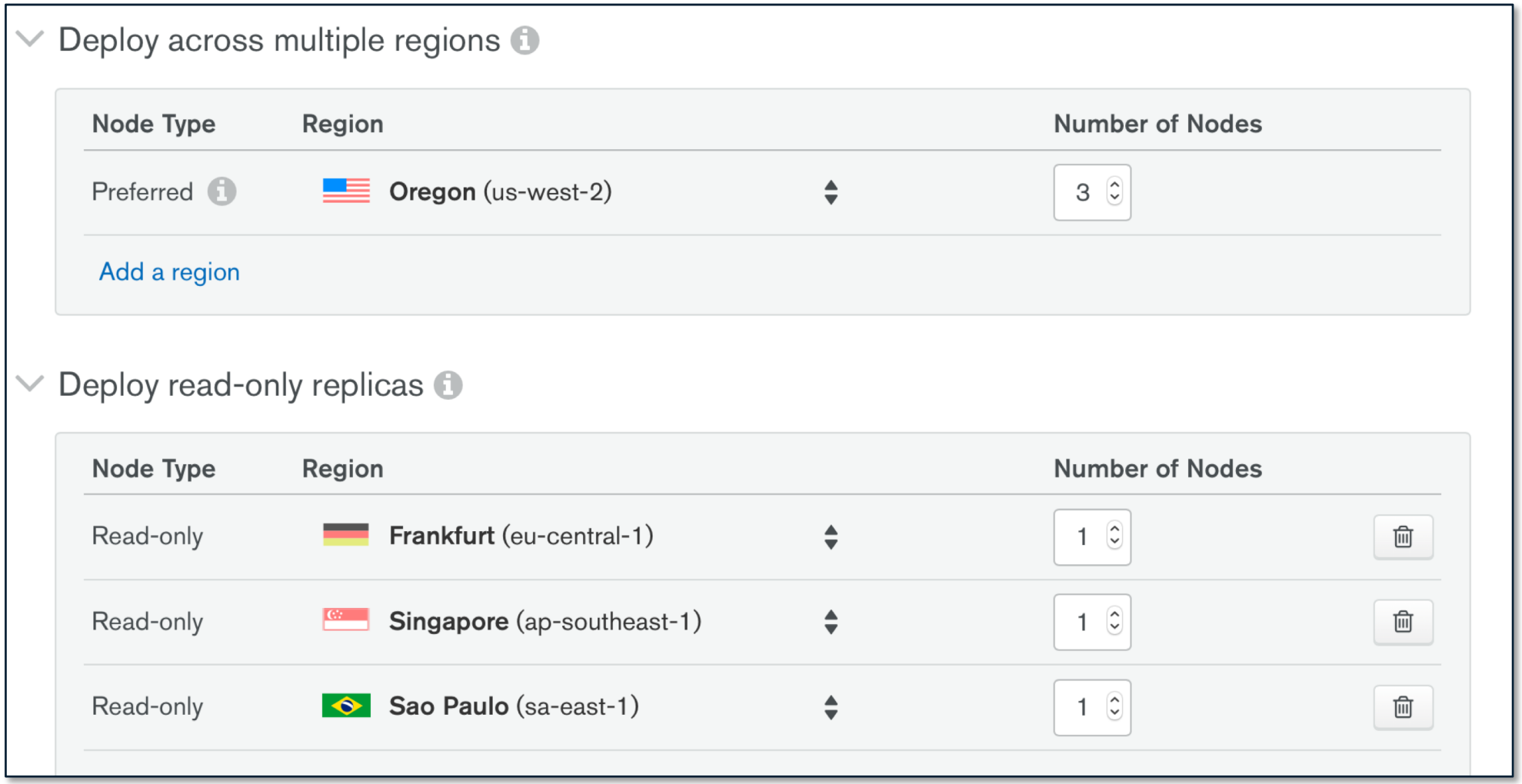

Where this is going and limits

Massive reach

MongoDB Atlas

- in-country regions for 27% of the world population
- with a much higher percent served by regions in nearby countries

Available in 56 global cloud regions

- AWS: 15 regions (38 availability zones)
- Azure: 26 regions (26 availability zones w/ 60 Fault Domains)
- GCP: 15 regions (38 Availability zones)

There are gaps

Africa

- S. Africa announced by Azure; a long way from most of Africa's population, however
- Biggest economies in Africa: Nigeria, South Africa, Egypt; with Ethiopia now the fastest growing

Middle East

- We'll see

China

- It's complicated...

Russia

- It's also complicated…
- Frankfurt remains best bet but also Finland on Google Cloud

Special / **Government** / Compliance contexts

But MongoDB runs everywhere

Over time the entire world will be well served by major cloud infrastructure

You can always run your own MongoDB outside of where the big public cloud

- MongoDB Ops Manager / MongoDB Cloud Manager
- Live Migrate to MongoDB Atlas when ready

So you can have a seamless development experience in any context

Imagine 2030

2030 Projection

GDP & relative position compared with today

1 China	↑	17 Spain	↓
2 United States	↓	18 Canada	↓
3 India	↑↑↑↑	19 Egypt	↑↑↑
4 Japan	↓	20 Pakistan	↑↑↑
5 Indonesia	↑↑↑	21 Nigeria	↑↑
6 Russia	↑	22 Thailand	↑↑
7 Germany	↓	23 Australia	↓
8 Brazil	↑	24 Philippines	↑↑
9 Mexico	↑	25 Malaysia	↑↑
10 United Kingdom	↓	26 Poland	↓
11 France	↓	27 Argentina	↓
12 Turkey	↑	28 Bangladesh	↑↑↑
13 Saudi Arabia	↑↑	29 Vietnam	↑↑↑
14 South Korea	↓	30 South Africa	↑↑
15 Italy	↓	31 Colombia	↑↑
16 Iran	↑↑	32 Netherlands	↓

You can go global incrementally

Path to Global Over Time

1. **Cluster – Single Region** ← deploy today for free on Atlas
   - Focus on finding traction
   - Scale up when needed in a few minutes on Atlas

Path to Global Over Time

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   - Get your application HA as well
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3. **Cluster – add Global Read Regions**
   - Route users to nearby application instance; use secondary reads
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4. **Enable Global Writes**
   - Add a second write zone
   - Add location attribute to your data & shard your global collections in the Atlas UI

Path to Global Over Time

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4. **Enable Global Writes**
   - Add a second write zone
   - Add location attribute to your data & shard your global collections in the Atlas UI
5. **Expand Reach of Global Cluster**
   - Add more write zones
   - Or add shards to existing zones
   - Scale up any time

And you can follow your users...

Now go out and reach those 4+ billion internet users

Thanks

Sigfrido “Sig” Narvaez

Principal Solution Architect, MongoDB
sig@mongodb.com

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