Challenges and Possibilities of Active-Active Databases

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PgConf Belgium
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Active-Active
Multi-Master
Distributed Databases
...so many names
and why do we need them anyway?

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Designing Data-Intensive Applications - Martin Kleppmann

Geo Redundancy

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Renting City Bikes Service

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Renting City Bikes Service

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Renting City Bikes Service with resilience

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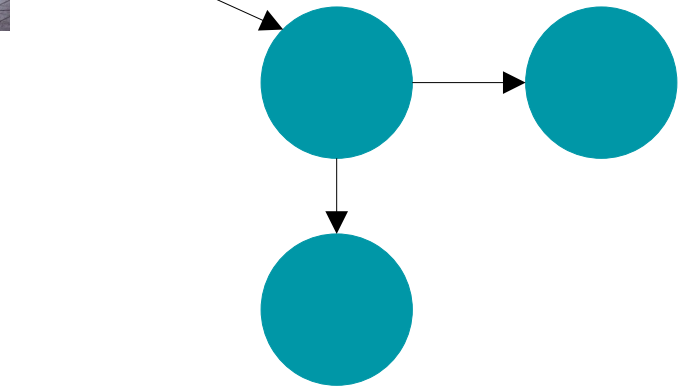
Renting City Bikes Service with synchronous replication



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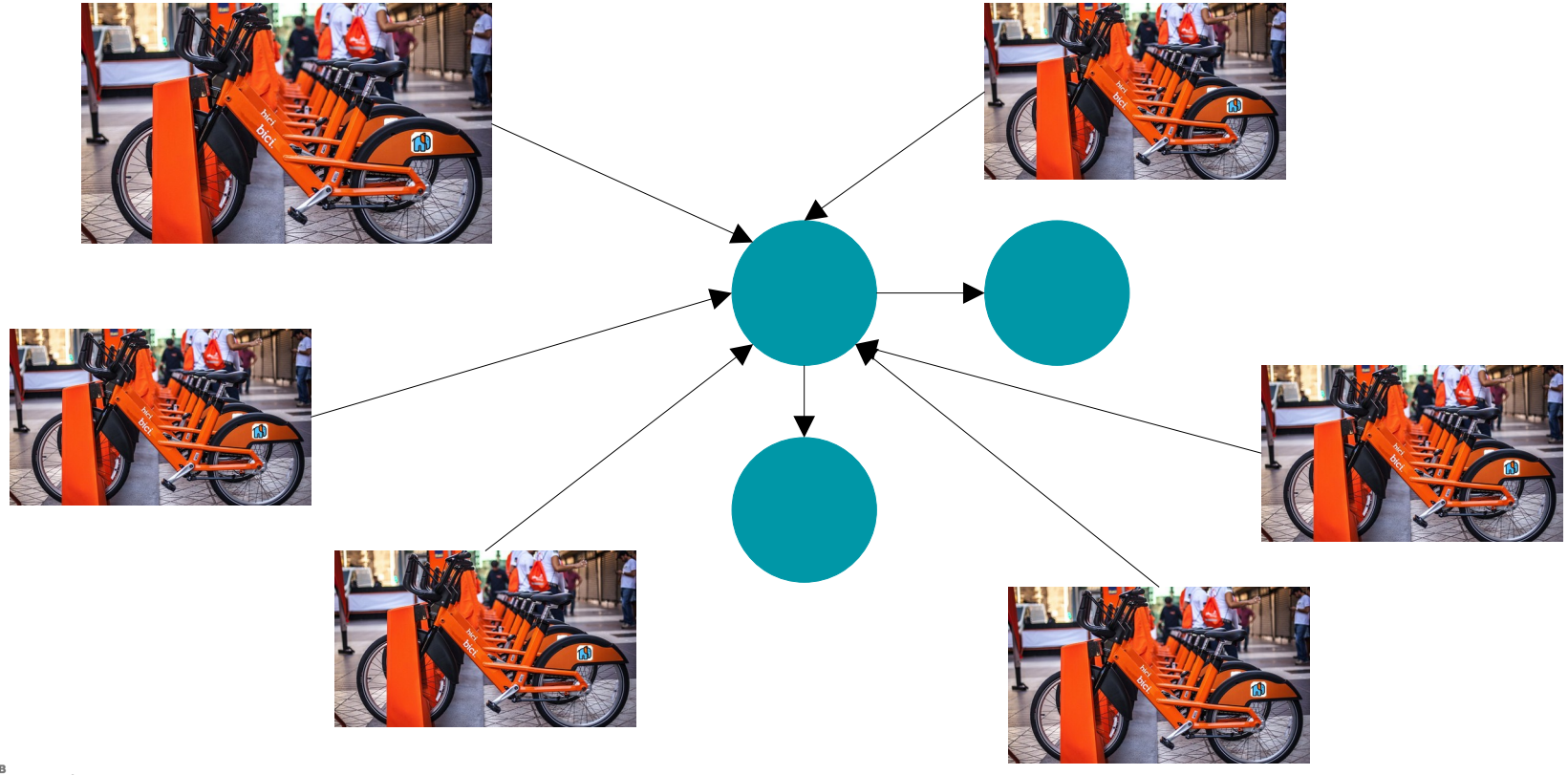
Renting City Bikes Service gets successful



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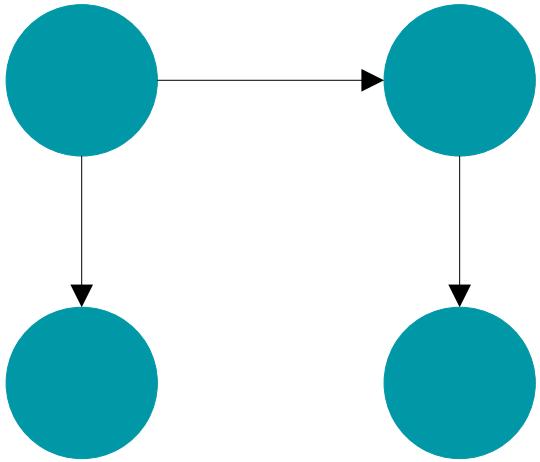
Physical replication with 2DC



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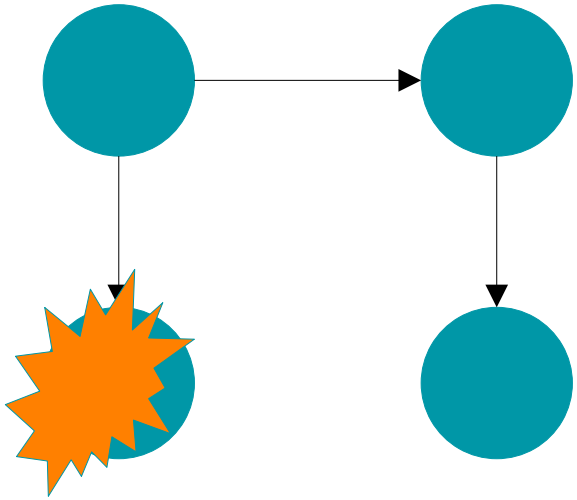
Resiliency – Partial Failure



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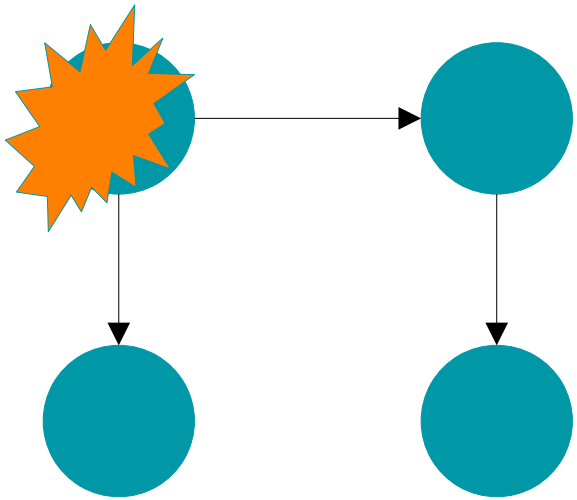
Resiliency - Failover



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Reliability and Scalability

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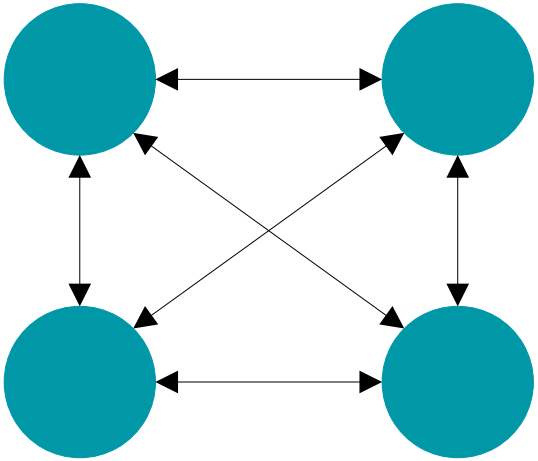
Active-Active – Distributed



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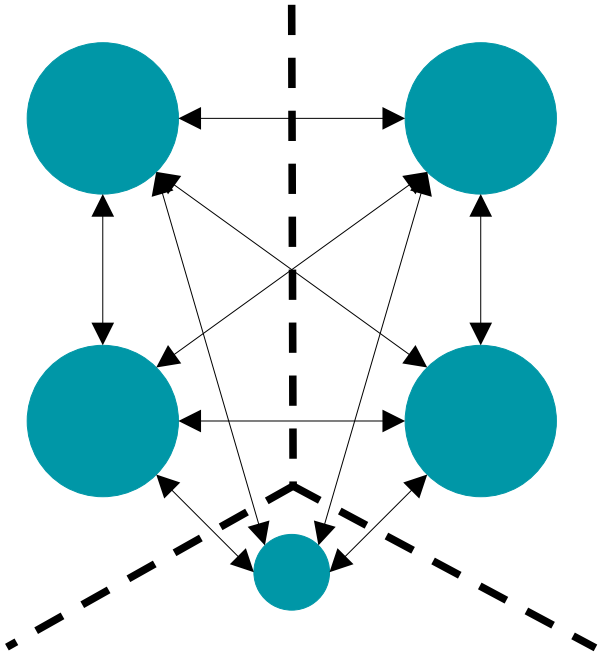
Active-Active – Distributed



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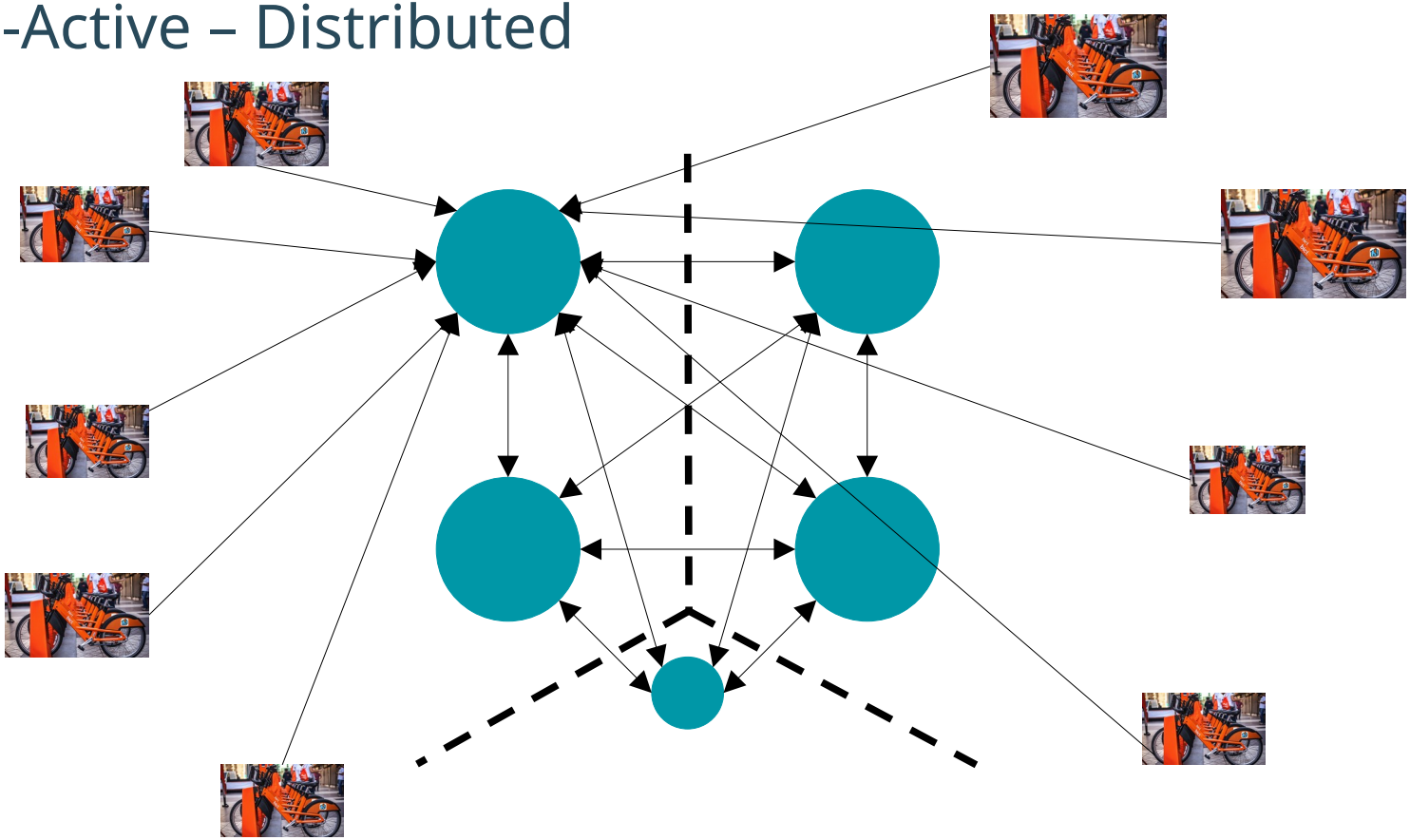
Active-Active – Distributed



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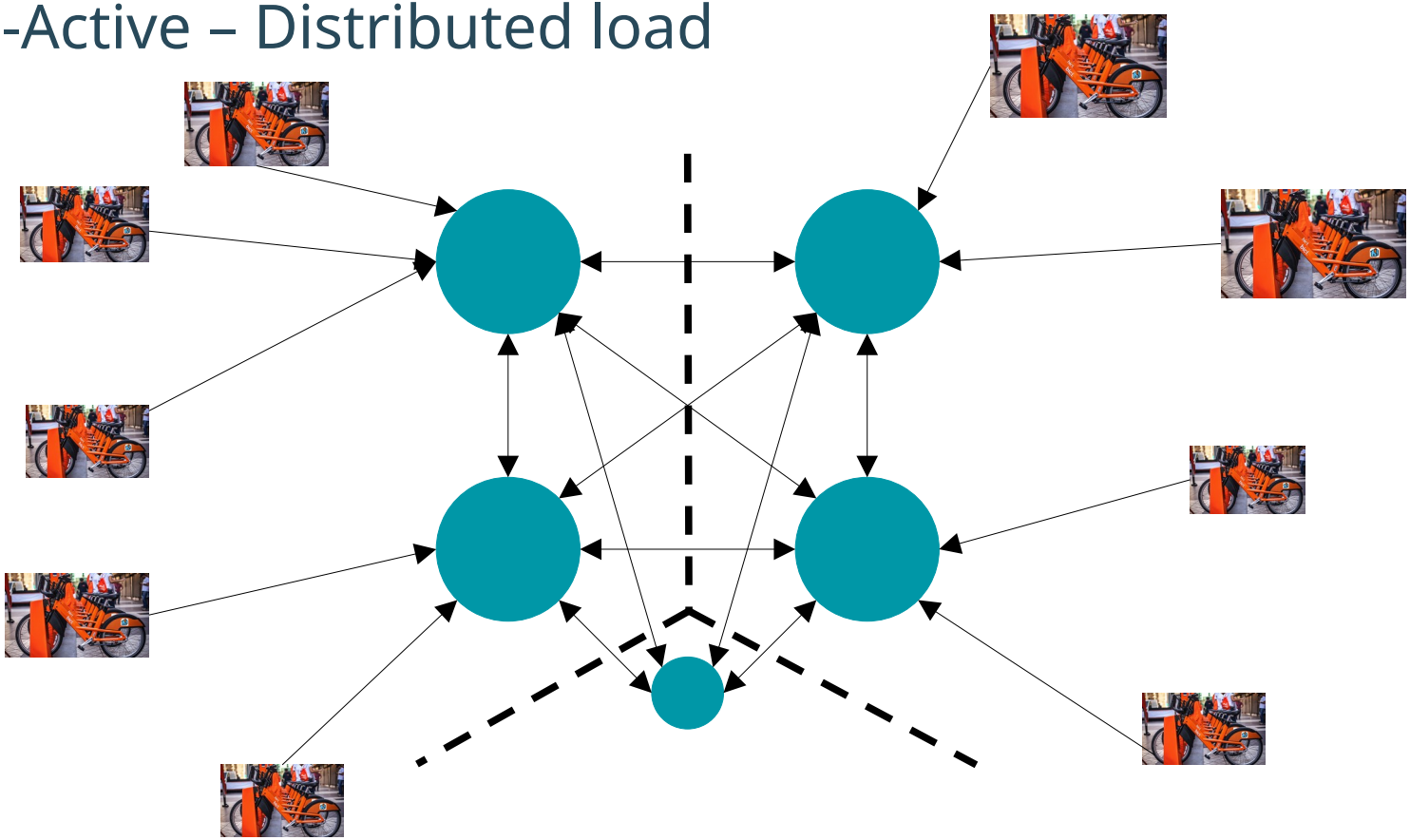
Active-Active – Distributed load



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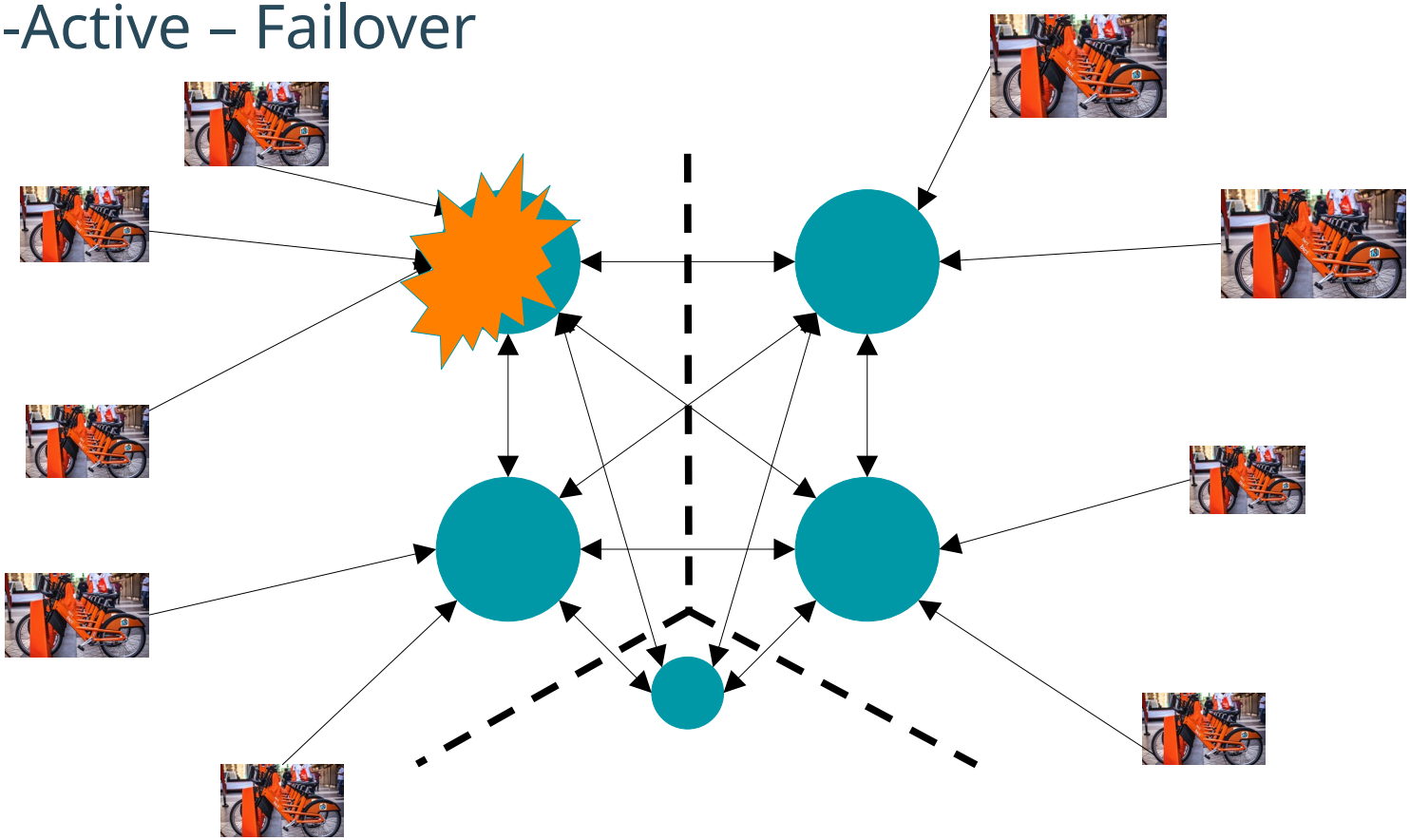
Active-Active – Failover



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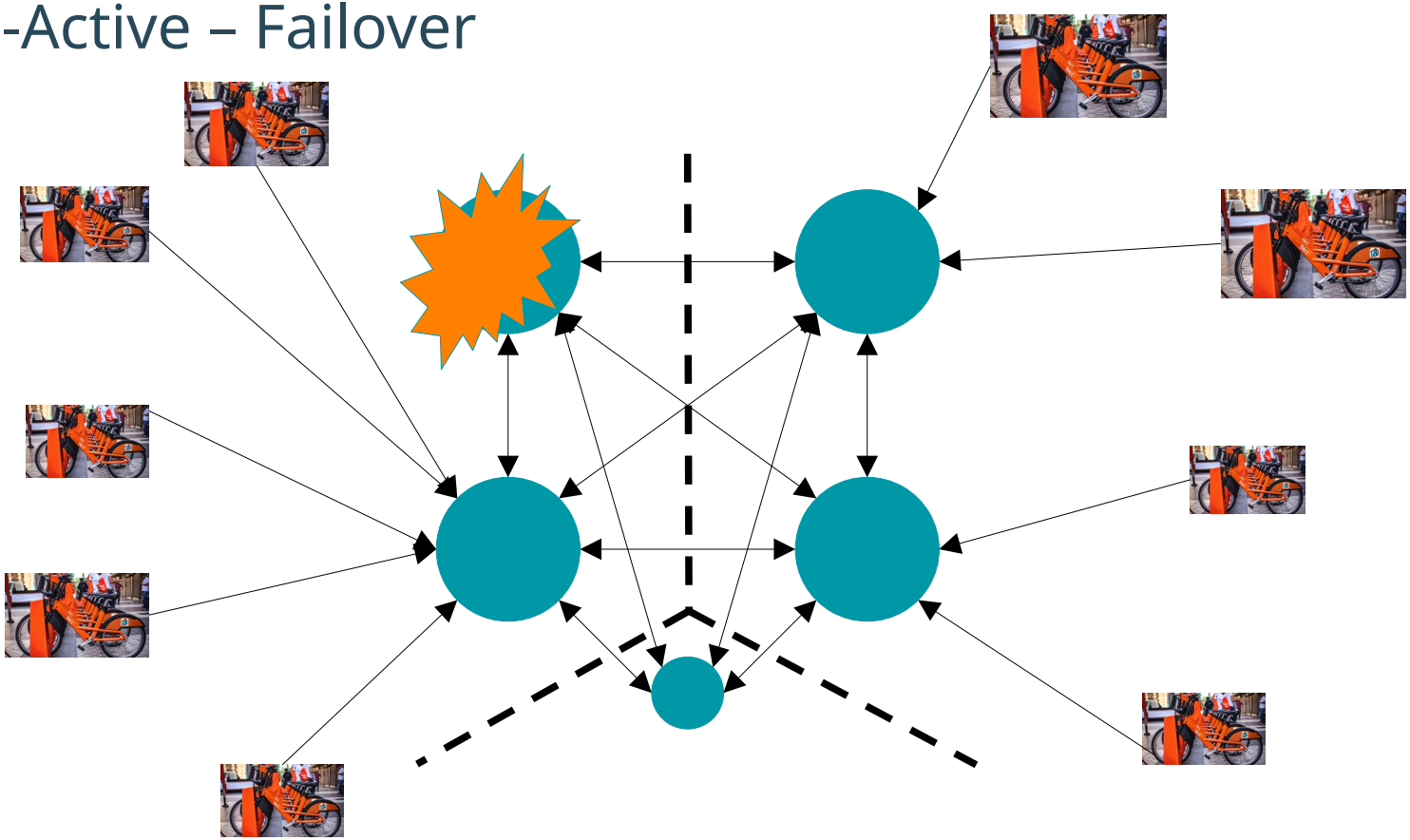
Active-Active – Failover



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PostgreSQL Distributed

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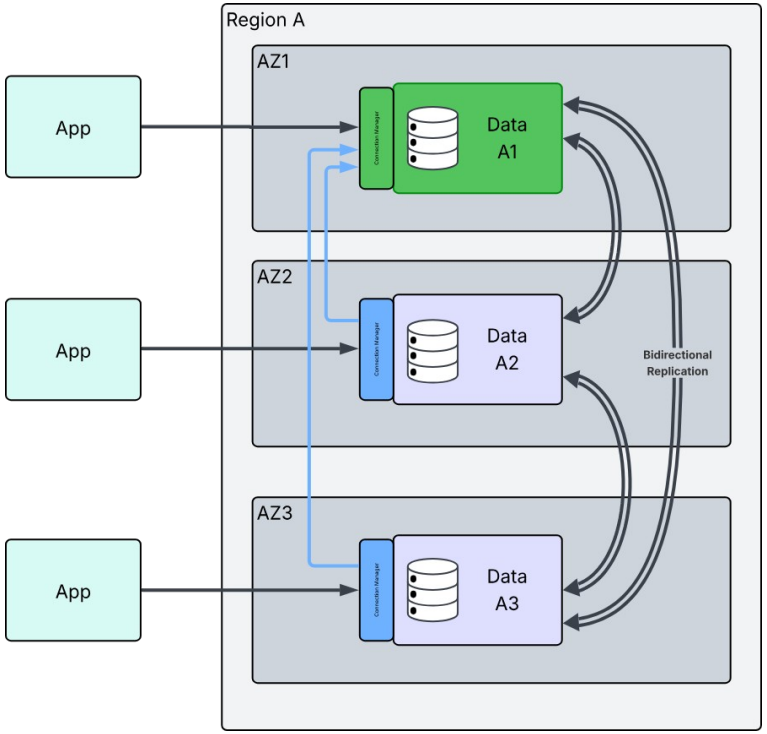
Active-Active → Distributed



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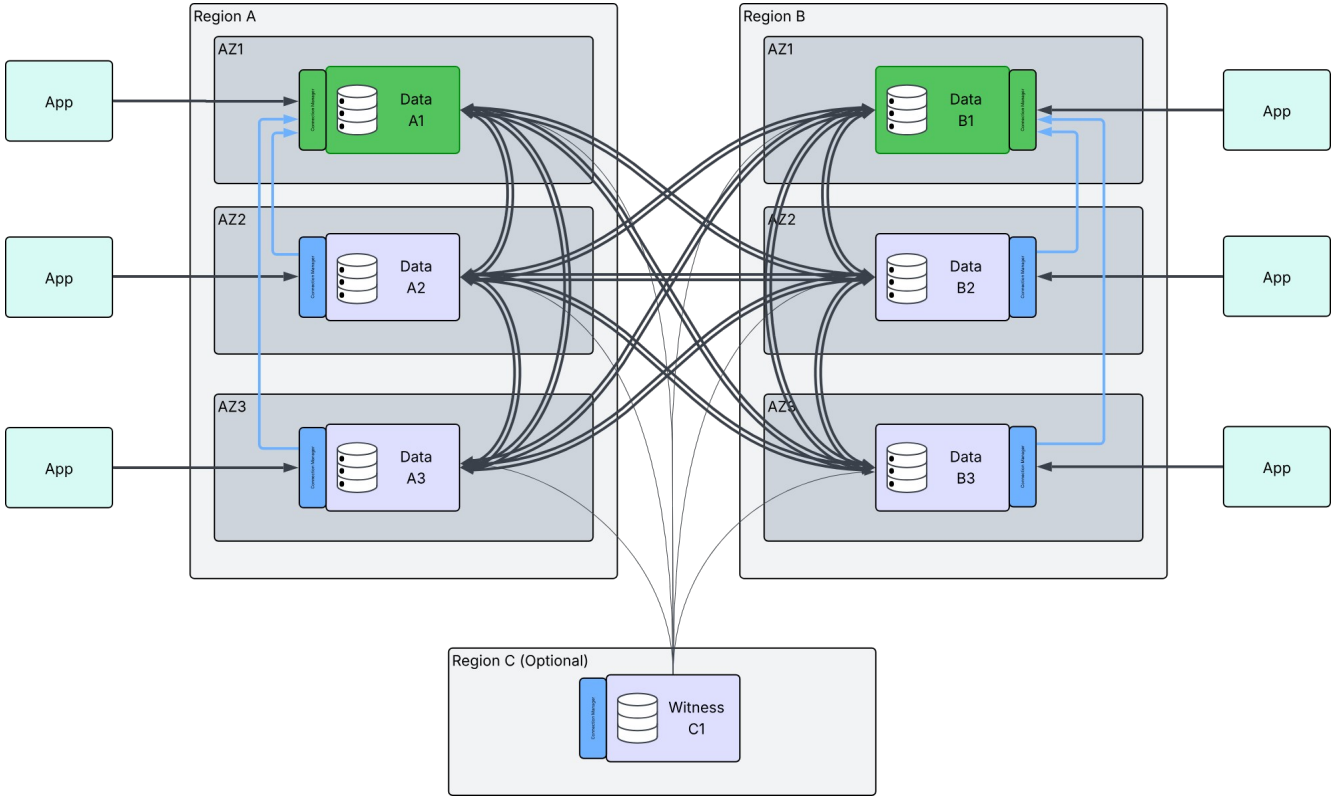
Active-Active → Distributed



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Share Nothing Architecture

Shared-State concurrency is the root of all evil

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What about DDL?

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DDL Replication

```
ALTER TABLE bikes
ADD COLUMN status TEXT;
```


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Lessons from Sparta

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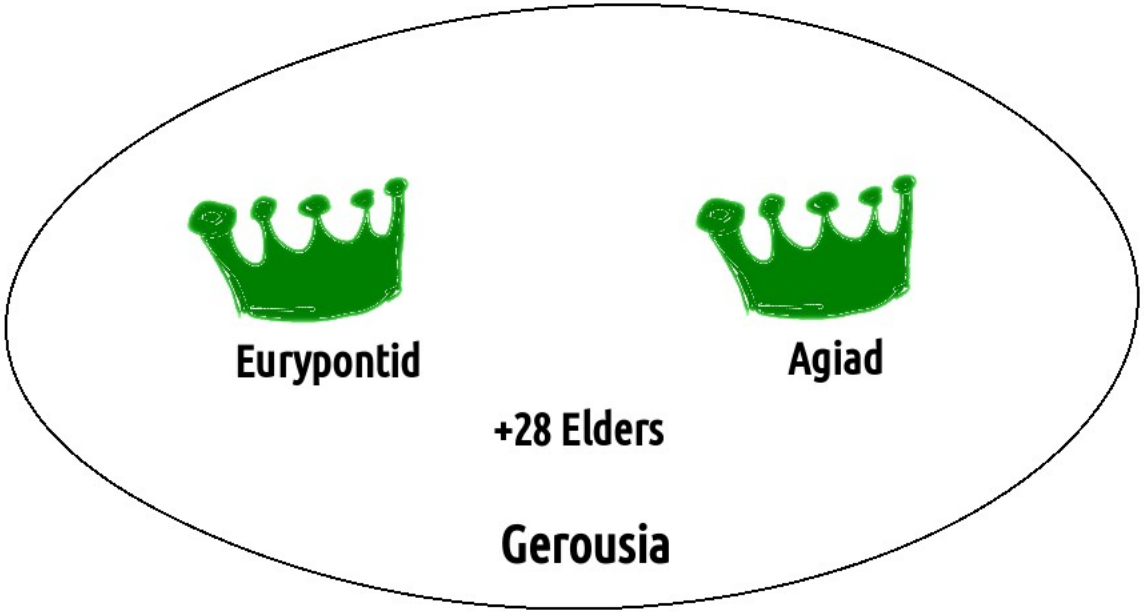
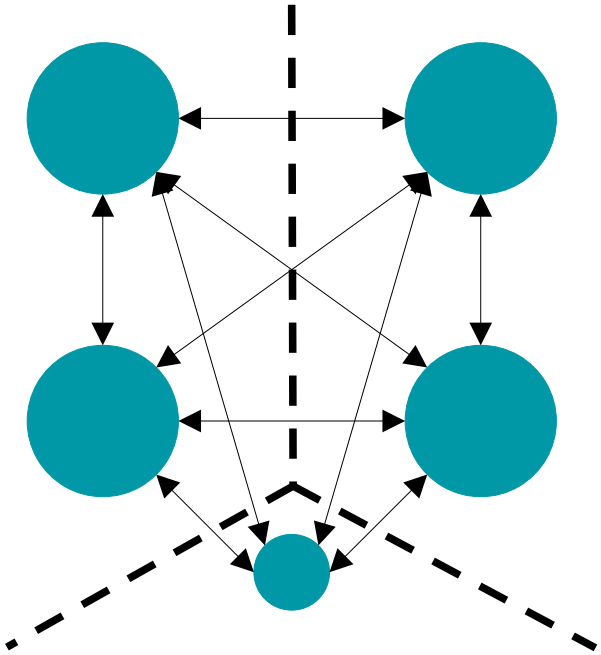
Dual Kingship and the Gerousia



Active-Active with RAFT consensus



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Sequences

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Global sequences

Galloc: globally allocated segment

Snowflakeid: ts + node + localseq

UUID: specially v7

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Conflicts

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Conflict

```
BEGIN;

INSERT INTO users
VALUES (2574,"An");


COMMIT;
```


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Conflict

```
BEGIN;

INSERT INTO users
VALUES (2574,"An");


COMMIT;
```

```
BEGIN;

INSERT INTO users
VALUES (2574, "Wim");

COMMIT;
```


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Conflict

`BEGIN;`	`BEGIN;`
`INSERT INTO users VALUES (2574,"An");`	`INSERT INTO users VALUES (2574, "Wim");`
	`COMMIT;`
`COMMIT;`	

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Conflict

```
BEGIN;

INSERT INTO users
VALUES (2574,"An");
```

```
BEGIN;

INSERT INTO users
VALUES (2574, "Wim");
```

```
COMMIT;
```

```
COMMIT;
```


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Conflict

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```

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BEGIN;

INSERT INTO users
VALUES (2574, "Wim");
```

```
COMMIT;
```

```
COMMIT;
```

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Conflict Resolution

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Conflict Resolution

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BEGIN;

INSERT INTO users
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COMMIT;
```

```
BEGIN;

INSERT INTO users
VALUES (2574, "Wim");

COMMIT;
```


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Conflict Resolution

```
BEGIN;

INSERT INTO users
VALUES (2574,"An");

COMMIT;
```

✔ ts2

```
BEGIN;

INSERT INTO users
VALUES (2574, "Wim");

COMMIT;
```

✔ ts1

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Conflict Resolution

```
BEGIN;

INSERT INTO users
VALUES (2574,"An");

COMMIT;
```

ts2

```
BEGIN;

INSERT INTO users
VALUES (2574, "Wim");

COMMIT;
```

ts1

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Conflict Resolution

```
BEGIN;

INSERT INTO users
VALUES (2574,"An");

COMMIT;
```

ts2

```
BEGIN;

INSERT INTO users
VALUES (2574, "Wim");

COMMIT;
```

ts1

ts2 > ts1

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Conflict Resolution

```
BEGIN;

INSERT INTO users
VALUES (2574,"An");

COMMIT;
```

ts2

```
BEGIN;

INSERT INTO users
VALUES (2574, "Wim");

COMMIT;
```

ts1

(2574,"An")

ts2 > ts1

(2574,"An")

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First Recap

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Geo Redundancy

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Maintainability

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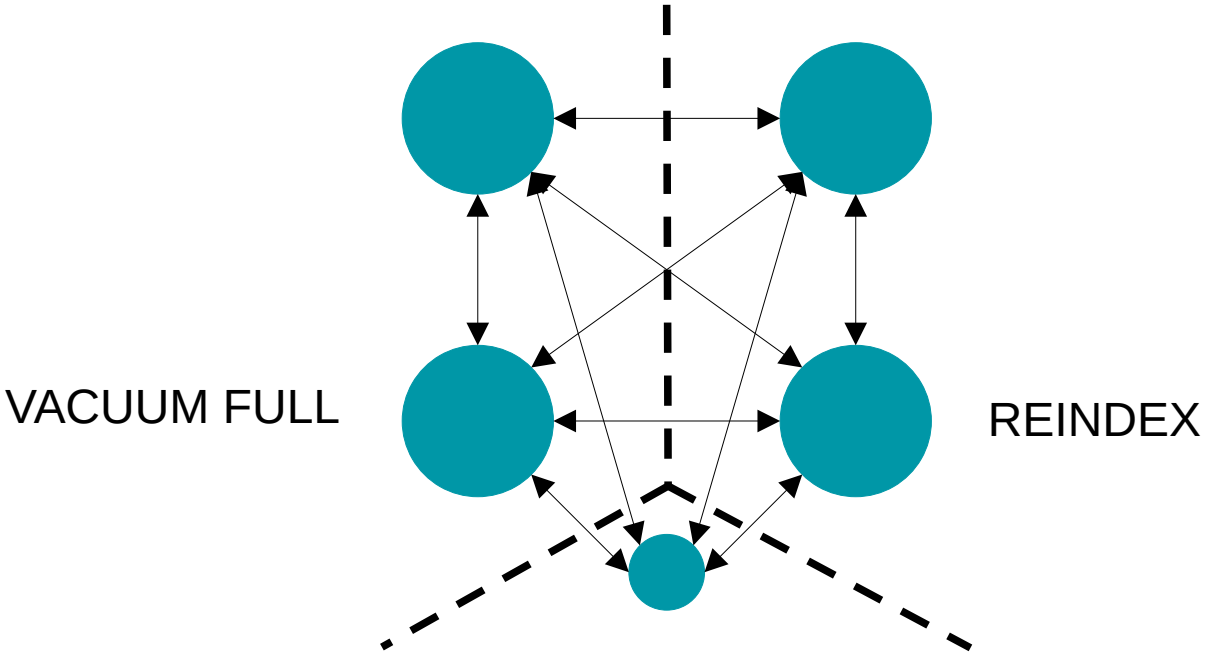
Postgres Distributed – All nodes are Primary



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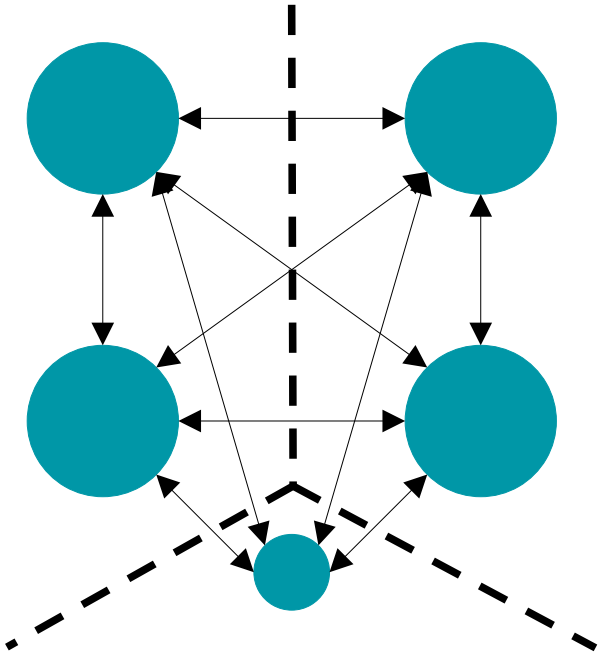
Postgres Distributed – Different indexes

CREATE INDEX
HNSW



CREATE INDEX
IVFFLAT

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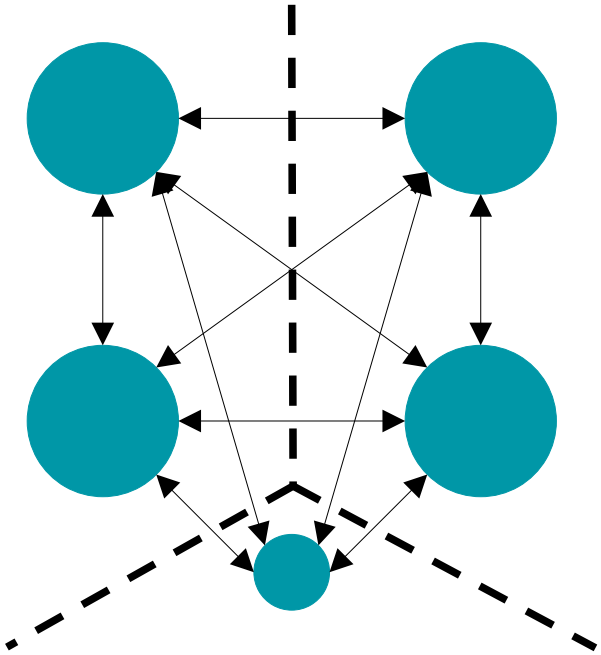
Postgres Distributed – Rolling Upgrade



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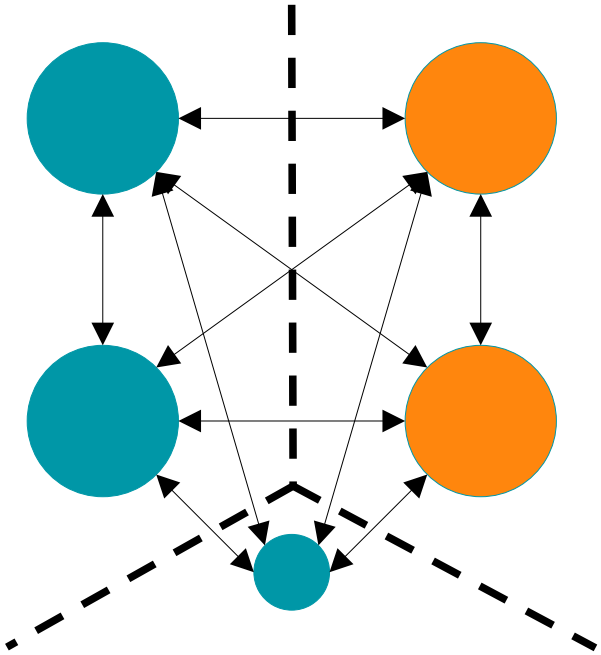
Postgres Distributed – Rolling Upgrade



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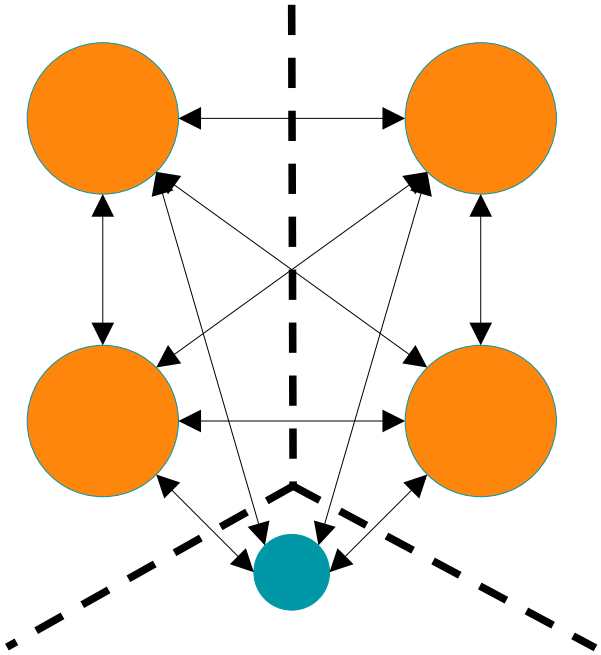
Postgres Distributed – Rolling Upgrade



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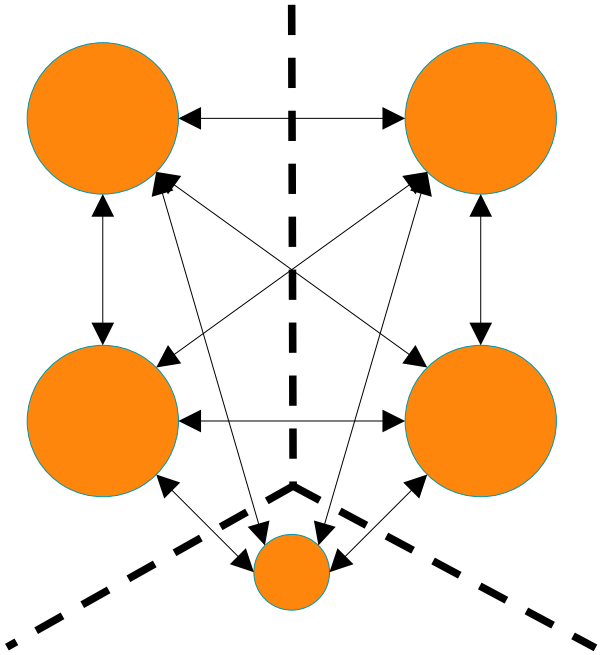
Postgres Distributed – Rolling Upgrade



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Real use case

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1·1·2 CANARIAS

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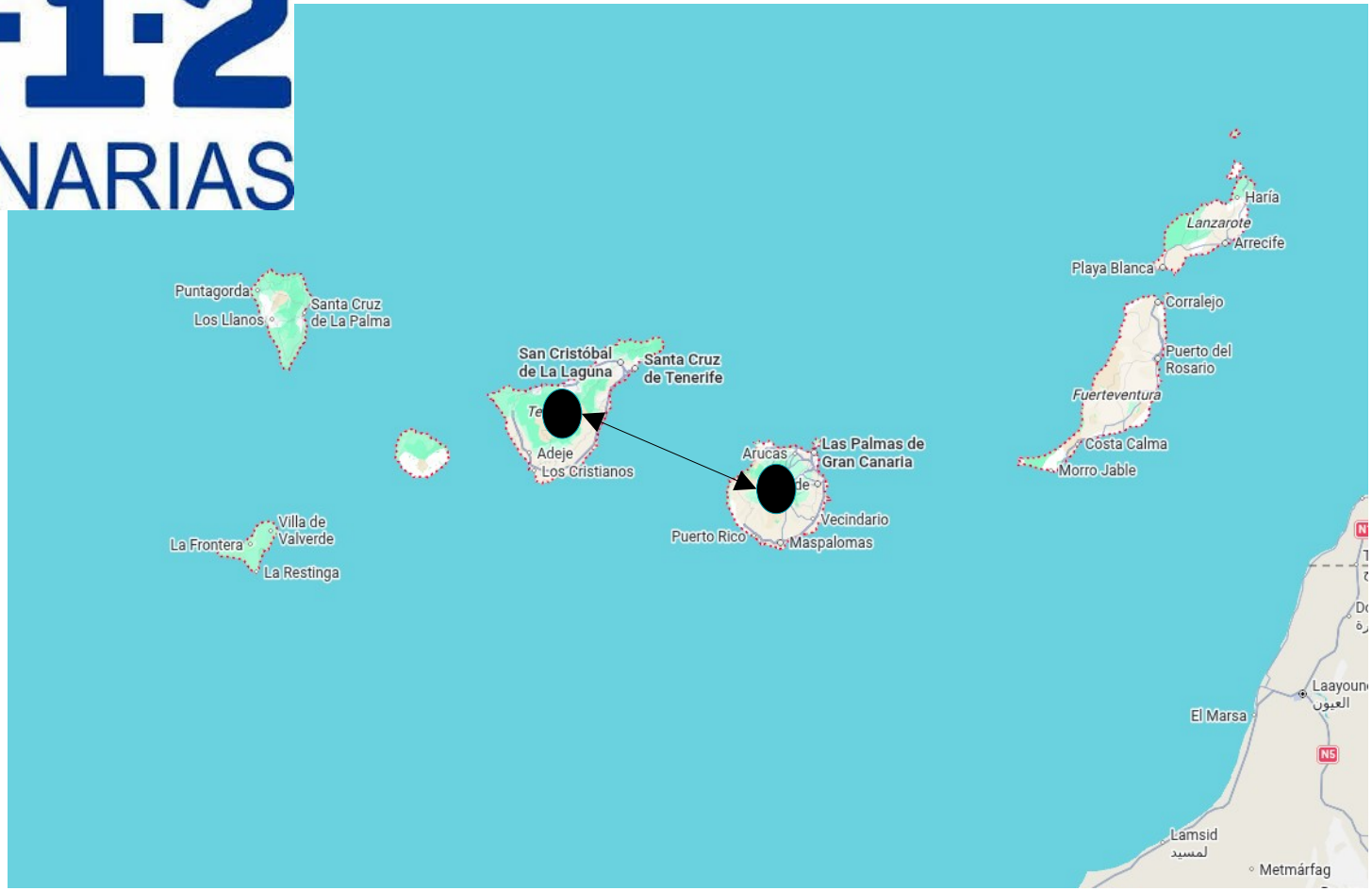
1·1·2 CANARIAS



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Closing Words

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Data is the new gold

Geo Redundancy

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Postgres Distributed

Possibilities and challenges

Not transparent – Use it with awareness
Design with Active-Active in mind

Consensus is key for Fault Tolerance

Support for DDL Replication

Support for Conflict Resolution

Support for Sequences

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Test your assumptions

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Thank You

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