Neo4J

Intro

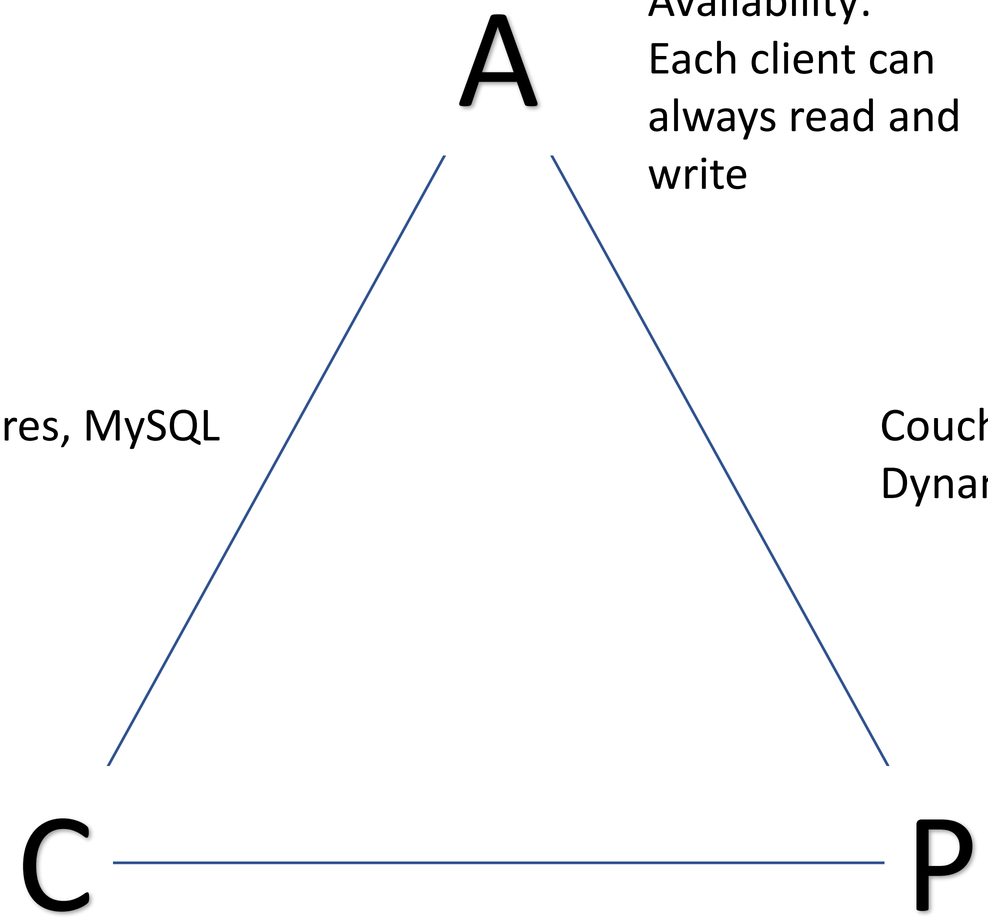
What is Neo4J

- Worlds leading graph database
- Fast traversal of nodes and relationships
- Four million hops per second
- Can store trillions of entities
- Cypher graph query language
- Scalable fault tolerant clusters

History

- Founded in 2007
- 1.0 Released in 2010
    - 34 billion node and relationship limit
- 2.0 released in 2013
- 3.0 released in 2016
    - 36m in funding secured
    - Unlimited nodes

Where does it fit in CAP Theorem



Availability:
Each client can always read and write

RDBMS, Postgres, MySQL
Neo4J

CouchDB, Cassandra, DynamoDB**,** Riak

Consistency: All clients always have the same view of data

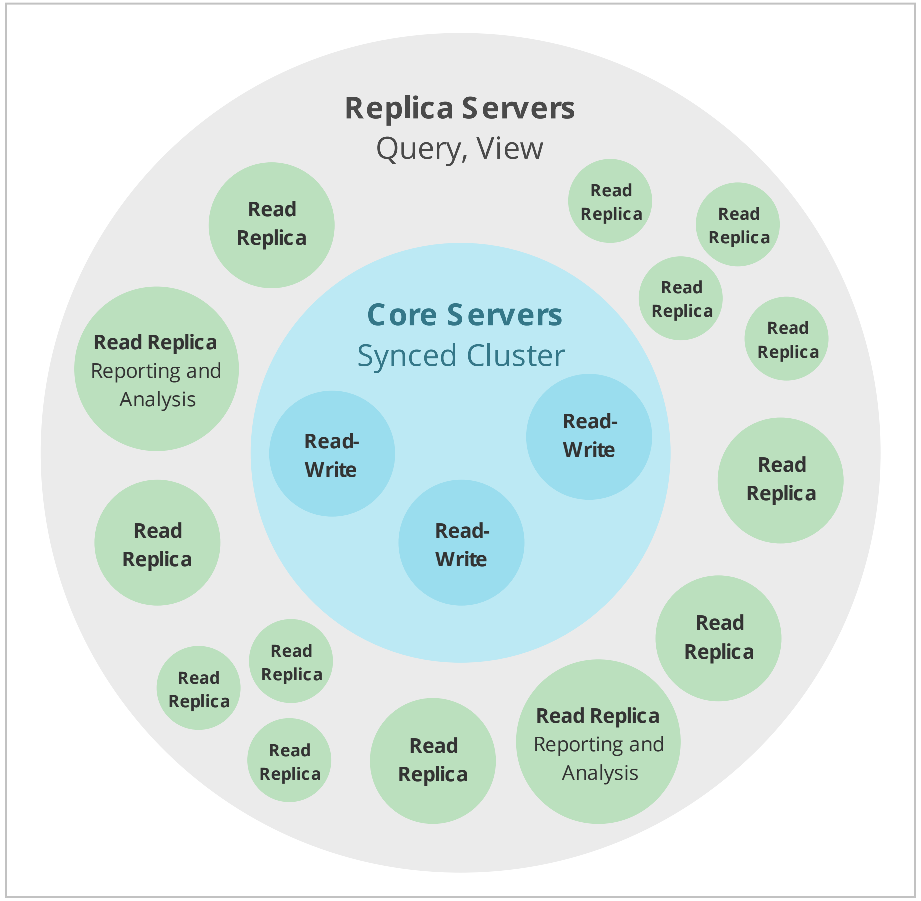
Big Table, Hbase, MongoDB, Redis

Partition Tolerance: Works well despite physical network partitions

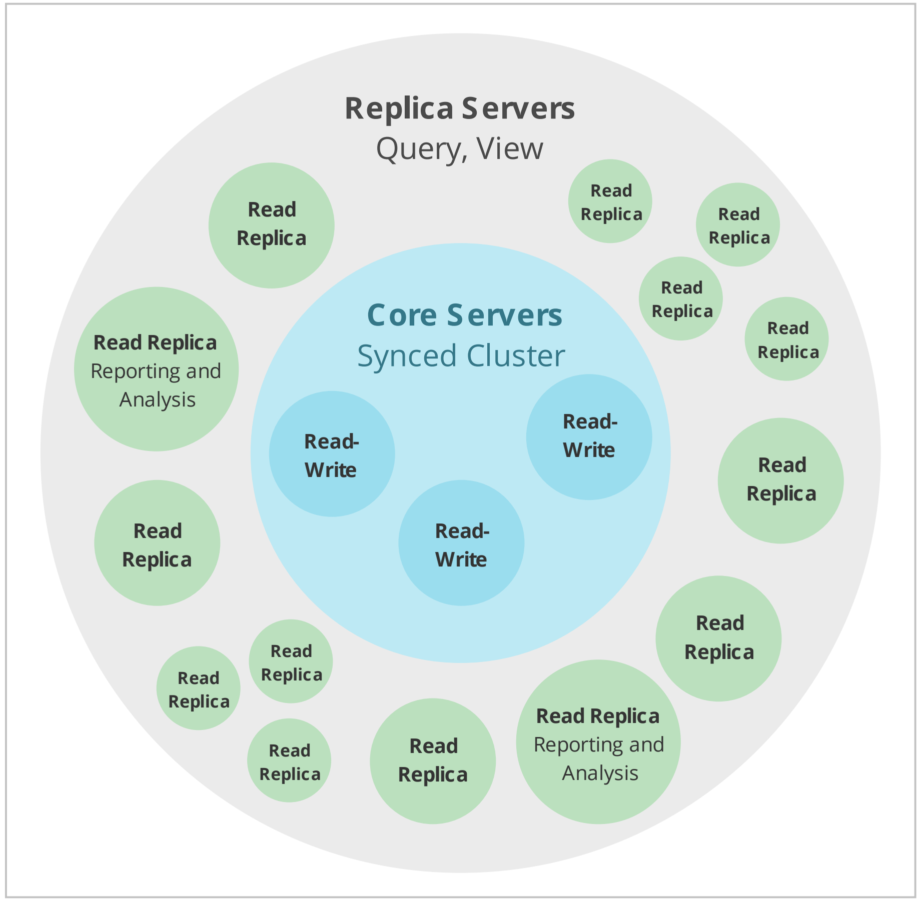
How is Neo4J Different

- Graph Storage
- Graph Processing Engine
- Relationships matter more than data points

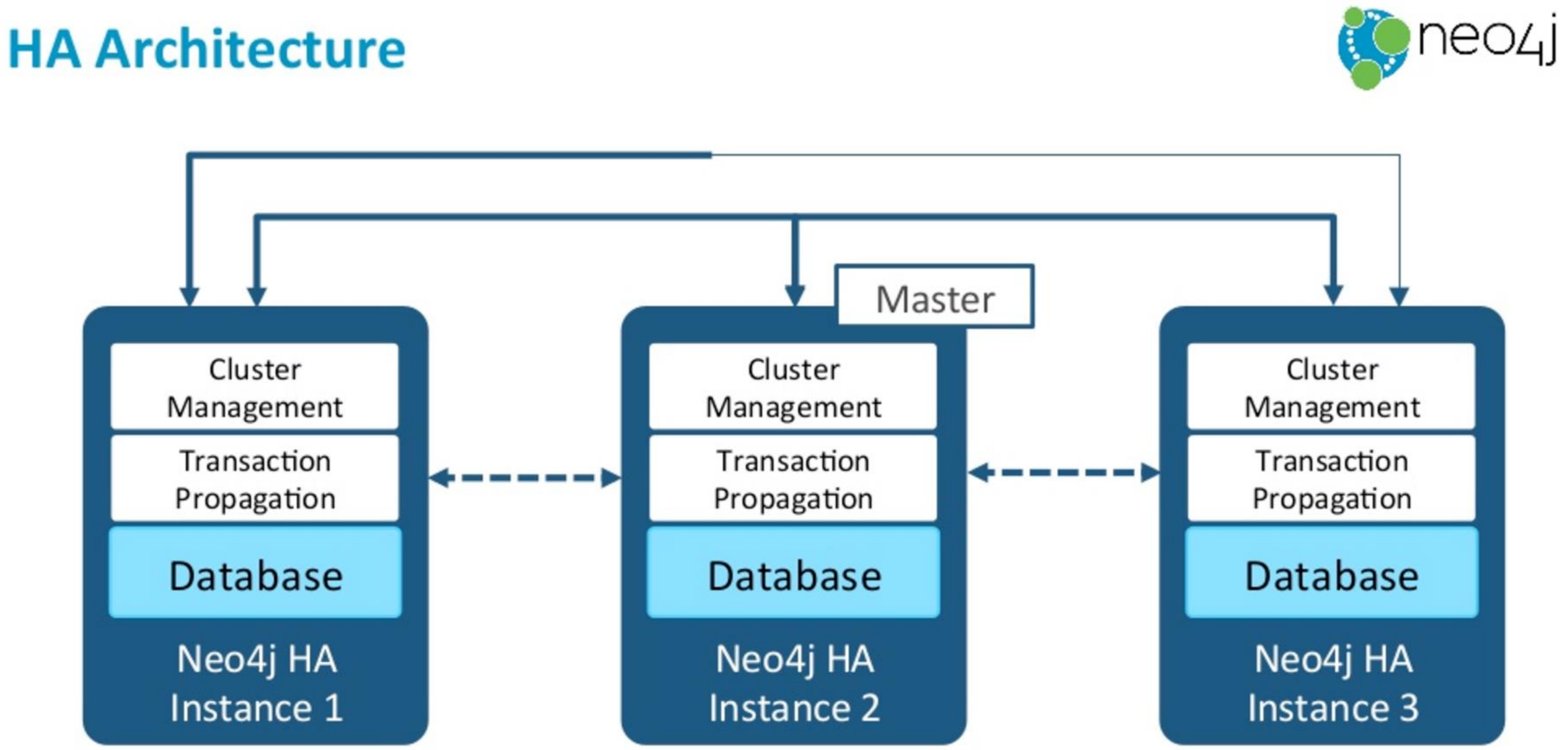
Neo4J Architecture Core Servers



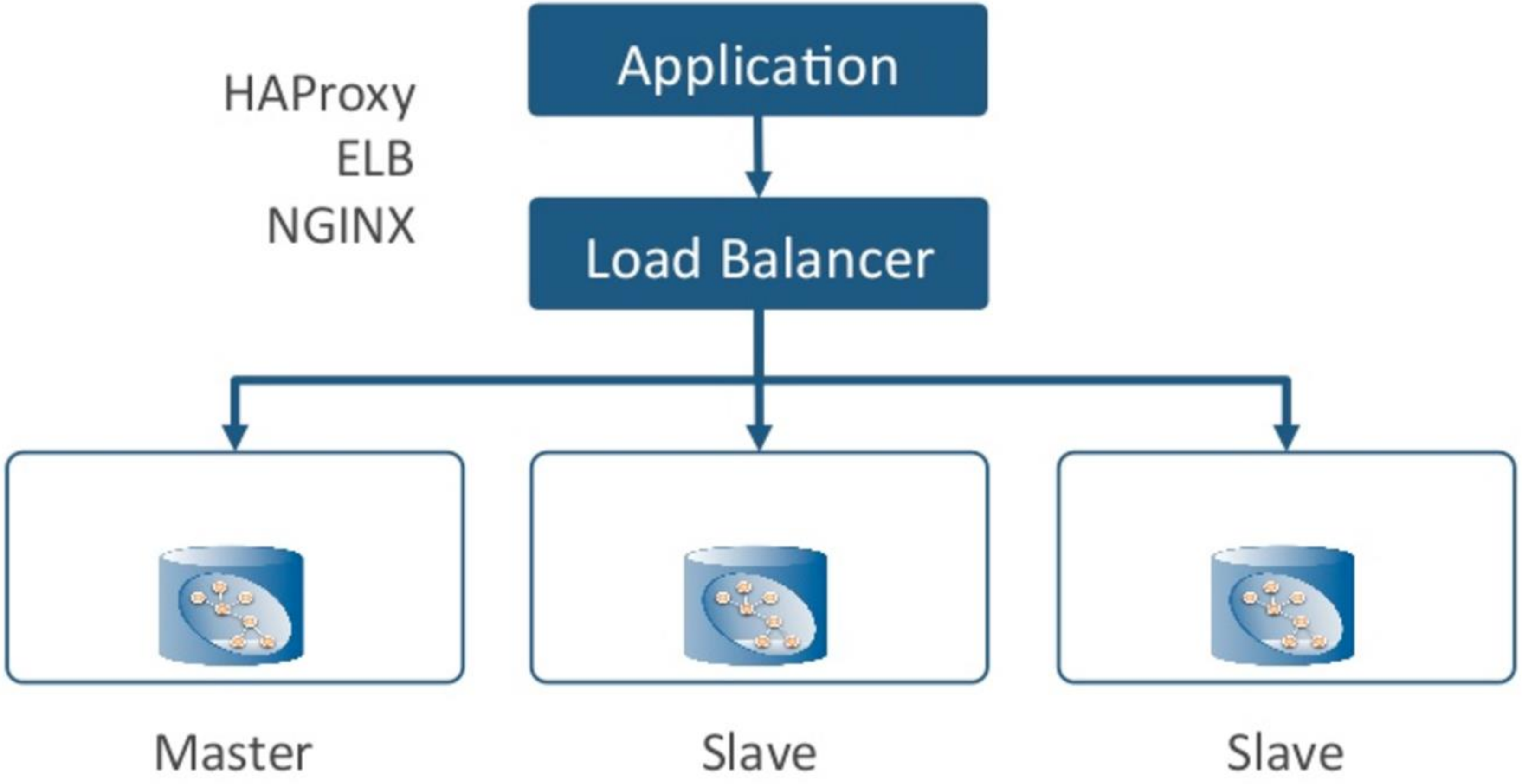
Neo4J Architecture Read Replicas



System Architecture



Load Balancing for Read Throughput



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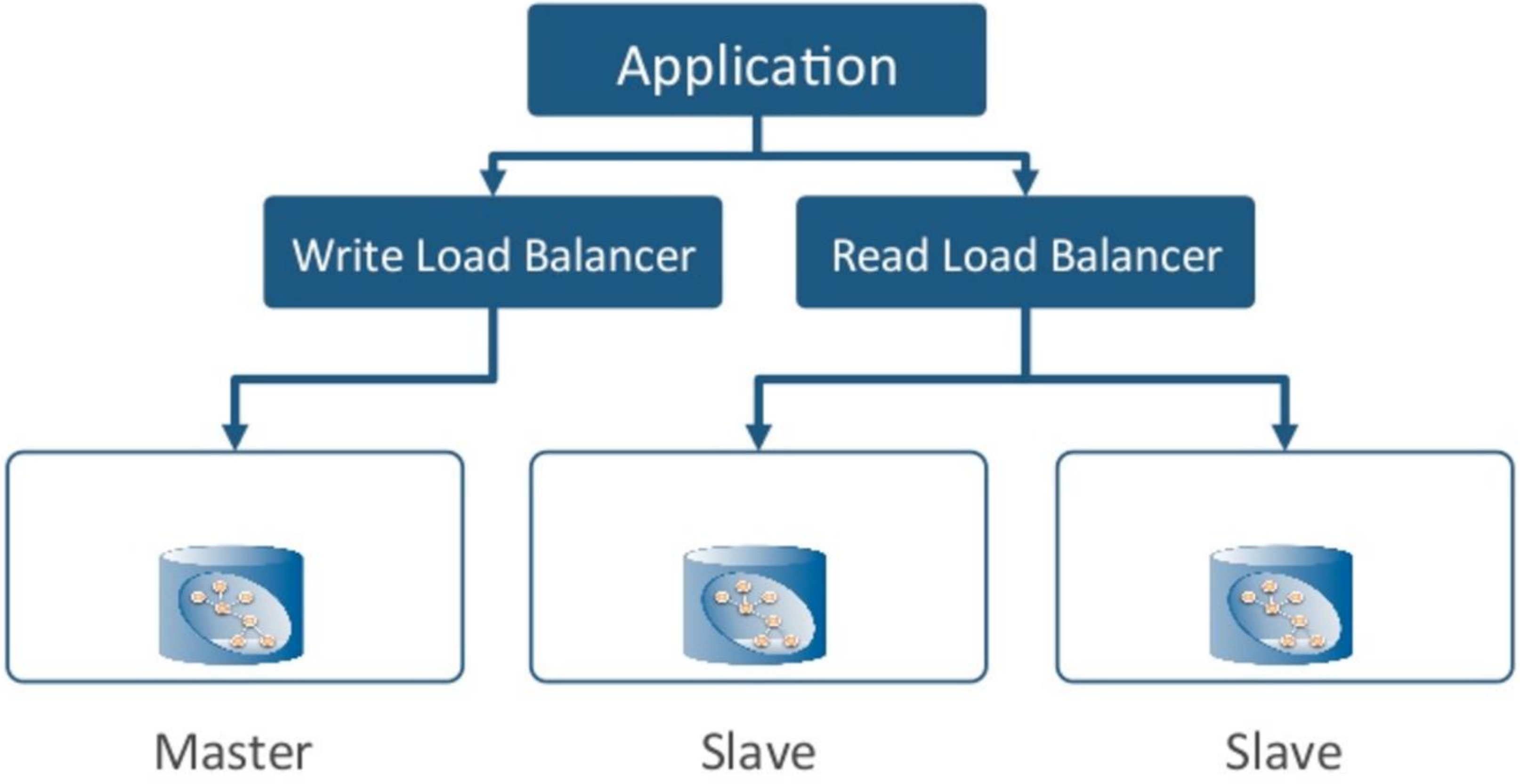
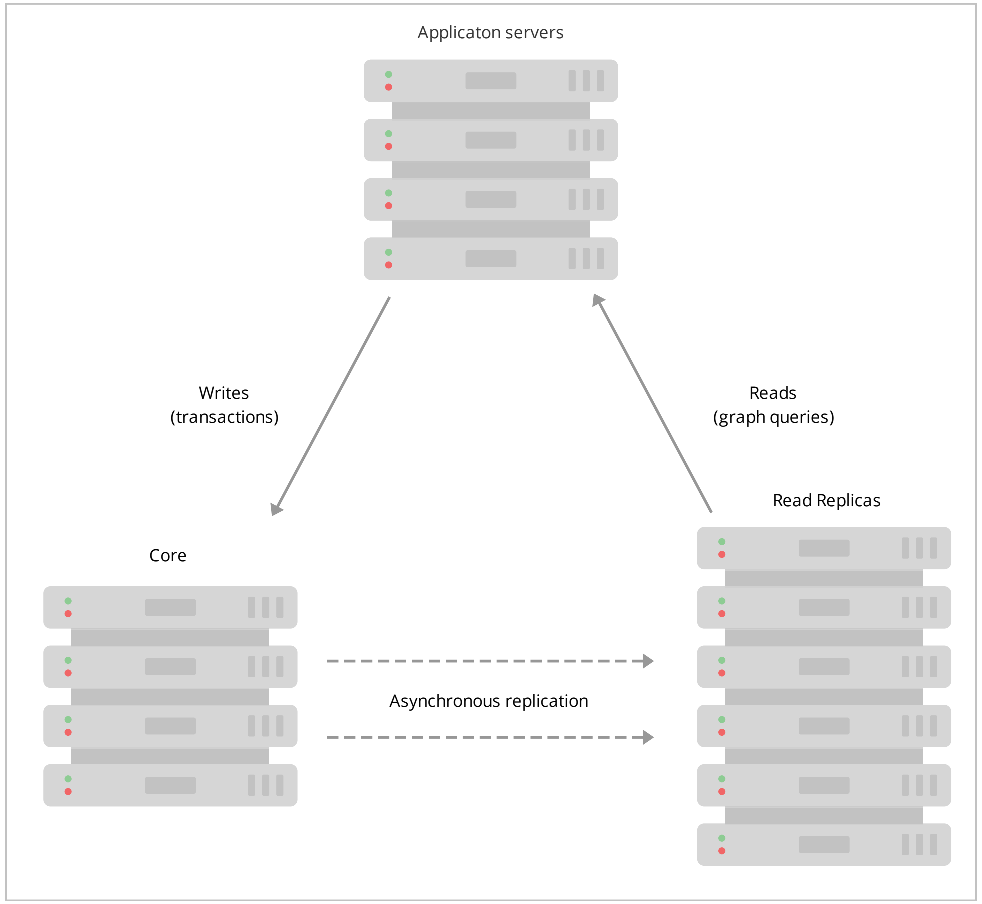
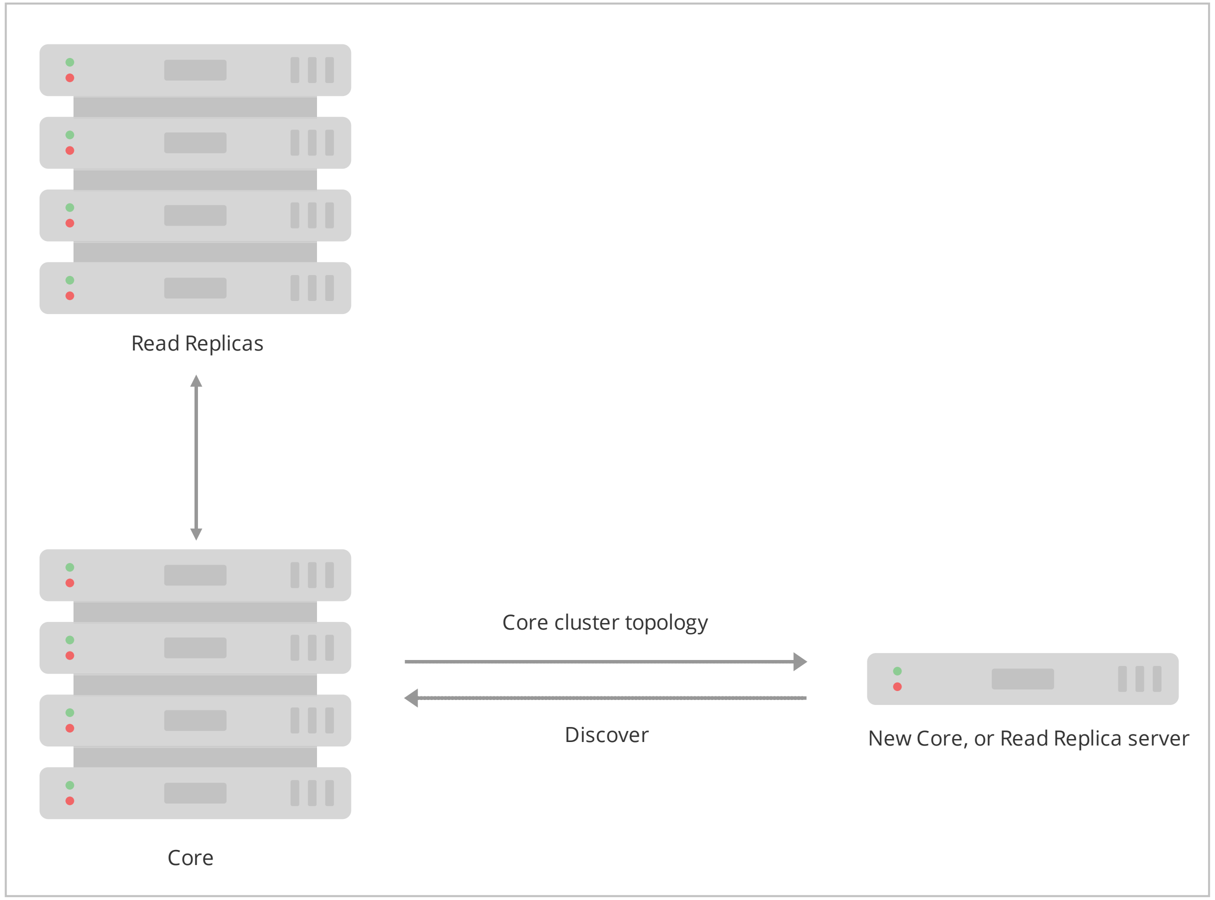
Load Balance for Writes



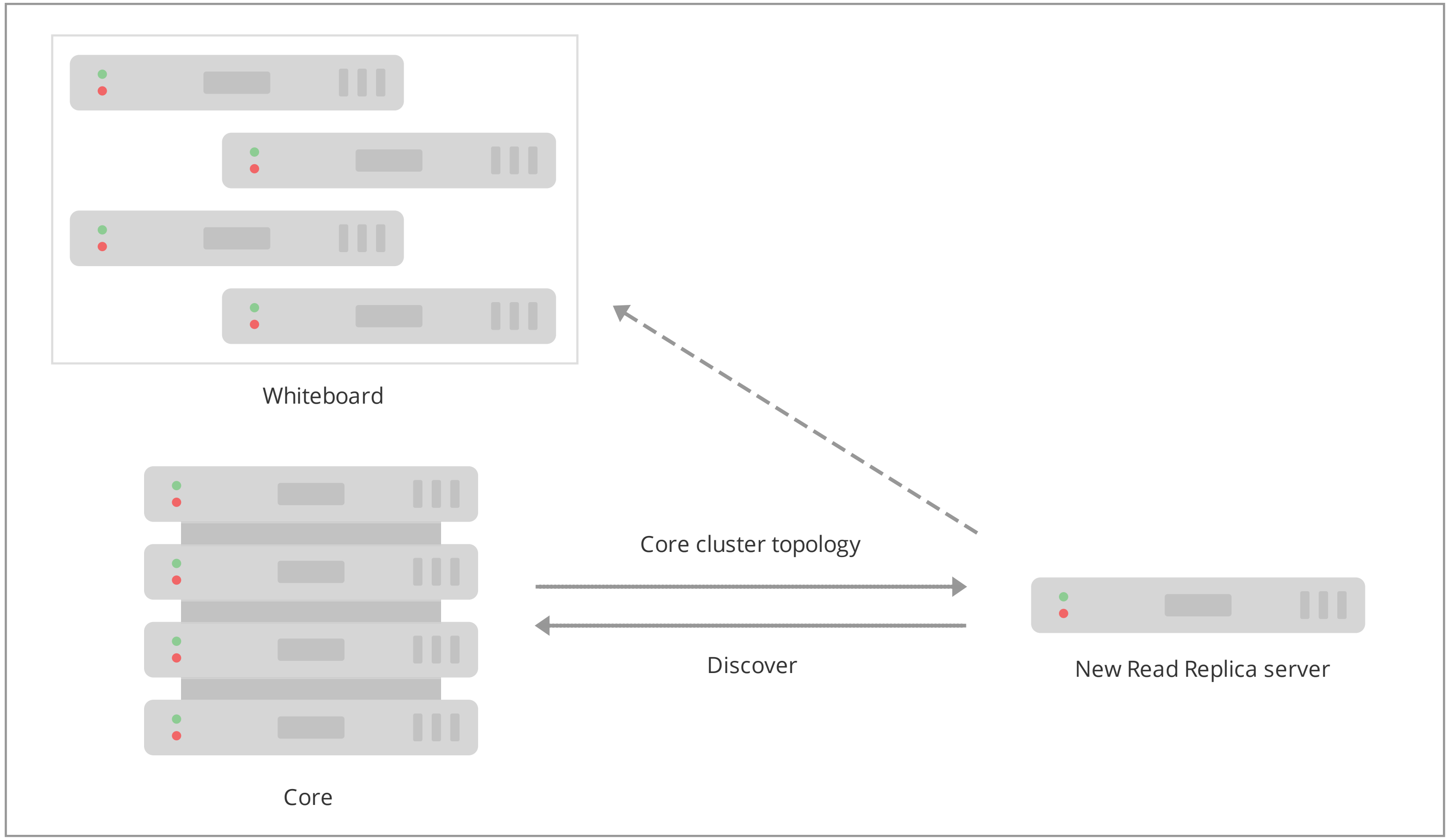
Causal Consistenty



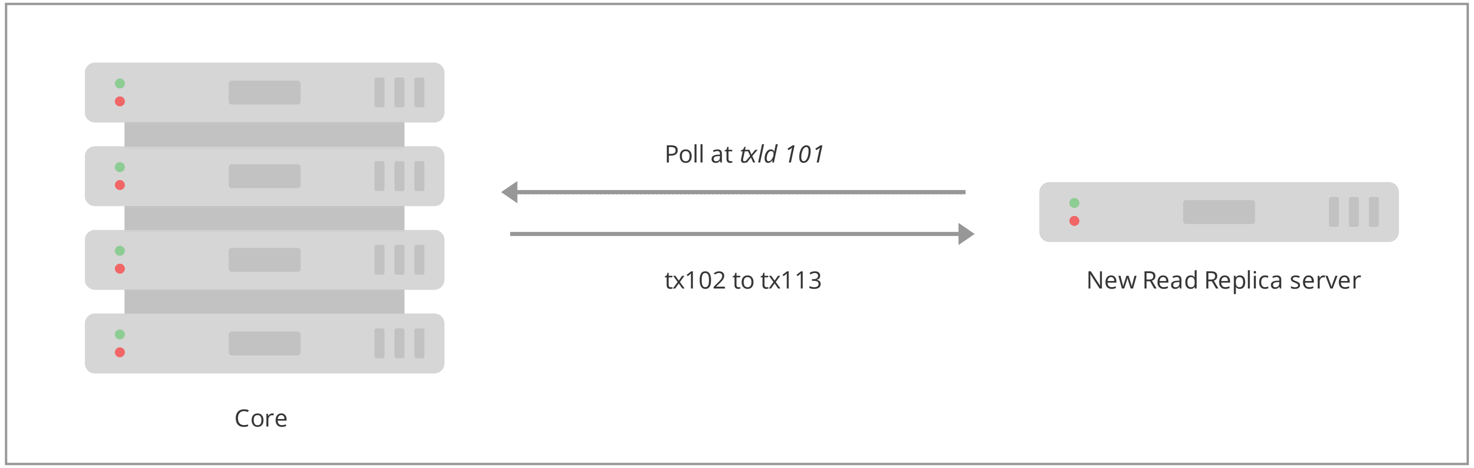
Clustering – Discovery Protocol



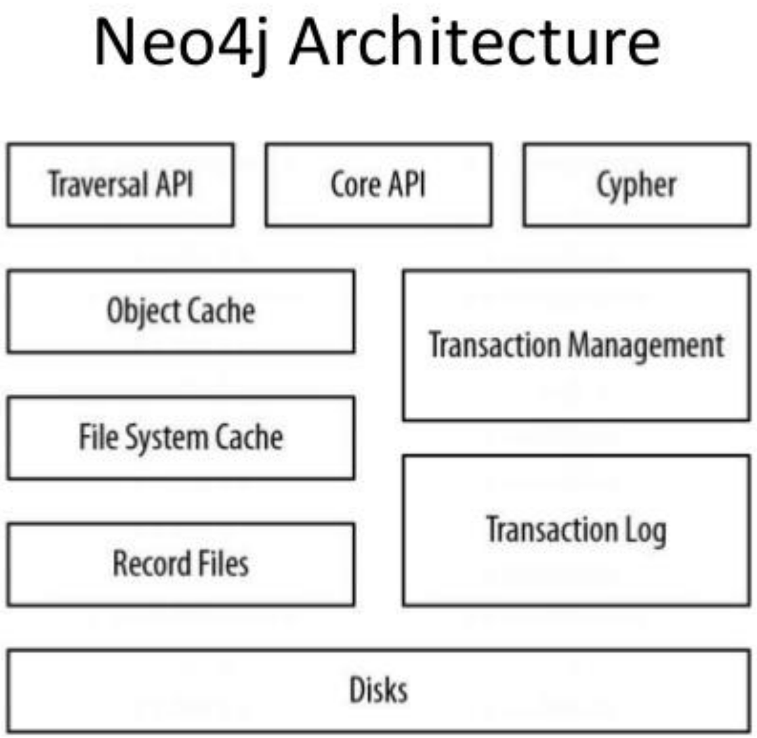
Clustering – Read Replica membership



Clustering Read Replica



Server Architecture



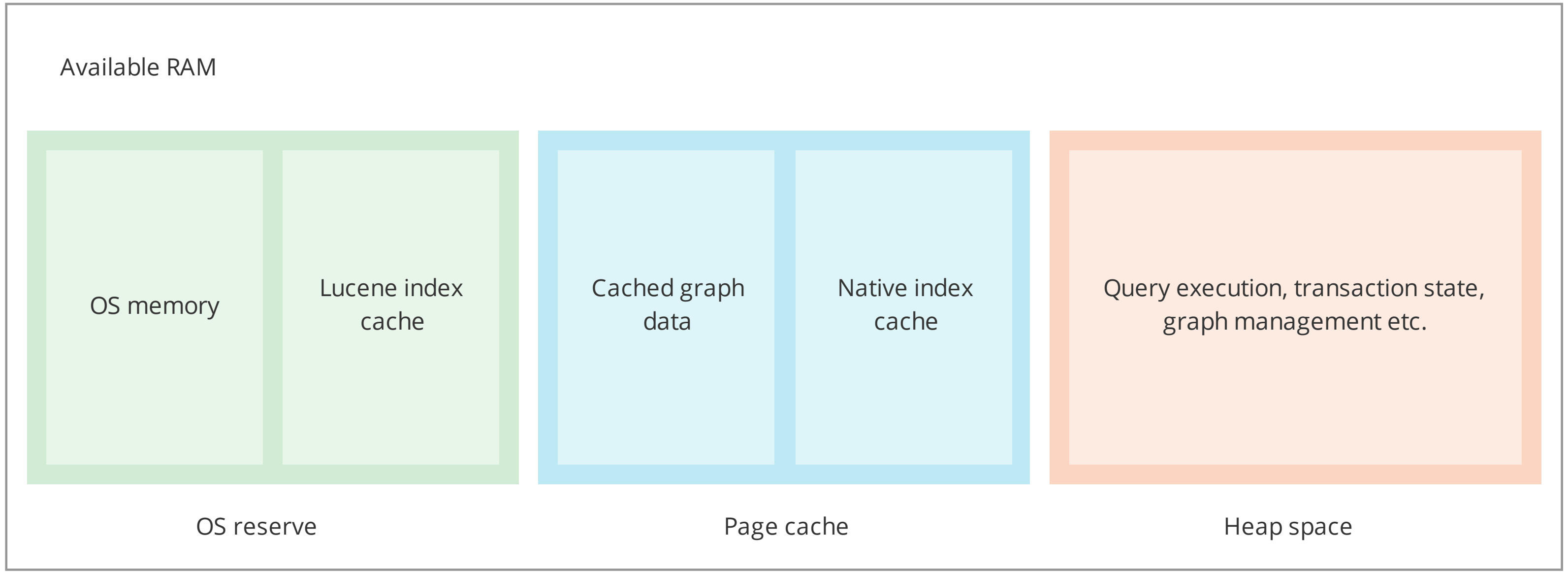
CQL

- Cypher Query Language is Neo4j's open graph query language

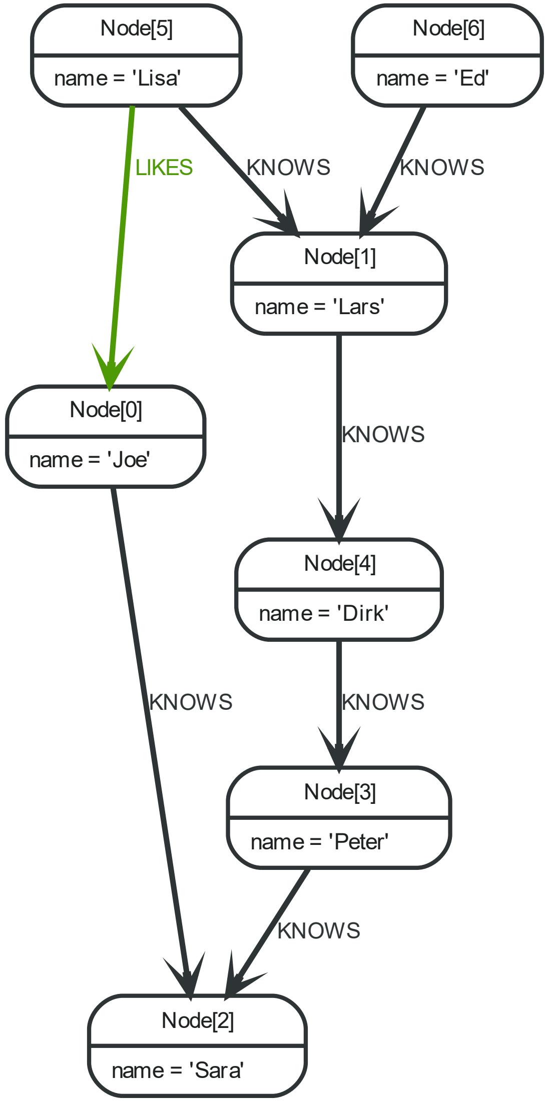
ACID Compliant

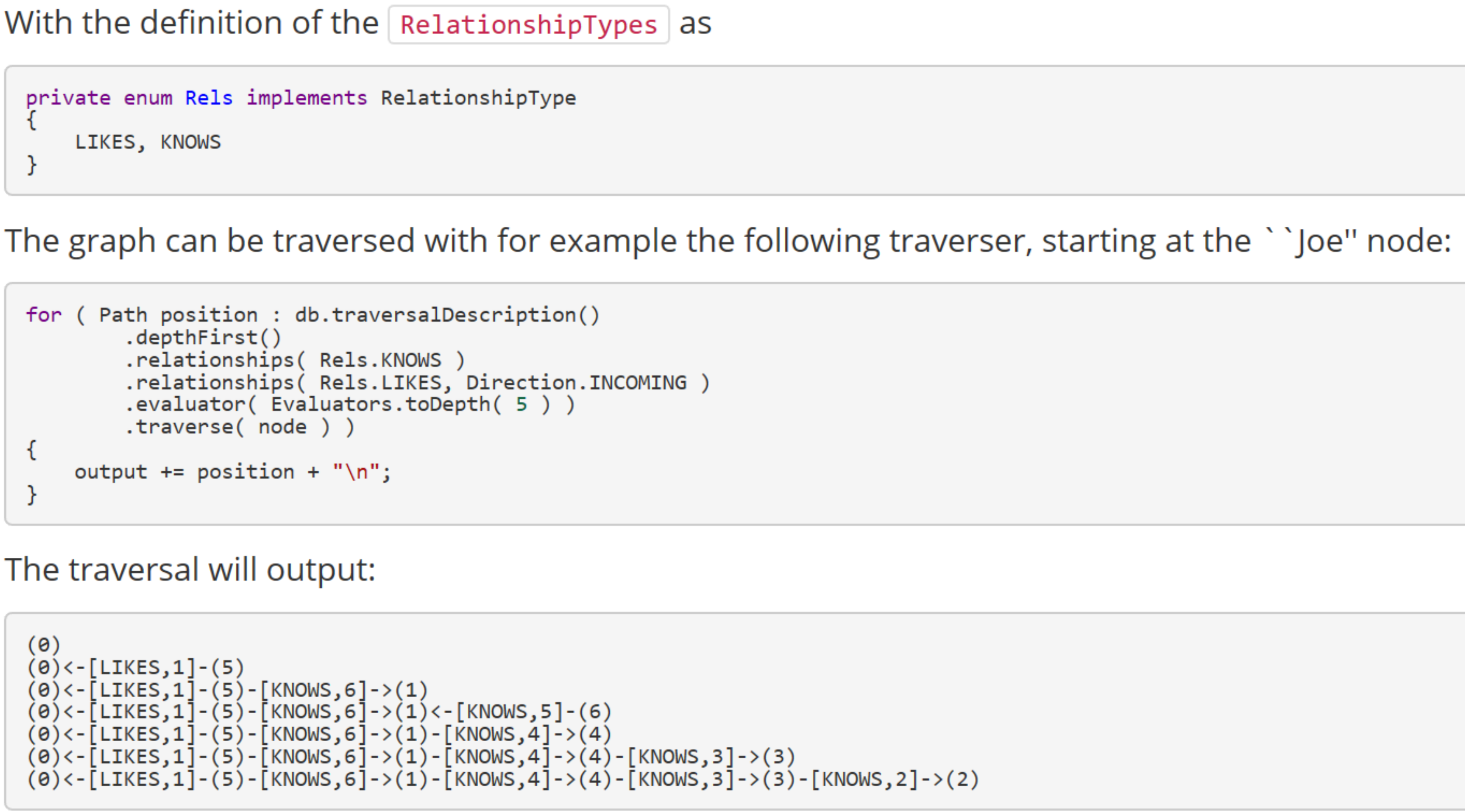
- Database operations that access the graph, indexes, or the schema must be performed in a transaction.

Memory Configuration



Traversal





With the definition of the `RelationshipTypes` as

```
private enum Rels implements RelationshipType
{
    LIKES, KNOWS
}
```

The graph can be traversed with for example the following traverser, starting at the ``Joe'' node:

```
for ( Path position : db.traversalDescription()
        .depthFirst()
        .relationships( Rels.KNOWS )
        .relationships( Rels.LIKES, Direction.INCOMING )
        .evaluator( Evaluators.toDepth( 5 ) )
        .traverse( node ) )
{
    output += position + "\n";
}
```

The traversal will output:

```
(0)
(0)<-[LIKES,1]-(5)
(0)<-[LIKES,1]-(5)-[KNOWS,6]->(1)
(0)<-[LIKES,1]-(5)-[KNOWS,6]->(1)<-[KNOWS,5]-(6)
(0)<-[LIKES,1]-(5)-[KNOWS,6]->(1)-[KNOWS,4]->(4)
(0)<-[LIKES,1]-(5)-[KNOWS,6]->(1)-[KNOWS,4]->(4)-[KNOWS,3]->(3)
(0)<-[LIKES,1]-(5)-[KNOWS,6]->(1)-[KNOWS,4]->(4)-[KNOWS,3]->(3)-[KNOWS,2]->(2)
```

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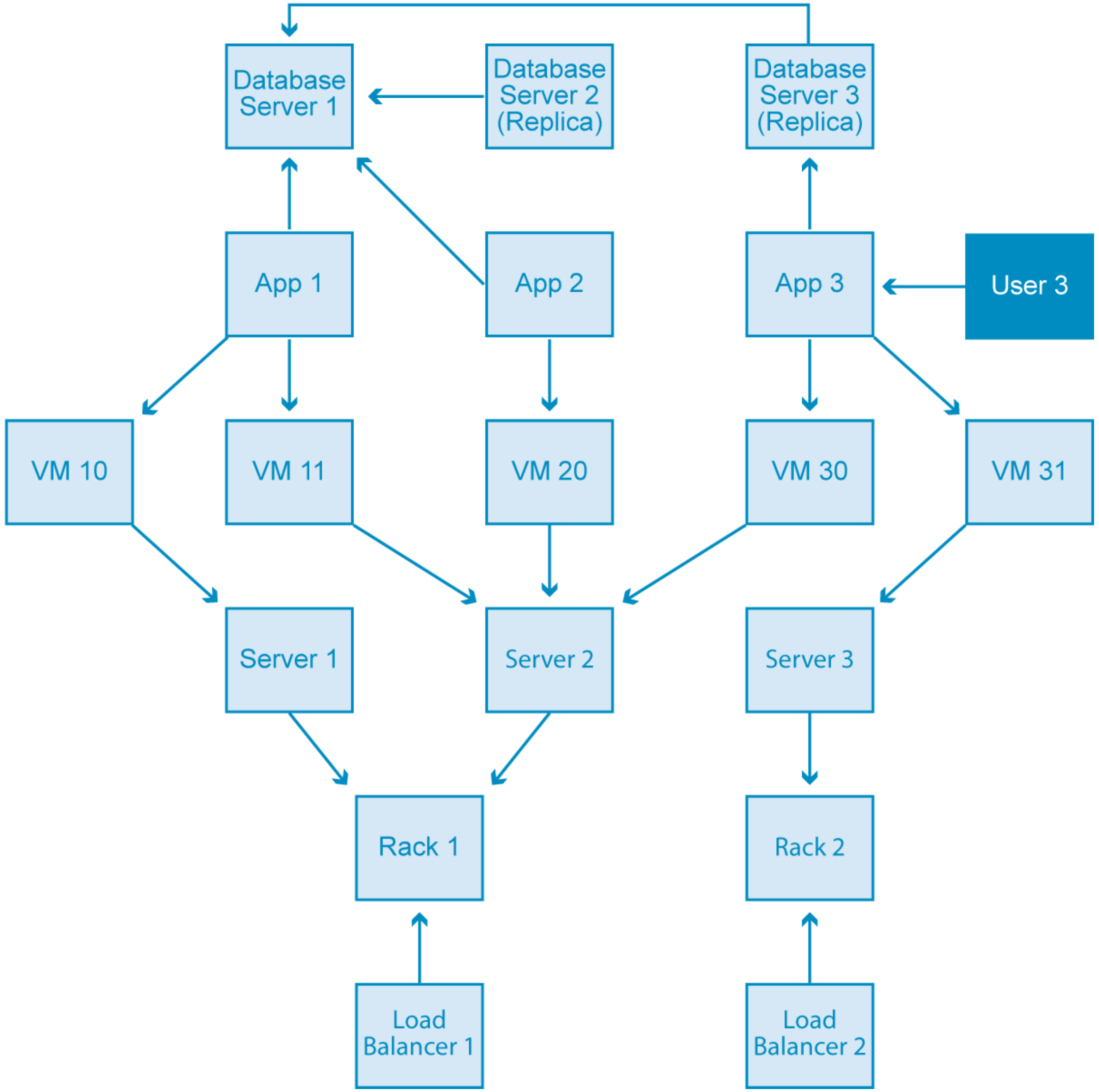
Data Modeling – Whiteboarding



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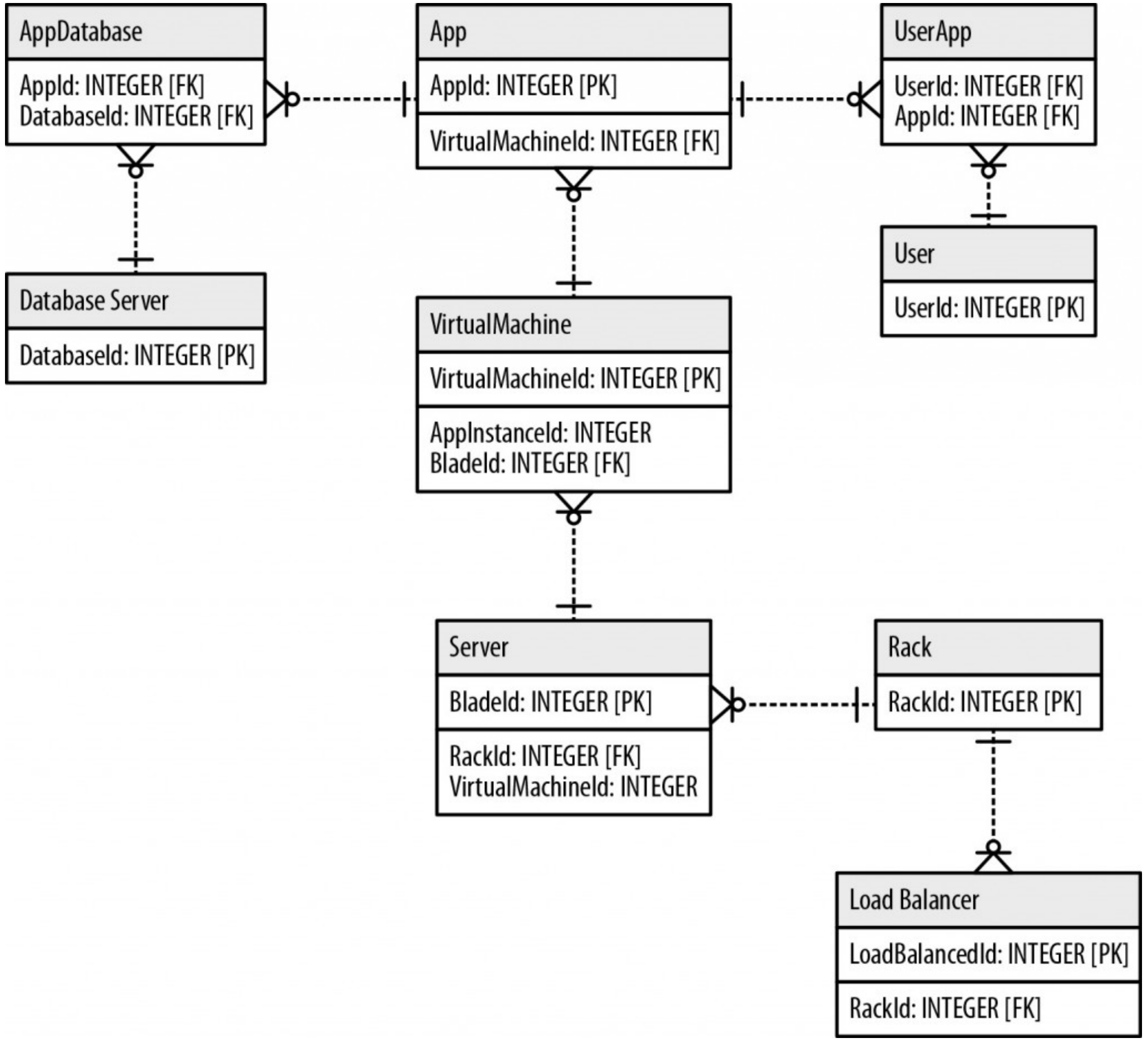
Relational Model



AppDatabase

AppId: INTEGER [FK]
DatabaseId: INTEGER [FK]

App

AppId: INTEGER [PK]

VirtualMachineId: INTEGER [FK]

UserApp

UserId: INTEGER [FK]
AppId: INTEGER [FK]

Database Server

DatabaseId: INTEGER [PK]

User

UserId: INTEGER [PK]

VirtualMachine

VirtualMachineId: INTEGER [PK]

AppInstanceId: INTEGER
BladeId: INTEGER [FK]

Server

BladeId: INTEGER [PK]

RackId: INTEGER [FK]
VirtualMachineId: INTEGER

Rack

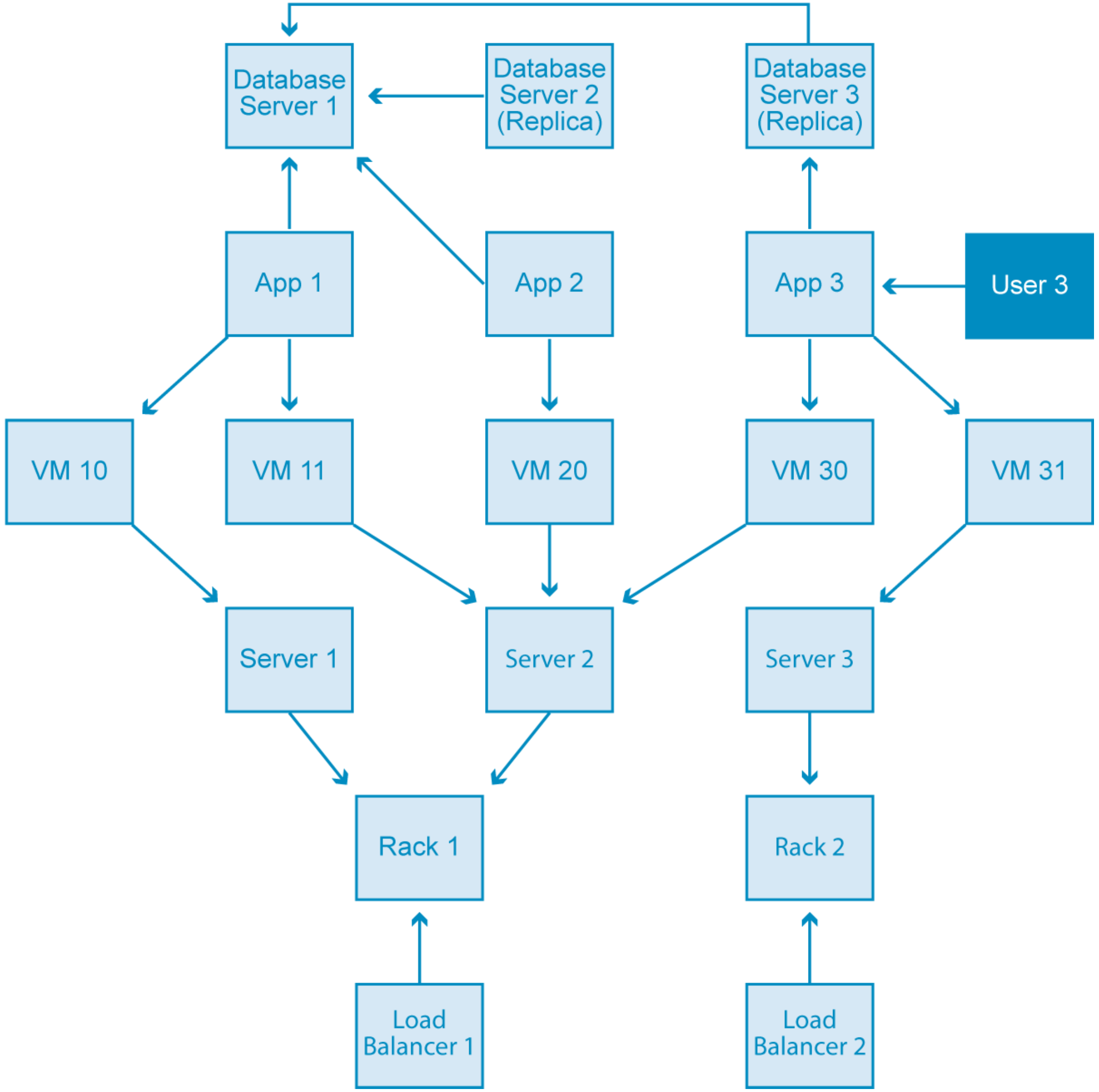
RackId: INTEGER [PK]

Load Balancer

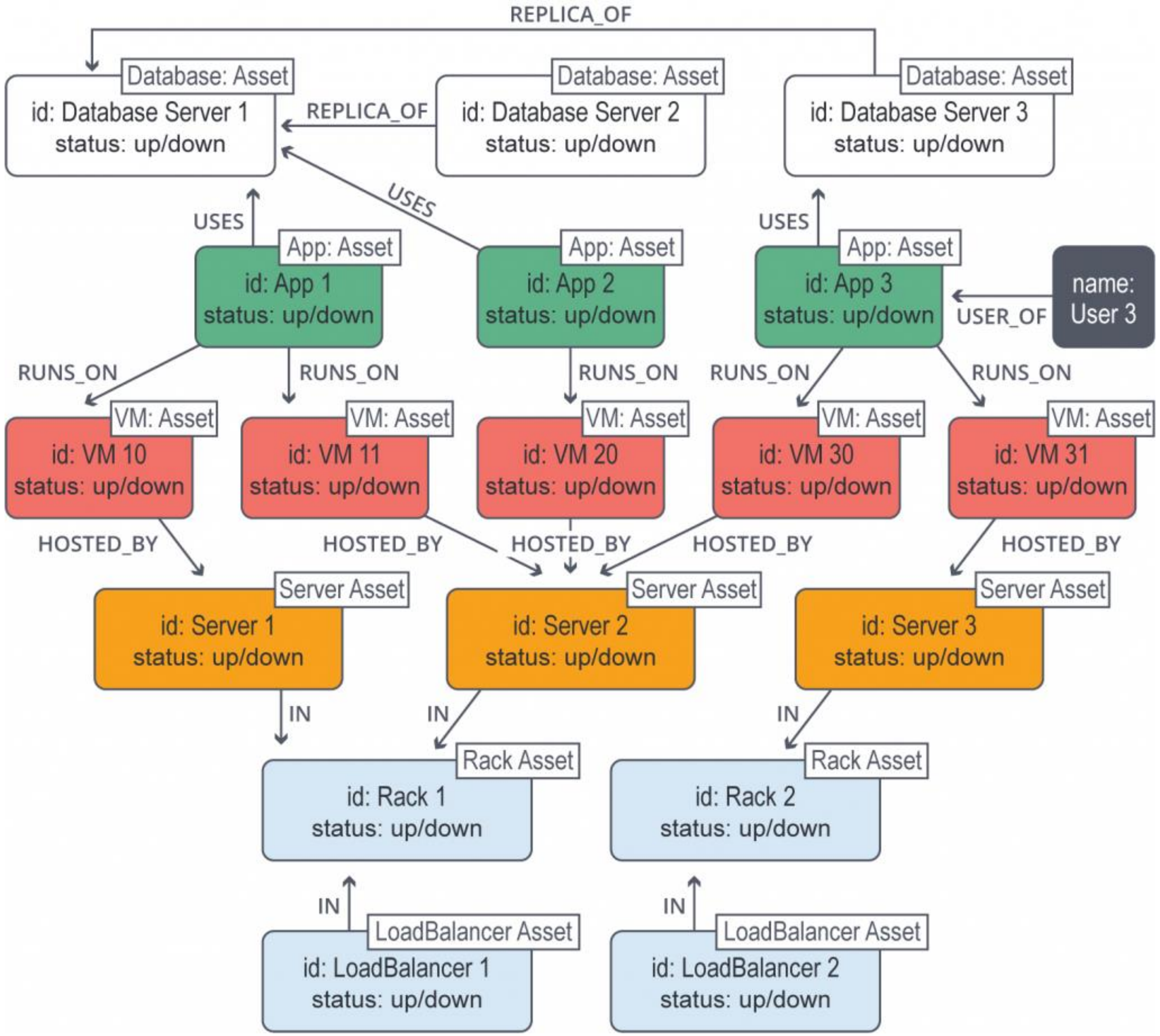
LoadBalancedId: INTEGER [PK]

RackId: INTEGER [FK]

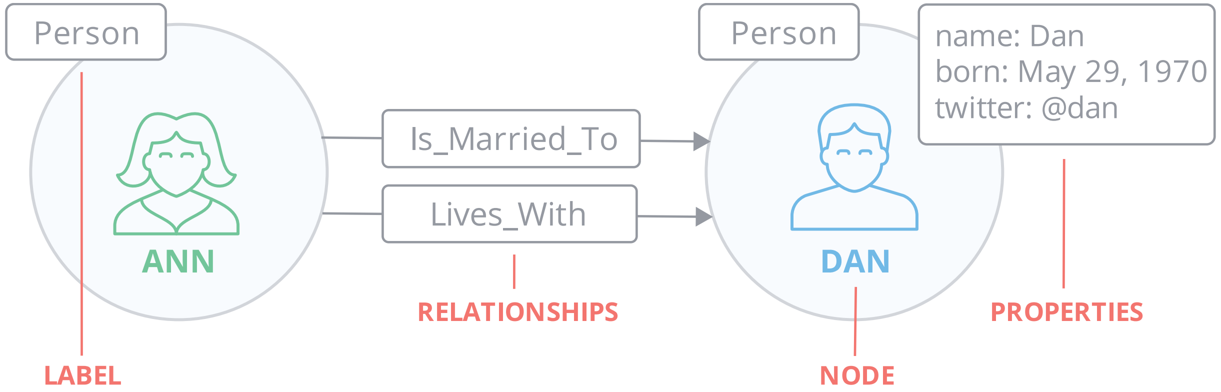
Graph Model


Database Server 1
Database Server 2 (Replica)
Database Server 3 (Replica)
App 1
App 2
App 3
User 3
VM 10
VM 11
VM 20
VM 30
VM 31
Server 1
Server 2
Server 3
Rack 1
Rack 2
Load Balancer 1
Load Balancer 2

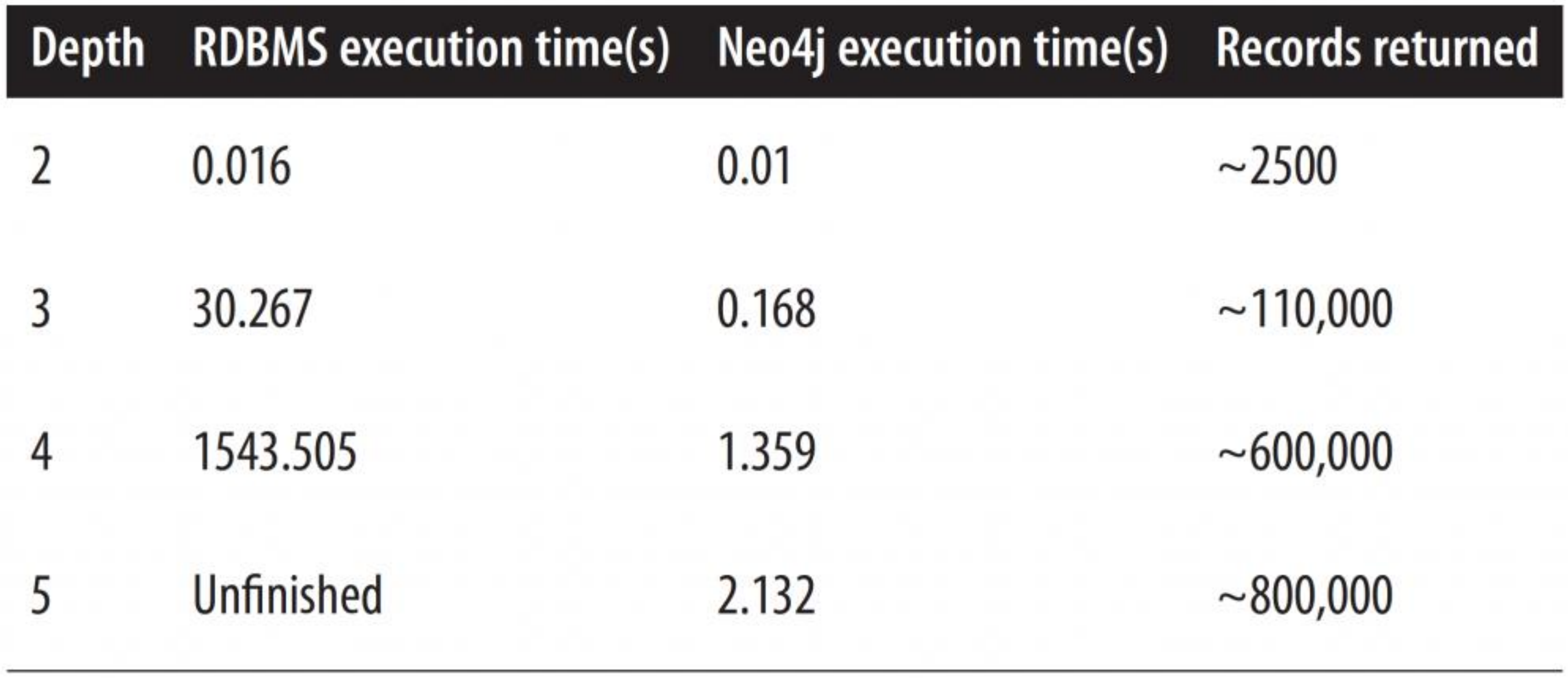
Enriched Model



Property Graph Model



Performance



Depth	RDBMS execution time(s)	Neo4j execution time(s)	Records returned
2	0.016	0.01	~2500
3	30.267	0.168	~110,000
4	1543.505	1.359	~600,000
5	Unfinished	2.132	~800,000

Intelligent Commerce for eBay App on Google Assistant

- Knowledge graph (Neo4j)
- Natural language understanding
- Artificial intelligence
- Store, remember and learn from past interactions with shoppers.
- eBay chose Neo4j as the native graph database that holds the probabilistic models that aid understanding in the conversational shopping scenario.
- The Neo4j graph contains both the product catalog and the attributes of shopper interactions while seeking products.

Examples

- https://neo4j.com/graphgist/degrees-offered-by-the-university-of-oviedo
- https://neo4j.com/graphgist/fitness-and-nutritional-recommendations
- https://neo4j.com/graphgist/credit-card-fraud-detection

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