Software Architecture

Persistence

Scaling Database
Use case: Cassandra

What are the trade offs of persistence/DB ?

Speed vs durability

- Pure in-memory, no persistence at all, such as memcached or Scalaris
- In-memory with periodic snapshots, such as Oracle Coherence or Redis
- Disk-based with update-in-place writes, such as MySQL ISAM or MongoDB
- Commitlog-based, such as all traditional OLTP databases (Oracle, SQL Server, etc.)

Data Model ?

key-value

Amazon DynamoDB (Beta)

ORACLE BERKELEY DB 11g

redis

graph

Neo4j the graph database

InfiniteGraph

sones

column

HBASE

riak

Cassandra

document

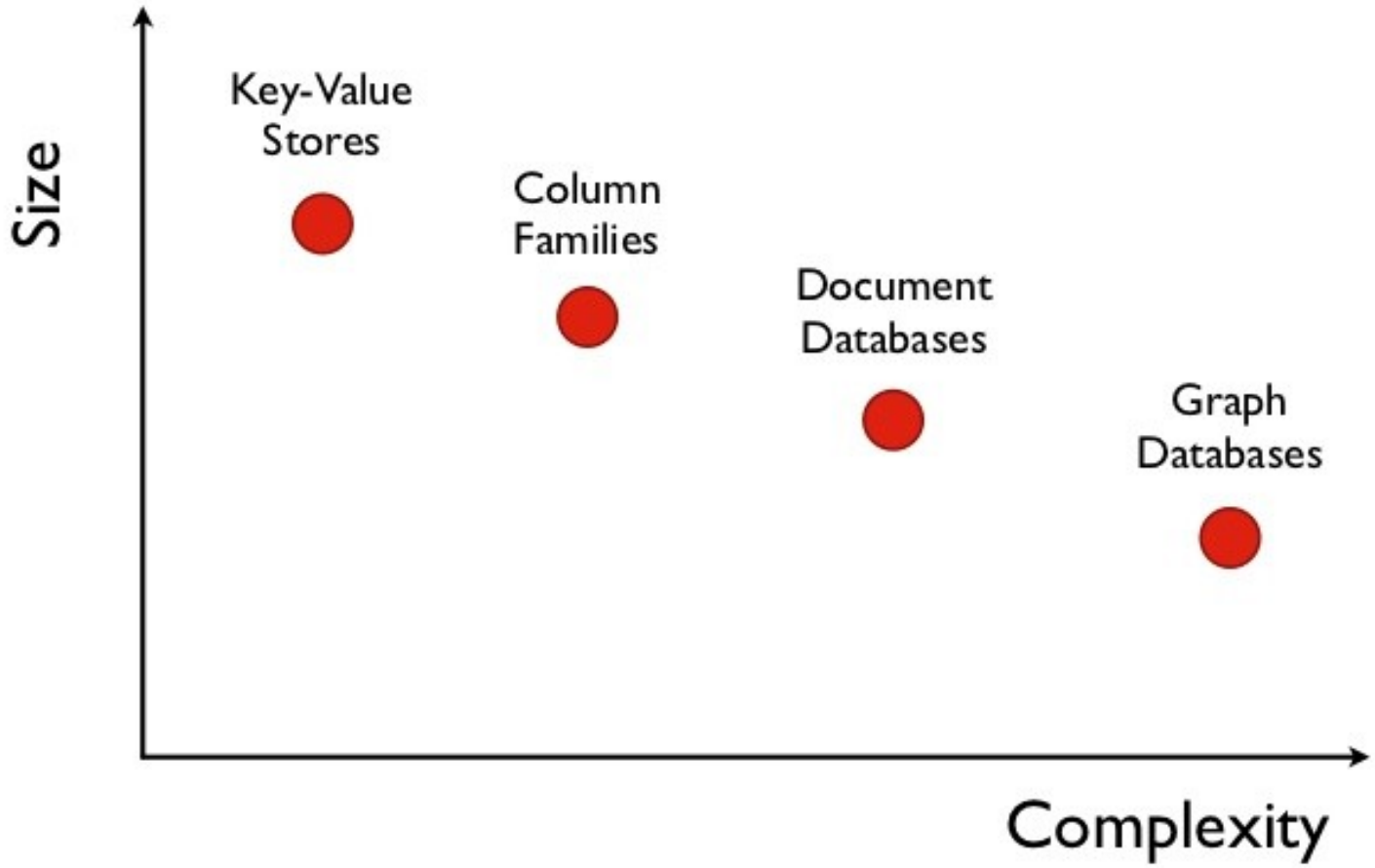
CouchDB relax

mongoDB

terrastore

https://www.analyticsvidhya.com/wp-content/uploads/2014/11/nosql-databases.jpg

Focus Of Different Data Models



http://www.slideshare.net/emileifrem/nosql-east-a-nosql-overview-and-the-benefits-of-graph-databases

https://www.slideshare.net/quipo/nosql-databases-why-what-and-when/97-Focus_Of_Different_Data_Models

Trade offs

- Read
  - https://www.datastax.com/blog/2010/10/what-persistence-and-why-does-it-matter

Cassandra

- Claim
  - A massively scalable open source NoSQL database.
  - Distributed across multiple data centers with no single point of failure.
  - Low latency queries

Cassandra

- Claim
  - A massively scalable open source NoSQL database.
  - Distributed across multiple data centers with no single point of failure.
  - Low latency queries

How would you build such system ?

Cassandra

- We can’t offer ACID RDBMS constraints
  - Two phase commit is anti-availability
- We need to compromise :(

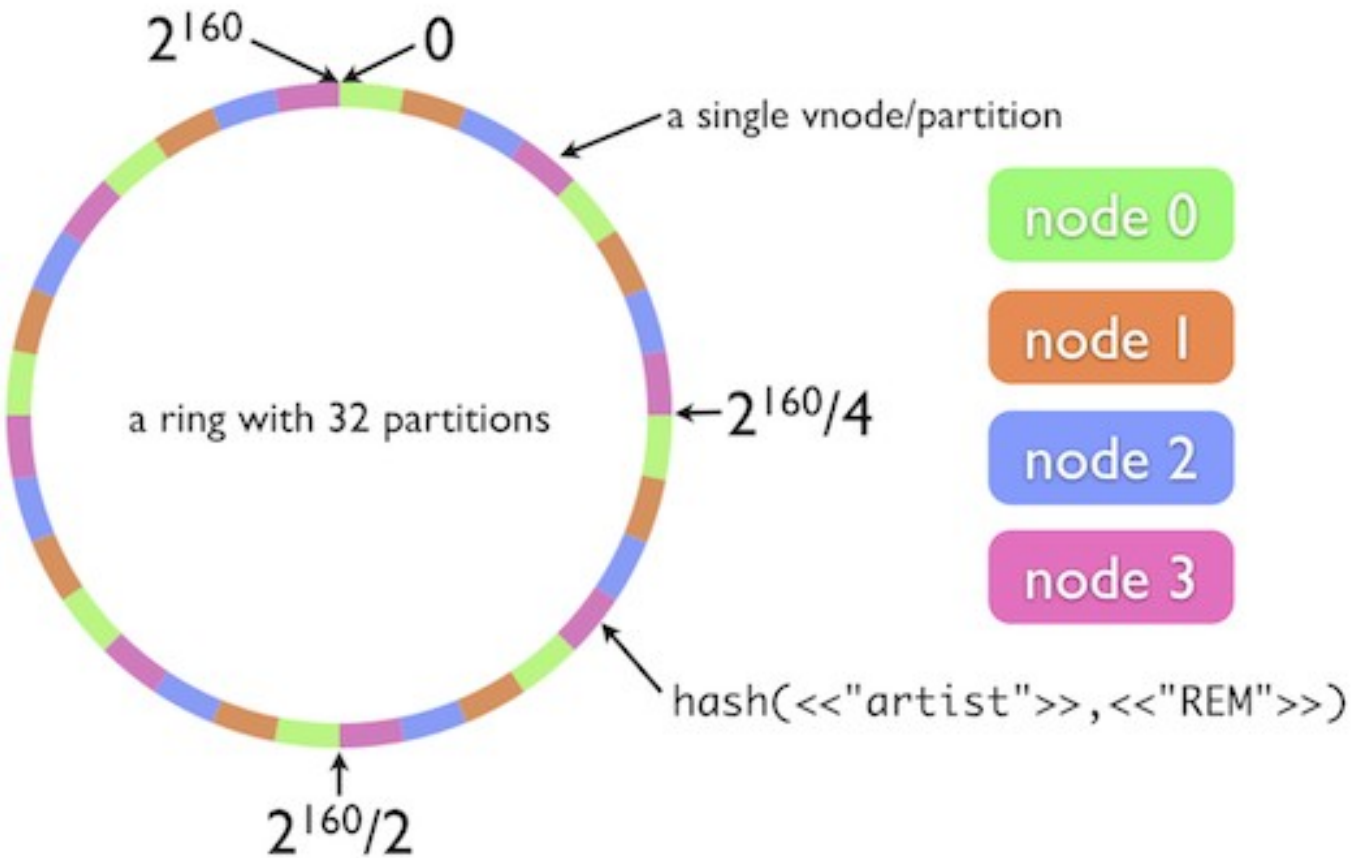
Sharding

- A developer can select an attribute and shard the table between different nodes
  - e.g. shard users table by country code

Do you see the problem ?

- Shared Nothing Architecture, scales well!
- Check Pros and Cons:
  - https://en.wikipedia.org/wiki/Shard_(database_architecture)

Consistent Hashing

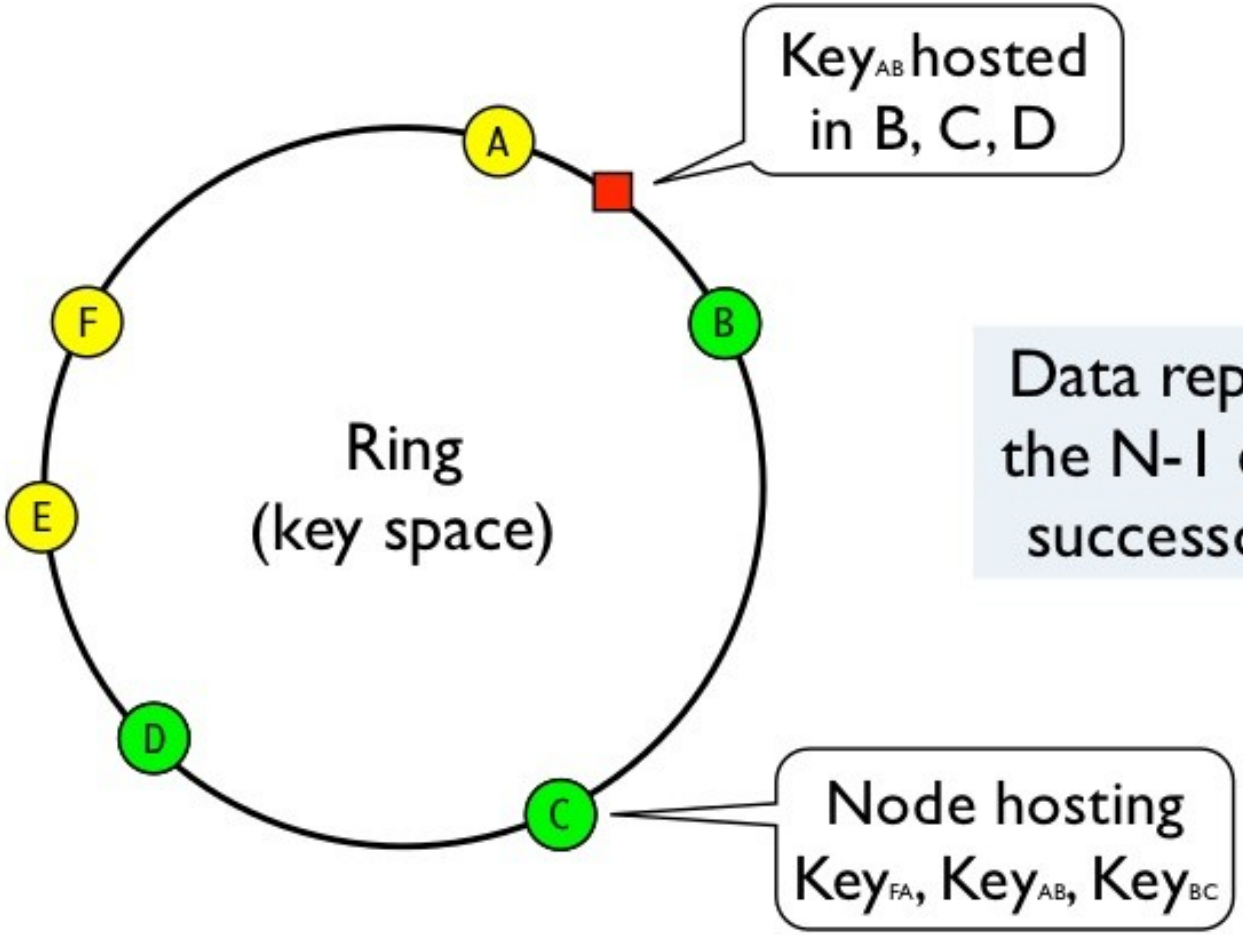


https://dzone.com/articles/simple-magic-consistent

Replication

- Storing copies of data on multiple nodes
- Replication of data ensures fault tolerance and reliability.

Consistent Hashing - Replication



Data replicated in the N-1 clockwise successor nodes

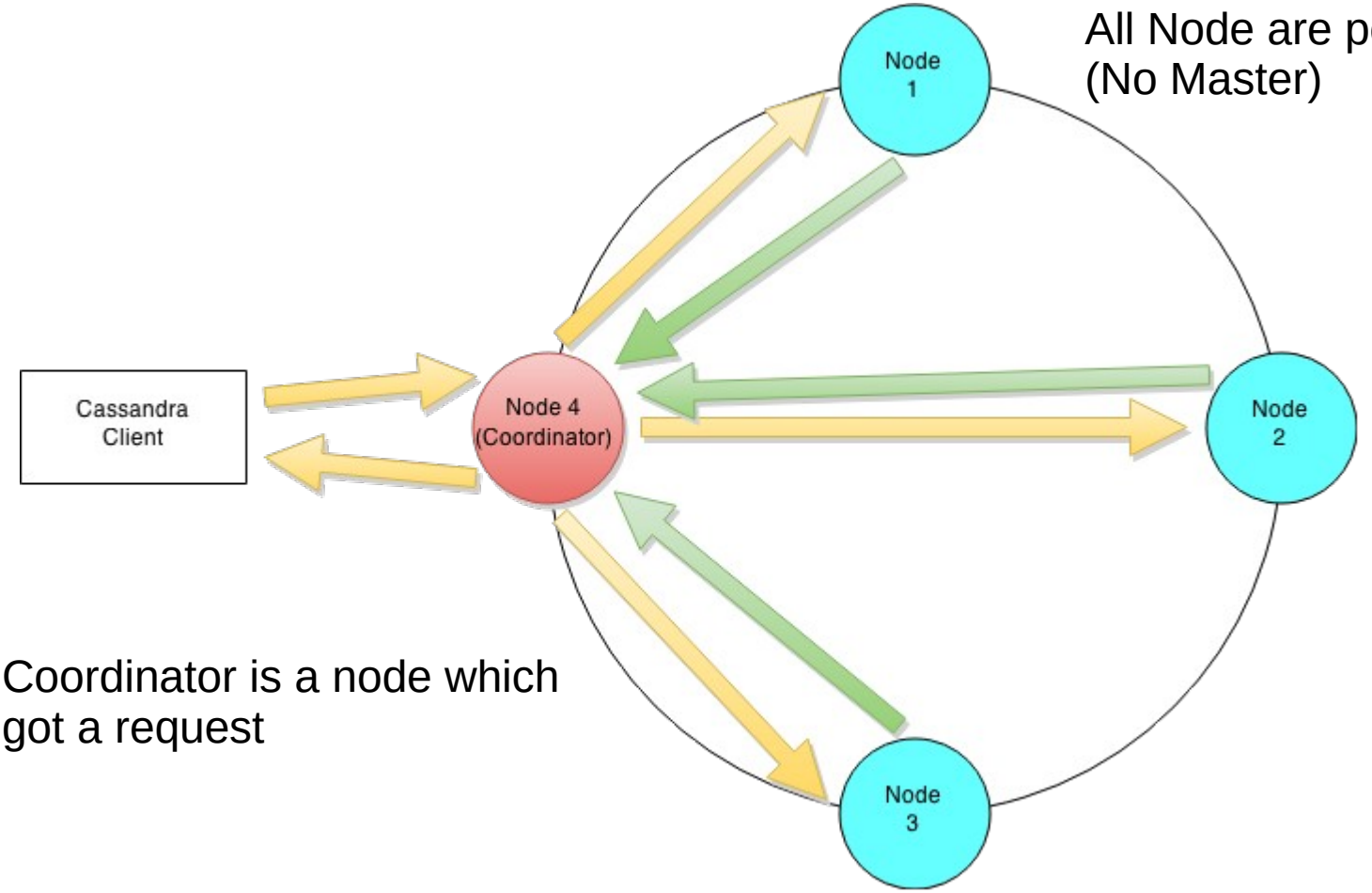
http://horicky.blogspot.com/2009/11/nosql-patterns.html

Cassandra

- Eventual Consistency
  - Typically it’s AP system (remember CAP?)
- Tunable Consistency by setting quorum level
    - From “writes never fail”→ A
    - to "block for all replicas to be readable" → C

Coordination

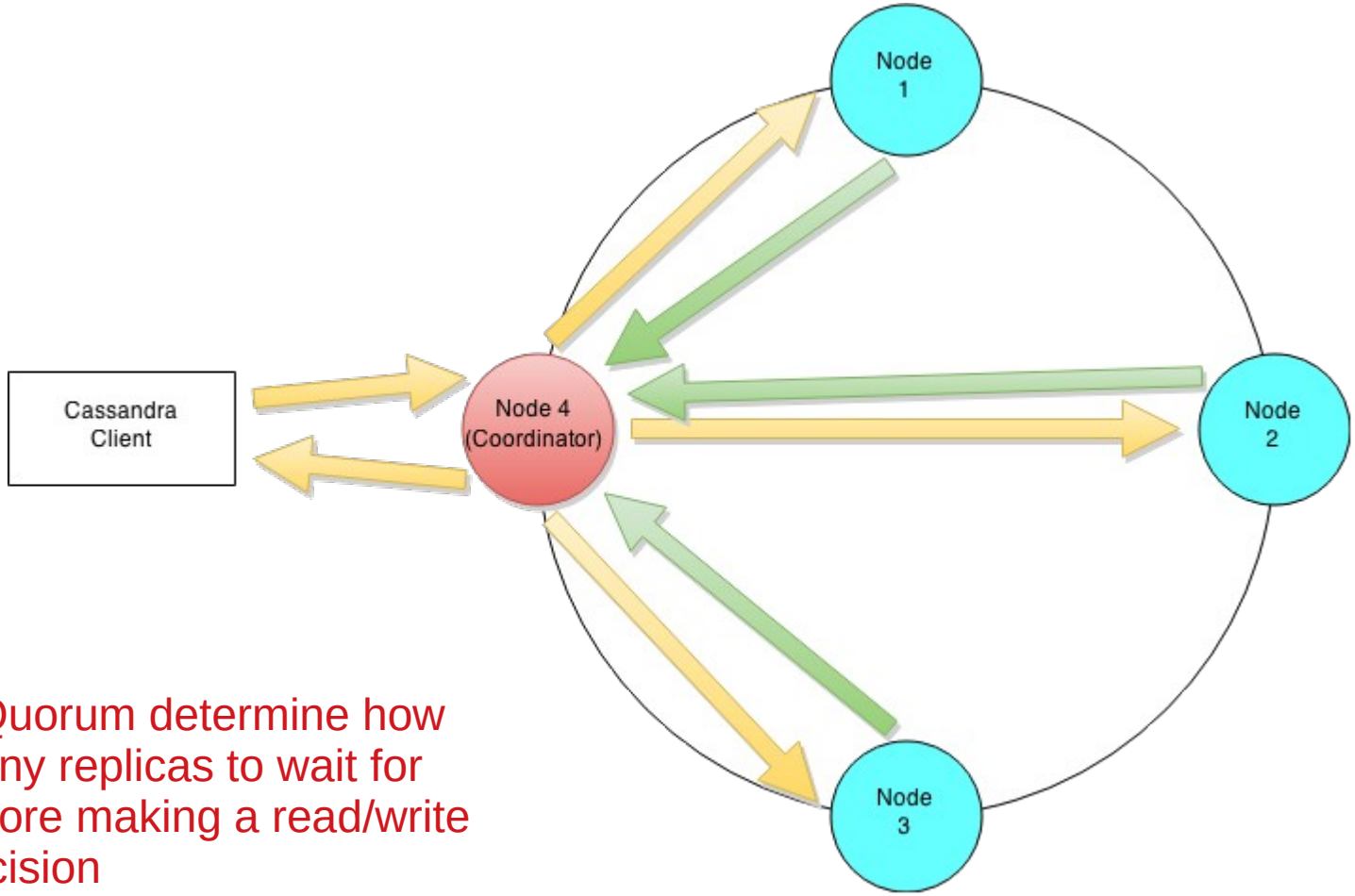
All Node are peers
(No Master)



Coordinator is a node which
got a request

https://dzone.com/articles/introduction-apache-cassandras

Coordination



Quorum determine how many replicas to wait for before making a read/write decision

How to choose

- Watch:
  - How to Choose the Right Database? - MongoDB, Cassandra, MySQL, HBase | Frank Kane
    - https://www.youtube.com/watch?v=v5e_PasMdXc

Final thoughts

- Know your data!
- Replication, sharding and consistent hashing are important concepts
  - Nothing is free :(
- We omitted several Cassandra speceifcs
  - SStable, tombstone ,..