Multi-Master Replication

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redisday
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Traditional Redis Replication

Been there forever...

Master -> Slave(s) model

Slave may be a master for other slaves

Slave may be read/only or read/write

Basic High Availability building block

Scaling to multi-region

Redis is fast!

> 1,000,000 ops/sec, < 1 millisecond latency

Light is slower…

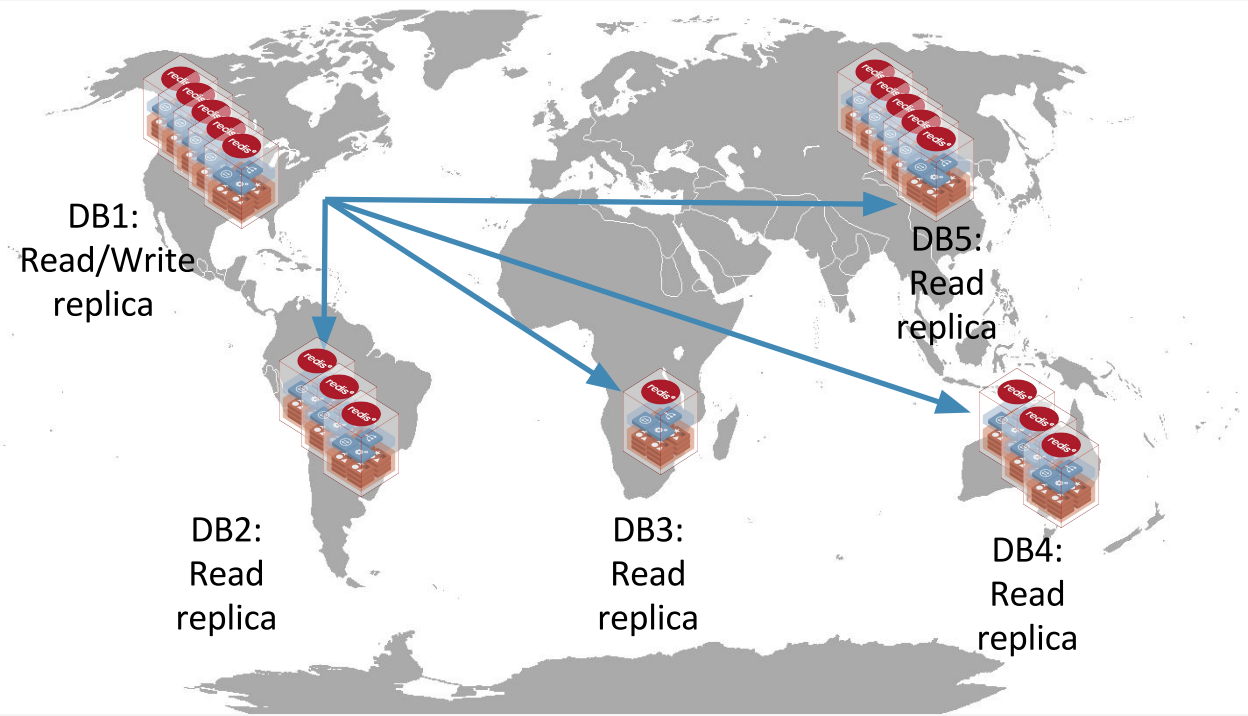
> 20 milliseconds us-east to us-west RTT

And network is even slower…

> 70 milliseconds RTT

Better keep our data near by!

Read Replicas (Single Master)



Multi-Master Replication - Requirements

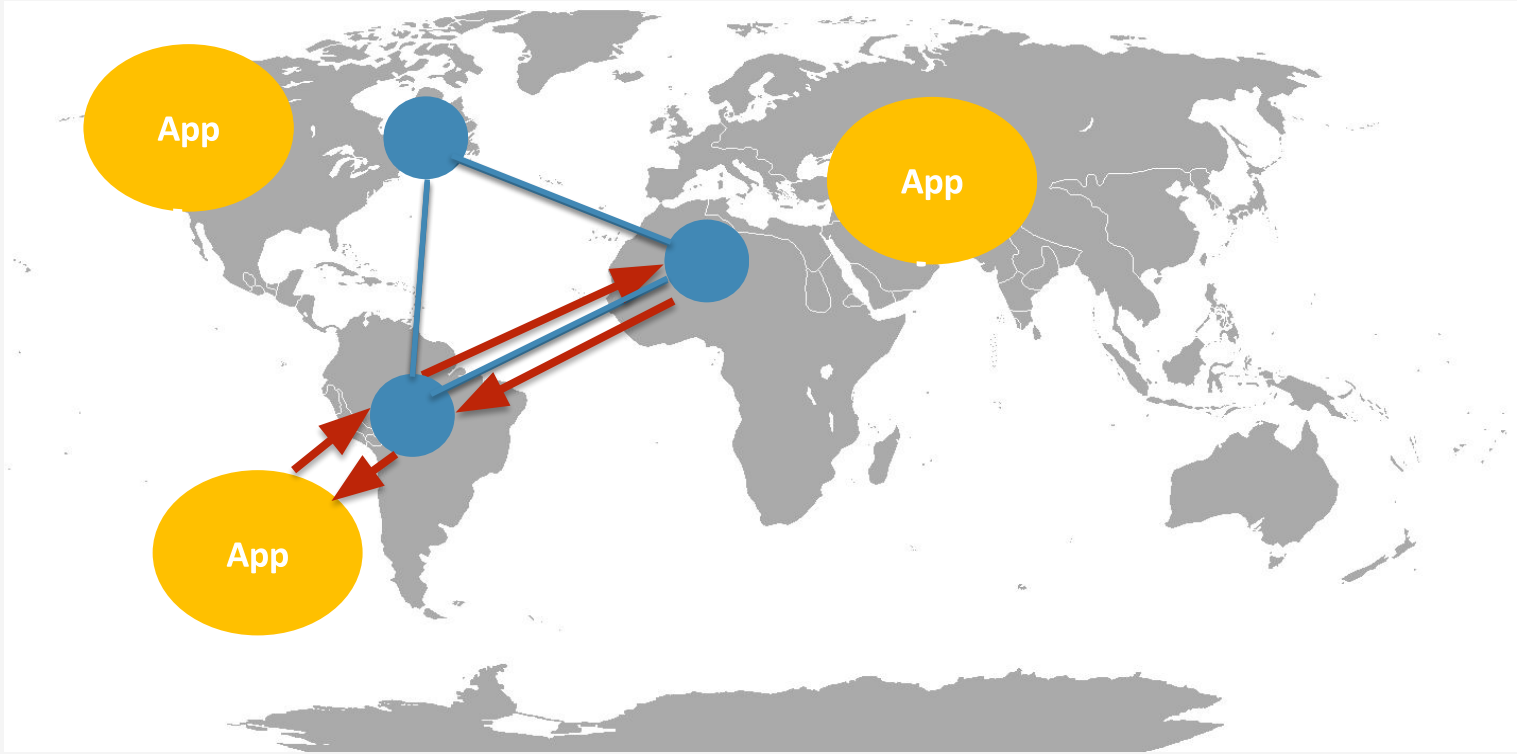
Support a **single** global data-set

Maintain dataset consistency

Maintain Redis speed

Maintain Redis commands and data-types

Consistency: Consensus is slow



Eventual Consistency

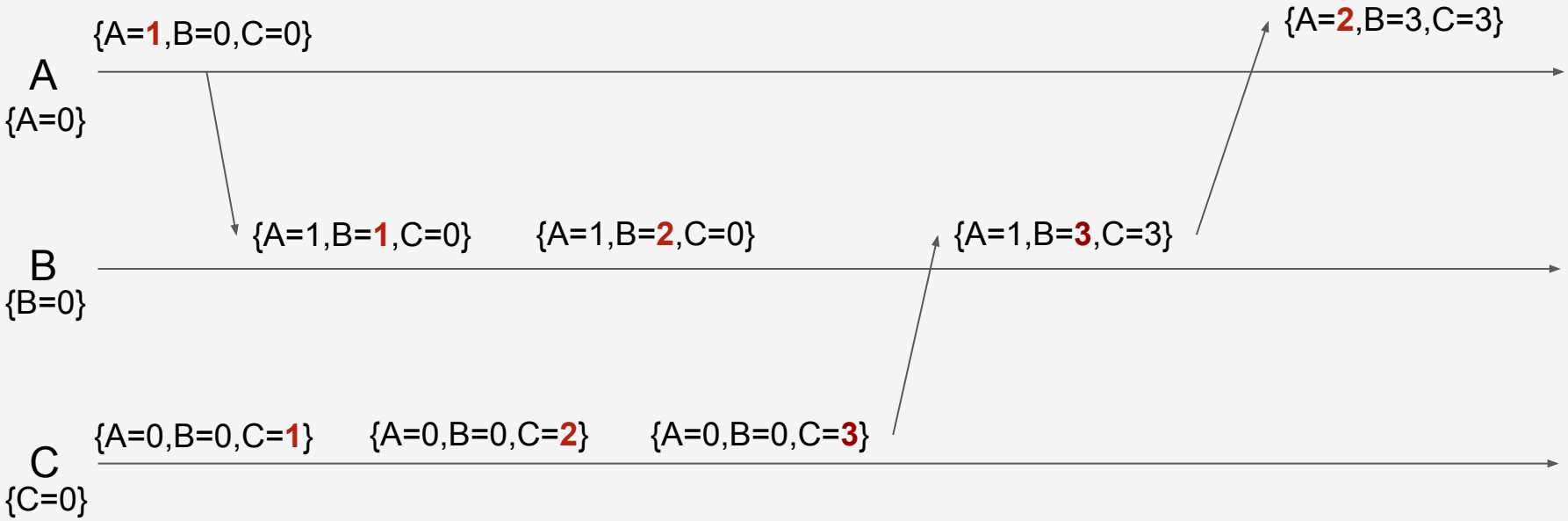
Reads & Writes are done locally

Writes are converged asynchronously

Reads are not guaranteed to be up to date

Global (partial) ordering - **vector clocks**

Vector Clocks



What about conflicts?

Conflict Free Replicated Data Types (CRDTs)

Consensus-free consistency

Long researched in the academy, formally verified

Apply to many data types

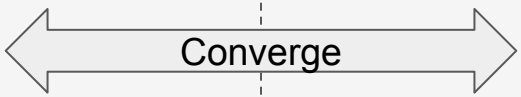
Enhanced and adapted to Redis

Mostly transparent to users

Example: Counter

```
INCRBY my-counter 5
GET my-counter
=> 5
```

```
INCRBY my-counter 8
GET my-counter
=> 8
```



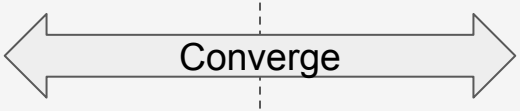

```
GET my-counter
=> 12
```

```
GET my-counter
=> 12
```

Example: Set (add-wins/observed remove)

```
SADD my-set element1
```

```
SADD my-set element1
SREM my-set element1
```

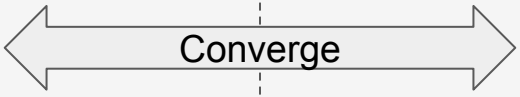



```
SISMEMBER my-set element1
=> 1
```

```
SISMEMBER my-set element1
=> 1
```

```
SREM my-set element1
SADD my-set element2
```

```
SREM my-set element2
```



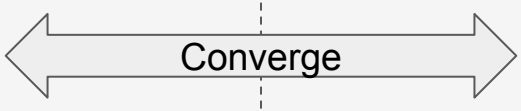

```
SISMEMBER my-set element2
=> 1
```

```
SISMEMBER my-set element2
=> 1
```

Example: LWW-Register (string)

```
SET my-key value1
```

```
SET my-key value2
```

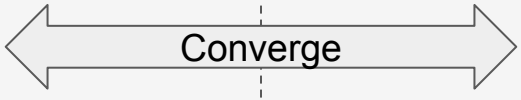



```
GET my-key
=> value1
```

```
GET my-key
=> value1
```

```
DEL my-key
```

```
SET my-key value3
```




```
GET my-key
=> value3
```

```
GET my-key
=> value3
```

Status & Availability

Alpha stage

Will be part of the Redis Enterprise product

CRDT is implemented as a Redis 4.x Data Type module

Dedicated Peer Replication mechanism

Thank you