

DataStax Meetups



Make your data speak



Hands-on Codelab



Apache Cassandra

3 hours, intermediate level + dinner break

An initiative by:



Powered by:



Live on Twitch!

Agenda

A – What is Apache Cassandra and why do you care ?

1. Getting starting with Apache Cassandra™ and use Cases
2. CodeLab : *Getting Started with Apache Cassandra*
3. Apache Spark™ and DataStax Enterprise Analytics

B – Machine Learning with DataStax Enterprise

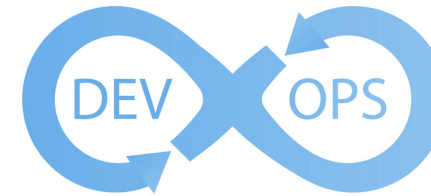
1. CodeLab : *Clustering with K-means*
2. CodeLab : *Classification with Naïve Bayes*
3. CodeLab : *Regression and Classific. with RandomForest*
4. CodeLab : *Recommendation with FP-Growth*
5. CodeLab : *Recommendation with Collaborating Filtering*

C – Resources and next steps

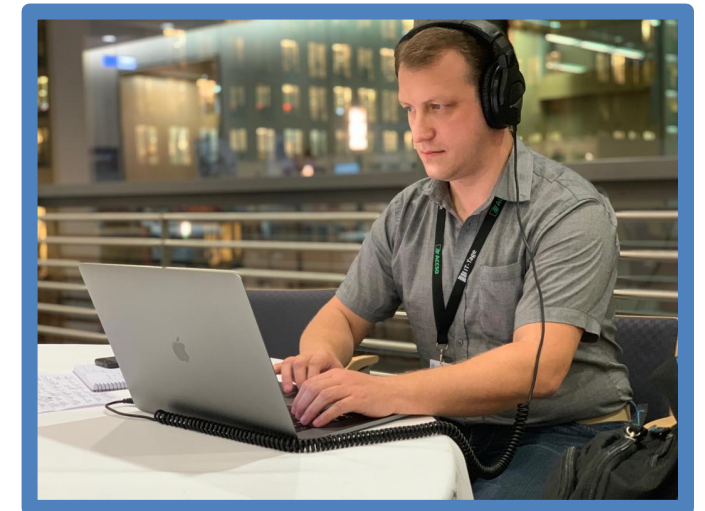
Your Instructors



Cedrick Lunven



**Aleks
Volochnev**




Before Starting






Hands-on Codelab

Apache Cassandra

3 hours, intermediate level + dinner break

An initiative by:  ITALIAN ASSOCIATION FOR MACHINE LEARNING

Powered by:  



Dear guest,

Welcome to this event organized in collaboration with *DataStax* and *SourceSense*. As a *codelab* we expect you to have your laptops to do the exercises.

The session has been designed for intermediate level software engineers and data scientists. We have a lot to cover and unfortunately not a lot of time to help you installing. Don't worry we made things as simpler as we can, still if you are beginner try to team up !

Prerequisites : To run the exercises you will simply need : Docker (cf link below)

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Installation

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jupyter
http://localhost:8888
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DataStax Academy	http://academy.datastax.com
DataStax Community	http://community.datastax.com





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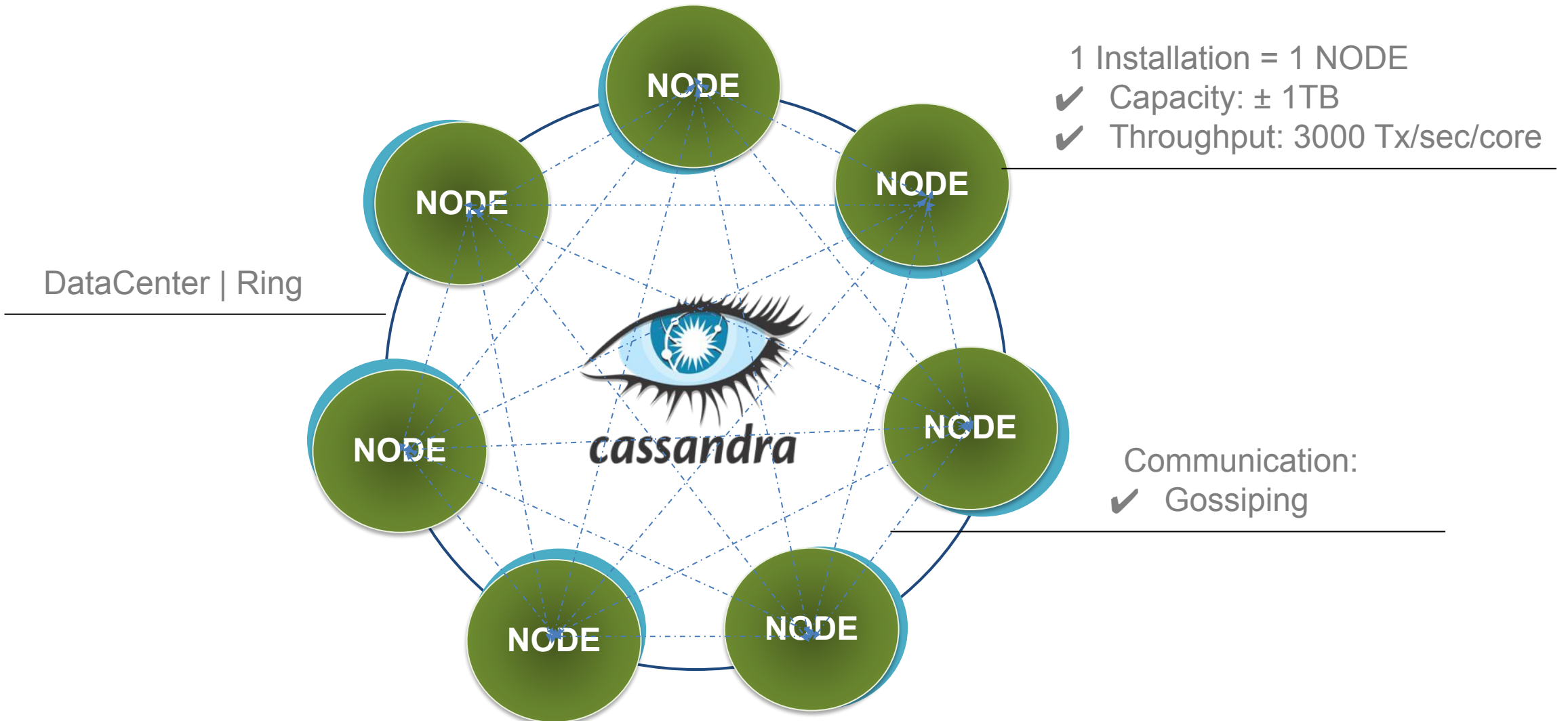
DataStax Meetup



Getting Started with Apache Cassandra

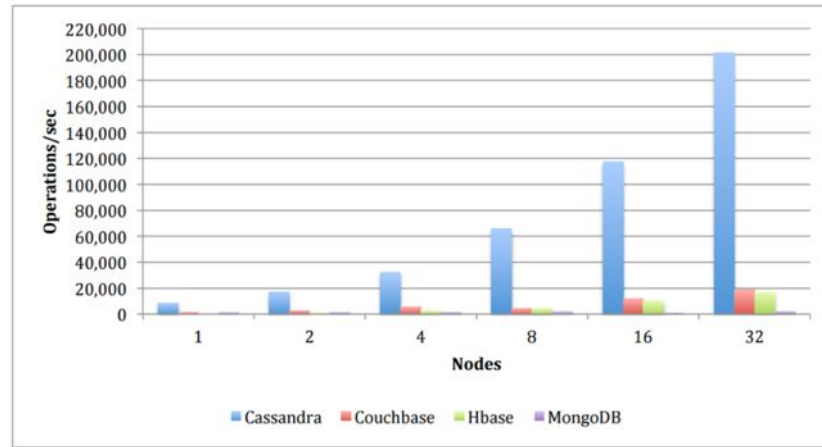


Apache Cassandra™ = Distributed NoSQL Database

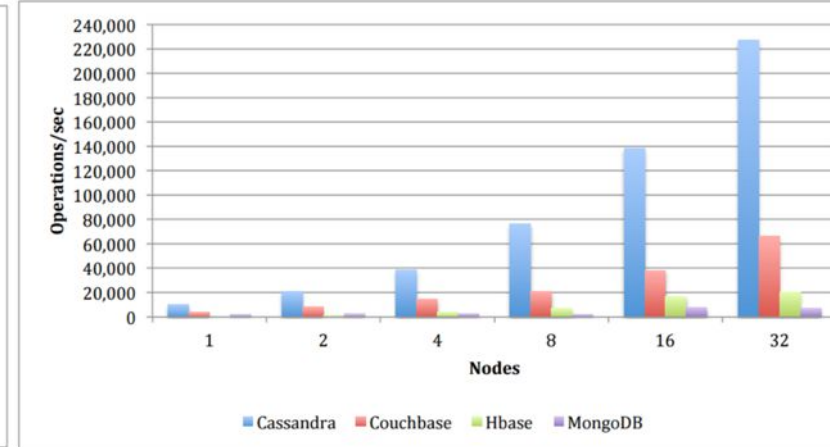


Linear Scalability

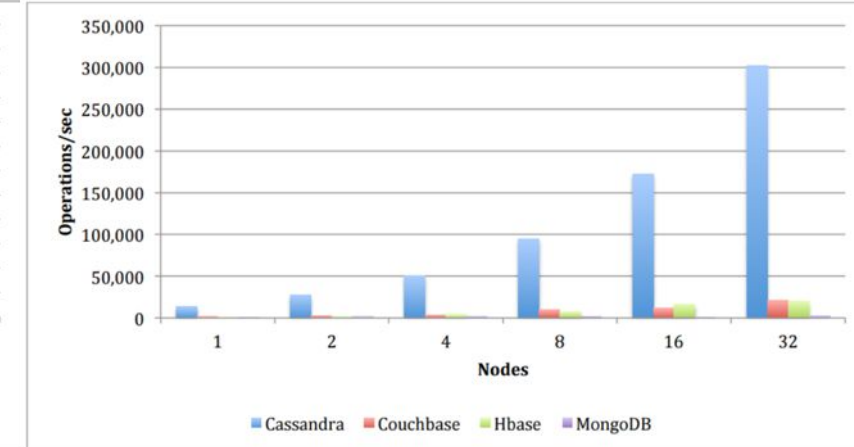
Read-Modify-Write Workload



Read-mostly Workload



Balanced Read/Write Mix



- **Need More Capacity ?** ☐ **Add new nodes**
- **Need more Throughput ?** ☐ **Add new nodes**

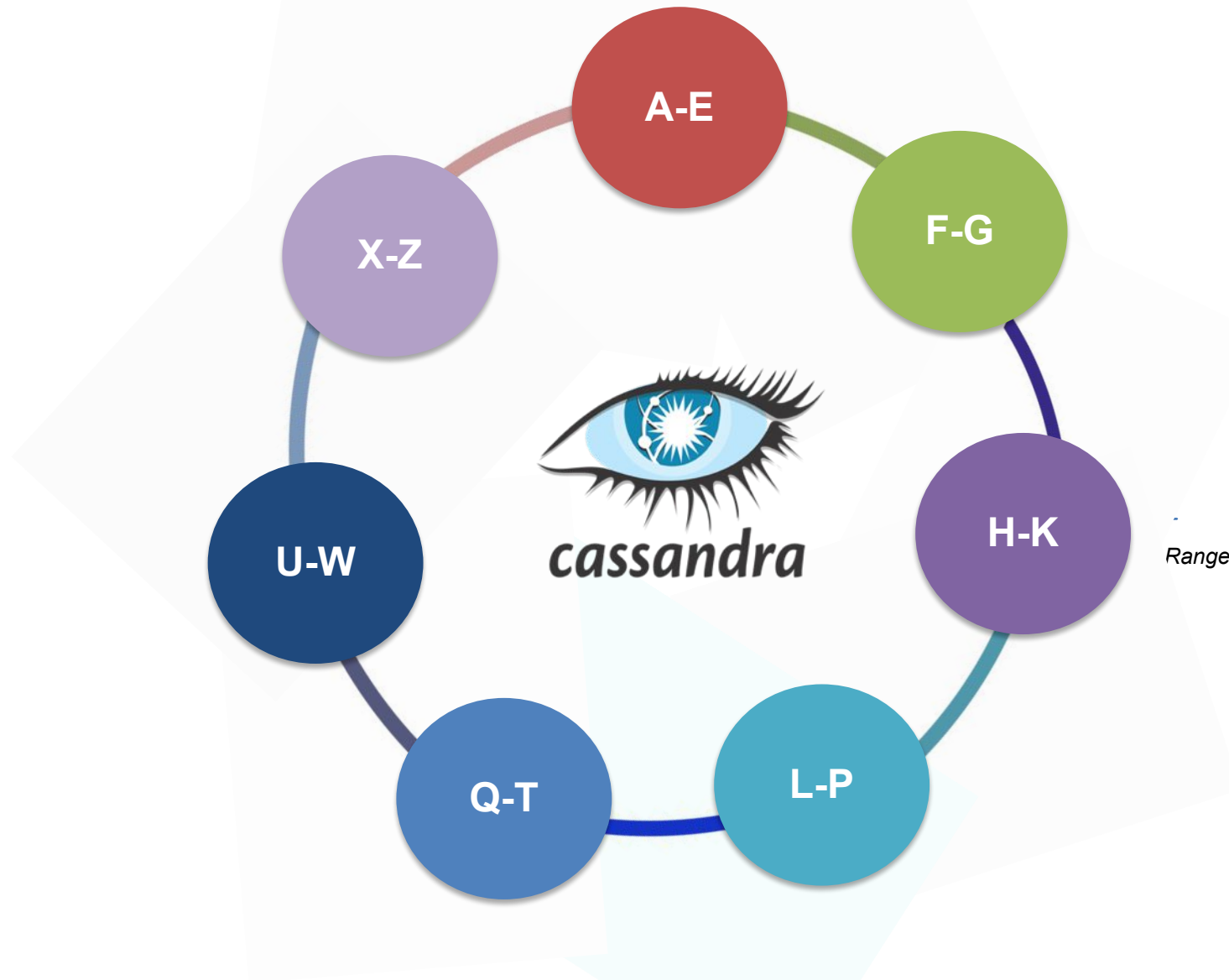
Data is Distributed



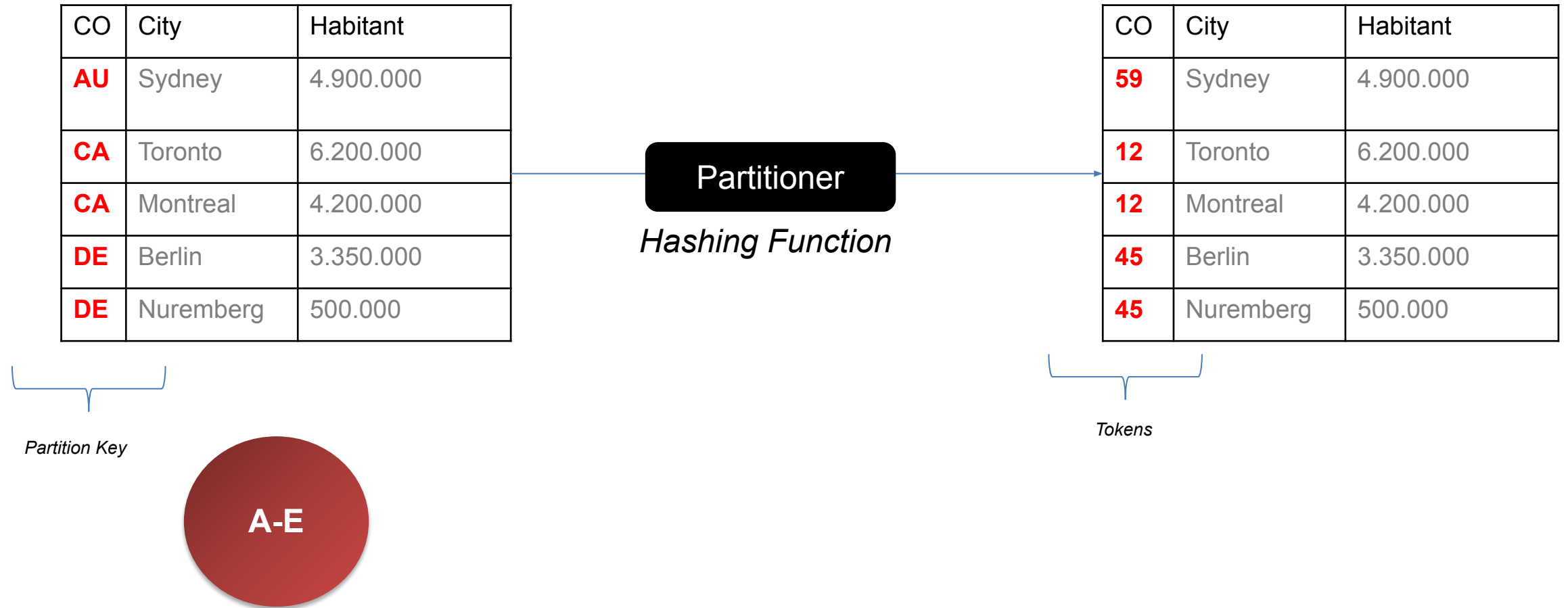
Country	City	Habitant
USA	New York	8.000.000
USA	Los Angeles	4.000.000
FR	Paris	2.230.000
DE	Berlin	3.350.000
UK	London	9.200.000
AU	Sydney	4.900.000
DE	Nuremberg	500.000
CA	Toronto	6.200.000
CA	Montreal	4.200000
FR	Toulouse	1.100.000
JP	Tokyo	37.430.000
IN	Mumbai	20.200.000

Partition Key

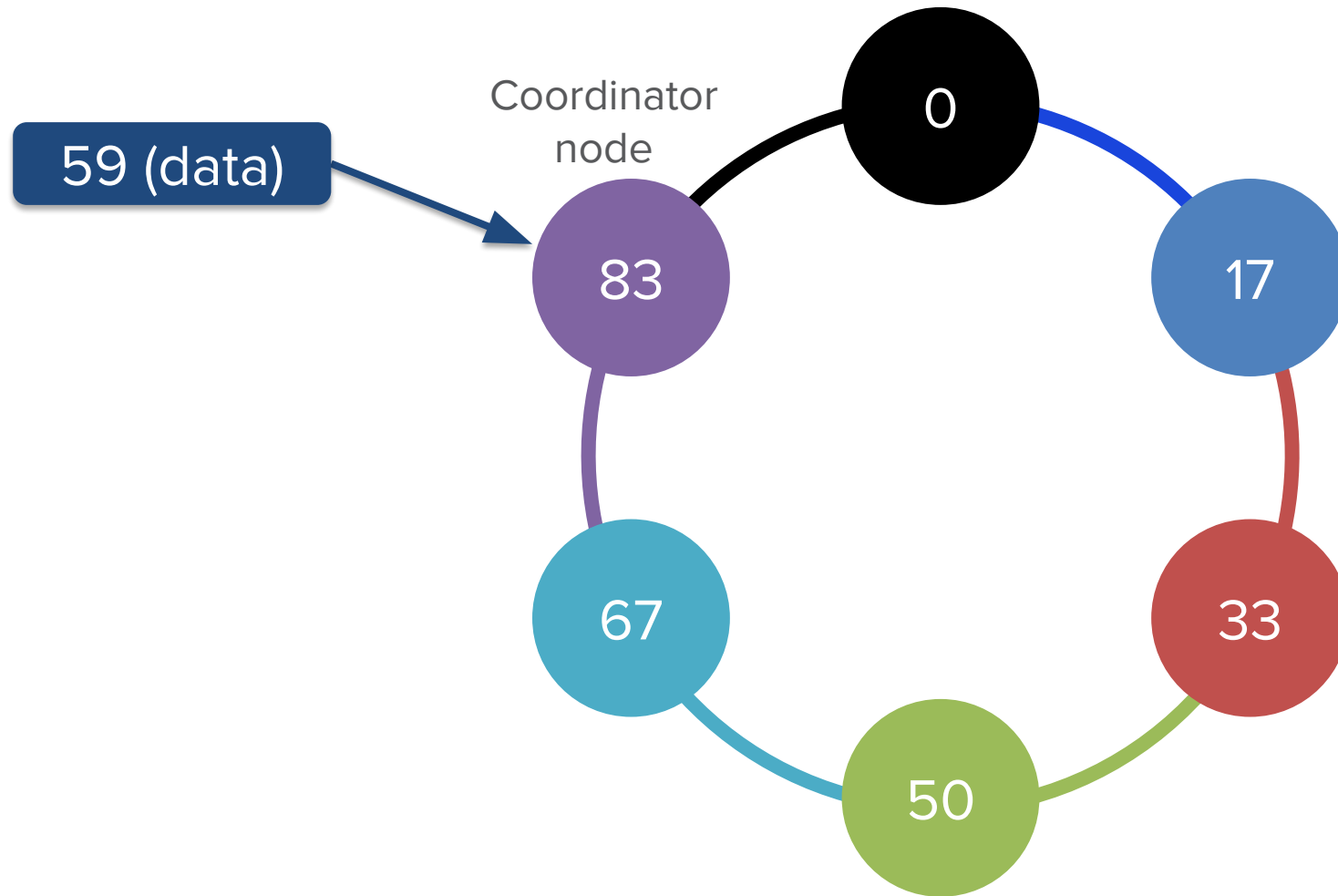
Data is Distributed



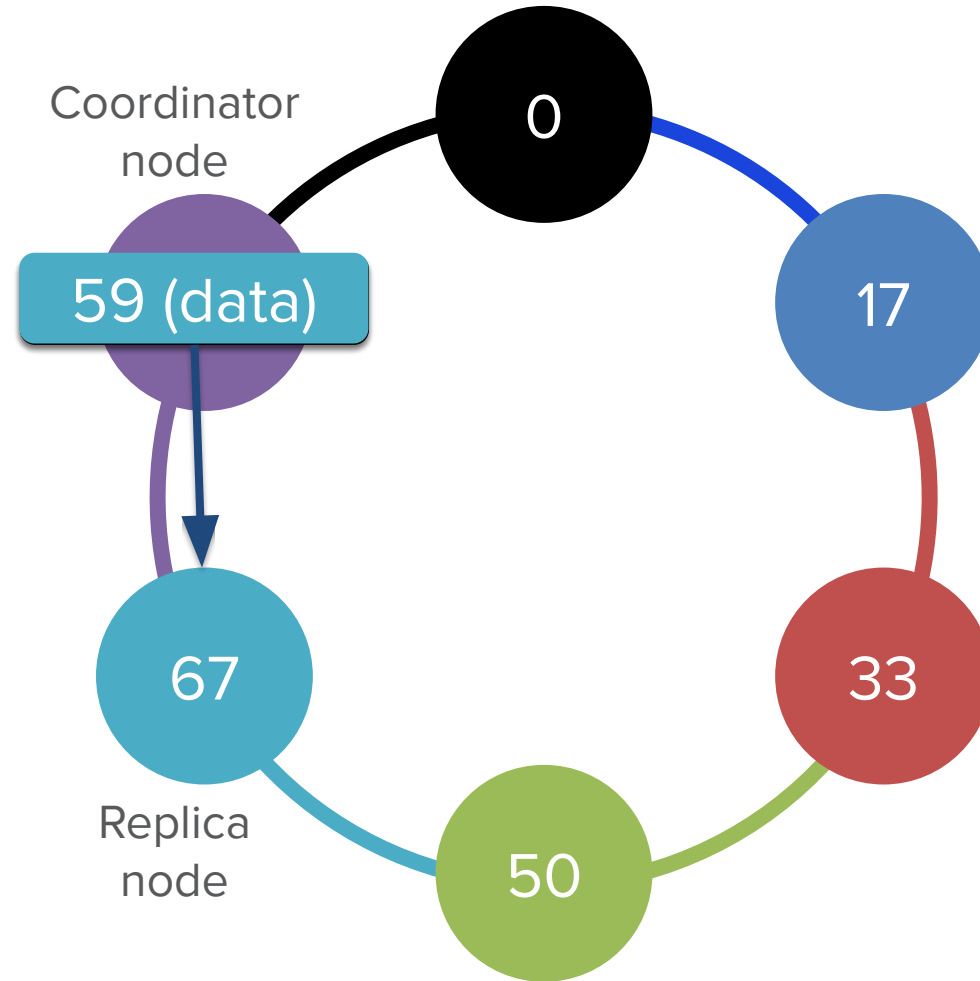
Data is *Evenly*-distributed



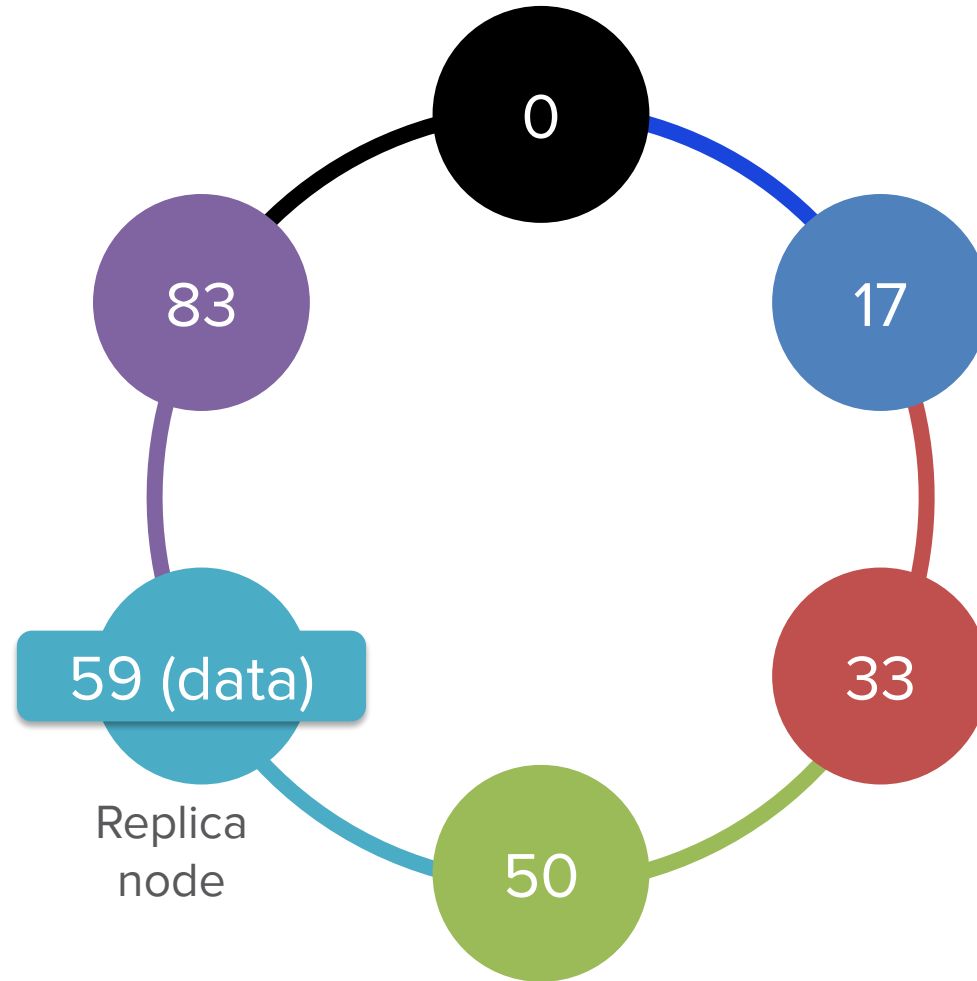
How the Ring Works



How the Ring Works

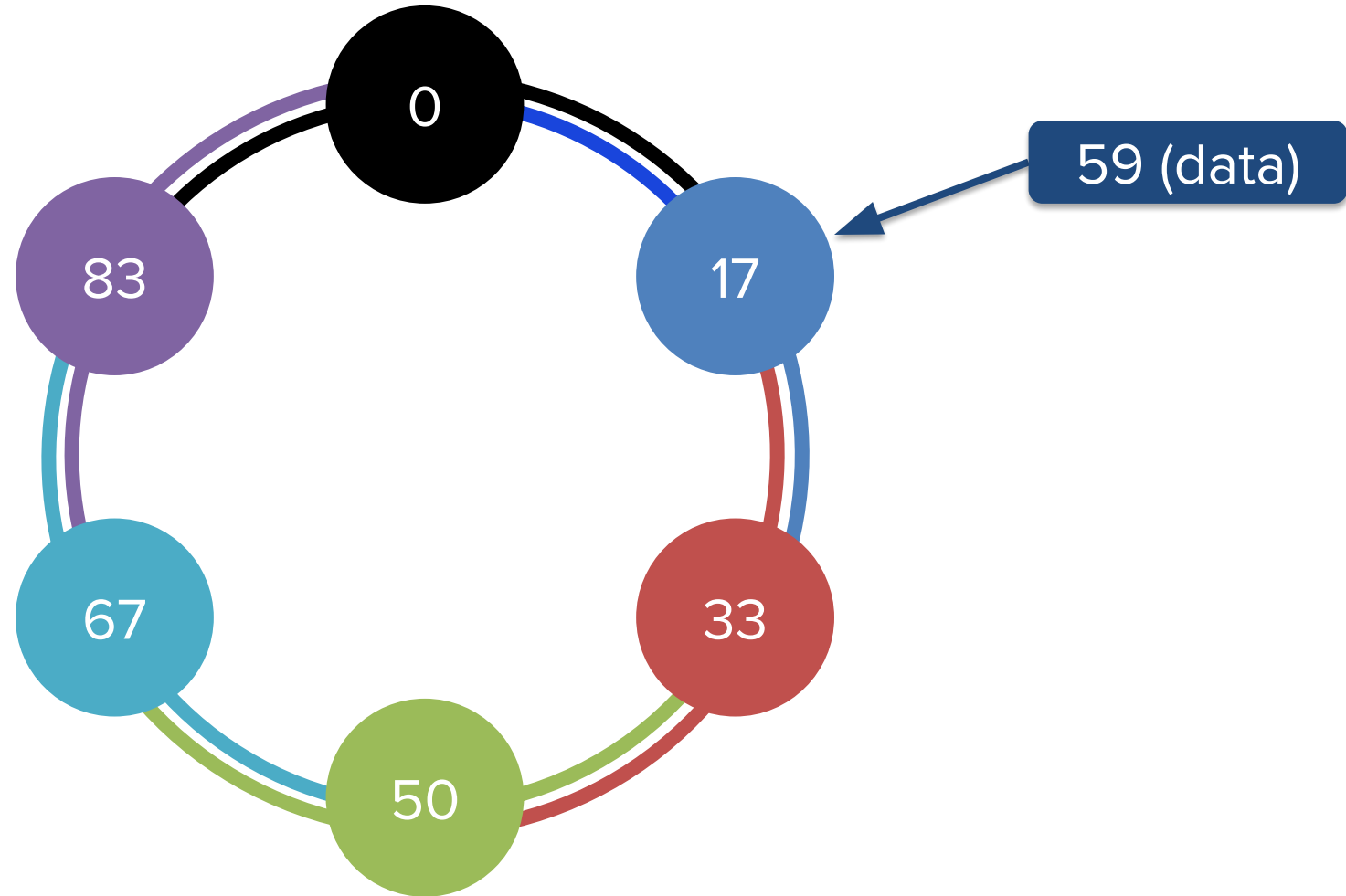


How the Ring Works



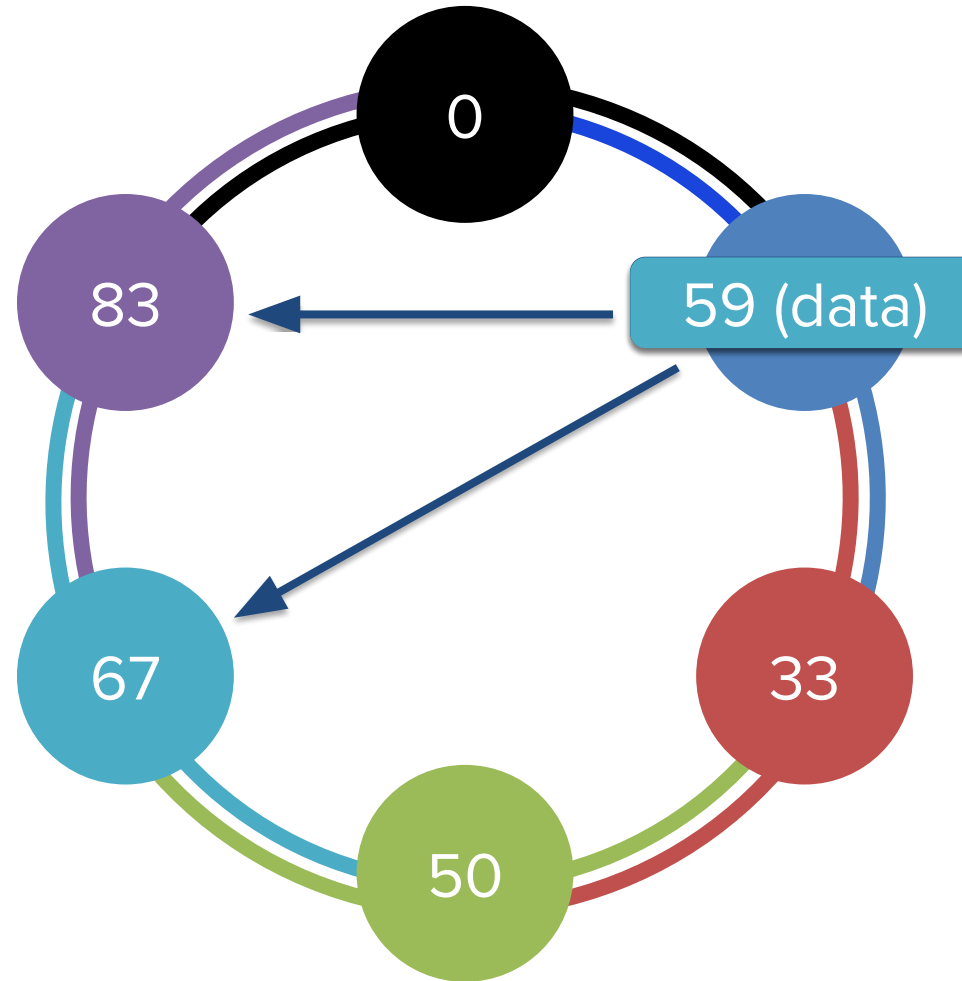
Replication within the Ring

RF = 2



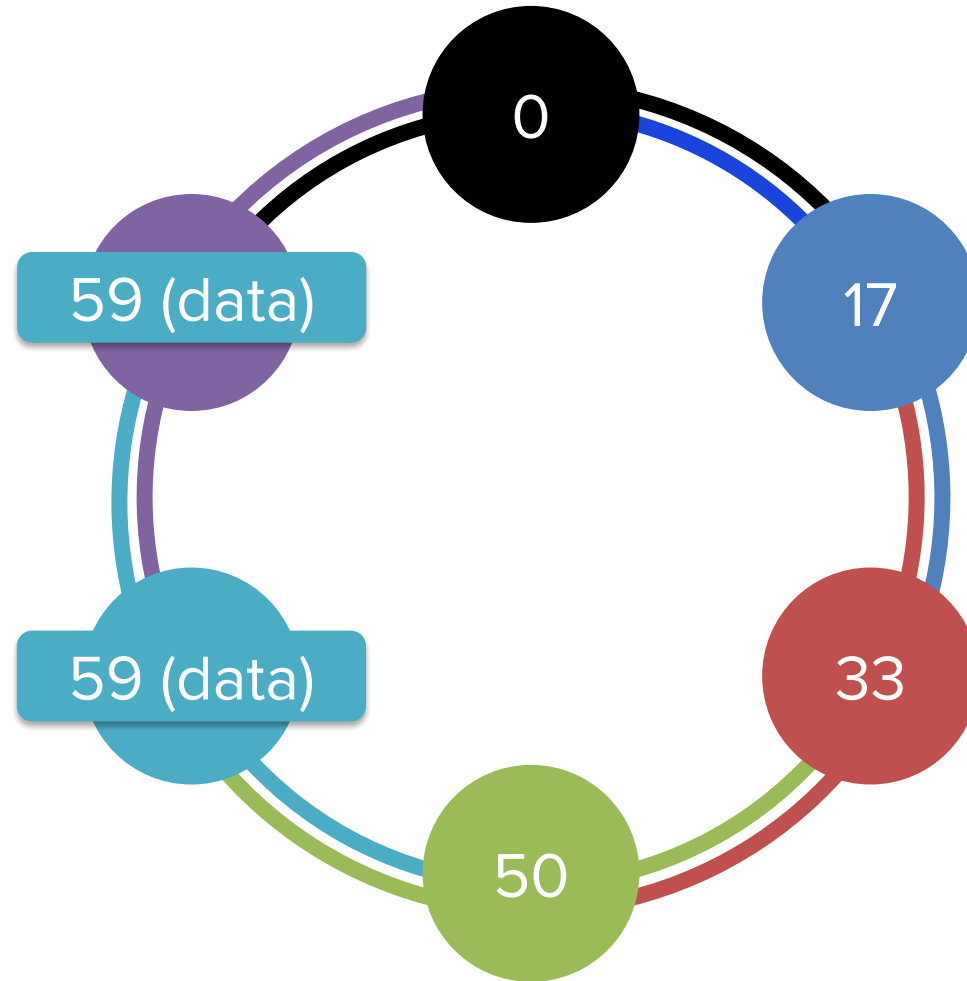
Replication within the Ring

RF = 2



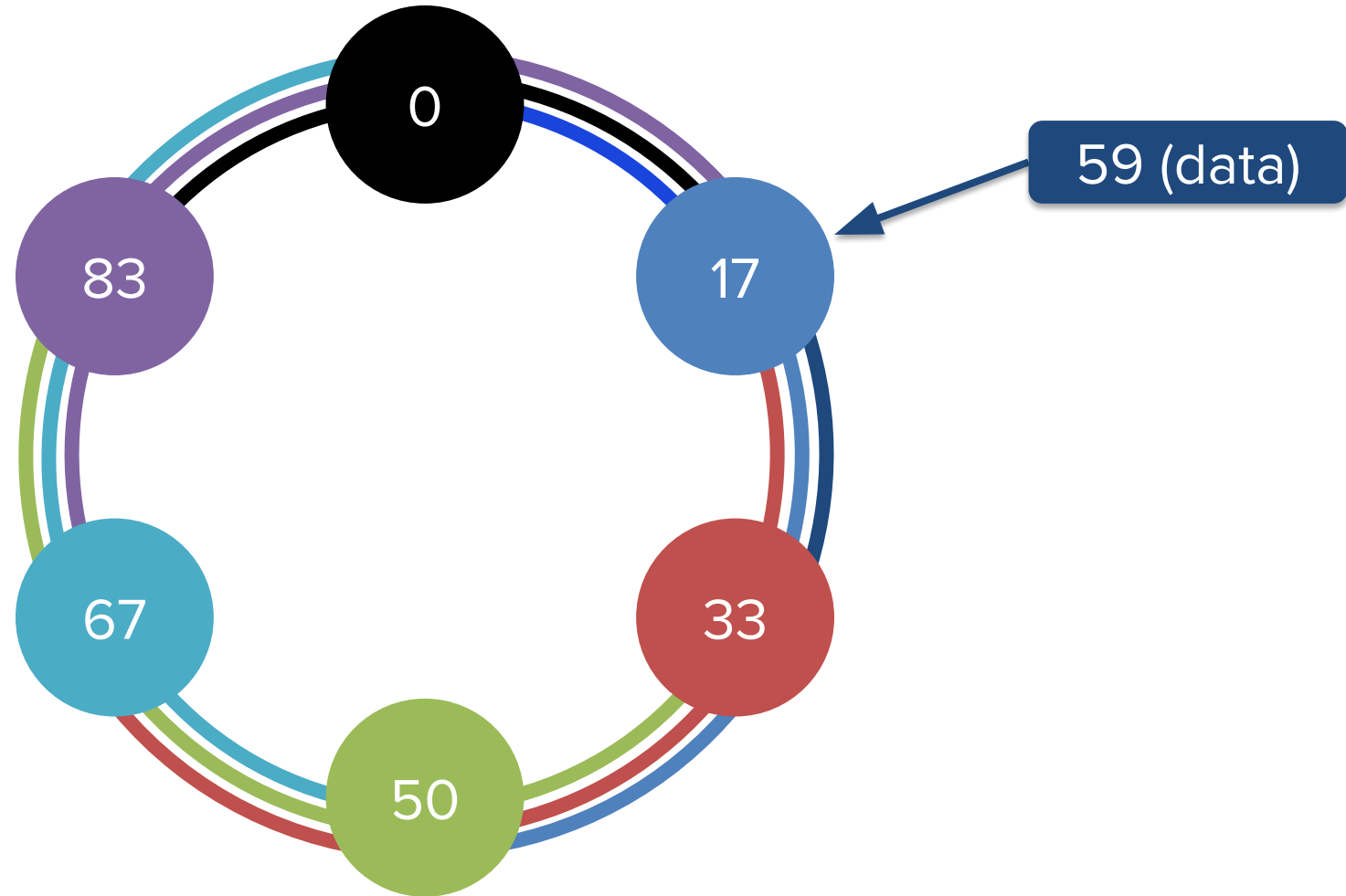
Replication within the Ring

RF = 2



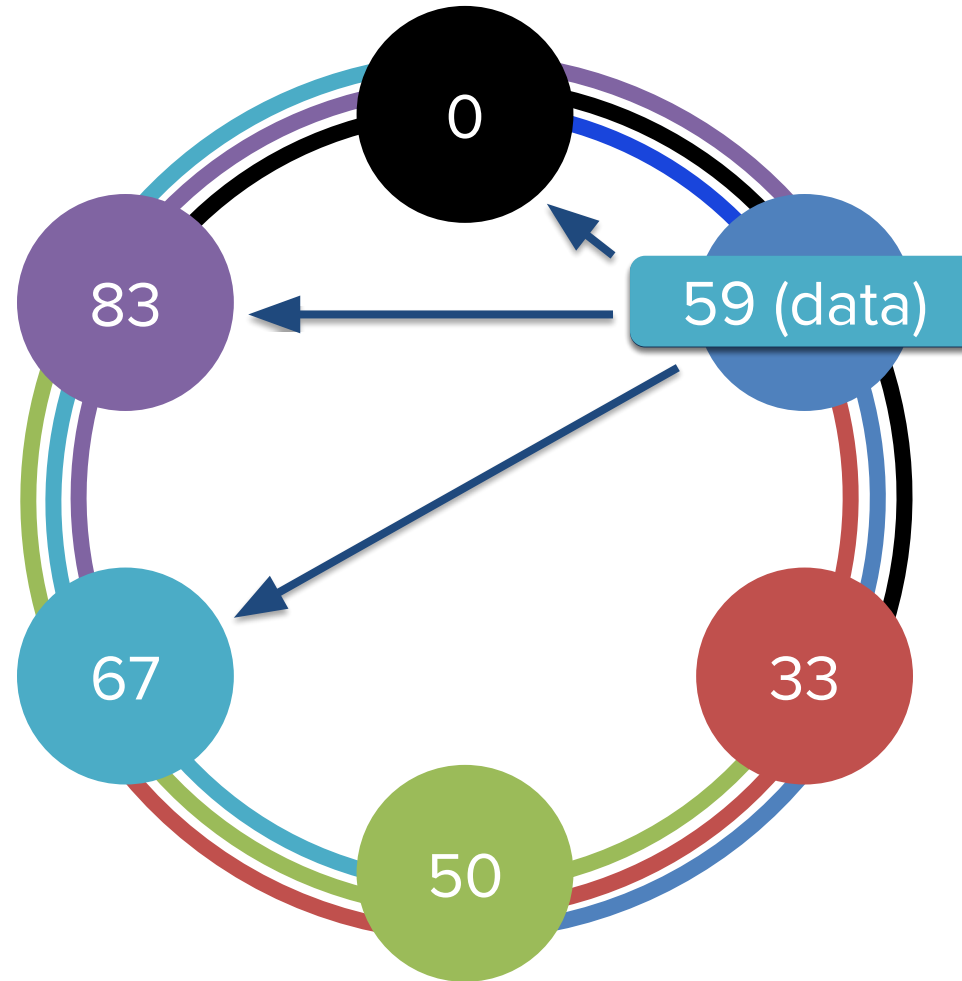
Replication within the Ring

RF = 3



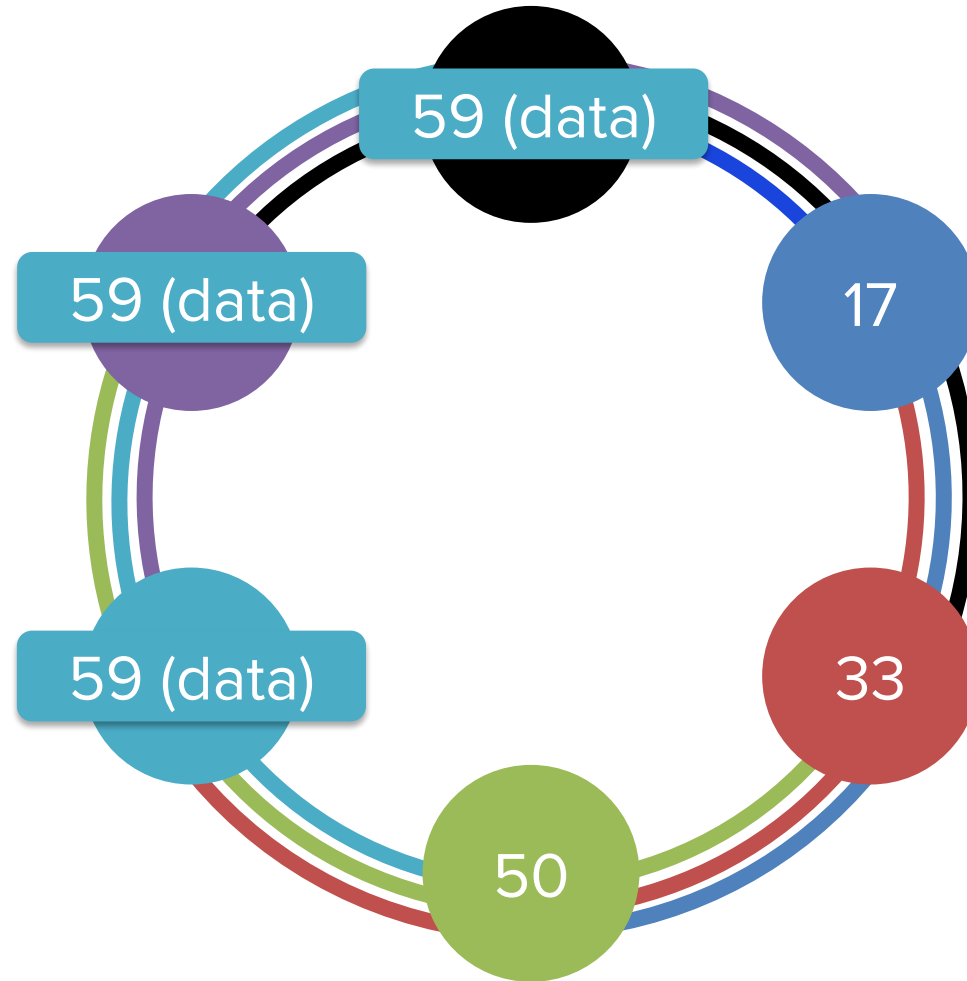
Replication within the Ring

RF = 3



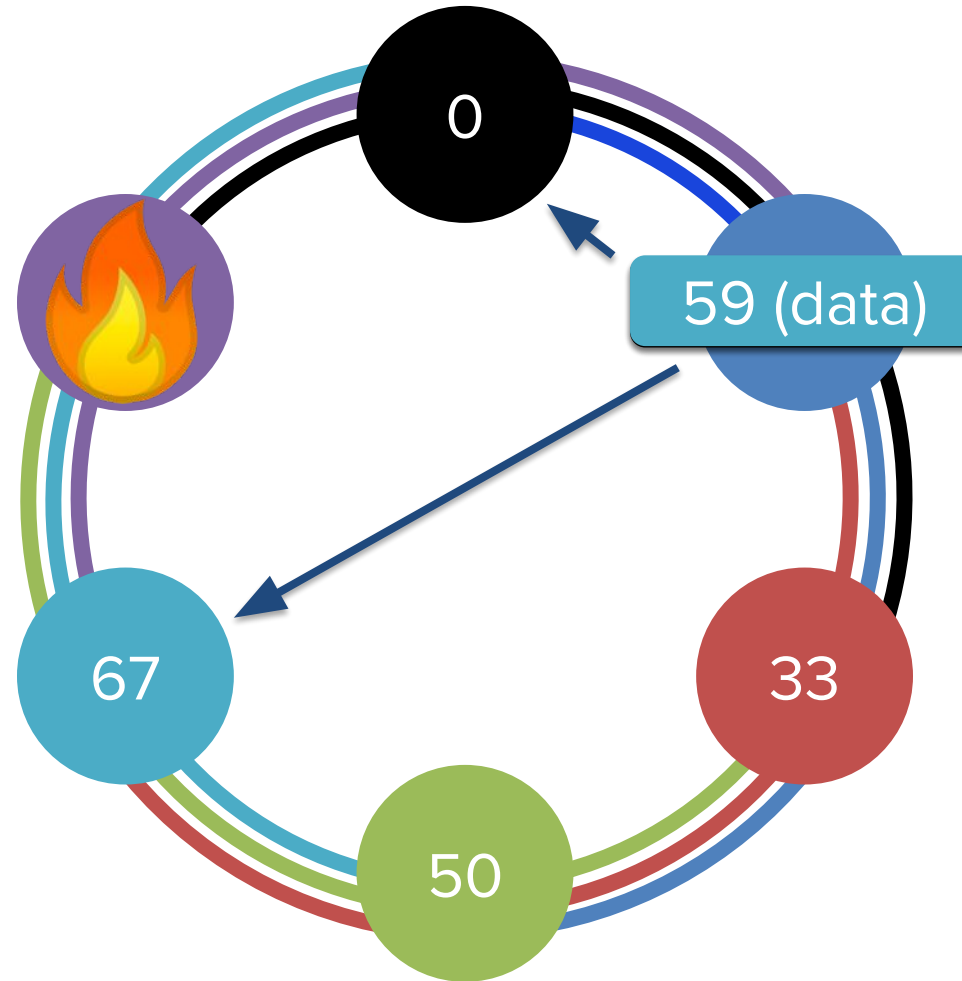
Replication within the Ring

RF = 3



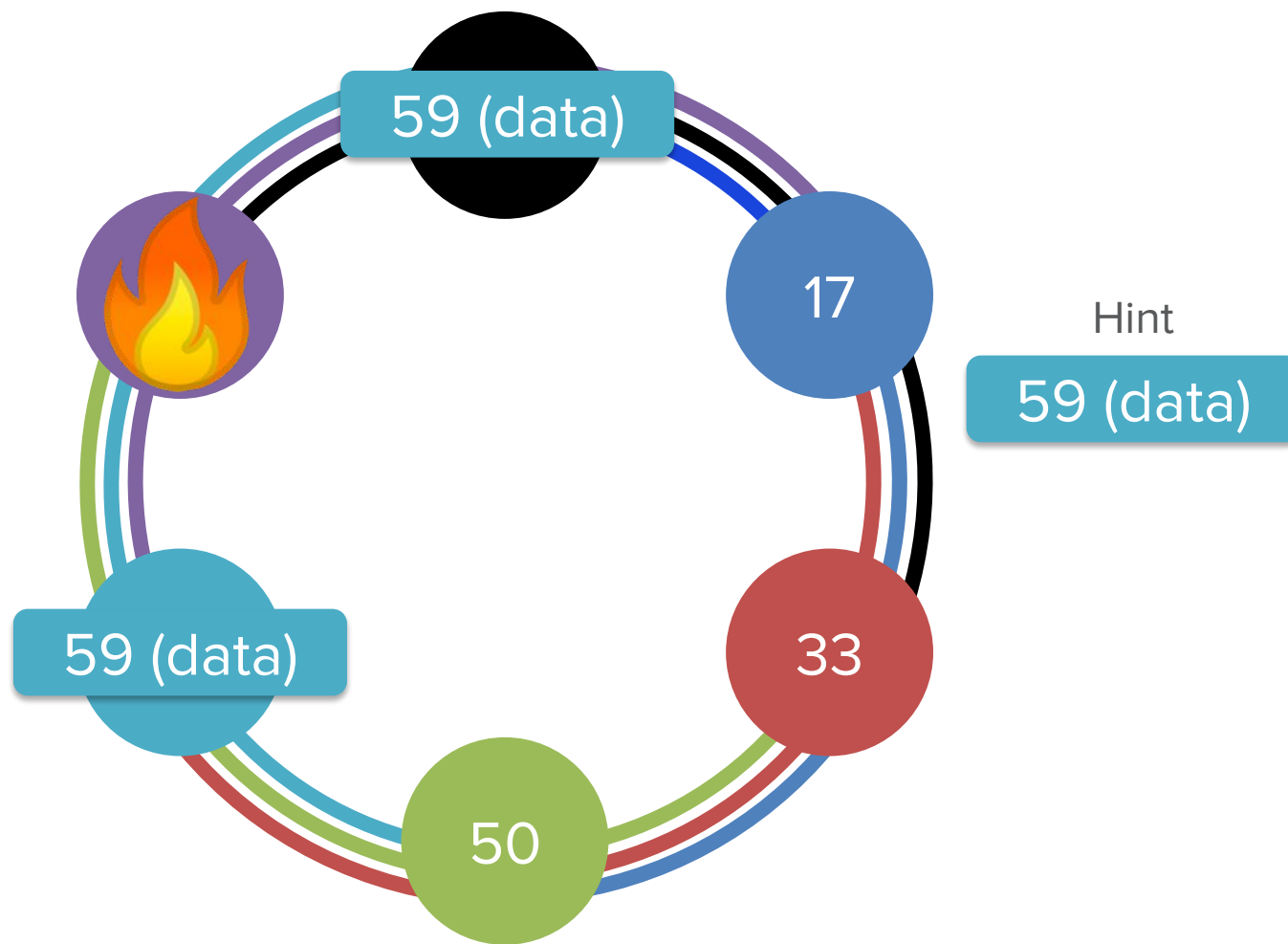
Node Failure

RF = 3



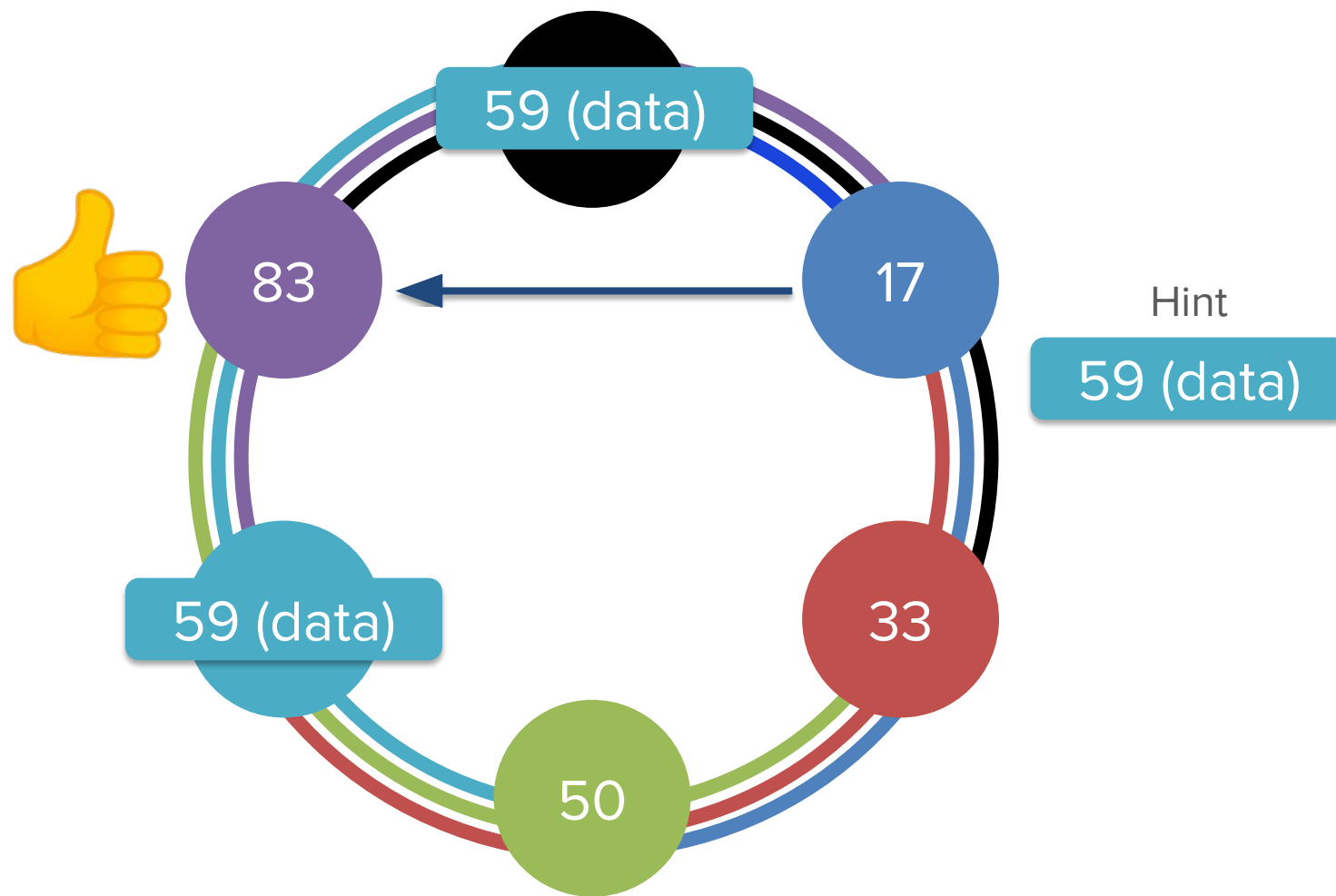
Node Failure

RF = 3



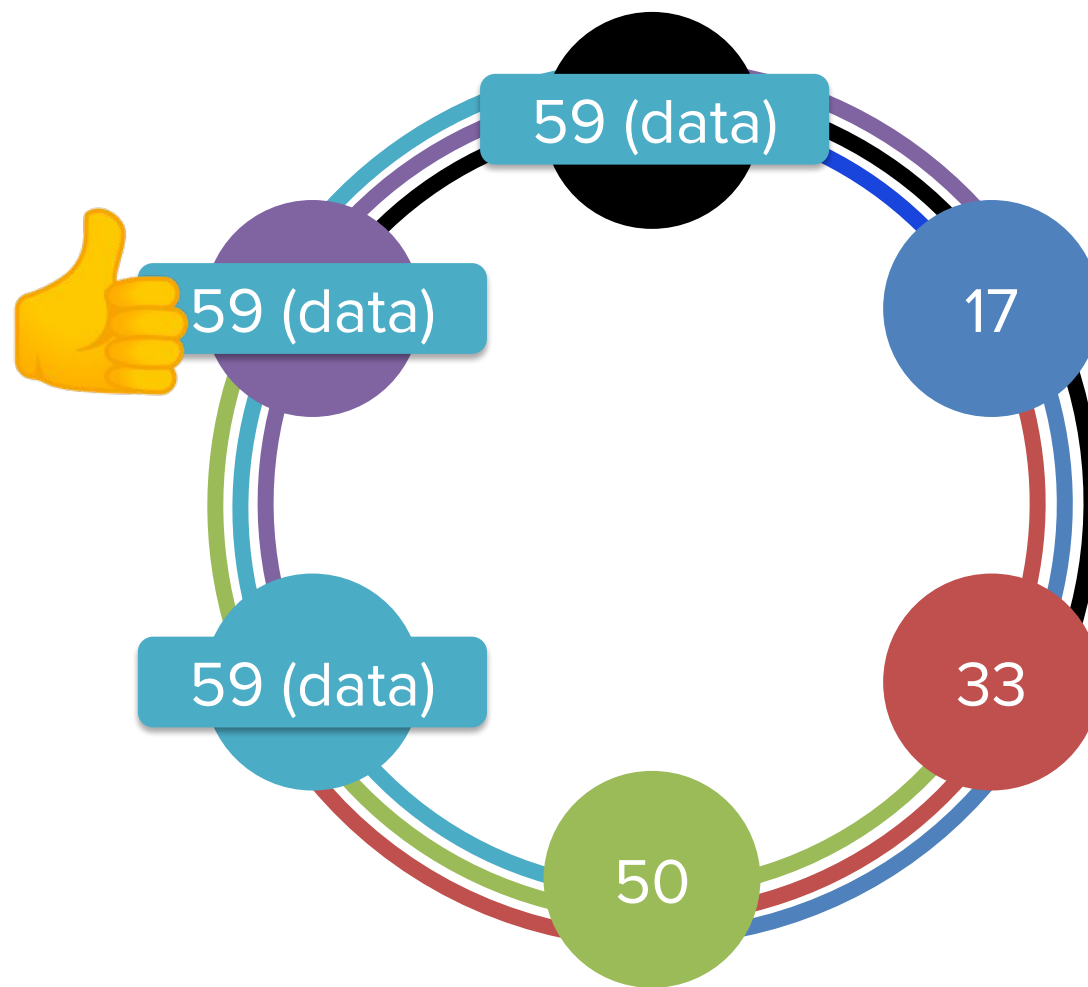
Node Failure

RF = 3

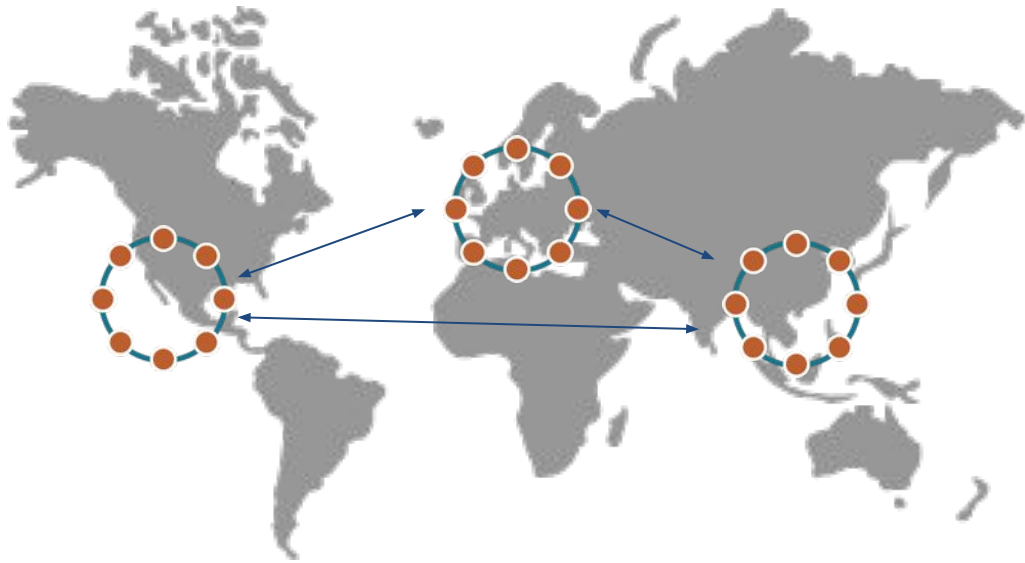


Node Failure – Recovered!

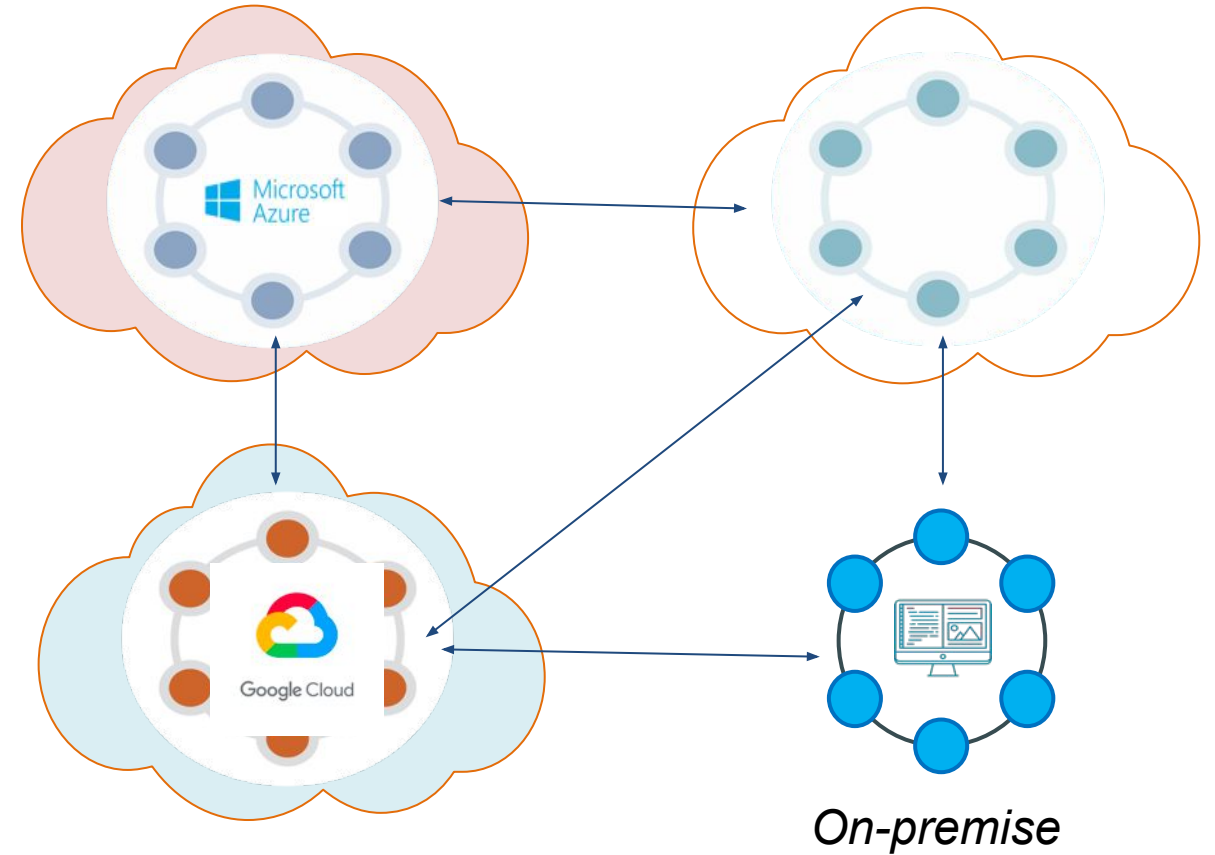
RF = 3



Data Distributed Everywhere



GEOGRAPHICALLY



HYBRID- MULTI CLOUD

Understanding Use Cases

S

High Throughput
High Volume

Heavy Writes
Heavy Reads

Event Streaming
Internet of Things
Log Analytics
Any TimeSeries

Caching
Market Data
Prices

A

Mission Critical Availability

No Data Loss
Reponsive System

Banking
Track and Trace
Customer Apps

R

Realtime

Any CRUD
API Layer

Enterprise Data Layer
Applications

D

Distributed

Geograhically
Deployments

Global Company
Retailers

Hybrid Cloud
MultiCloud

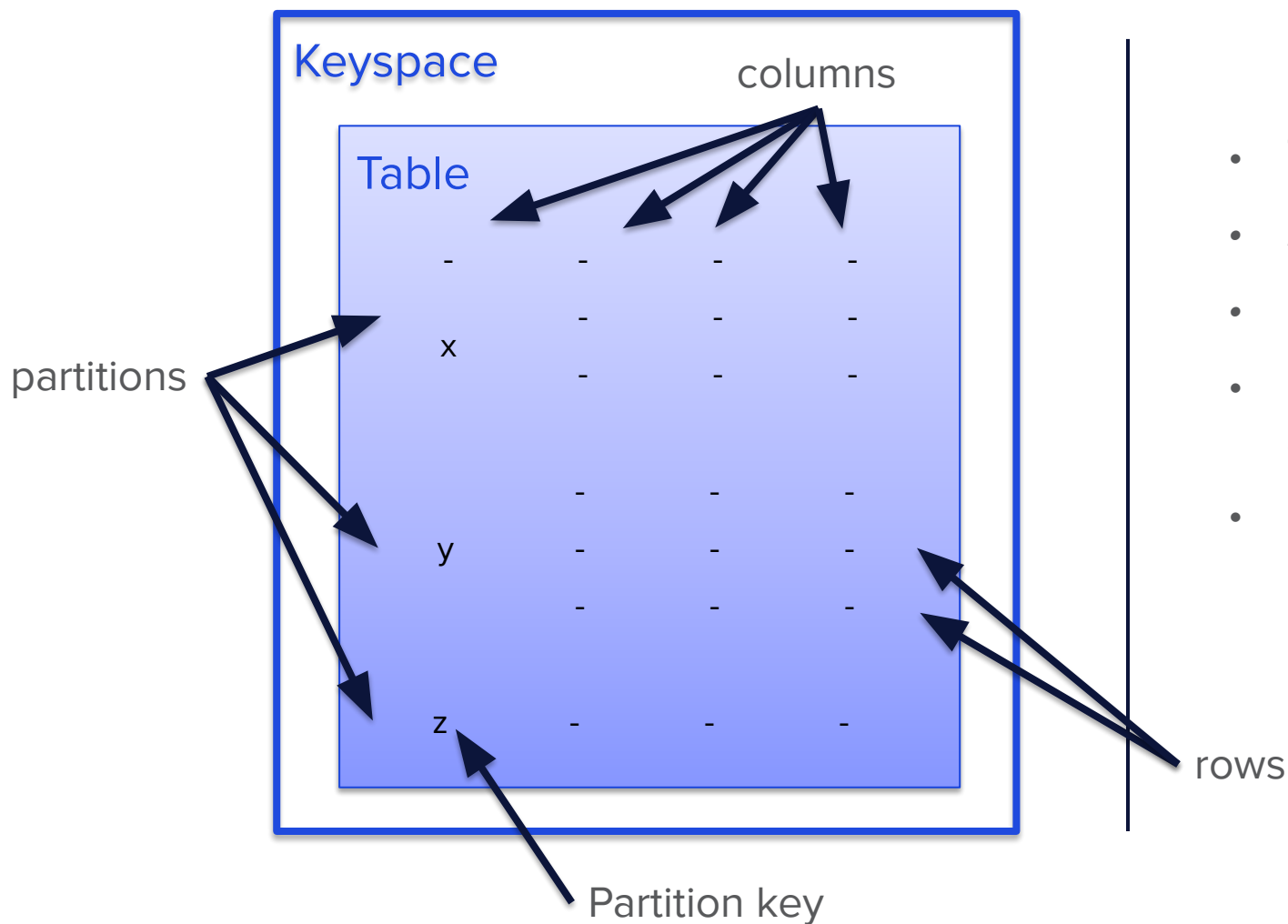
DataStax Meetup



Cassandra's Data Model



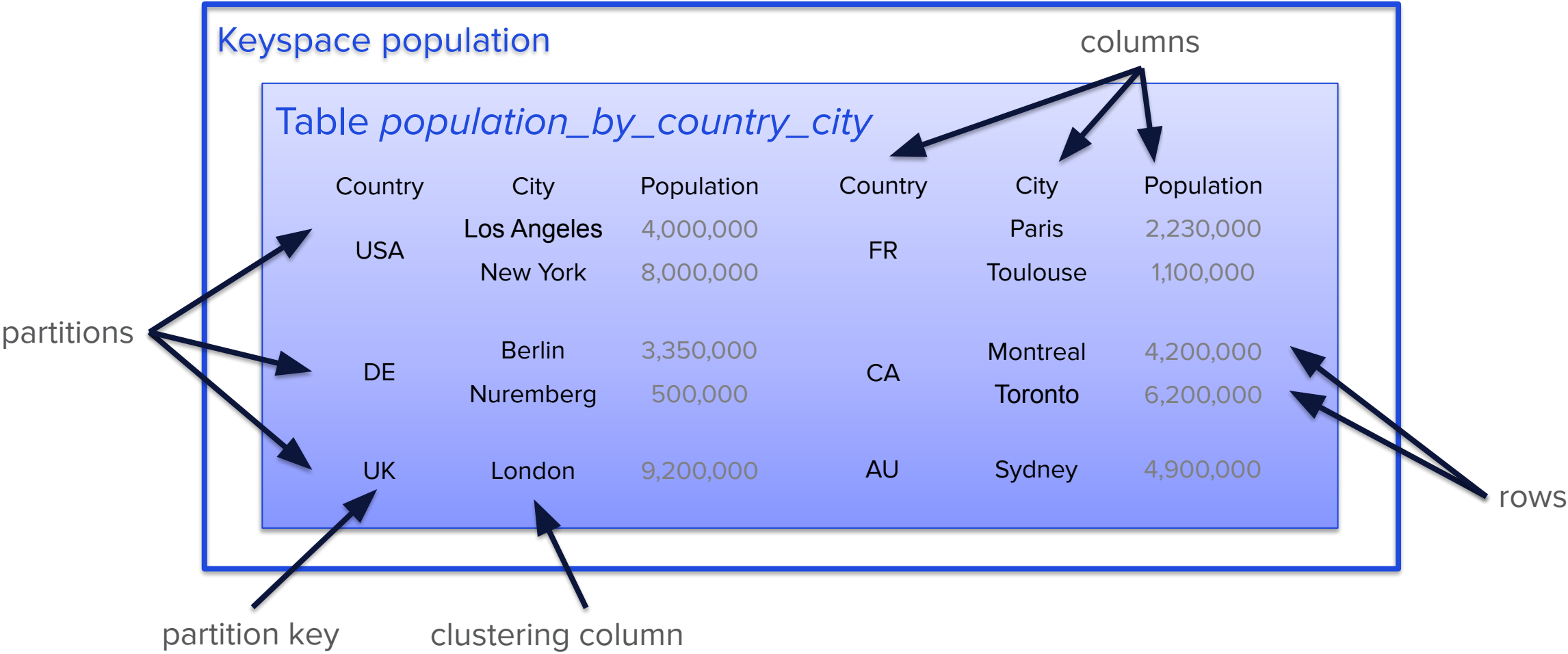
How does Cassandra structure data?



- Tabular data model, with one twist
- *Keyspaces* contain *tables*
- *Tables* are organized in *rows* and *columns*
- Groups of related rows, called *partitions*, are stored together on the same node (or nodes)
- Each row contains a *partition key*
 - One or more columns that are hashed to determine which node(s) store that data



Example Data – City populations organized by country



Example Data – City populations organized by country

Keyspace population

Table *population_by_country_city*

Country	City	Population
USA	Los Angeles	4,000,000
	New York	8,000,000
DE	Berlin	3,350,000
	Nuremberg	500,000
UK	London	9,200,000

CQL Equivalent:

```
CREATE TABLE population_by_country_city (  
  country text,  
  city text,  
  population int,  
  PRIMARY KEY((country), city)  
);
```

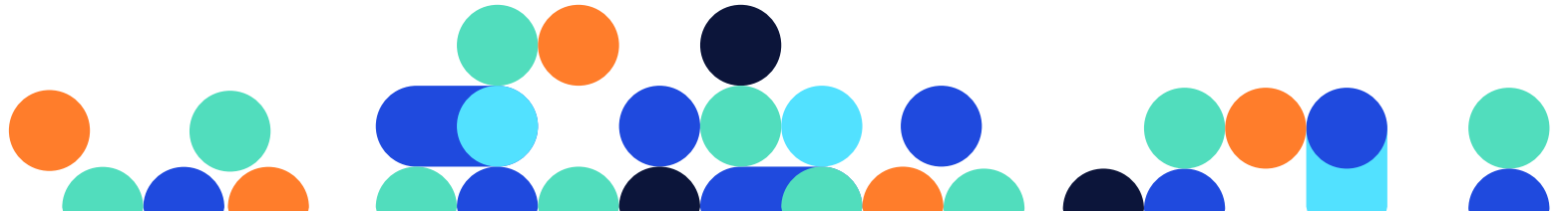
partition key

clustering column



Time for an exercise!

“Getting Started with Apache Cassandra[™]” Notebook



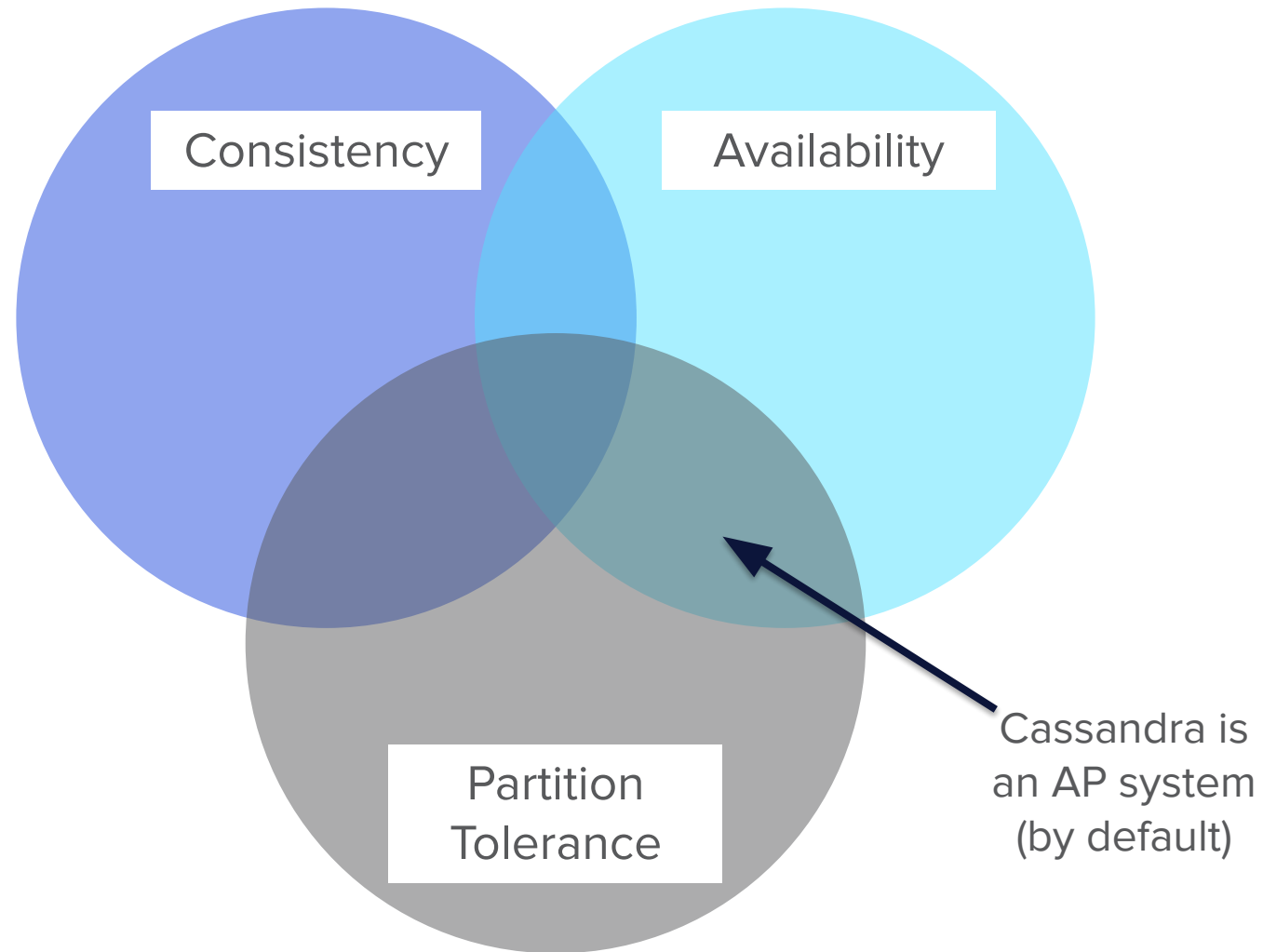
DataStax Developer Day



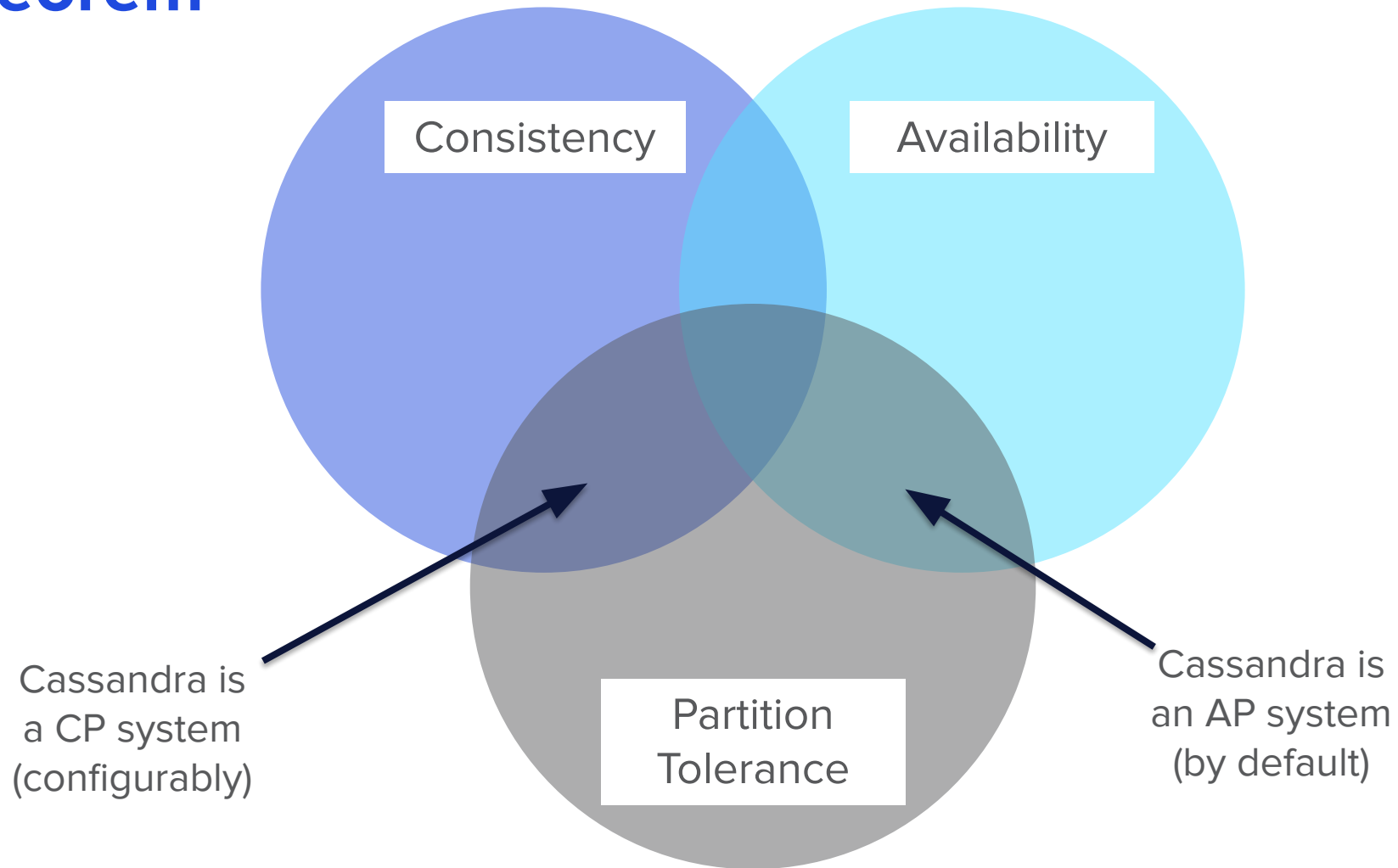
Cassandra's Consistency



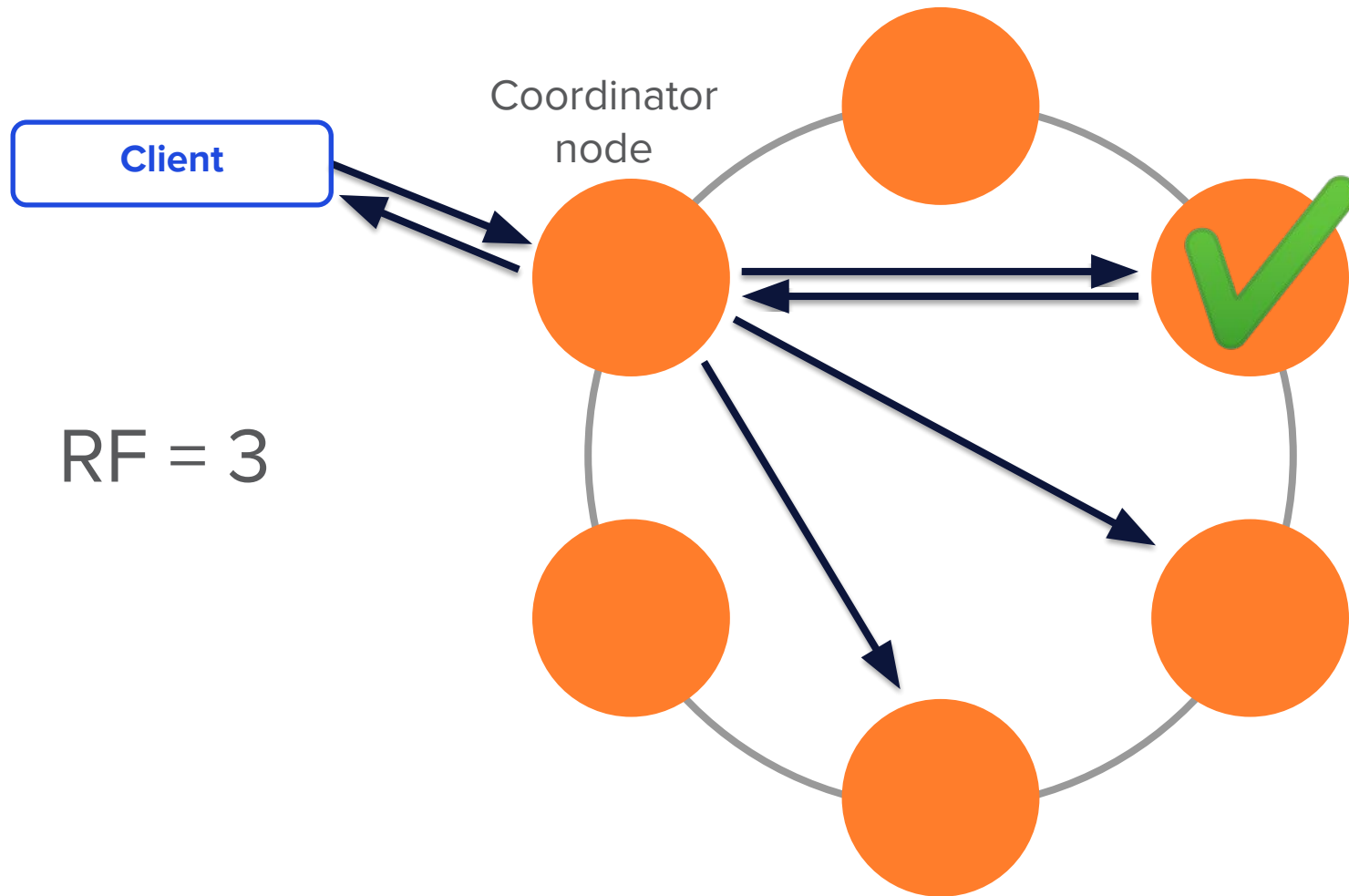
CAP Theorem



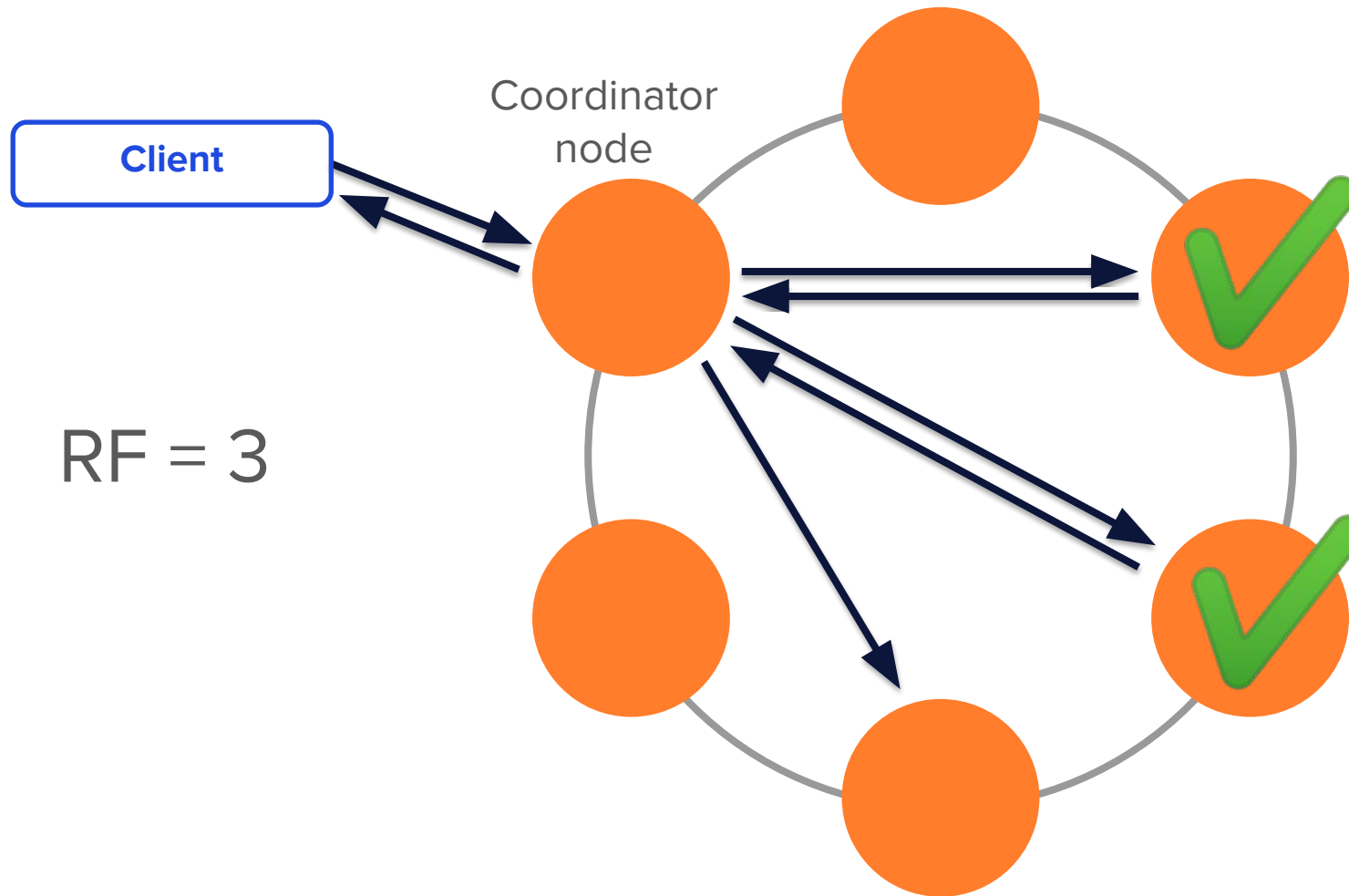
CAP Theorem



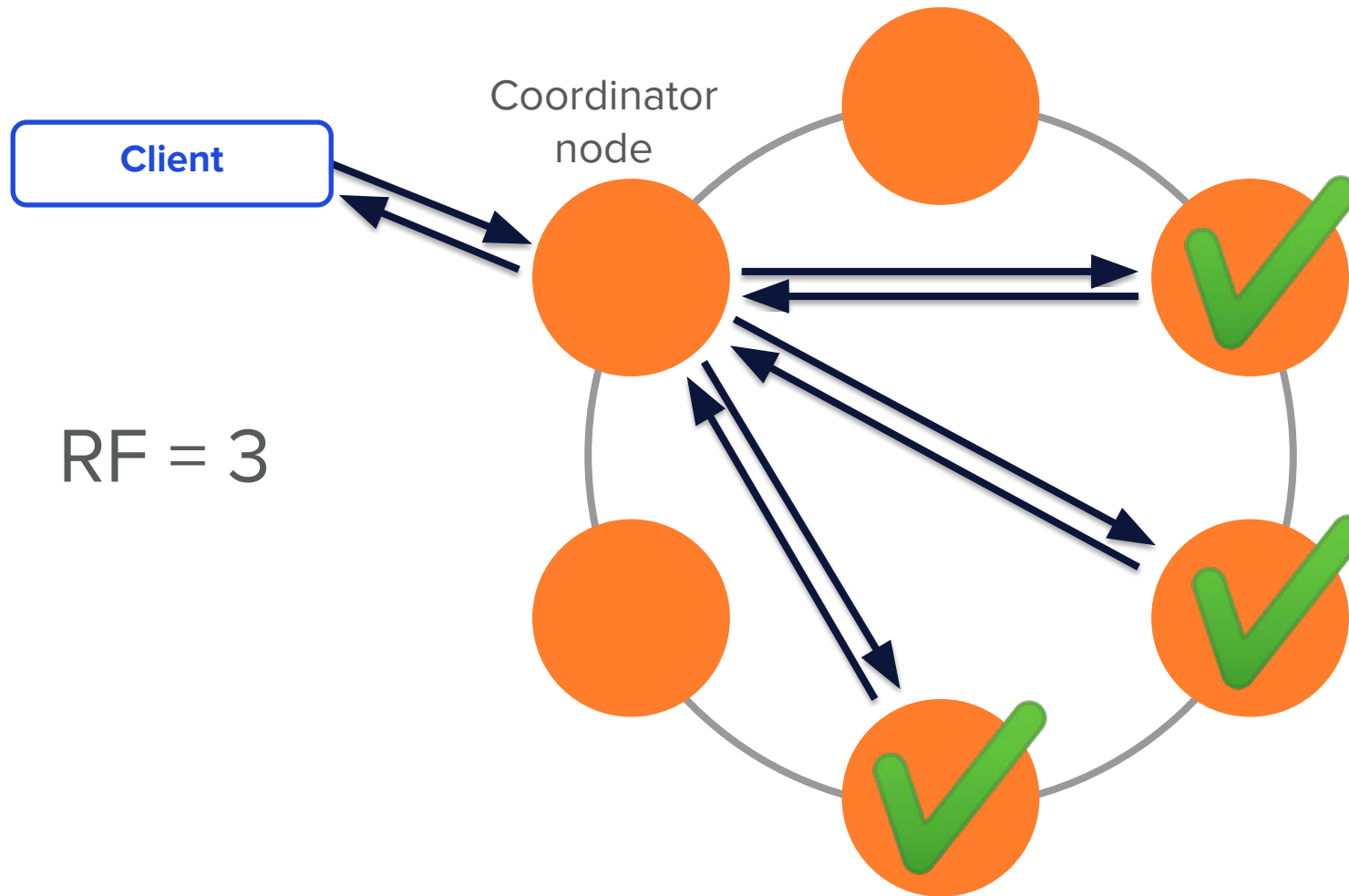
Consistency Levels



Consistency Levels



Consistency Levels



DataStax Drivers

- **DataStax Cassandra Drivers (OSS)**

- CQL Support
- Sync / Async API
- Address Translation
- Load Balancing Policies
- Retry Policies
- Reconnection Policies
- Connection Pooling
- Auto Node Discovery
- SSL
- Compression
- Query Builder
- Object Mapper

- **DataStax Enterprise Drivers**

- OSS Drivers capabilities plus Enterprise improvements for
 - Performance, Usability, Scalability, Ecosystem
- DSE Advanced Security, Unified Authentication
- DSE Graph Fluent API
- DSE Geometric Types



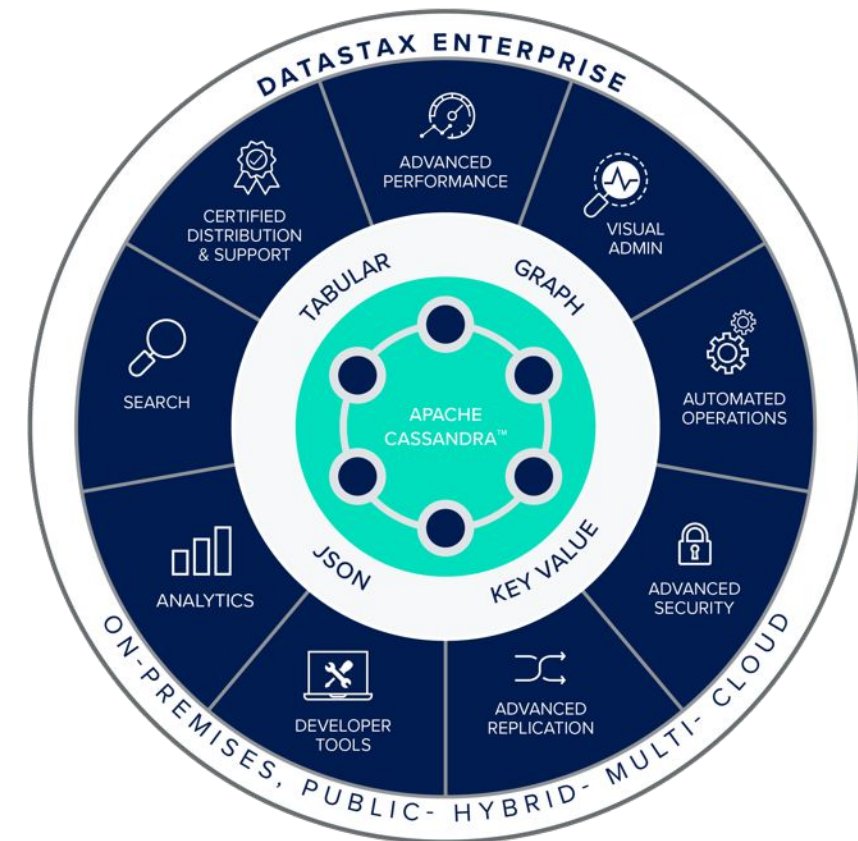
DataStax Meetup



Getting Started with Apache Spark

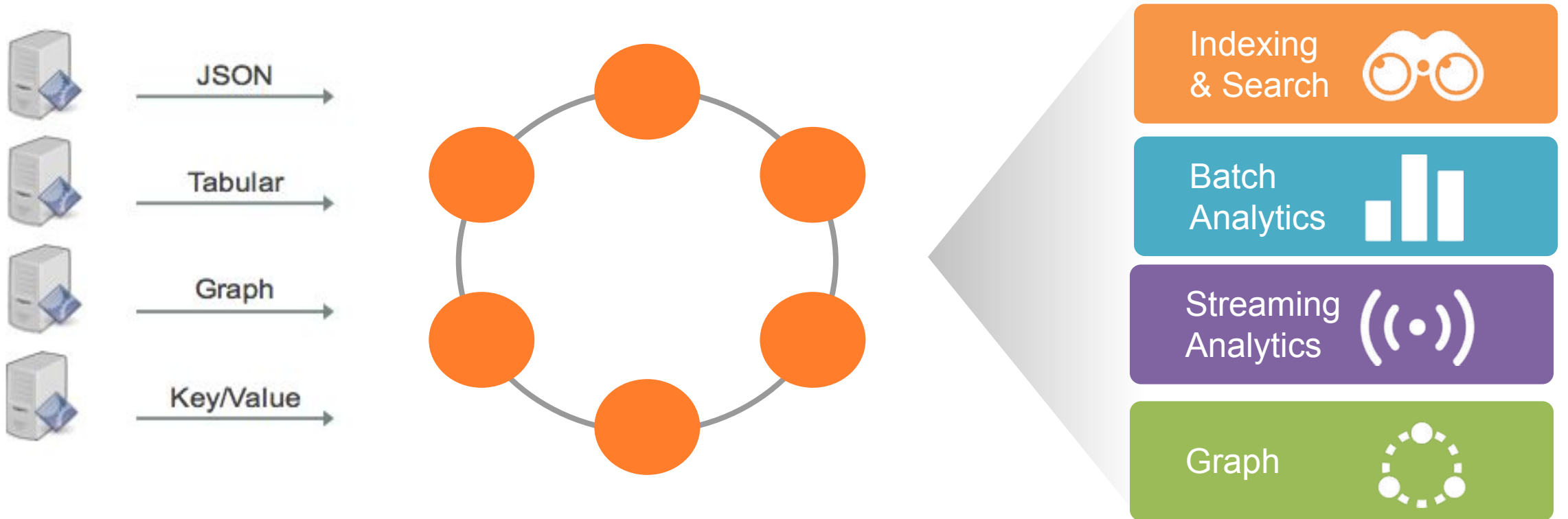


Our solution DataStax Enterprise (DSE)



- A **unified data layer** of database, search, and analytics, all independent of the public cloud provider and portable
- Consistent data management built for on-prem, hybrid-, and/or multi-cloud
- Consistent security **model** across entire data layer
 - Row and columnar level control of your data helps you achieve data governance and compliance

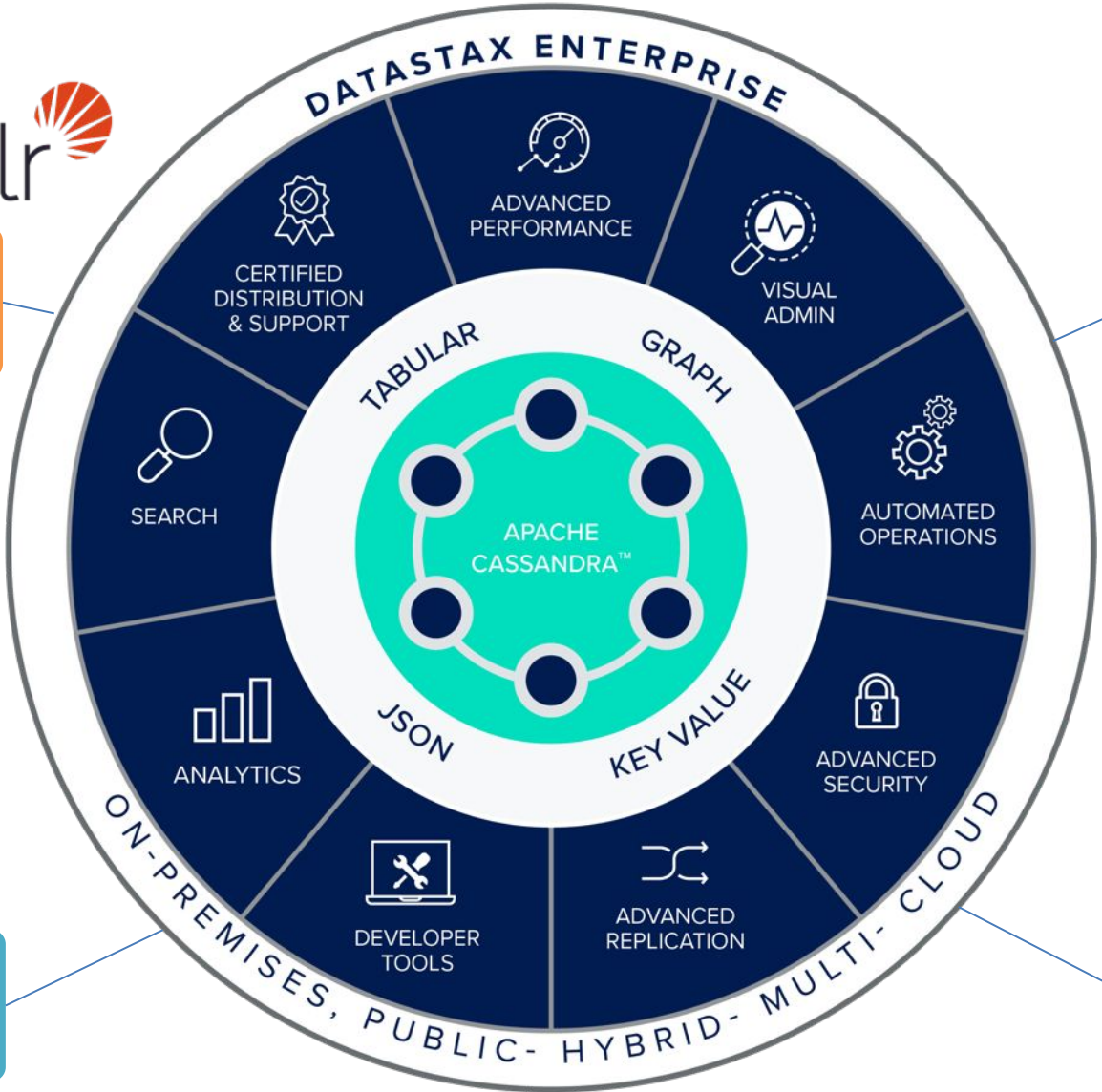
Integrated multi-model/mixed workload platform



DataStax Enterprise



Indexing & Search 



Graph 



Batch Analytics 



cassandra

OLTP 

Data Analytics

- **Definition**

Science and craft of building applications from data analysis steps to discover useful information and support data-driven decision making

- **Use cases**

- Recommendations
- Fraud detection
- Social networks and Web link analysis
- Marketing and advertising decisions
- Customer 360
- Sales and stock market analytics
- IoT analytics

- **Analysing Steps**

- Statistical analysis
- Classification
- Clustering
- Regression
- Similarity matching
- Collaborative filtering
- Profiling
- Dimensionality reduction
- Feature extraction

Distributed computation engine
designed for **big data** and in-memory processing

- Interactive and batch analytics
- Up to 100x faster than Hadoop
- 5-10x less code than Hadoop
- Efficiency and scalability
- Fault-tolerance

Spark
SQL

Spark
Streaming

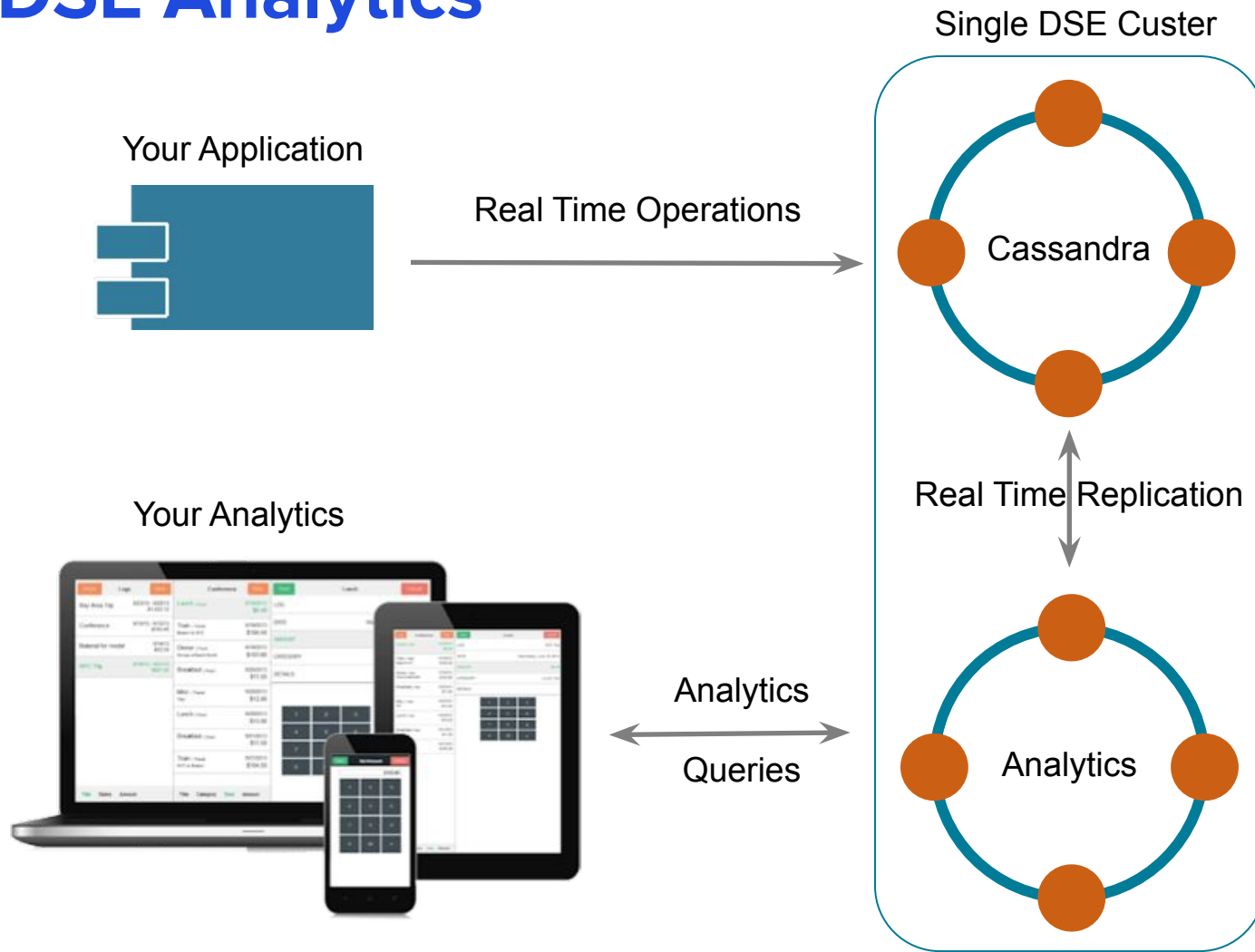
MLlib

GraphX

SparkR



DSE Analytics



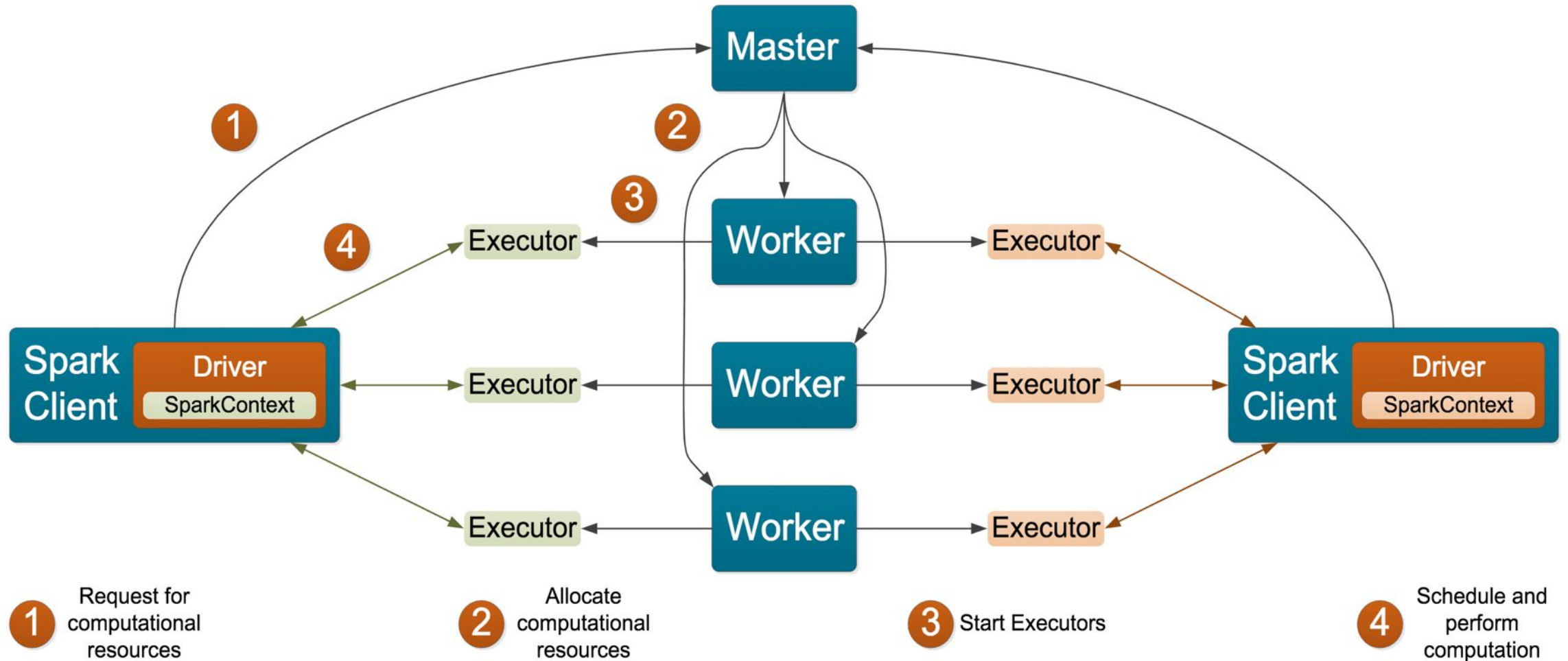
Streaming, ad-hoc, and batch

- High-performance
- High availability
- Workload management
- SQL reporting

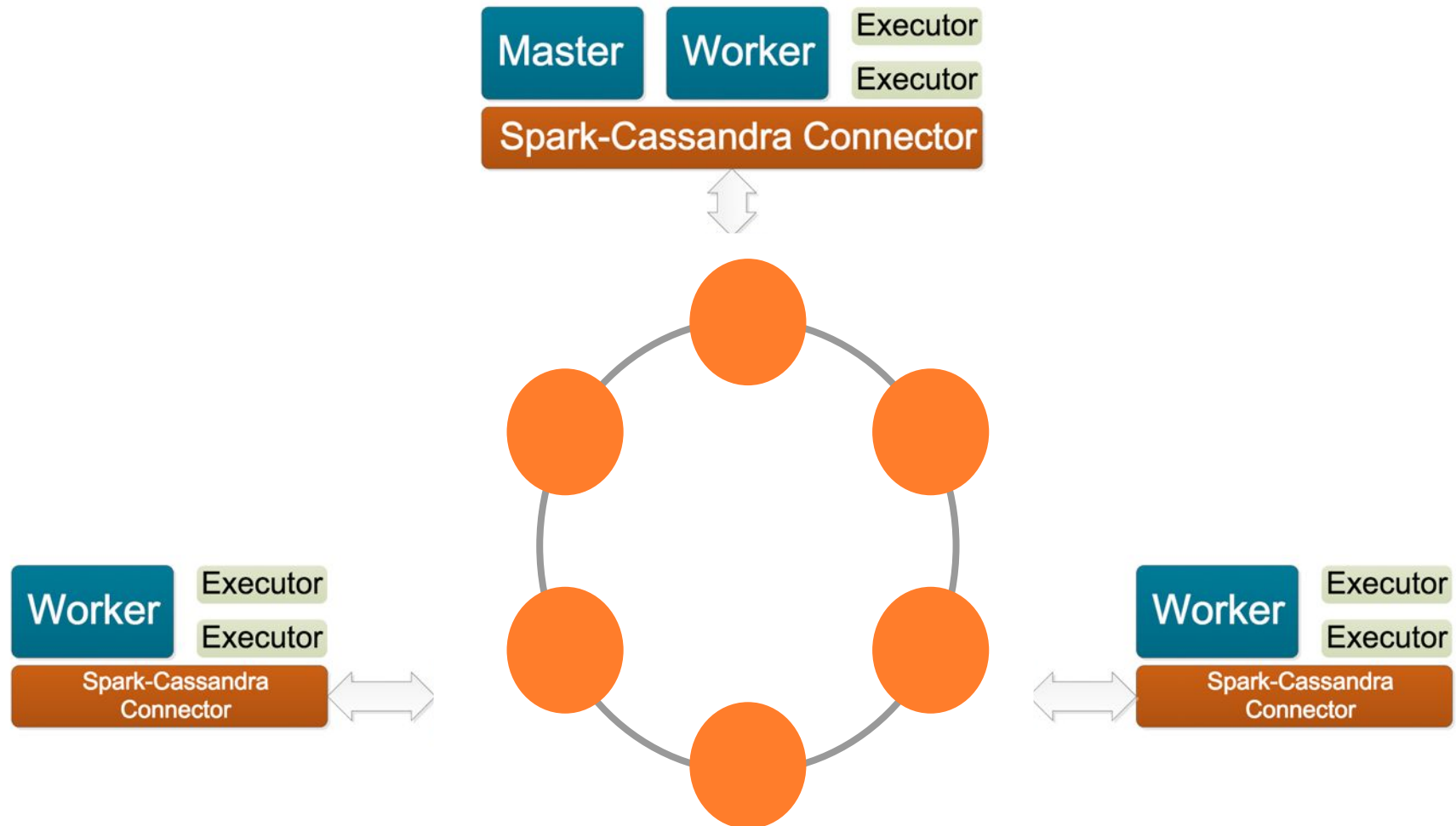
Compared to self-managed:

- No ETL
- True HA without Zookeeper

Spark Architecture



Architecture with Spark DSE Driver



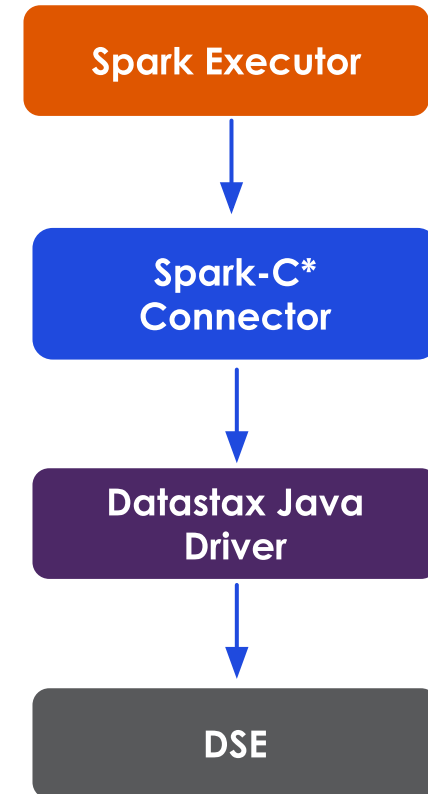
Database Access with DataStax Driver

- DataStax Cassandra Spark driver
 - Implemented mostly in Scala
 - Scala + Java APIs
 - Does automatic type conversions

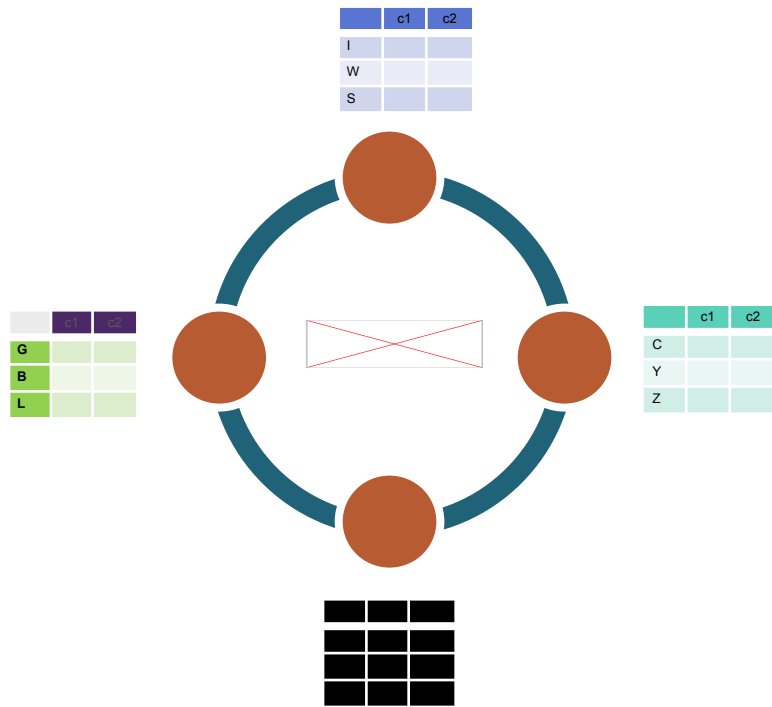
```
// Spark connection options
val conf = new SparkConf(true)
.set("spark.cassandra.connection.host", "127.0.0.1")
.set("spark.cassandra.auth.username", "cassandra")
.set("spark.cassandra.auth.password", "cassandra")
val sc = new SparkContext("spark://127.0.0.1:7077", "myapp", conf)

// Read from DSE and add partitioner with primary key
val rdd = sc.cassandraTable("my_keyspace", "my_table").byKey("pk", "cc")

// Save to DSE
rdd.saveToCassandra("my_keyspace", "my_table", SomeColumns("key",
"value"))
```



Data Locality

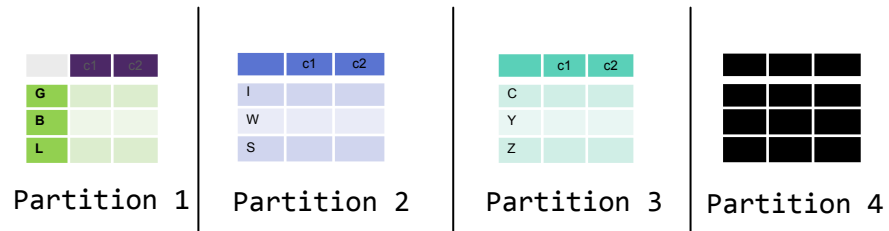


- DSE Analytics respects data locality
- No need for ETL between separated clusters
- Spark Master HA

Every Spark task uses a CQL-like query to fetch data for a given token range:

```
SELECT "key", "value" FROM "keyspace"."table"  
WHERE  
    token("key") > 384023840238403 AND  
    token("key") <= 38402992849280  
ALLOW FILTERING
```

In Memory: Distributed on all available nodes



Integrating Analytics into your application

```
dse cassandra -k
```

- Aaaaand you're done




DataStax Meetup

Exercises Bootstrap

DATASTAX[®]




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Powered by:  SOURCESENSE  DATASTAX



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DataStax Studio	http://localhost:9091
DataStax Academy	http://academy.datastax.com
DataStax Community	http://community.datastax.com





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Your environment

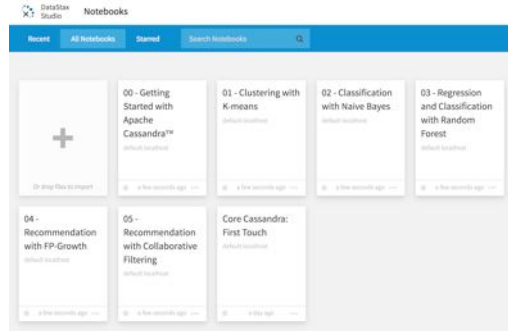
`docker-compose up -d`



DOCKER

9091

DataStax Studio



DataStax Enterprise (DSE)

CASSANDRA

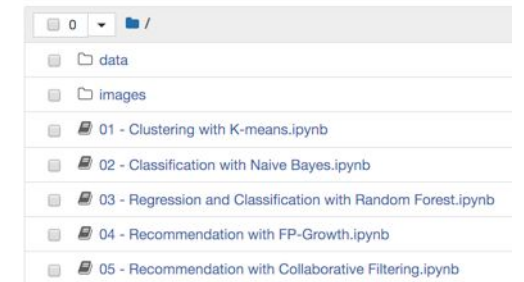
SEARCH

ANALYTICS



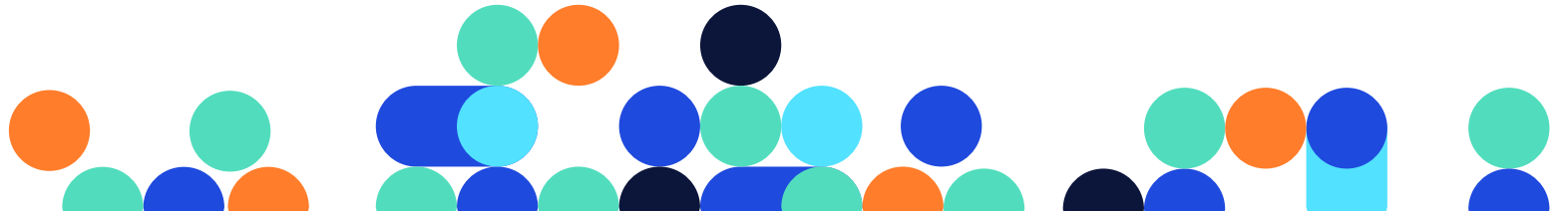
8888

Jupyter Notebook



Time for an exercise!

“Getting Started with Apache Spark[™]” Notebook



DataStax Meetup

Machine Learning

DATASTAX[®]



DataStax Meetup



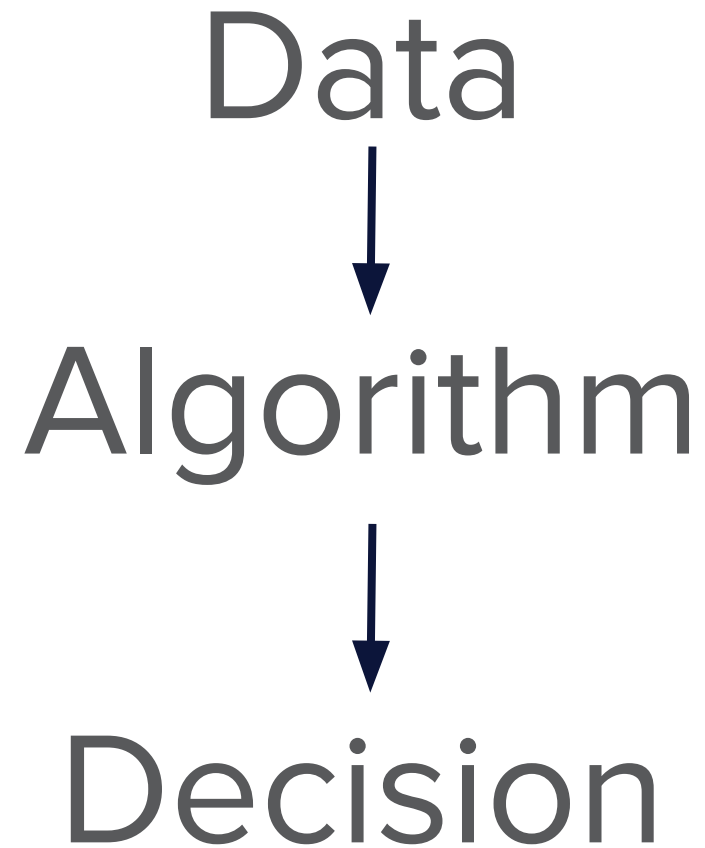
Machine Learning

“Machine Learning is a science of
drawing circles and colorizing them”

A. Volochnev

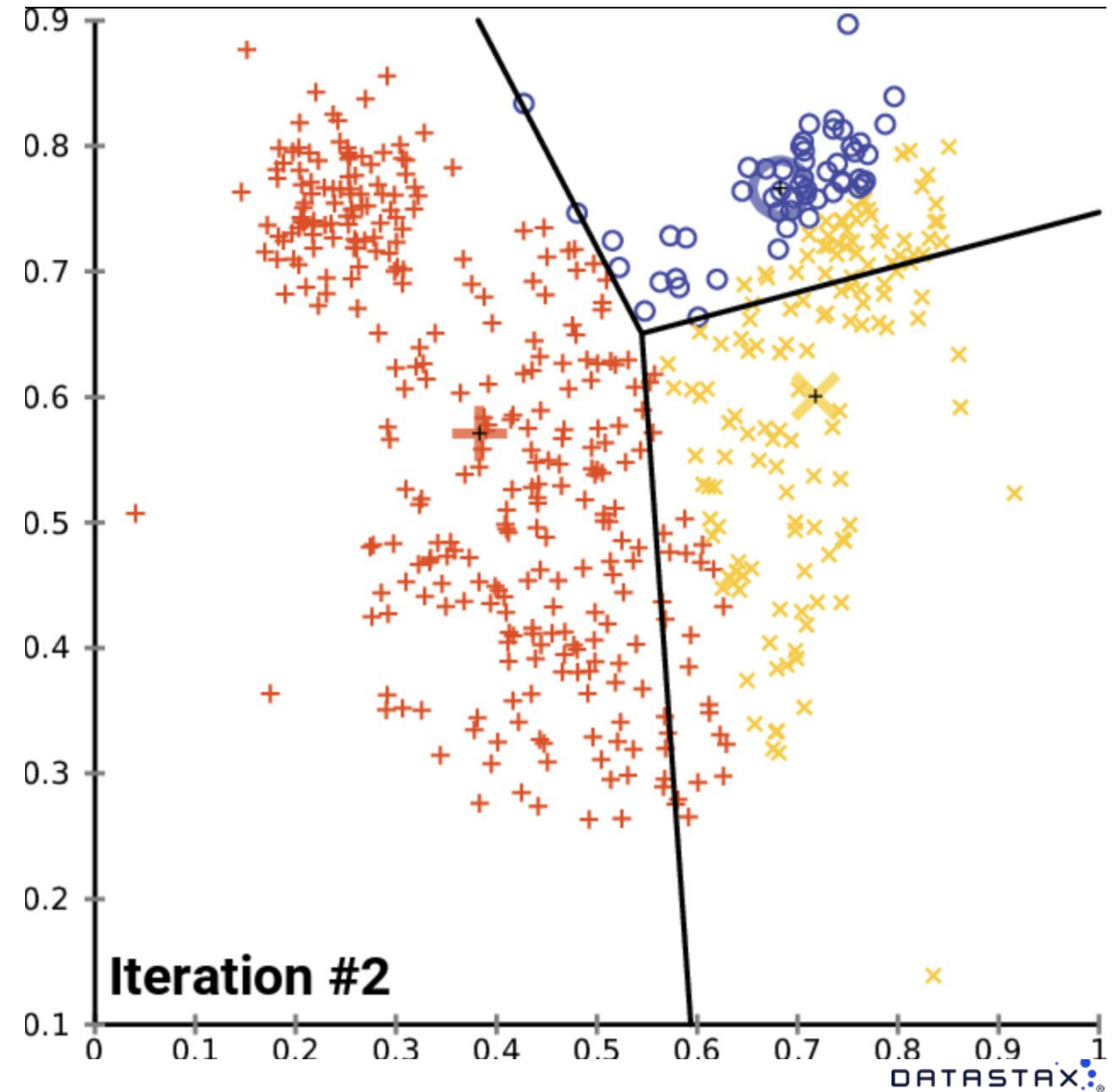


Machine Learning



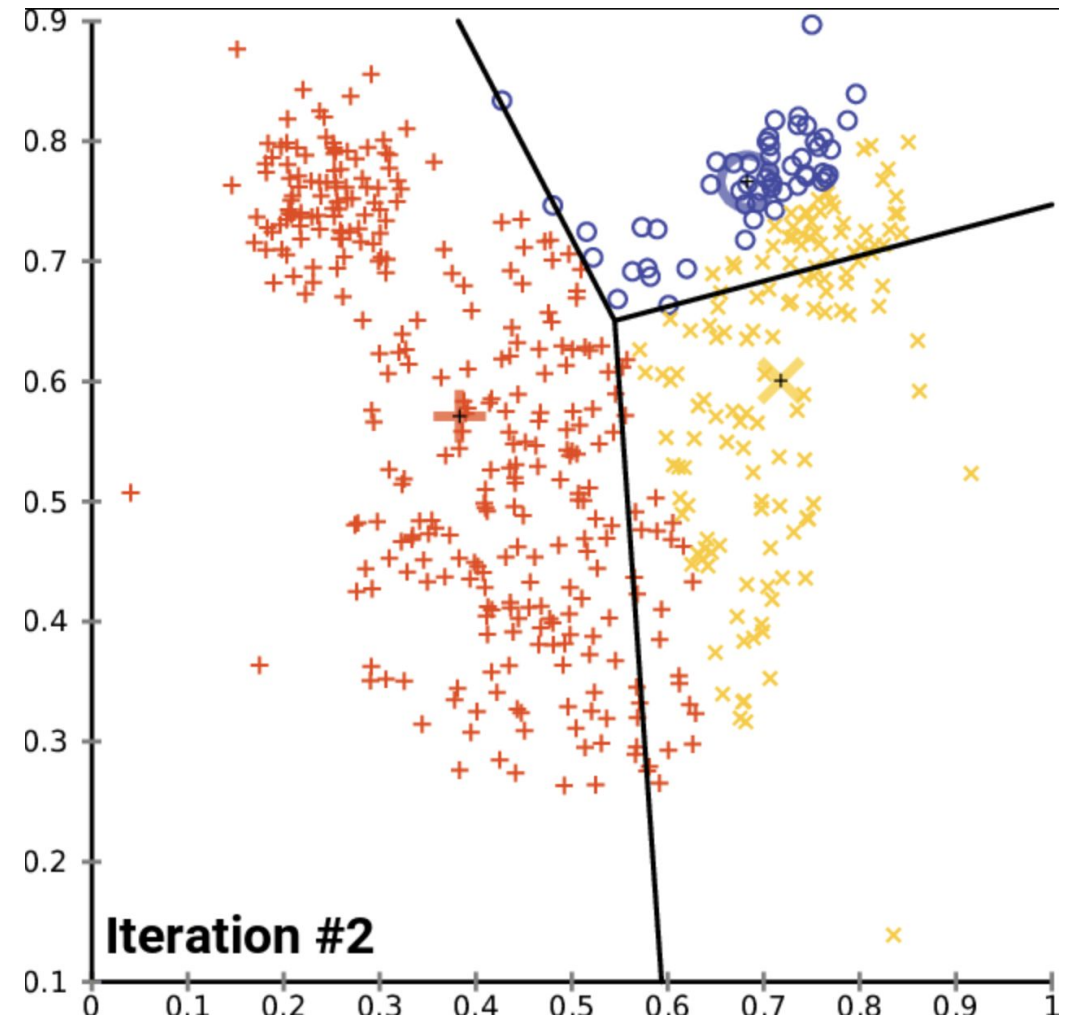
K-Means Clustering

“K-means clustering is a method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining. K-means clustering aims to partition observations into clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. This results in a partitioning of the data space into Voronoi cells. K-Means minimizes within-cluster variances (squared Euclidean distances), but not regular Euclidean distances, which would be the more difficult Weber problem: the mean optimizes squared errors, whereas only the geometric median minimizes Euclidean distances.”



K-Means Clustering Lab

- <https://github.com/HadesArchitect/CaSpark>
- <http://localhost:8888>
- password: datastax
- **K-Means Notebook**



Naïve Bayes

“Naïve Bayes classifiers are a family of simple "probabilistic classifiers" based on applying Bayes' theorem with strong “naïve” independence assumptions between the features.

Naïve Bayes is a popular method for text categorization, the problem of judging documents as belonging to one category or the other (such as spam or legitimate, etc.) with word frequencies as the features. With appropriate pre-processing, it is competitive in this domain with more advanced methods including support vector machines. It also finds application in automatic medical diagnosis.

Naïve Bayes classifiers are highly scalable, requiring a number of parameters linear in the number of variables in a learning problem. Maximum-likelihood training can be done by evaluating a closed-form expression, which takes linear time, rather than by expensive iterative approximation as used for many other types of classifiers.”

The diagram shows the Naïve Bayes formula with arrows pointing from descriptive labels to the corresponding parts of the equation:

$$P(c | x) = \frac{P(x | c) P(c)}{P(x)}$$

- Likelihood** points to $P(x | c)$
- Class Prior Probability** points to $P(c)$
- Posterior Probability** points to $P(c | x)$
- Predictor Prior Probability** points to $P(x)$

$$P(c | X) = P(x_1 | c) \times P(x_2 | c) \times \cdots \times P(x_n | c) \times P(c)$$

Naïve Bayes Lab

- <https://github.com/HadesArchitect/CaSpark>
- <http://localhost:8888>
- password: datastax
- **Naïve Bayes Notebook**

The diagram shows the Naïve Bayes formula with arrows pointing from descriptive labels to the corresponding terms in the equation:

$$P(c | x) = \frac{P(x | c)P(c)}{P(x)}$$

Labels and their corresponding terms:

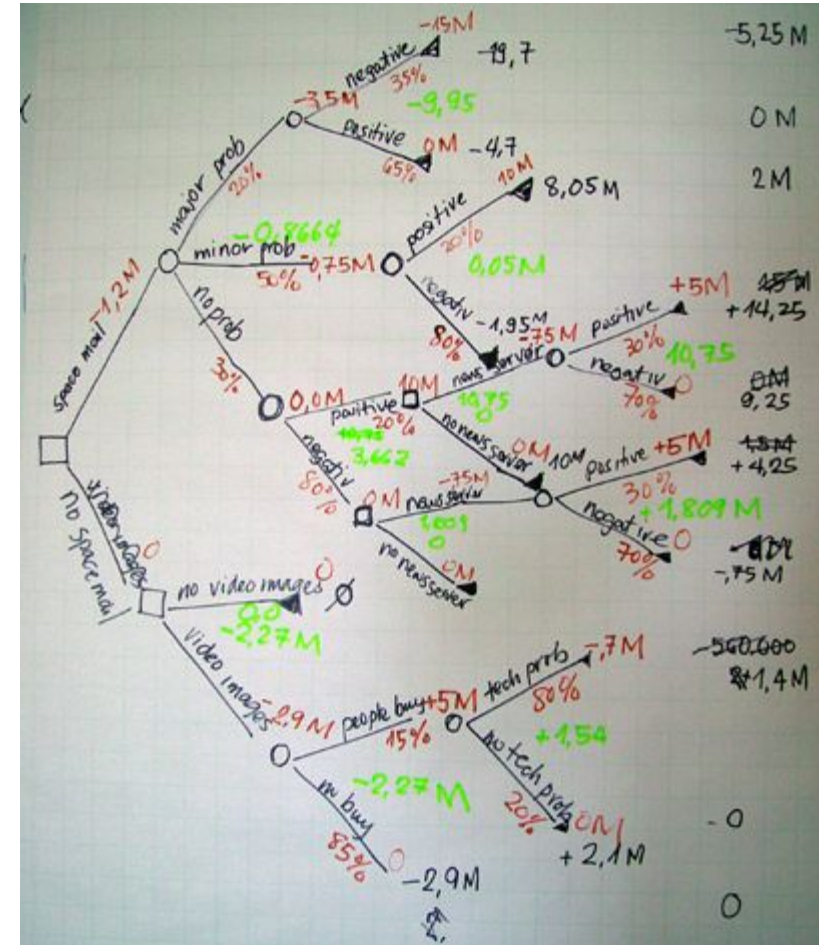
- Likelihood** points to $P(x | c)$
- Class Prior Probability** points to $P(c)$
- Posterior Probability** points to $P(c | x)$
- Predictor Prior Probability** points to $P(x)$

$$P(c | X) = P(x_1 | c) \times P(x_2 | c) \times \cdots \times P(x_n | c) \times P(c)$$

Random Forest

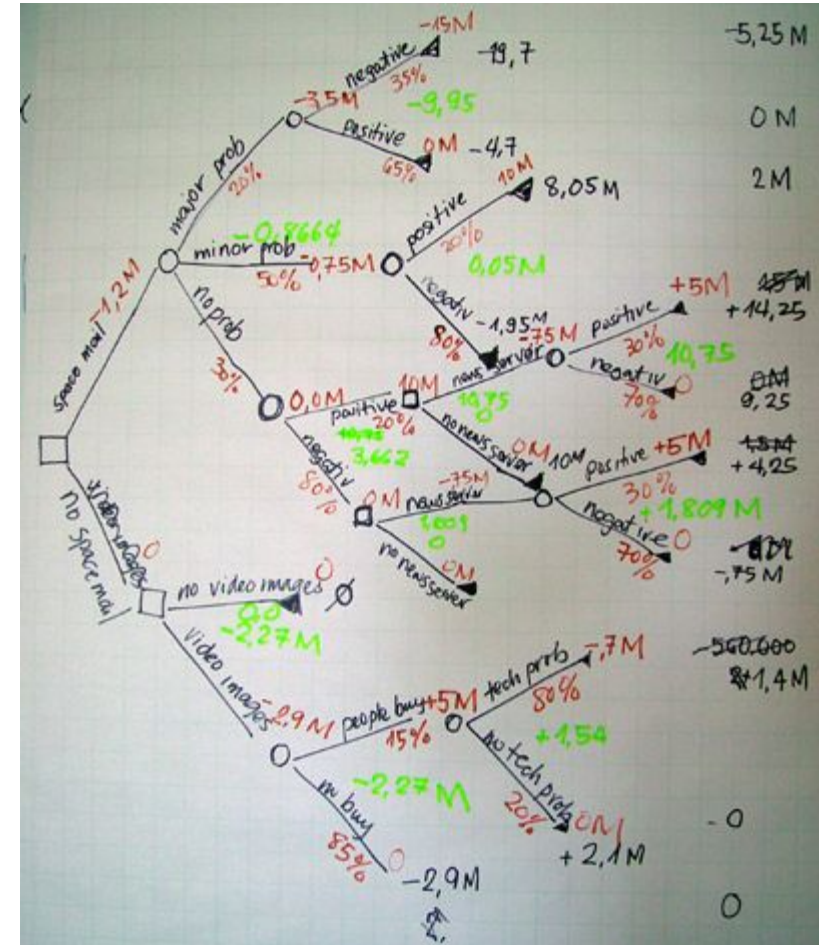
“Random forests or random decision forests are an ensemble learning method for classification, regression and other tasks that operates by constructing a multitude of decision trees at training time and outputting the class that is the mode of the classes (classification) or mean prediction (regression) of the individual trees. Random decision forests correct for decision trees' habit of overfitting to their training set.

The first algorithm for random decision forests was created by Tin Kam Ho using the random subspace method, which, in Ho's formulation, is a way to implement the "stochastic discrimination" approach to classification proposed by Eugene Kleinberg."



Random Forest Lab

- <https://github.com/HadesArchitect/CaSpark>
- <http://localhost:8888>
- password: datastax
- **Random Forest Notebook**

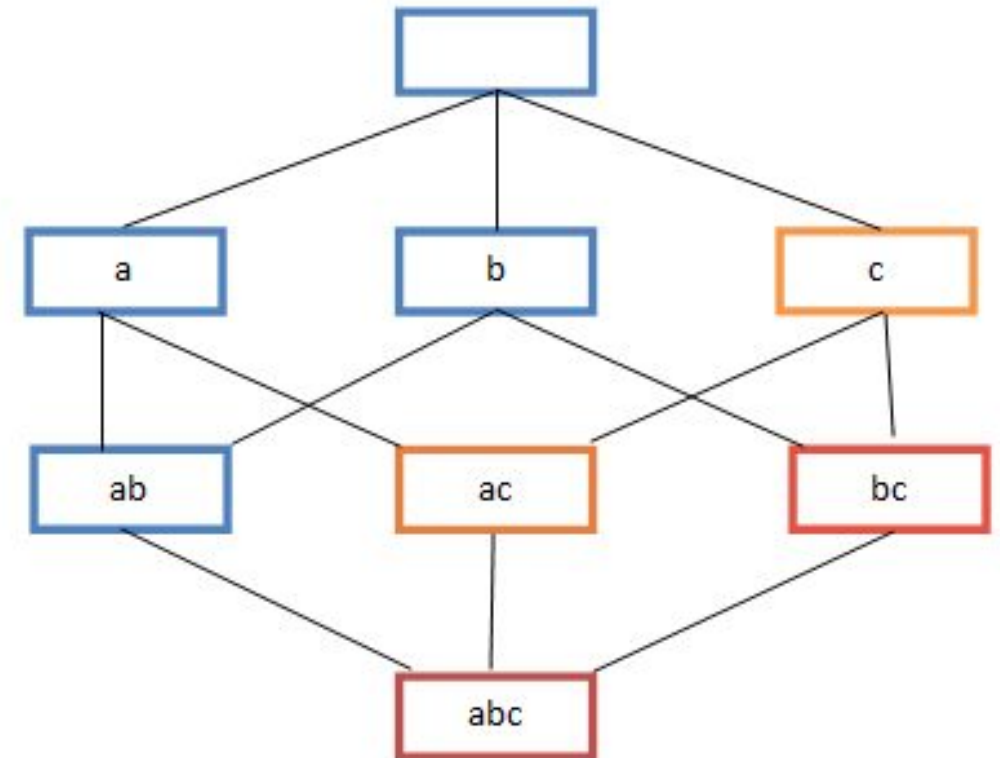


FP-Growth (Frequent Pattern Growth)

“In the first pass, the algorithm counts the occurrences of items (attribute-value pairs) in the dataset of transactions, and stores these counts in a header table. In the second pass, it builds the FP-tree structure by inserting transactions into a trie.

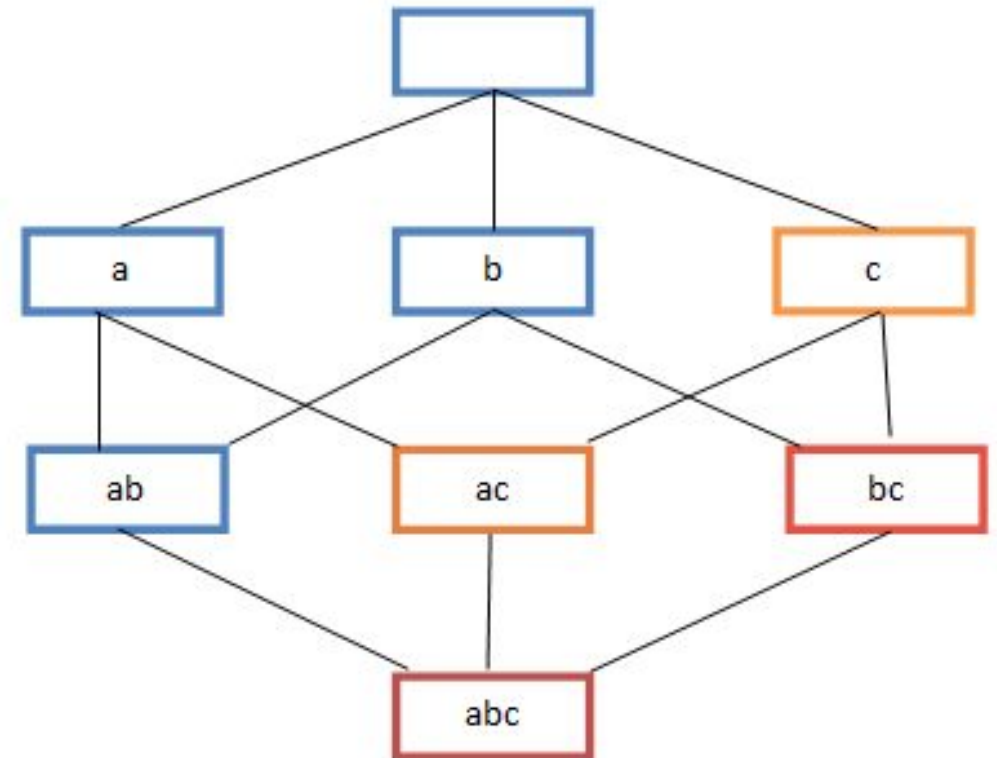
Items in each transaction have to be sorted by descending order of their frequency in the dataset before being inserted so that the tree can be processed quickly. Items in each transaction that do not meet the minimum support requirement are discarded. If many transactions share most frequent items, the FP-tree provides high compression close to tree root.

Recursive processing of this compressed version of the main dataset grows frequent item sets directly, instead of generating candidate items and testing them against the entire database”




























FP-Growth Lab

- <https://github.com/HadesArchitect/CaSpark>
- <http://localhost:8888>
- password: datastax
- **FP-Growth Notebook**




























Collaborative Filtering

“Collaborative filtering is a method of making automatic predictions about the interests of a user by collecting preferences or taste information from many users. The underlying assumption of the collaborative filtering approach is that if a person A has the same opinion as a person B on an issue, A is more likely to have B's opinion on a different issue than that of a randomly chosen person. For example, a collaborative filtering recommendation system for television tastes could make predictions about which television show a user should like given a partial list of that user's tastes. Note that these predictions are specific to the user, but use information gleaned from many users. This differs from the simpler approach of giving an average score for each item of interest, for example based on its number of votes.”

Collaborative Filtering Lab

- <https://github.com/HadesArchitect/CaSpark>
- <http://localhost:8888>
- password: datastax
- **Collaborative Filtering Notebook**

DataStax Developer Day

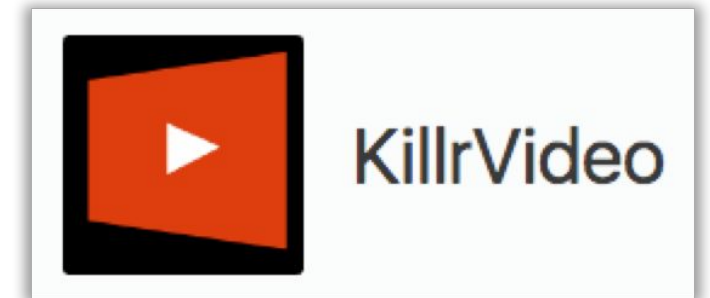


Developer Resources



Resources for Developers

- DataStax Academy
 - [Training Courses](#) and [Certifications](#)
 - [Developer Blog](#)
 - [Distributed Data Show podcast](#)
- Live Events
 - [Developer Day](#)
 - [Meetups](#)
- More Content
 - [YouTube Channel](#)
 - [Live coding on Twitch](#)
 - [KillrVideo reference application](#)
 - [DataStax Academy Slack](#)



Developer Day

A day of hands-on learning about DataStax Enterprise and Apache Cassandra™

- Use Cases
- Core Cassandra
- Cassandra Data Modeling
- Application Development
- Search, Analytics and Graph
- Operations and Security

Network with experts, Developer Advocates and peers

Open to the public, or schedule a private event



Training Courses at DataStax Academy

- Free self-paced DSE 6 courses
 - [DS201: DataStax Enterprise 6 Foundations of Apache Cassandra™](#)
 - [DS210: DataStax Enterprise 6 Operations with Apache Cassandra™](#)
 - [DS220: DataStax Enterprise 6 Practical Application Data Modeling with Apache Cassandra™](#)
 - [DS330: DataStax Enterprise 6 Graph](#)
 - [DS332: DataStax Enterprise 6 Graph Analytics \(NEW\)](#)



Learning Paths on DataStax Academy

- Unsure where to start?
- Follow a learning path to learn about topics related to your role.
 - Administrator
 - Analytics Specialist
 - Architect
 - Developer
 - Graph Specialist
 - Search Specialist

<https://academy.datastax.com/paths>

Bringing together the Apache Cassandra experts from the community and DataStax.

Want to learn? Have a question? Want to share your expertise? You are in the right place!

Not sure where to begin? [Getting Started](#)

Tous les messages



- nagasam17_177126 répondu · il y a 19 heures · General forum
Course status not updated to completion
- tim.mason_177848 demandé · il y a 23 heures · General forum
How to get free book after completion of academy courses
- Erick Ramirez répondu · il y a 3 jours · General forum
multi node cluster installation on ubuntu
- Erick Ramirez répondu · il y a 5 jours · General forum
Will changing data partitioning help with the load ?
- pmcfadin répondu · il y a 6 jours · General forum
Data Modeling : One to Many and Many to Many
- Erick Ramirez répondu · il y a 6 jours · General forum
Datastax Exam Issue
- Erick Ramirez répondu · il y a 6 jours · General forum
How can I troubleshoot OpsCenter showing agent is unreachable?

4 Réponses 0 Aime

0 Réponses 0 Aime

1 Répondre 0 Aime

1 Répondre 0 Aime

2 Réponses 0 Aime

1 Répondre 0 Aime

2 Réponses 0 Aime

SUJETS POPULAIRES

cassandra spark spark-connector driver performance
dse search search opscenter dse certification graph
data modelling docker datastax cassandra upgrade
compaction query solr datastax community dse 6.7.3
java delete dse-java-driver-core partition restore
datastax enterprise server 6.7.4 timeout opscenter-backup
cpp cassandra-connection

VOIR TOUT

BADGES RÉCENTS

- nagasam17_177126
- Beck
- amitosh
- csplinter
- joao.reis_163533
- muzimilbasha_178465
- muzimilbasha_178465
- Erick Ramirez

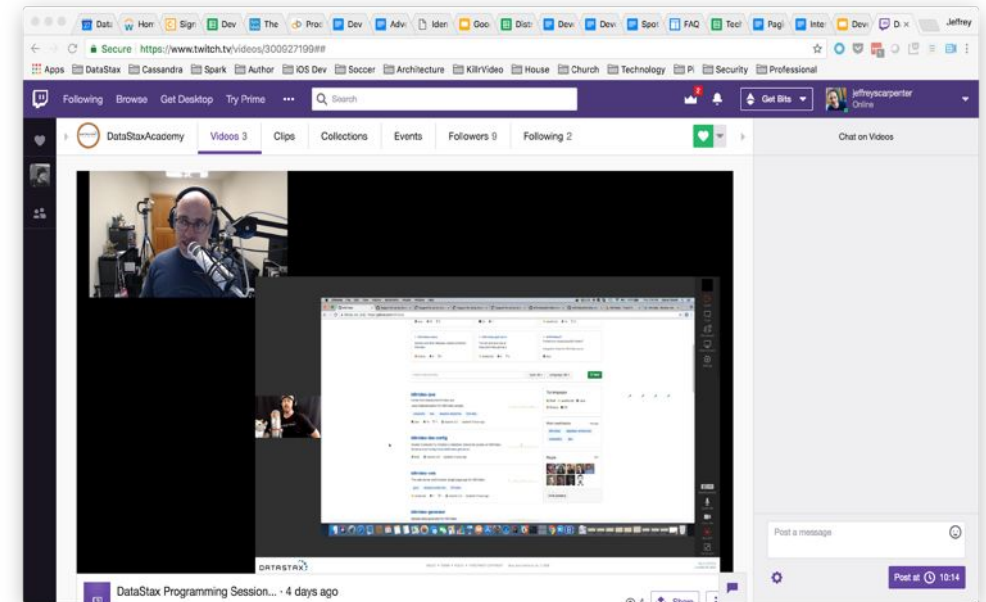
Distributed Data Show

- Interview-style show featuring a mix of DataStax and industry guests
- We go in-depth on the technology and challenges of data in large-scale distributed systems
- Released weekly on DataStax Academy [YouTube channel](#) and as a podcast
- Send us your suggestions for topics and guests – we love customer use cases



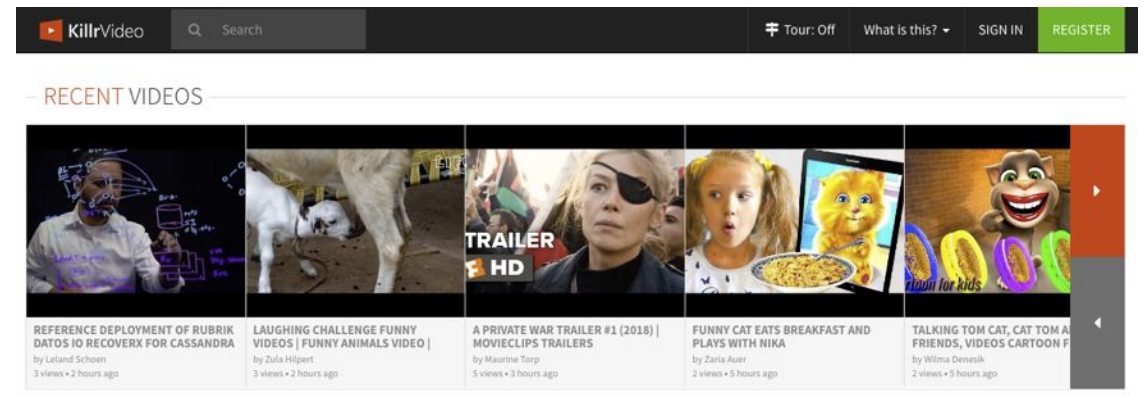
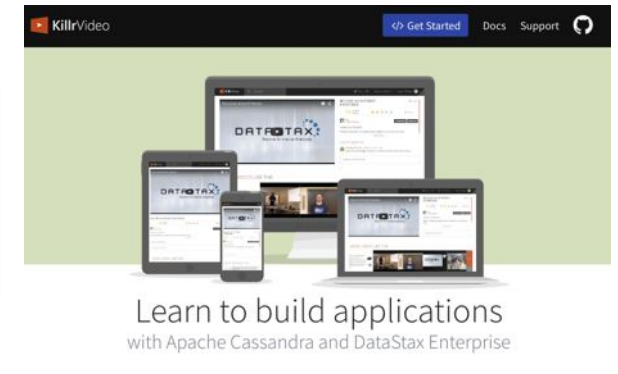
Live Coding on Twitch

- Live coding sessions with advocates and guests each Thursday
 - <https://www.twitch.tv/datastaxacademy>
- Working through the challenges of building distributed systems
- Join the conversation and ask questions
- Some advocates also do streaming on personal channels



KillrVideo Reference Application

- Reference application for learning how to use Apache Cassandra and DataStax Enterprise
 - DataStax Drivers
 - Docker images
- Source code freely available
 - <https://github.com/killrvideo>
- Live version
 - <http://killrvideo.com>
- Download, test, modify, contribute!

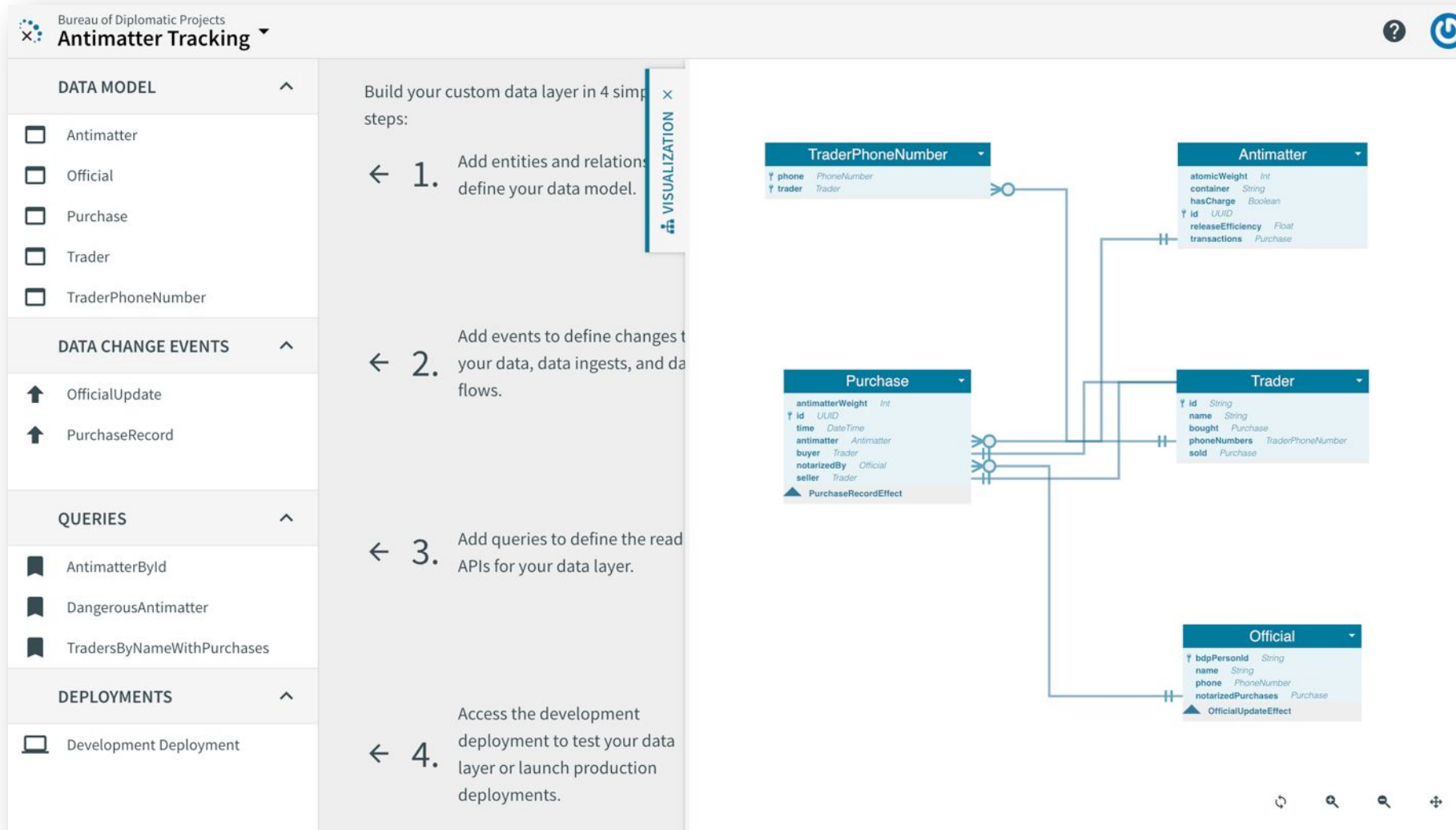


DataStax Meetup

We need you

DATASTAX[®]





Constellation

<http://constellation.datastax.com>



COMING SOON...

**DATASTAX
CONSTELLATION**
Cloud Data Platform

A cloud-native platform with smart services that radically simplify and accelerate application development while eliminating the complex overhead of database operations.

Sign up now to receive updates including details on the early access program.

First Name: *
First Name

Last Name: *
Last Name

Email Address: *
Business Email

Company Name: *
Company

Job Title: *
Job Title

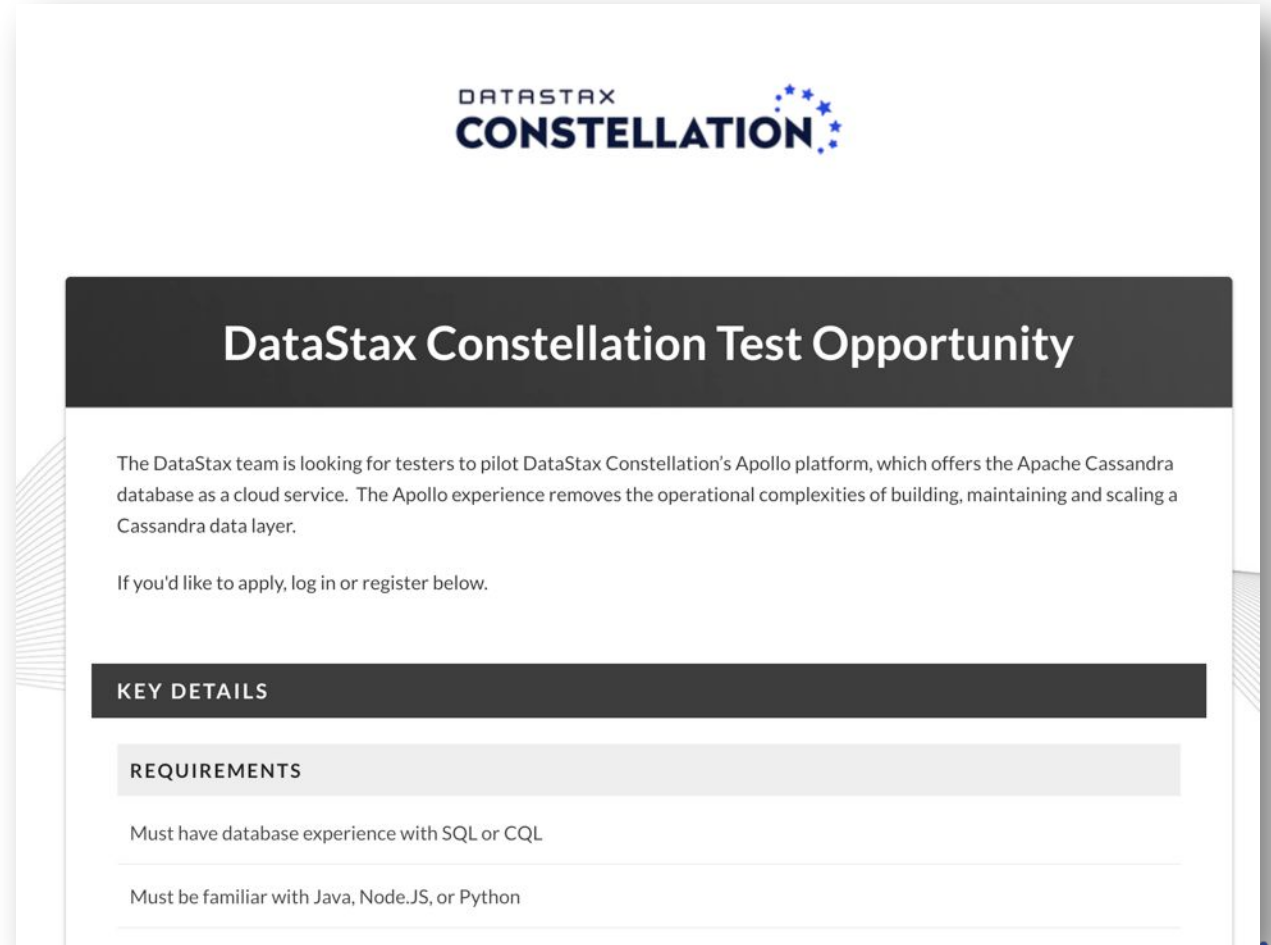
Country: *
Select...

☐ Check this box if you are interested in participating in the Constellation early access program.

By continuing you confirm you agree to the processing of information as described in our website privacy policy and agree to our website terms of use. If you prefer not to receive emails from us you can opt-out by changing your email preferences at any time.

SUBMIT

<https://datastax.centercode.com/key/opportunity>



**DATASTAX
CONSTELLATION**

DataStax Constellation Test Opportunity

The DataStax team is looking for testers to pilot DataStax Constellation's Apollo platform, which offers the Apache Cassandra database as a cloud service. The Apollo experience removes the operational complexities of building, maintaining and scaling a Cassandra data layer.

If you'd like to apply, log in or register below.

KEY DETAILS

REQUIREMENTS

Must have database experience with SQL or CQL

Must be familiar with Java, Node.JS, or Python

DataStax Labs (<https://downloads.datastax.com/#labs>)

Download DataStax

DataStax Desktop

With DataStax Desktop you're a few clicks away from a working DSE and DataStax Studio launched in a local or remote Kubernetes cluster! More to come!

DataStax CDC for Apache Kafka

DataStax CDC for Apache Kafka extends existing Sink Connector with Source functionality. Now changes may be pushed from a source DataStax Enterprise cluster to Kafka topics. Change Data Capture events include inserts, updates, and deletes.

DataStax Labs

DataStax Labs provides the Apache Cassandra™ and DataStax communities with non-supported previews of enhancements that may or may not be included in future DataStax production software, as well as tools, aids, and partner software designed to increase productivity.

As a guest, have fun with DataStax Labs previews, and try it out. And note our disclaimer that these are not supported, and so should not be put into production.

You try out some of our new Labs technologies, tools, and experimental features we would love your feedback. Good or bad, let us know!

Connect with us through the [DataStax Community](#).

"Who better to help us shape our software than our developers? We listen to you every day. We have a lot of ideas, but we want to make sure we're building the cutting-edge builds and let us know."

— PATRICK MCFADIN, VP DEVELOPER RELATIONS, DATASTAX

DataStax Graph (DSG)

Mix DSG and Cassandra workloads in the same app, and note the new speed on traversals--up to 14X! (and it's bundled with a DataStax Studio just for DSG).

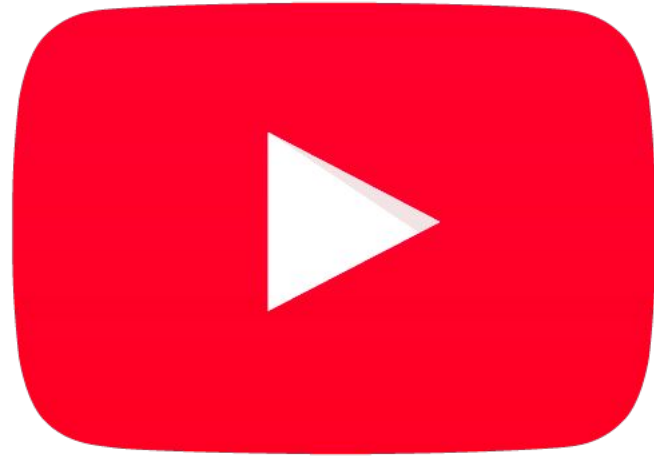
DataStax Proxy for DynamoDB™ and Apache Cassandra™

Preview version of an open source tool that enables developers to run their AWS DynamoDB™ workloads on Apache Cassandra™. With the proxy, developers can run DynamoDB workloads outside of AWS (including on premises, other clouds, and in hybrid configurations).

DataStax Spring Boot Starter

The DataStax Spring Boot Starter streamlines the development of Spring applications with Cassandra and DataStax.

Insights (<https://www.datastax.com/products/datastax-insights>)



<https://youtu.be/iZ47rrKENuc>



Thank You

@CLUNVEN
@HadesArchitect

