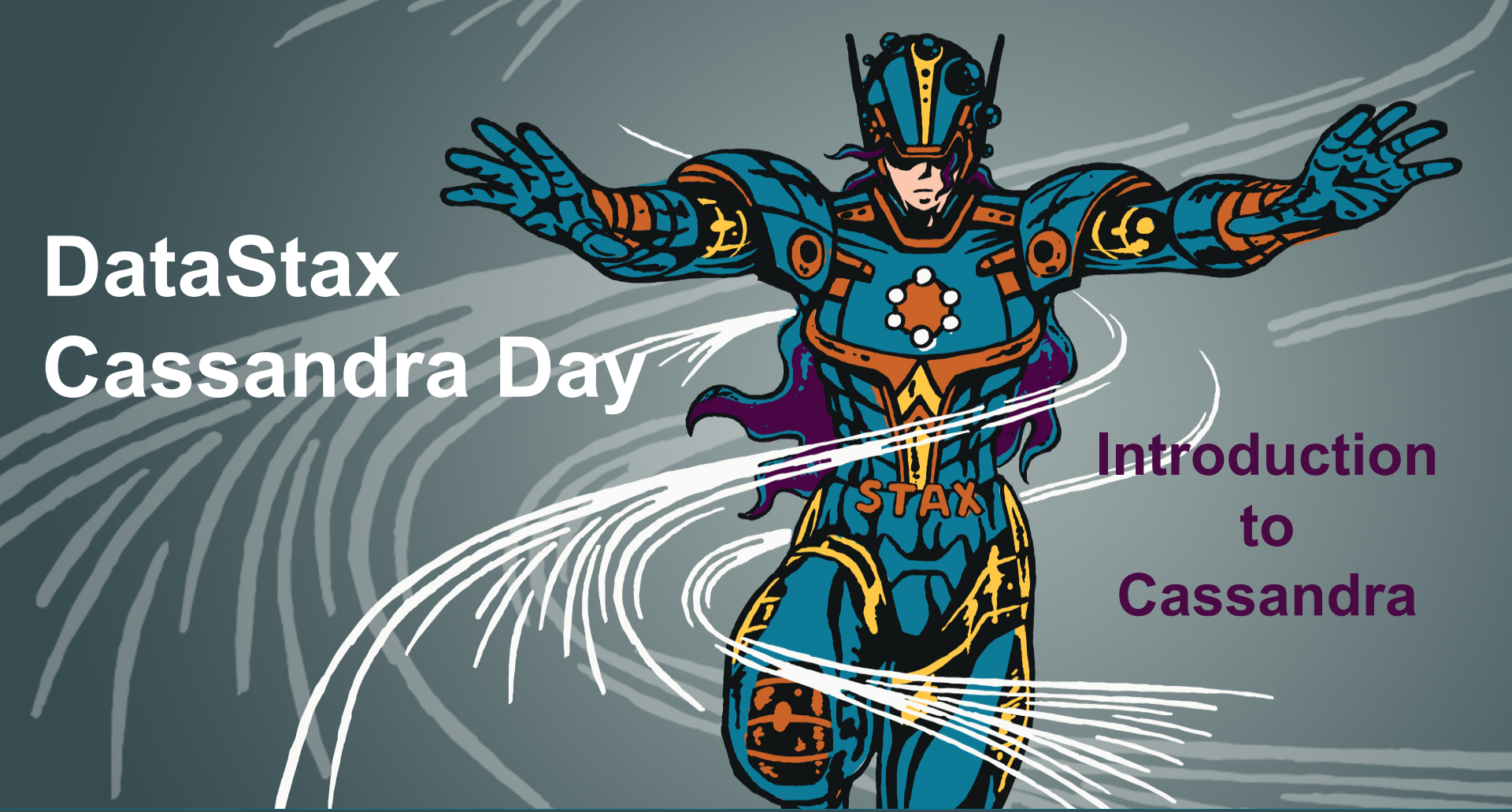
DataStax Cassandra Day



Introduction to Cassandra

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You've Worked Hard

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Finally, it's Taking off!

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Are You Ready?

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Well, You May be Ready…

But, What about Your Data?

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Start with “Why?”

Why do I need DSE & Apache Cassandra™?

- Only DataStax Enterprise offers CARDS – and you need it all:
  - Contextual – relevant data in context
  - Available – always on, no downtime
  - Realtime – response time in MS
  - Distributed – many servers in datacenters around the world
  - Scalable – near linear increase for each additional server

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How does Cassandra do it?

Here's our agenda:

- We'll take a quick look at a Cassandra cluster
- Then, we'll discuss Cassandra's architectural
- Finally, we'll do some more hands-on
  - Load some data
  - Write CQL queries against the data
  - Demonstrate the power of replication

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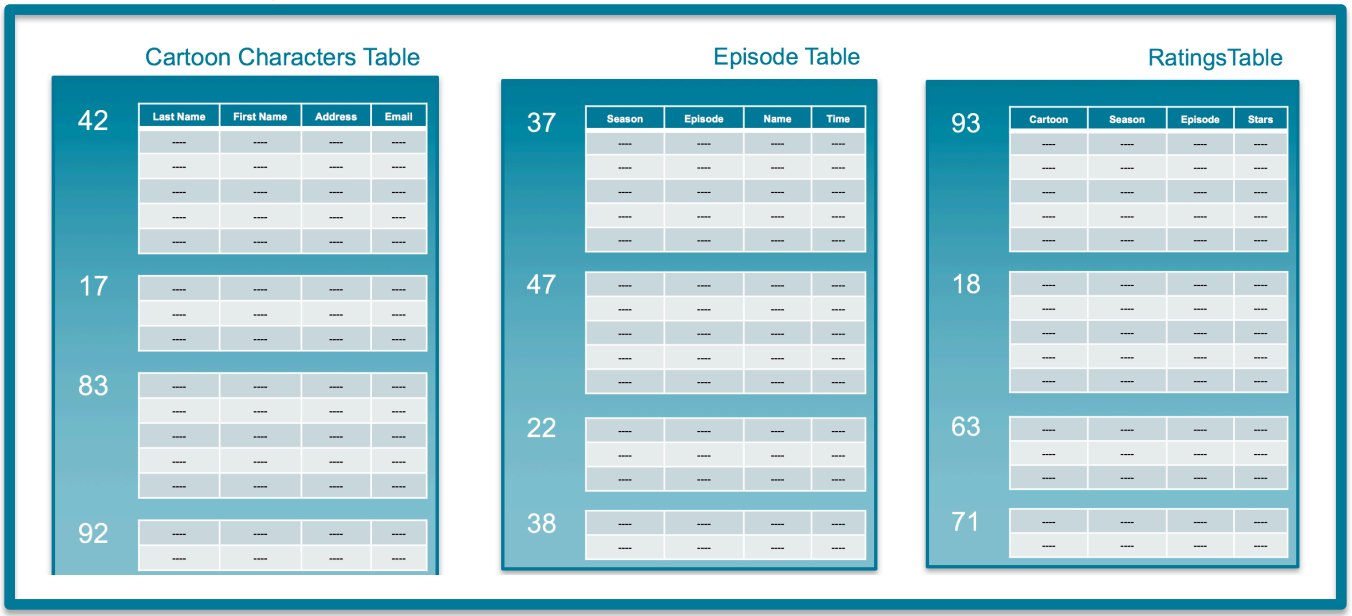
Apache Cassandra™ First Touch

What Does Cassandra Look Like?

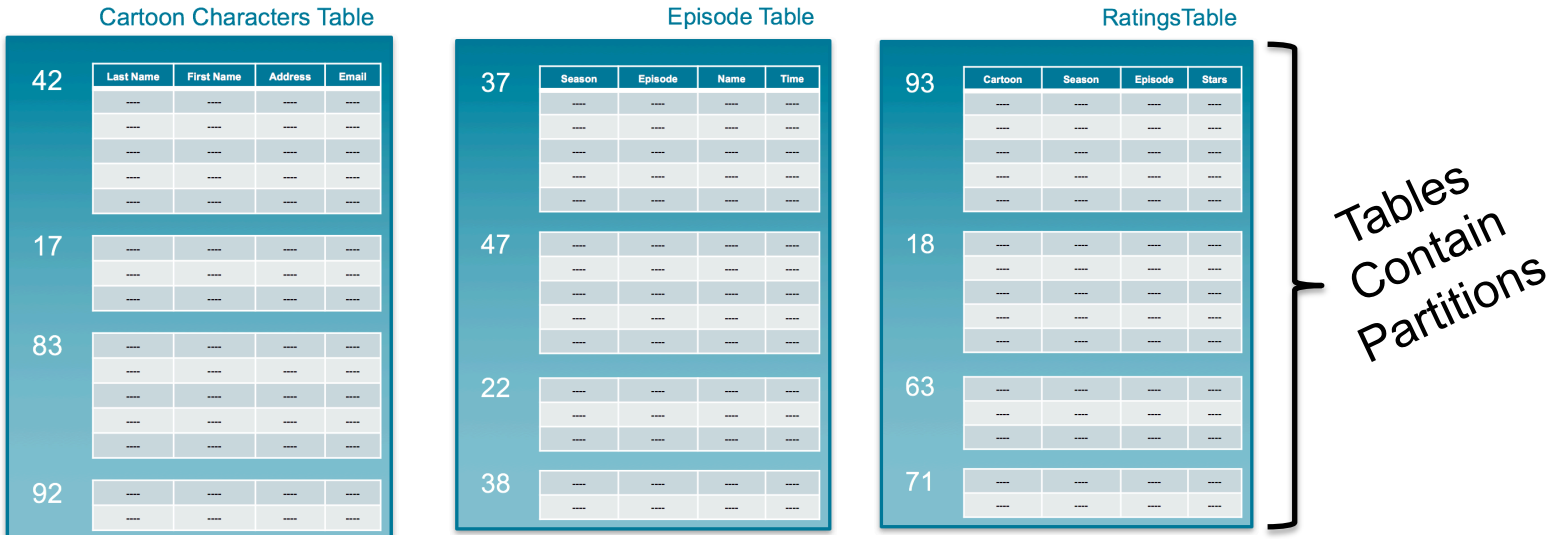
The basic structure of data

Cartoon Keyspace



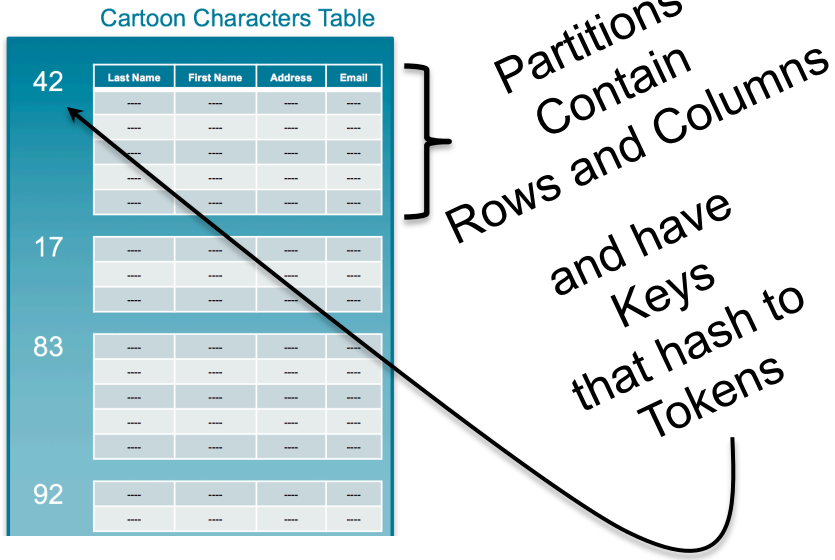
What Does Cassandra Look Like?

The basic structure of data



What Does Cassandra Look Like?

The basic structure of data



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Want to try it?

Let's look at a cluster

- Open a browser
- Go to http://<your IP address>:9091
- Open notebook
  - "Core Cassandra: First Touch"

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Apache Cassandra™ First Touch

Quick review

- Key Take-aways:
  - Clusters contain keyspaces
  - Keyspaces contain tables
  - Tables contain partitions
  - Partitions contain rows and columns
  - CQL has syntax similar to SQL

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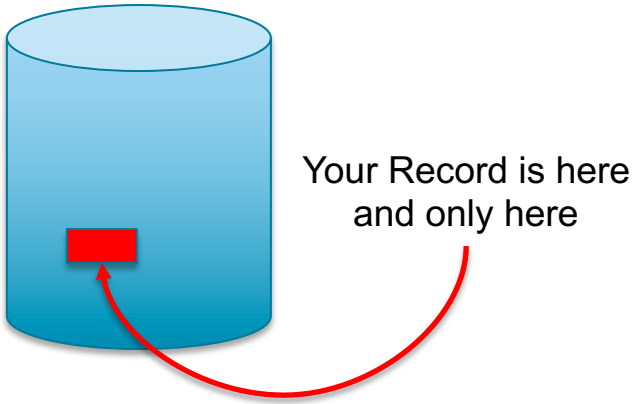
Cassandra Architecture

Problems with Traditional RDBM

Each record is in one location

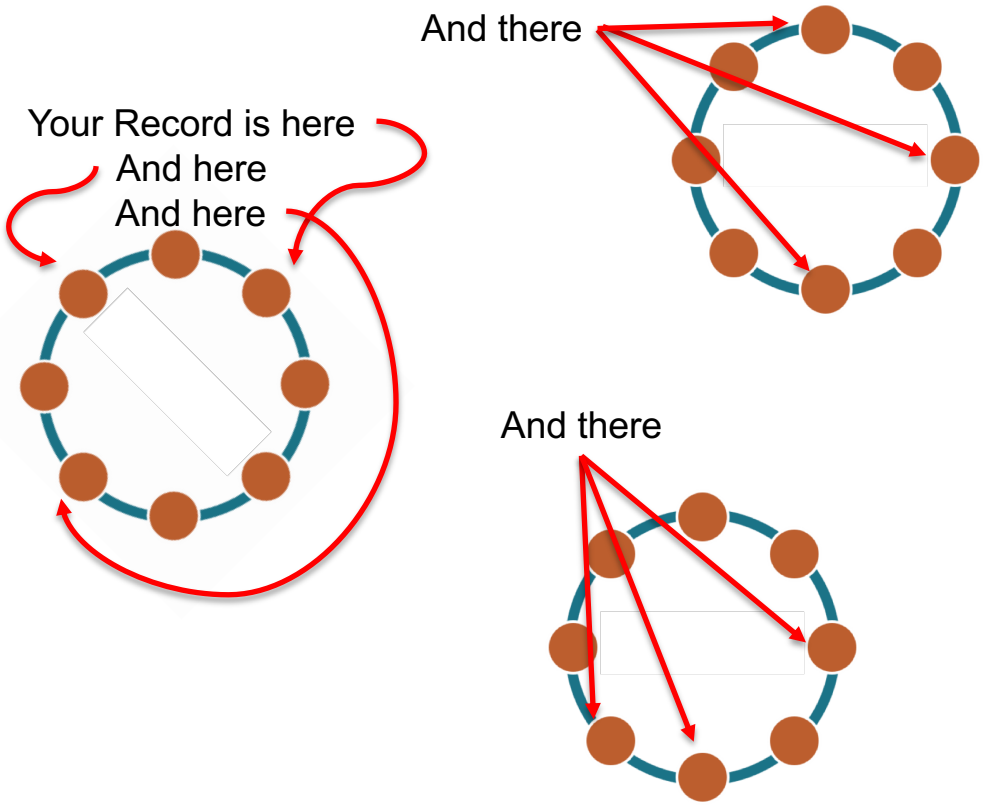
- Update in place – causes bottlenecks
  - Reduced throughput and latency
- Single point of failure
  - Availability risk
- Dogmatic consistency



Cassandra

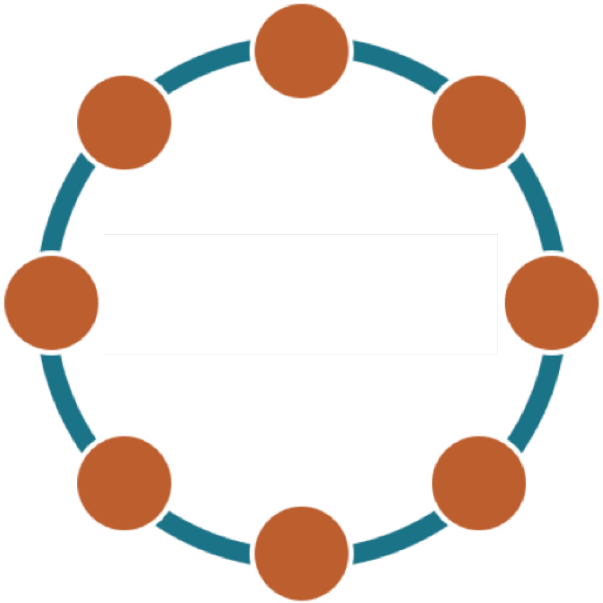
Features

- Distributed
  - Available
  - Responsive
  - Scalable
- Log-structured
  - No bottlenecks
- Tunable consistency



Cassandra is Distributed

- Cassandra clusters have many nodes



Cassandra is Distributed

- Cassandra clusters have many nodes
- How does Cassandra manage all the nodes?

Cassandra is Distributed

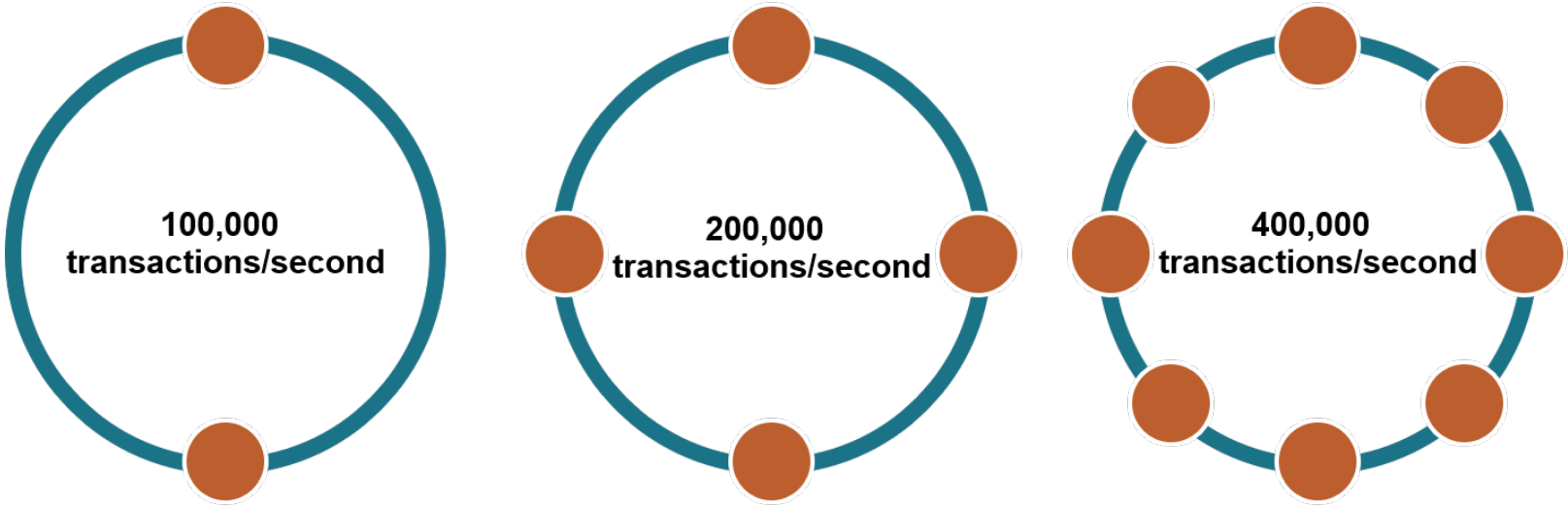
- Each cluster has many nodes
- How does Cassandra manage all the nodes?
  - There is no boss-node

Cassandra is Distributed

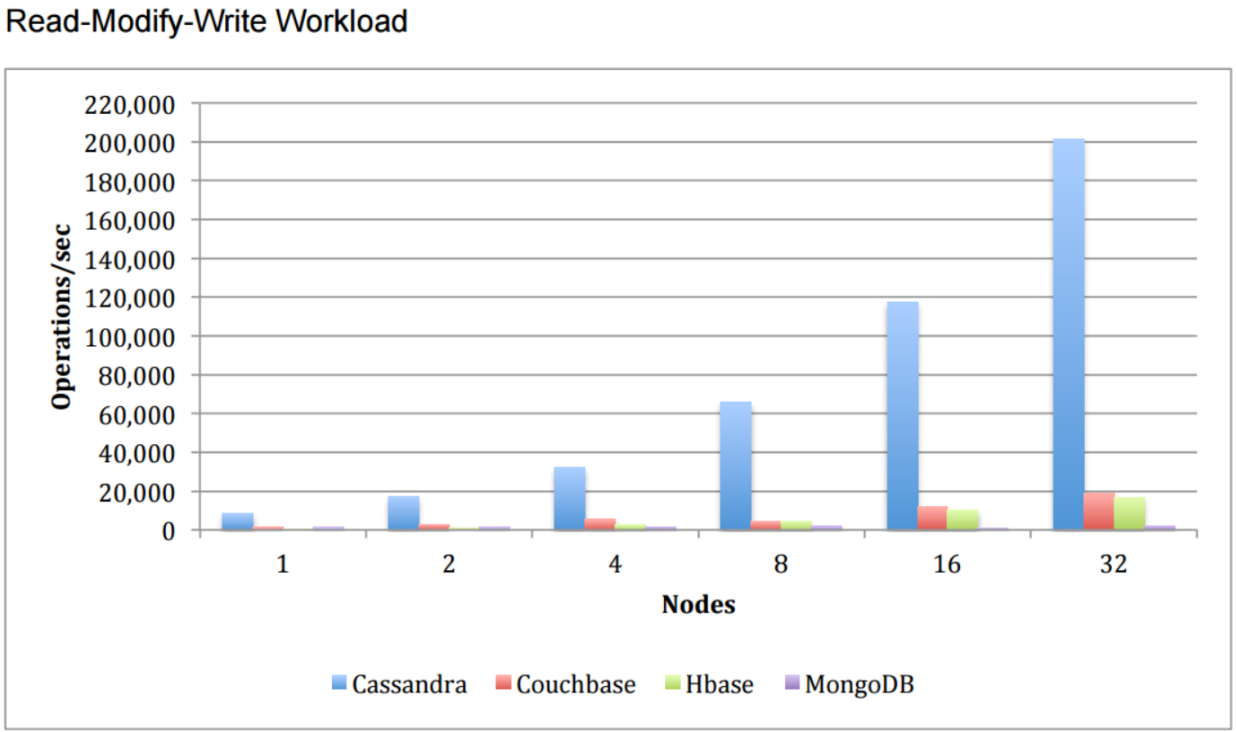
- Cassandra clusters have many nodes
- How does Cassandra manage all the nodes?
  - There is no boss-node
  - The nodes collaborate

Horizontal vs. Vertical Scaling

- Vertical scaling requires one large expensive machine
- Horizontal scaling requires multiple less-expensive commodity hardware

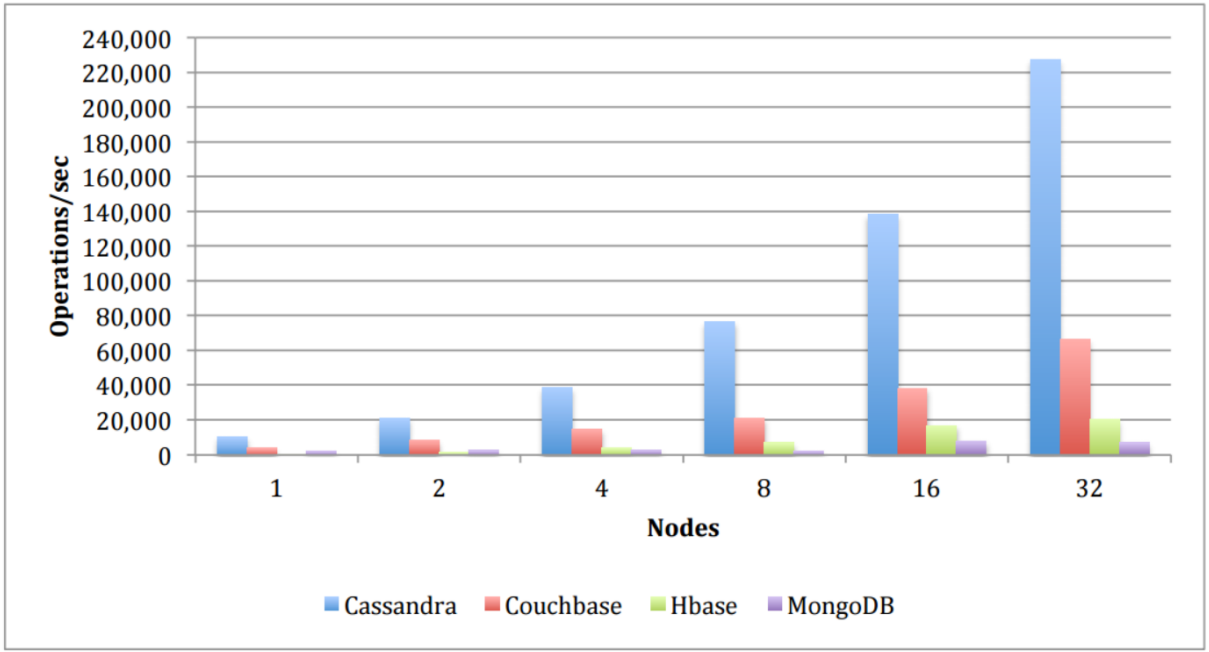


Scales Linearly

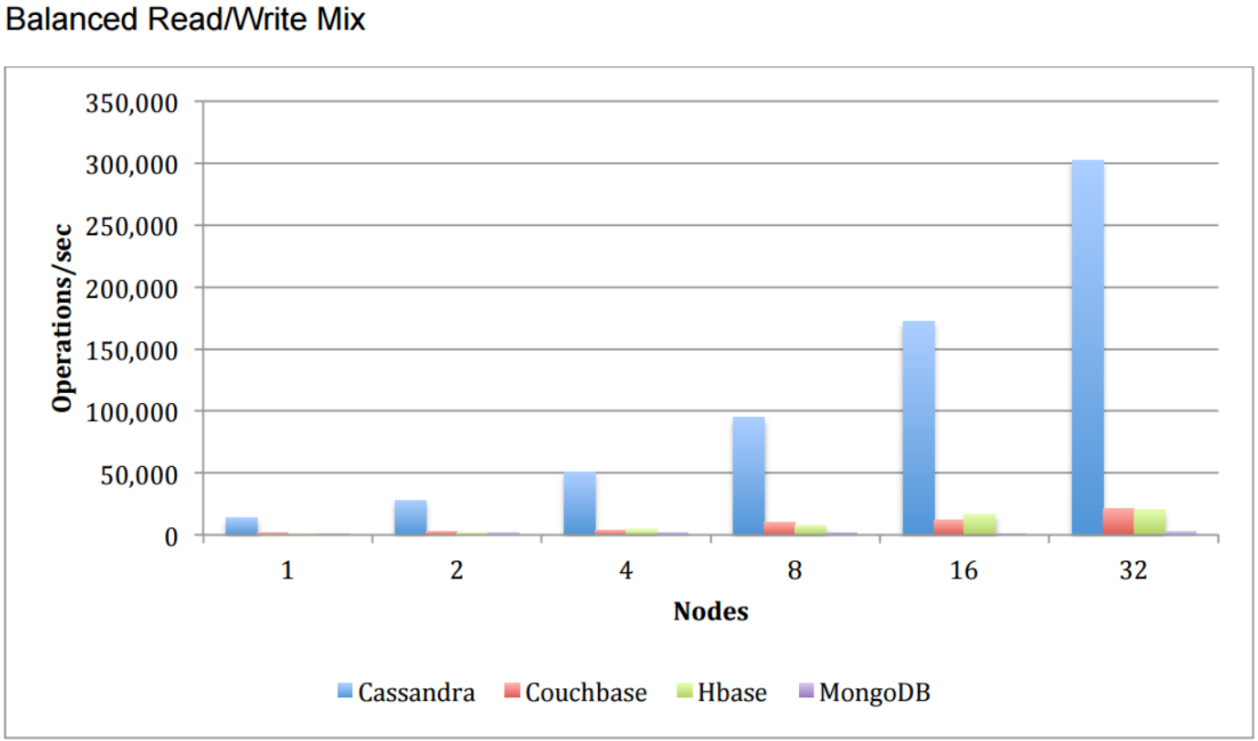


Scales Linearly

Read-mostly Workload



Scales Linearly



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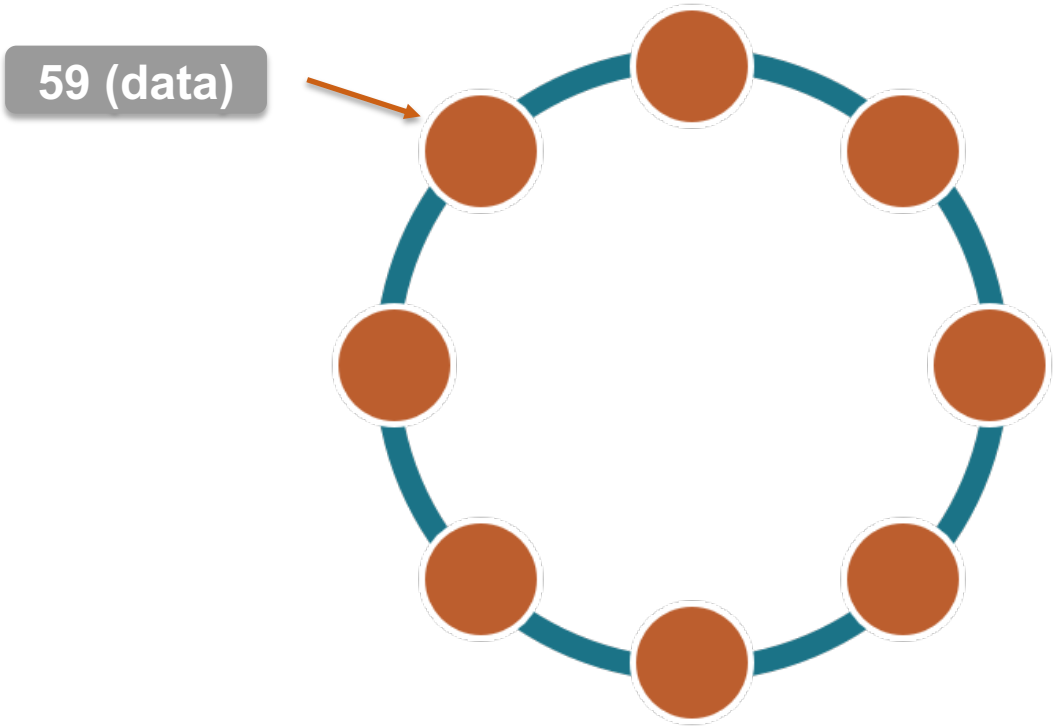
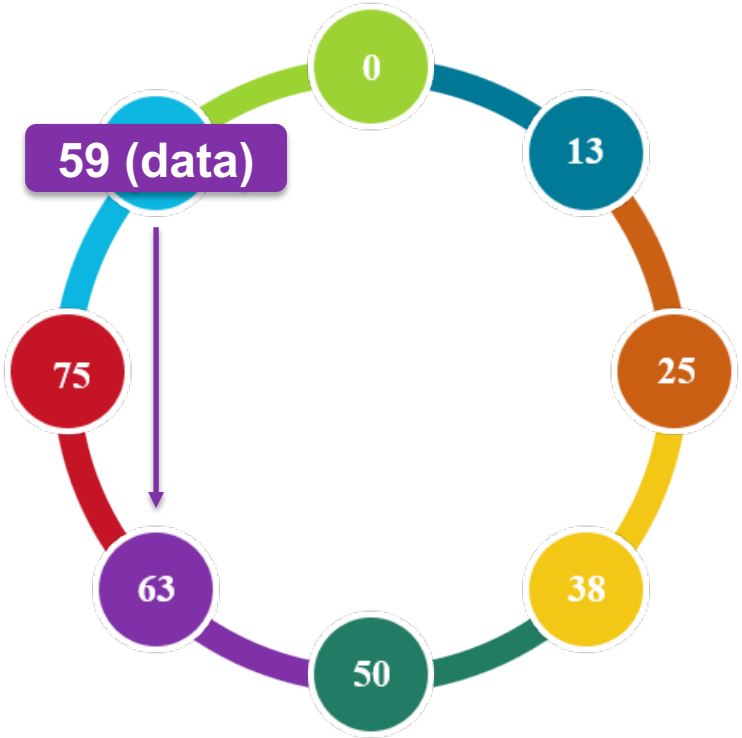
Cassandra's Token Ring and Data Replication

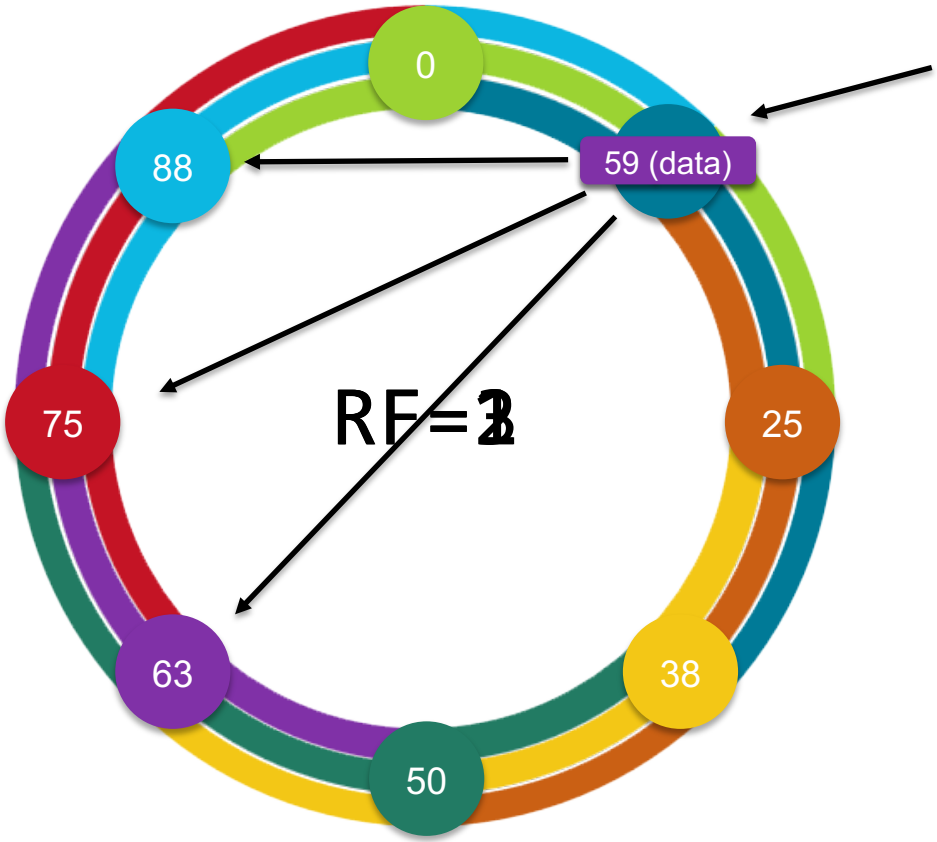
How the Ring Works



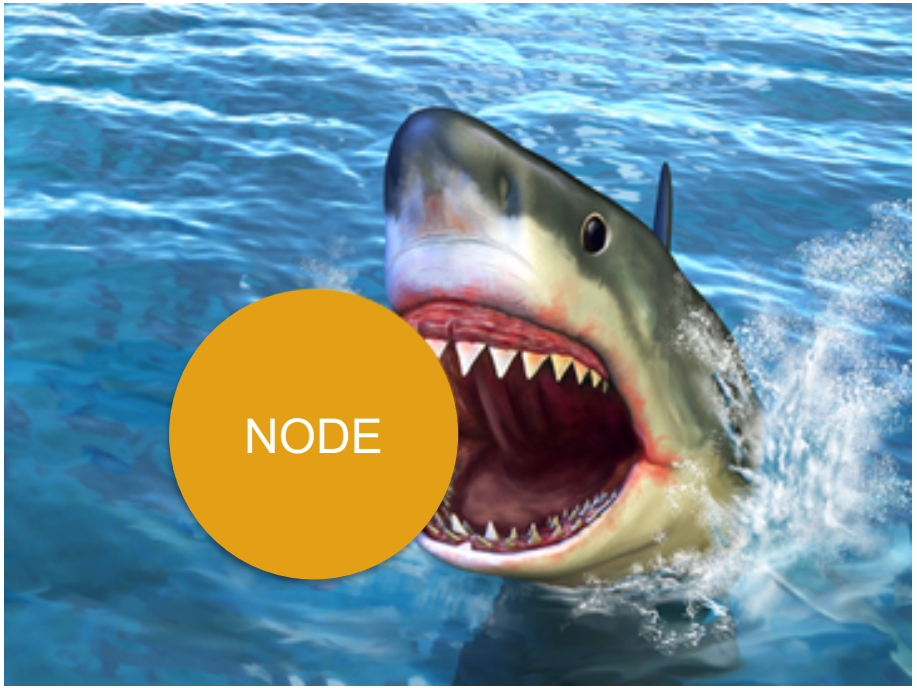
How the Ring Works



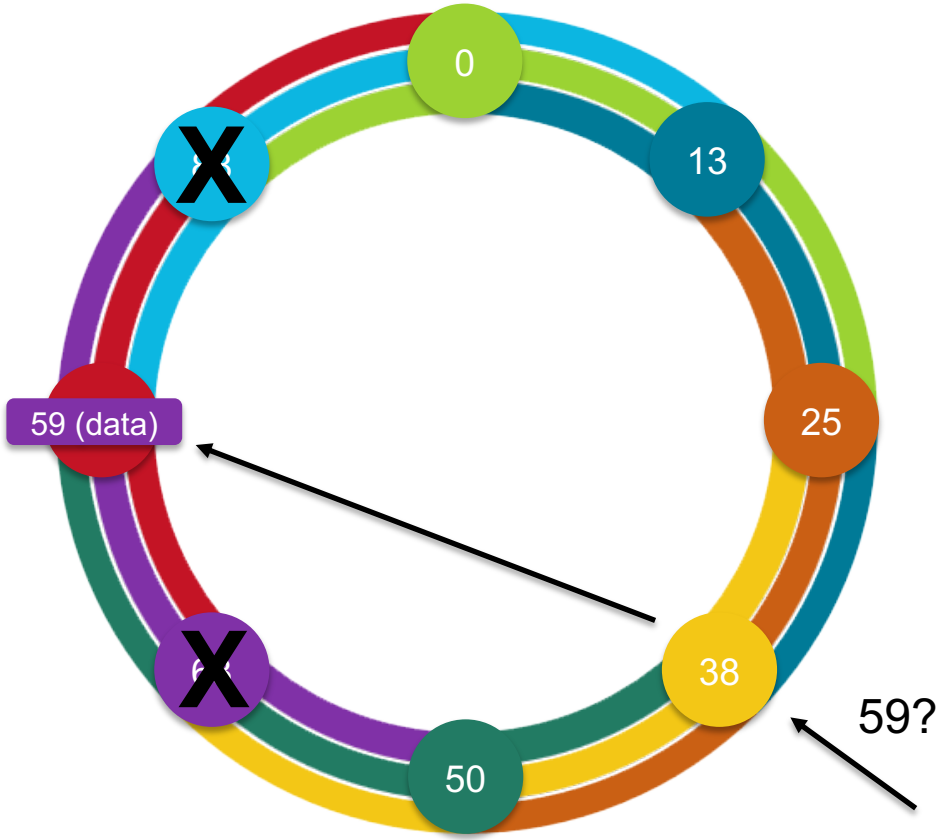
Replication within the Ring



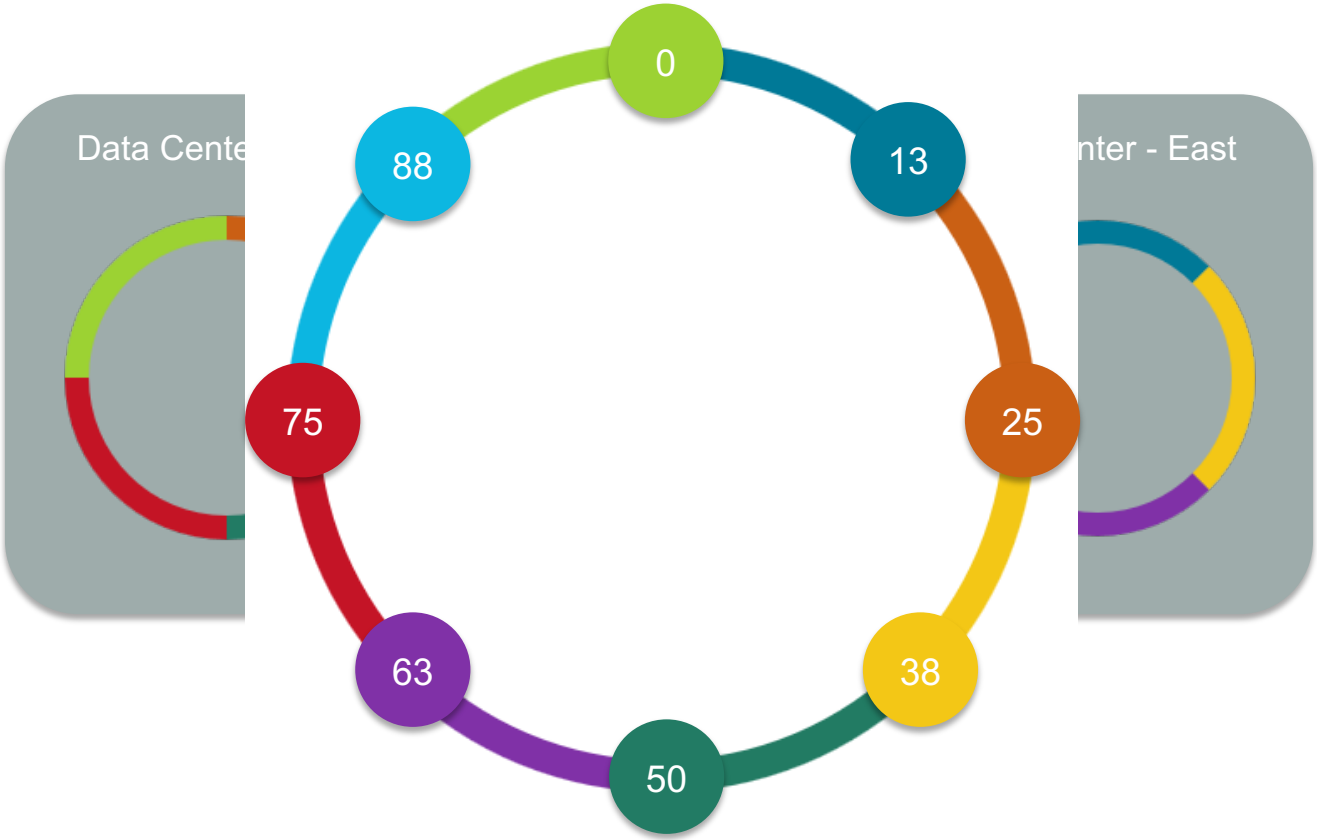
Node Failure



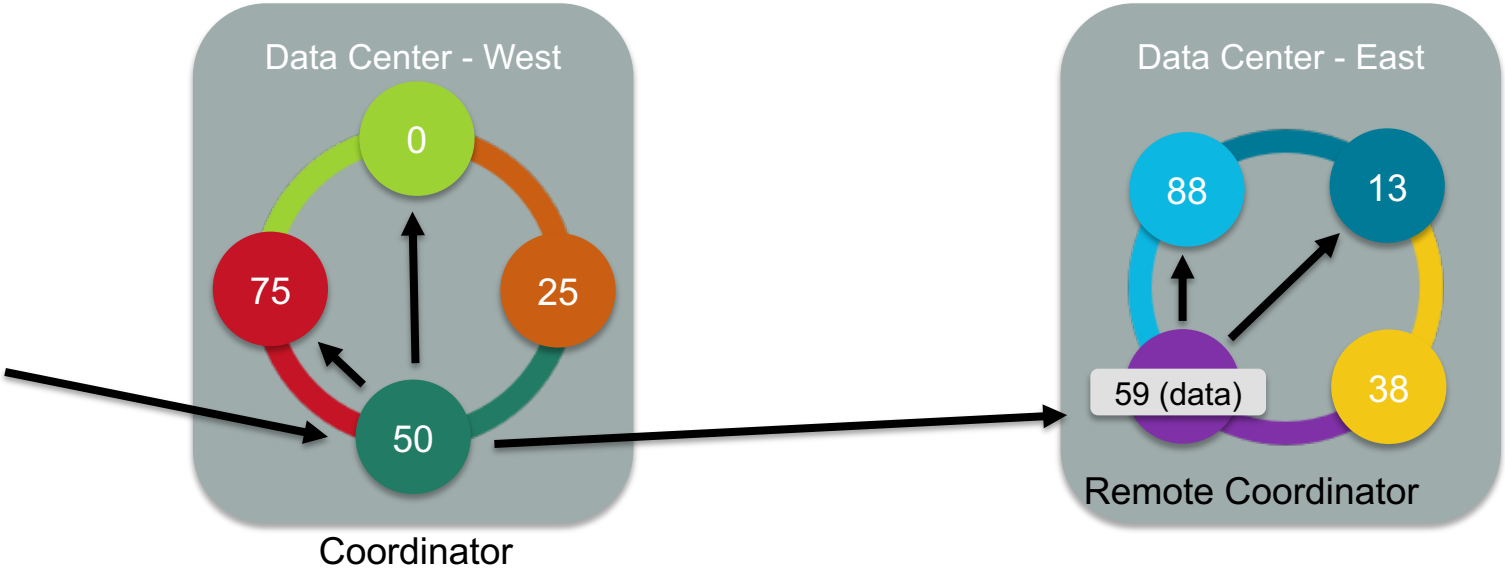
Replication



Multi-Data Center Replication



Multi-Data Center Replication



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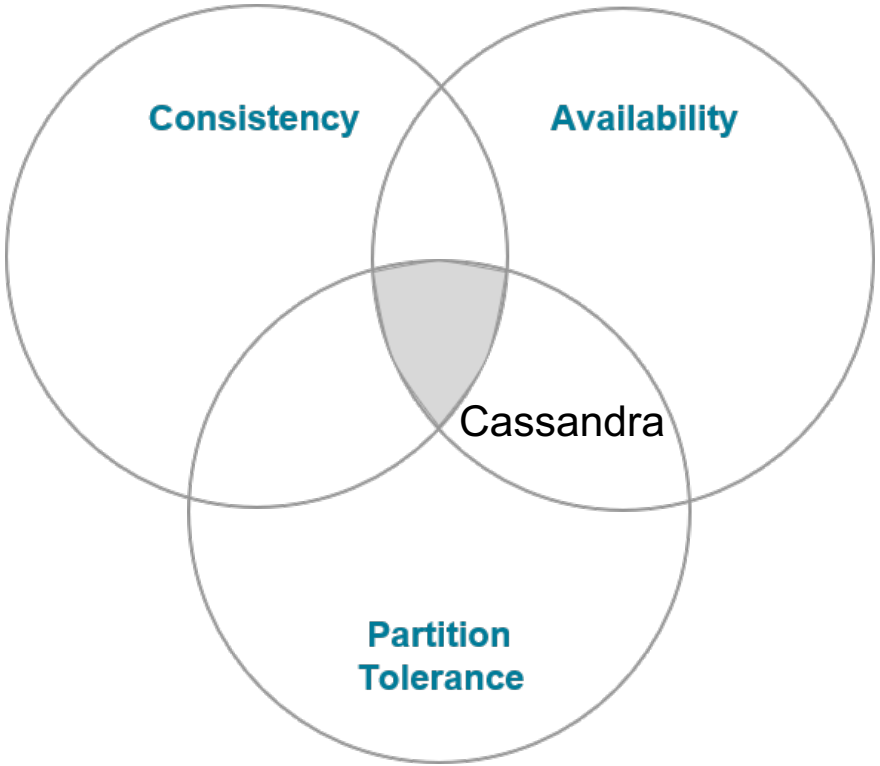
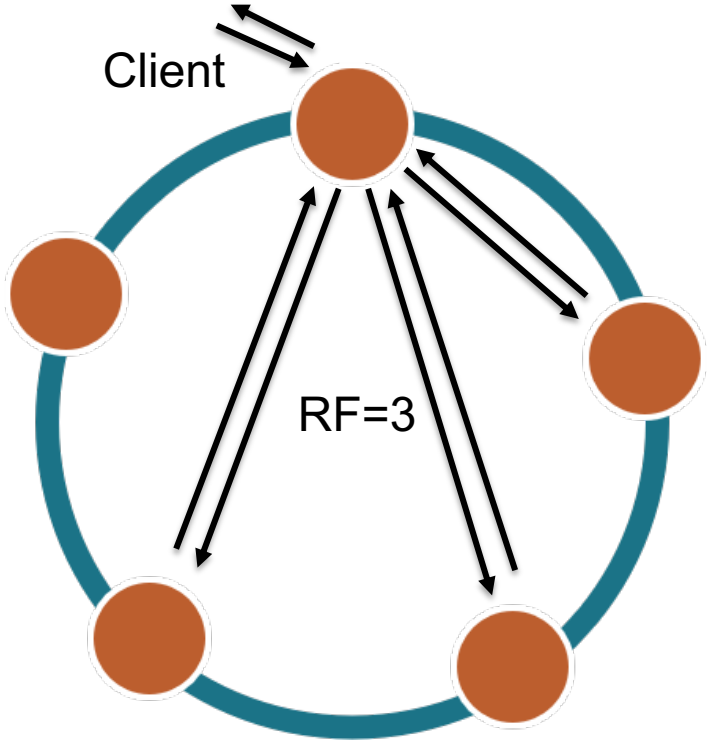
Cassandra's Consistency

CAP Theorem

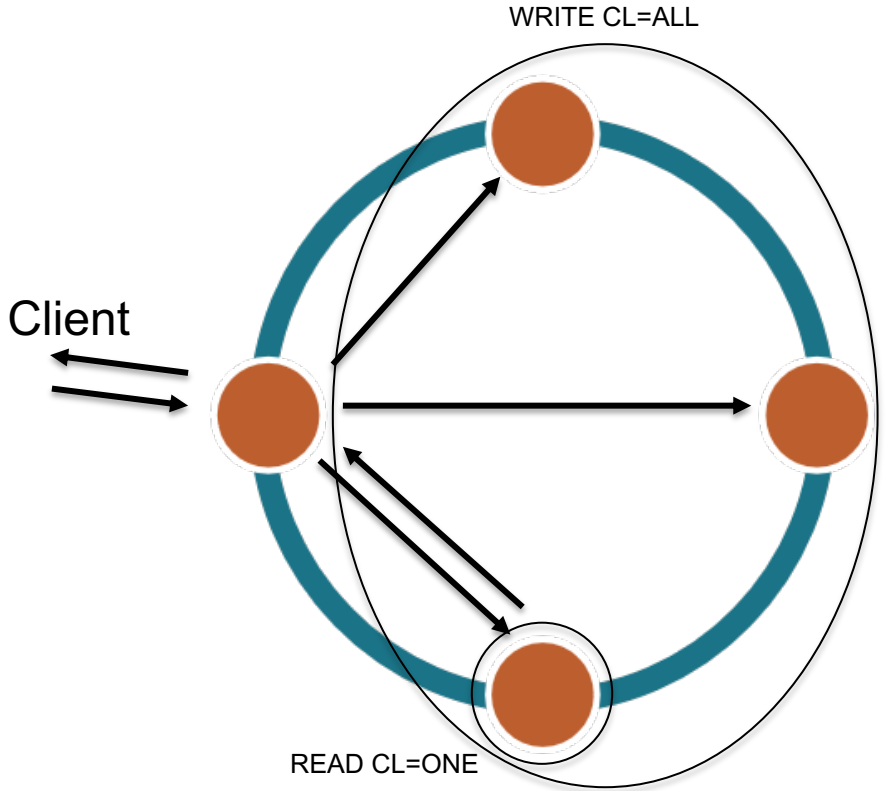


Consistency Levels

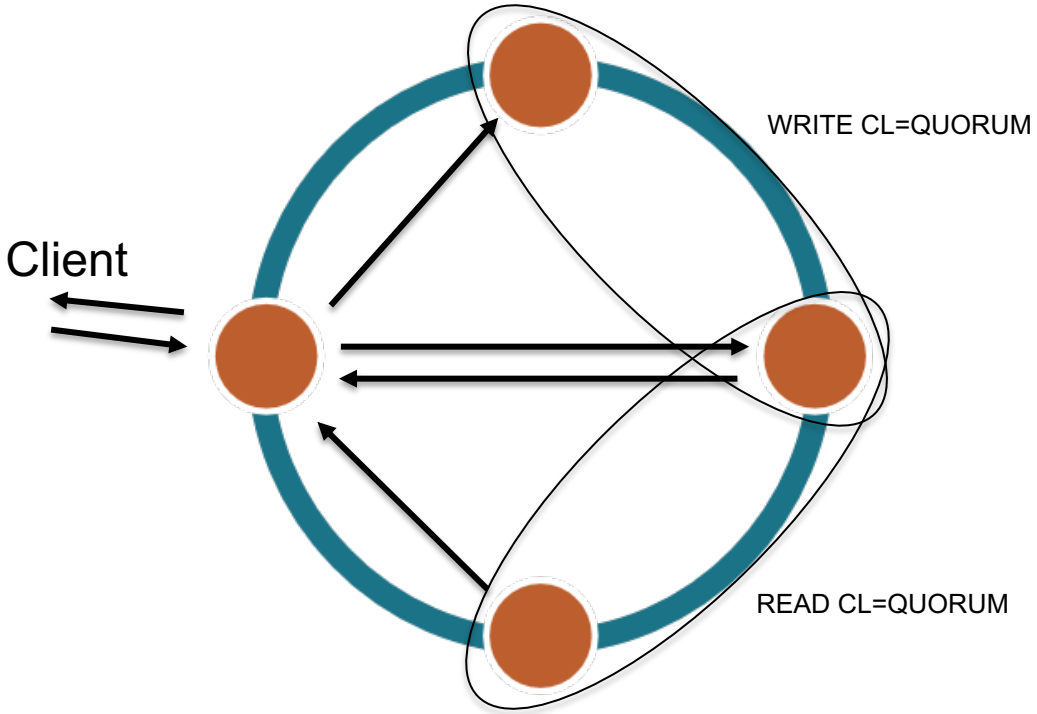


CL=QUORUM

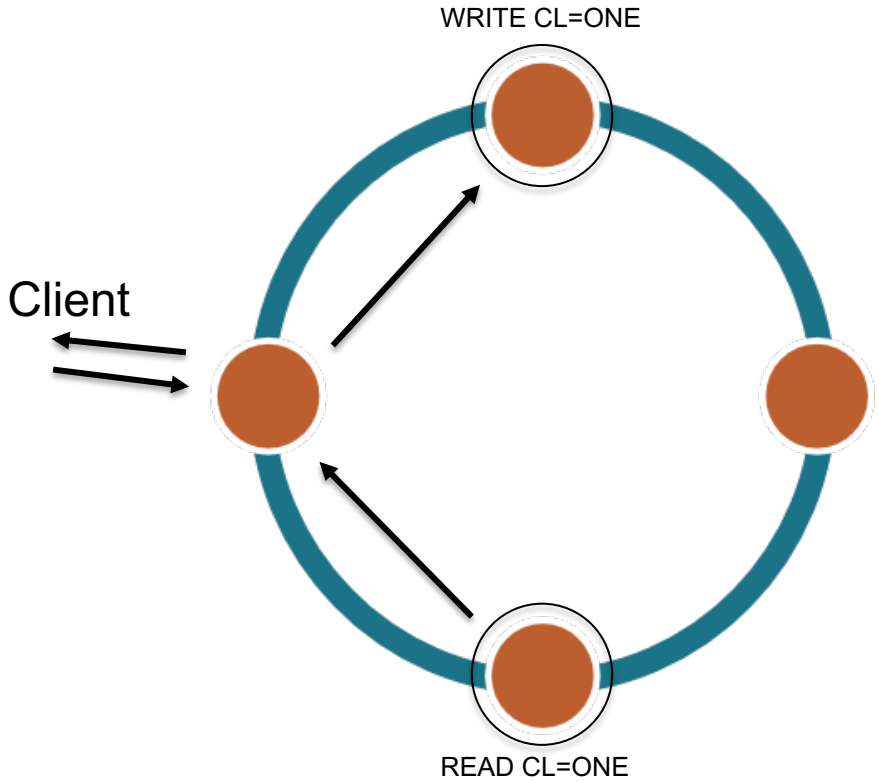
Strong Consistency



Quorum



CL=ONE



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Cassandra's Write Path

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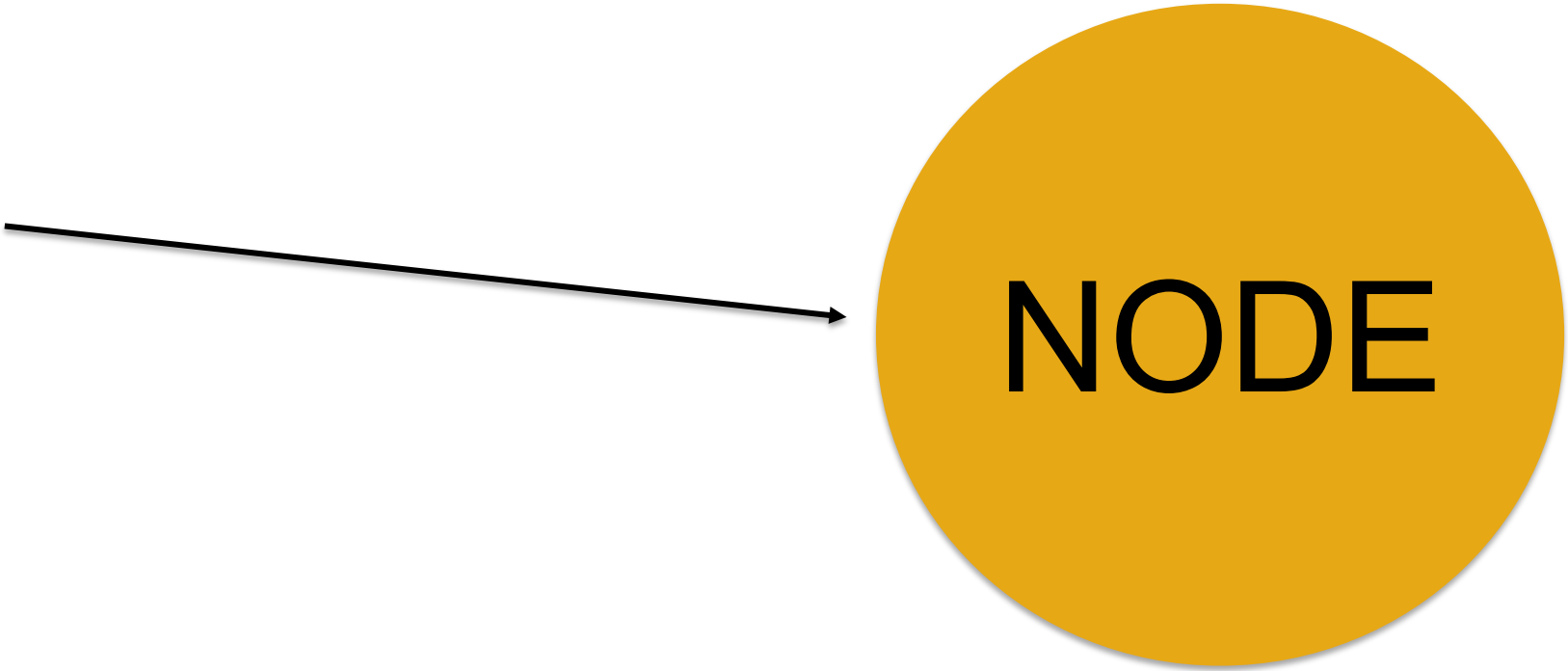

MemTable

RAM

4	IgotUr Data	TX	Austin
5	Always Onomnom	TX	Dallas
2	ComeTo DSE	TX	Dallas
4	Lone Star	TX	El Paso
1	Dev Awesome	TX	Houston
6	Lone Node	TX	Snyder

2	ComeTo DSE	TX	Dallas

Commit Log

HDD

SSTable

RAM

7	Data Rowman	TX	Austin
11	Prepar yer Query	TX	Austin
10	Cluster yer Rows	TX	Dallas
3	Lone Node	TX	Dallas
12	Learnin' to Model	TX	Houston
8	Lovin' Ur Bytes	TX	Sealy

HDD

SSTable
(immutable)

4	IgotUr Data	TX	Austin
5	Always Onomnom	TX	Dallas
2	ComeTo DSE	TX	Dallas
4	Lone Star	TX	El Paso
1	Dev Awesome	TX	Houston
3	Lone Node	TX	Snyder

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Loading Data into Cassandra

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Loading Data into Cassandra

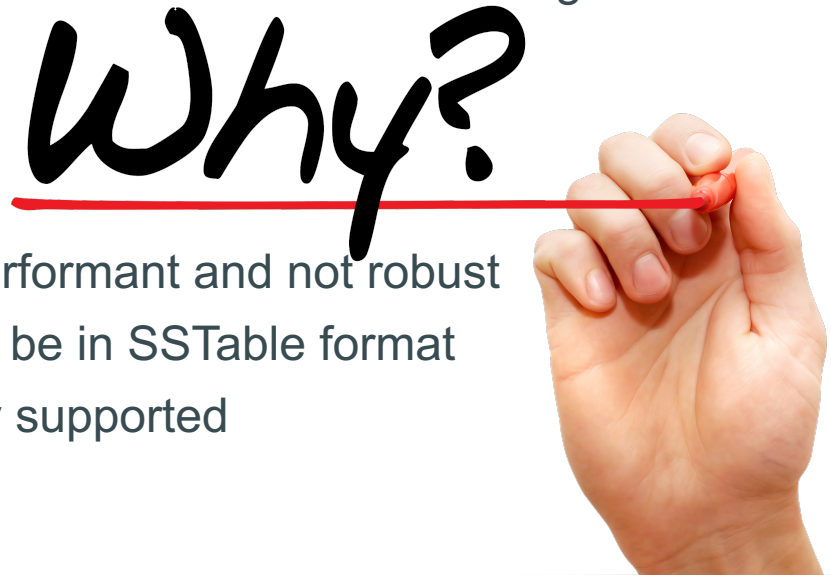
DSBulk – What is it?

- Moves Cassandra data to/from files in the file system
- Uses both CSV or JSON formats
- Command-line interface
- DSE Customer First feature

Loading Data into Cassandra

DSBulk – Why?

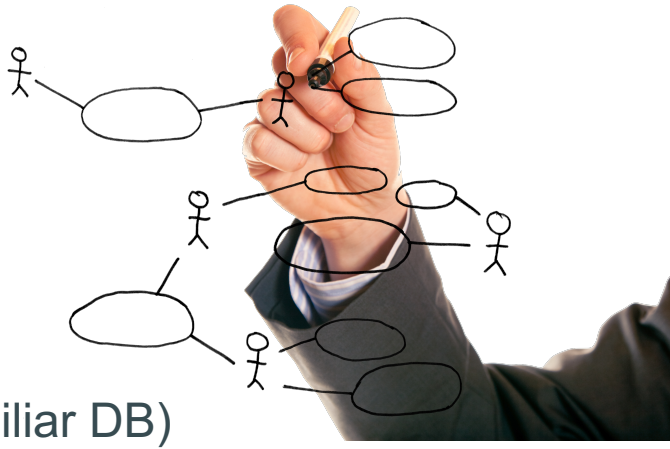
- Loading a lot of data into Cassandra has been difficult for a long time
- Unloading was needed too
- Previous tools were not ideal:
  - CQLSH COPY FROM is non-performant and not robust
  - SSTableLoader requires data to be in SSTable format
  - cassandra-loader is not formally supported



Loading Data into Cassandra

DSBulk Use-cases:

- Loading data from a pile of files
- One-time load or part of production flow
- Initial developer experience (load an existing familiar DB)
- Unload data for backup
- Migration from DSE to DSE (due to data model changes)

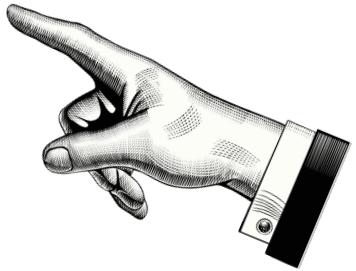


Loading Data into Cassandra

DSBulk Example

```
dsbulk load -url file1.csv -k ks1 -t table1
```

- Parameters:
  - file1.csv – this is the input file
  - ks1 – this is the keyspace name
  - table1 – this is the table name
- Steps:
  - Create the keyspace and table
  - Map the column using the header or via a config file
  - Run the command



Loading Data into Cassandra

DSBulk - Let's try it!

- Open a browser and go to <Your node's IP Address>:9091
- Click on the notebook "**Core Cassandra: Data Loading**"
- Work your way through the steps of this notebook (it's short)

Loading Data into Cassandra

Quick Review

- dsbulk is a command line tool for loading/unloading data
  - Use header or config file to map columns
  - Works for CSV and JSON
  - Create your table first
  - Handles various data types (e.g., text, date, float)

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Data Availability

Cassandra Data Availability

What's it all about?

Availability = Replication

Replication implies consistency concerns

Consistency can be absolute!

Strong ⟷ Weak

Tunable!

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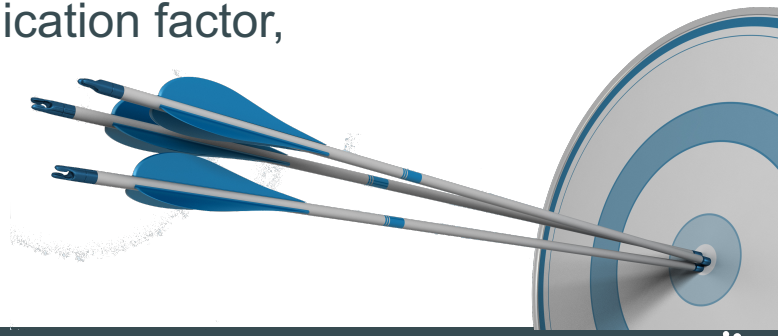
Cassandra Data Availability

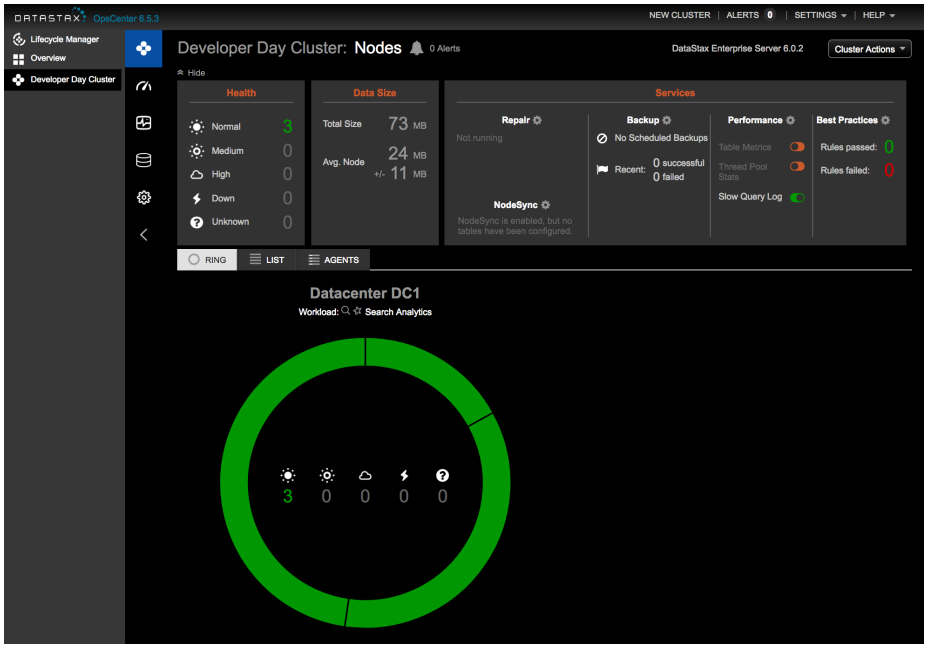
Some key concepts

- Replication Factor – the number of copies of your data
  - Increasing replication increases chances of availability
  - Increasing replication increases chances of inconsistency
- Consistency Level – the number of acknowledged copies read/written
- If number of writes + number of reads > replication factor,
  - You are guaranteed strong consistency



OpsCenter

For Creating, Managing and Monitoring Your Cluster



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Cassandra Data Availability

“**Core Cassandra: Data Availability**” Notebook - Let’s try it!

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Final Words

Thanks for Participating in Cassandra Core Session

- Now, you should:
  - Understand what Apache Cassandra[tm] is
  - Know what Cassandra does
  - Yearn to have Cassandra in your shop
- Want More?
  - Visit academy.datastax.com
  - It's free!