DATASTAX

From Zero to Cloud with Apache Cassandra™

NOVEMBER 25th 2019

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About me

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DATASTAX DEVELOPERS

FF4J

DevFest du Bout du Monde

VOXXED DAYS MICROSERVICES

TNT #19

Meetup

Breizh C@mp La conférence à l'Ouest

BIG DATA LDN MEETUP

VOXXED DAYS LUXEMBOURG

Shift _ DEV

KILLRVIDEO

DATASTAX

Agenda

0 Bootstraping

1 Understanding Apache Cassandra™ Use Cases

2 Data Modelling with Apache Cassandra™

3 Application Development

4 What's NEXT ?

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Meetup @Stockholm

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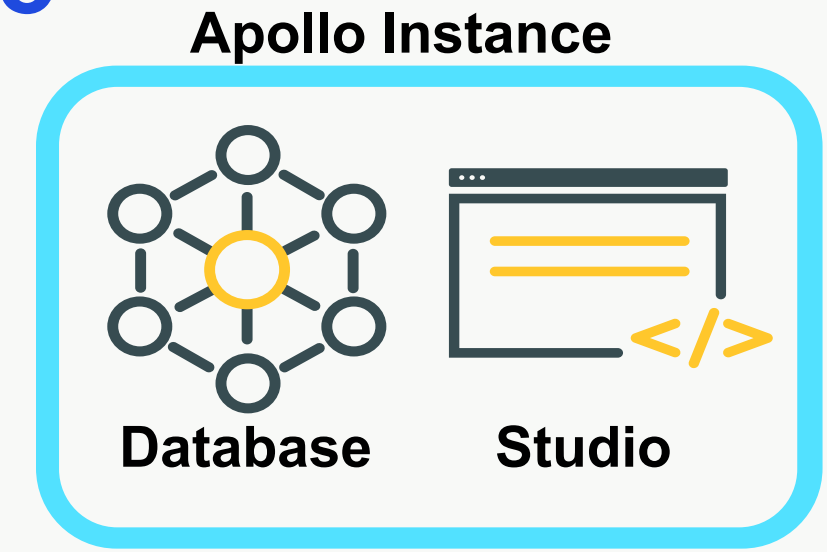
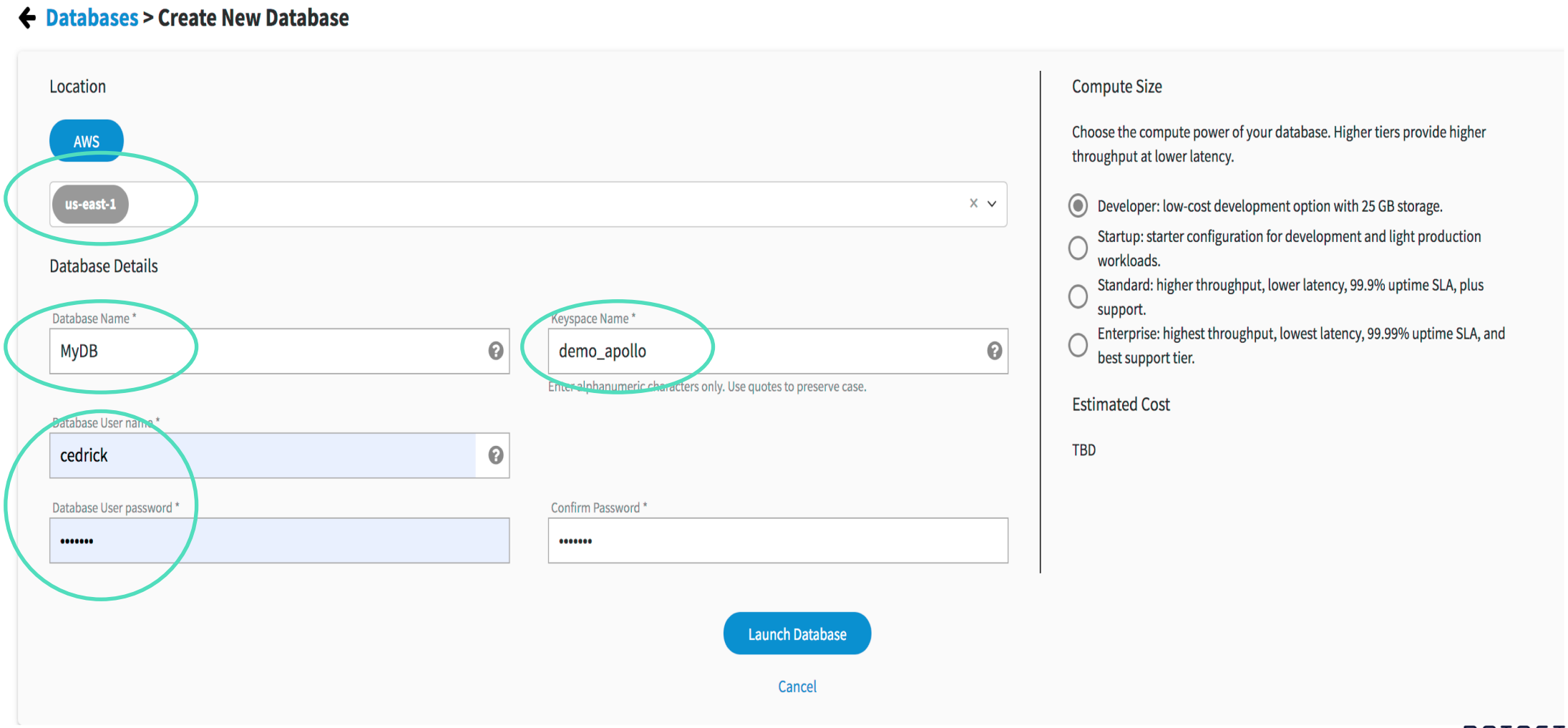
Bootstrapping

Exercise

Set-up Apollo



Apollo.datastax.com



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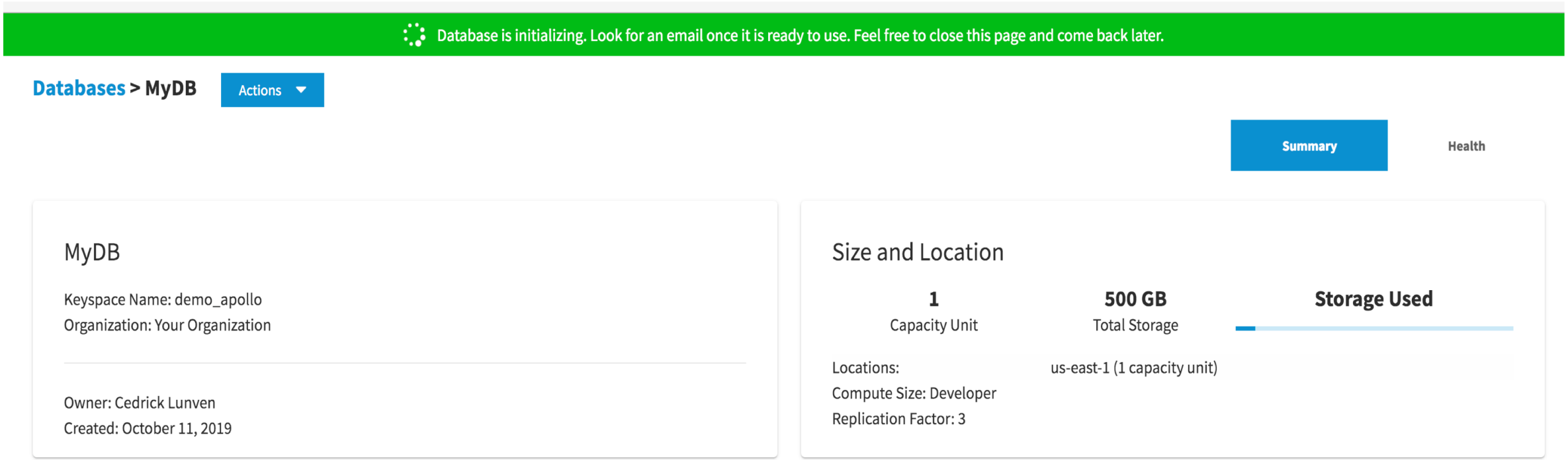
Let’s things initializing…



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Simplify application development

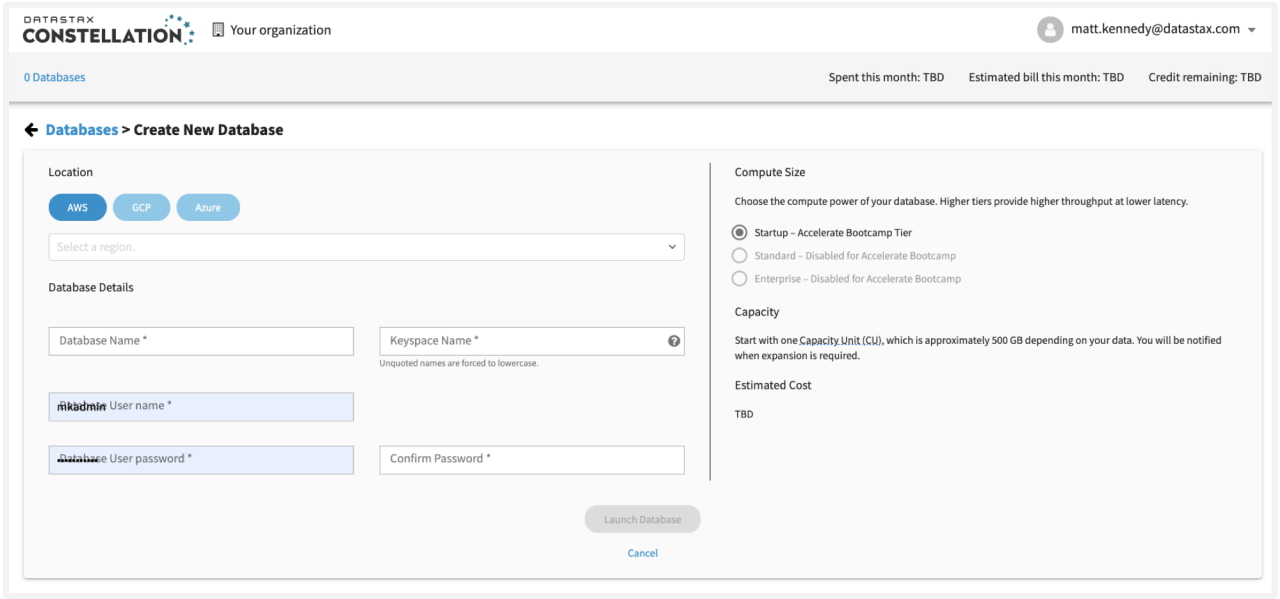
DATASTAX APOLLO

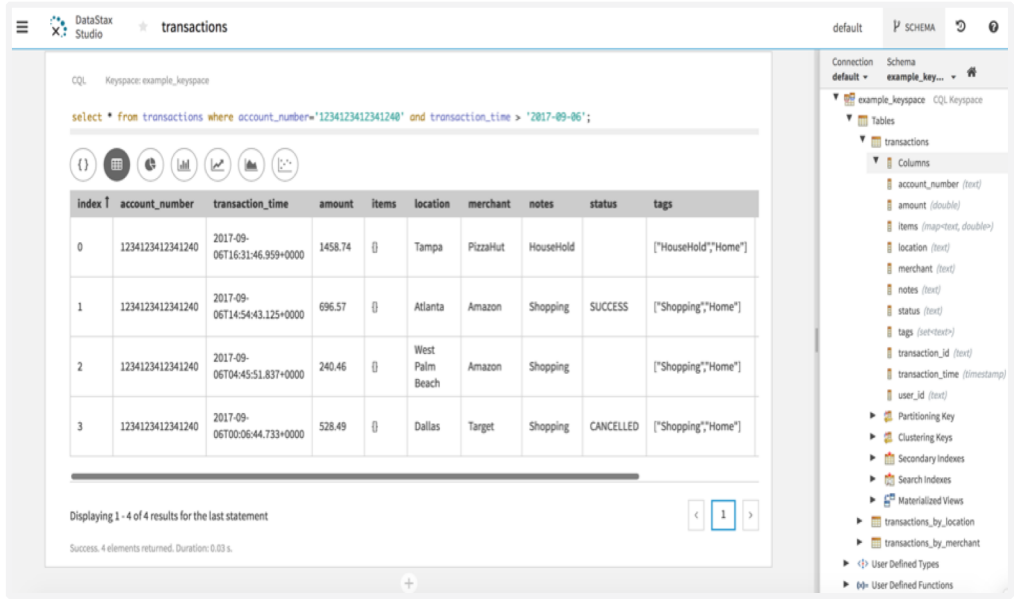
DATASTAX

Simplify application development

DATASTAX APOLLO

1-BUTTON CLICK FROM CLOUD CONSOLE TO WEB-HOSTED INTEGRATED DEVELOPER ENVIRONMENT (DATASTAX STUDIO)





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0 **Bootstraping**

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Meetup @Stockholm

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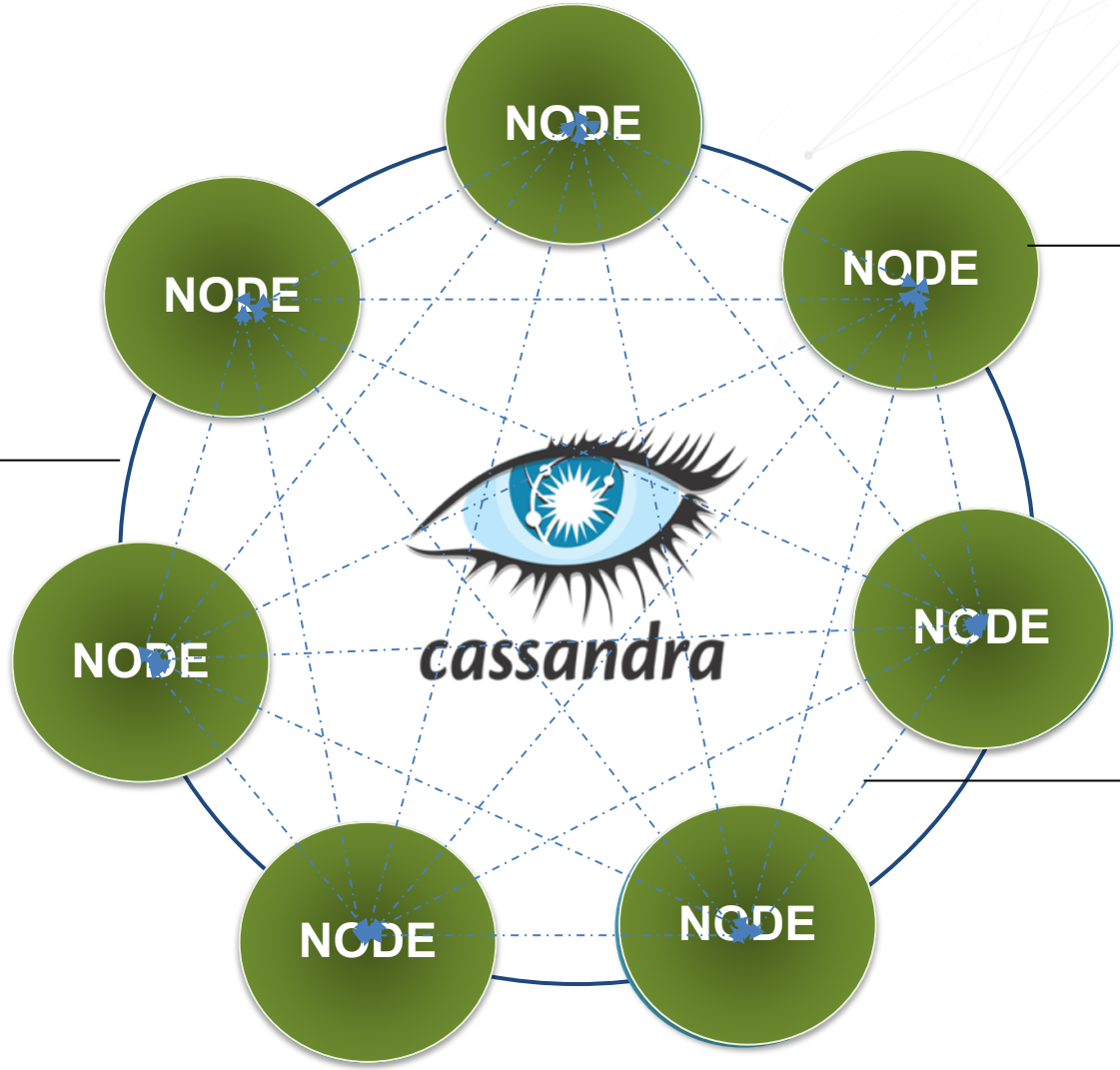
Understanding Apache Cassandra™ Use Cases

Apache Cassandra™ = Distributed NoSQL Database



1 Installation = 1 NODE
- ✓ Capacity: ± 1TB
- ✓ Throughput: 3000 Tx/sec/core

DataCenter | Ring

Communication:
- ✓ Gossiping

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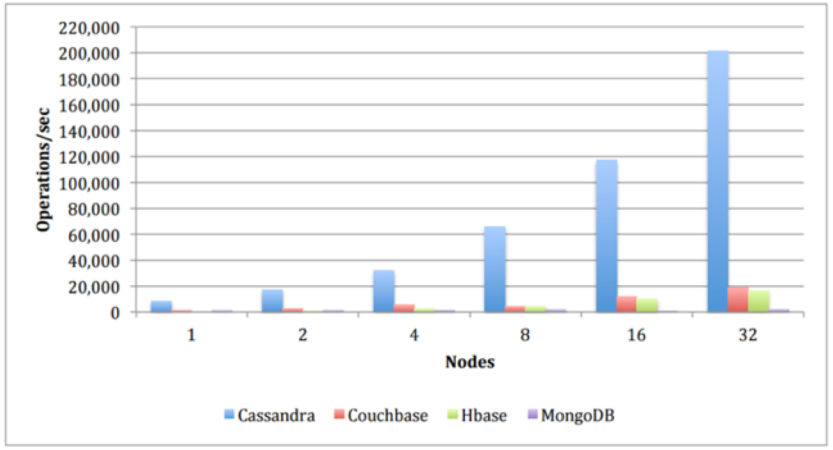
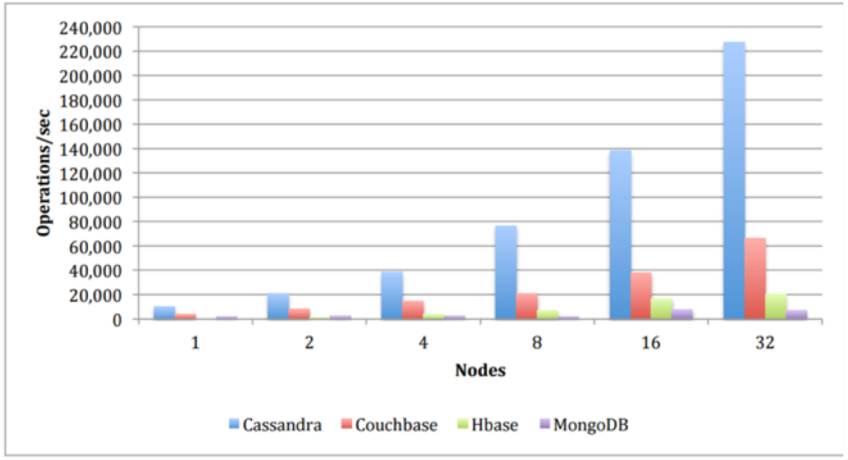
Linear Scalability

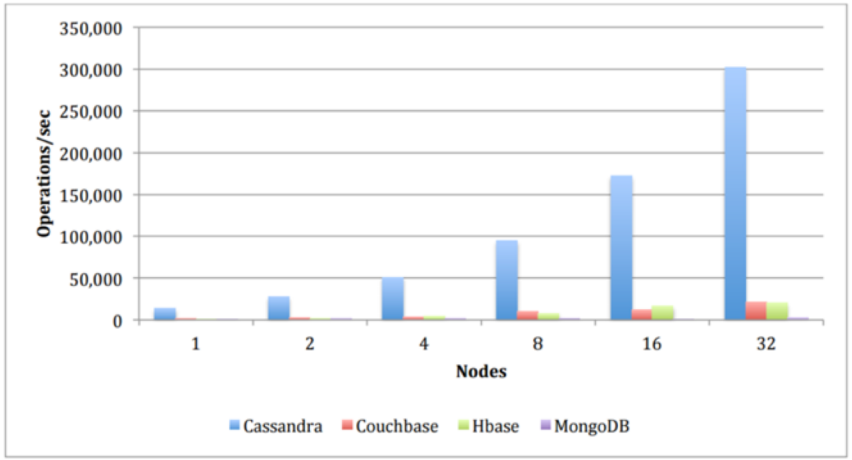
Read-Modify-Write Workload



Read-mostly Workload



Balanced Read/Write Mix



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

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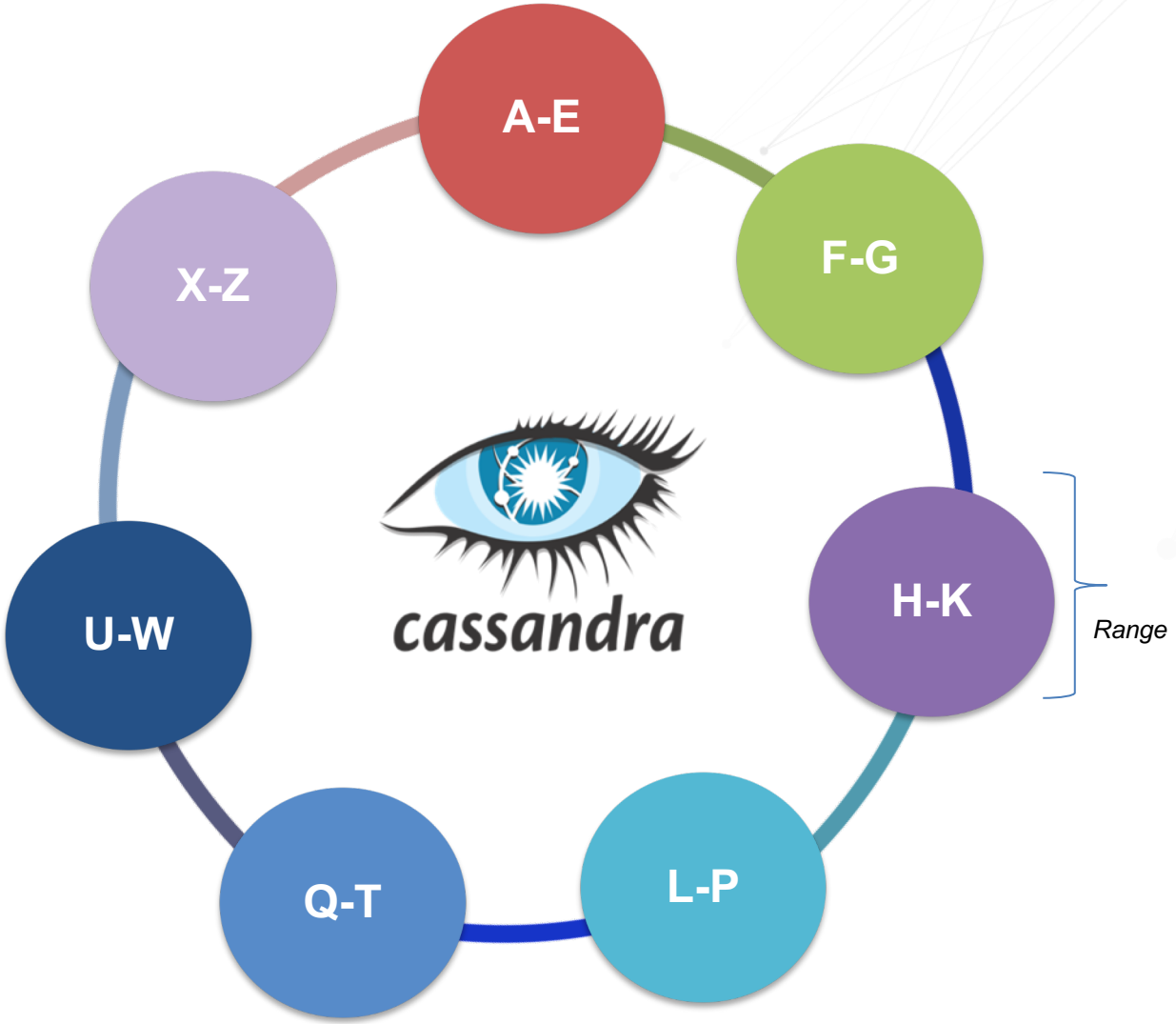
Data is Distributed

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	4.200.000
FR	Toulouse	1.100.000
JP	Tokyo	37.430.000
IN	Mumbai	20.200.000

Partition Key

DATASTAX

Data is Distributed



Data is *Evenly*-distributed

CO	City	Habitant
AU	Sydney	4.900.000
CA	Toronto	6.200.000
CA	Montreal	4.200.000
DE	Berlin	3.350.000
DE	Nuremberg	500.000

Partition Key

Partitionner

Hashing Function

CO	City	Habitant
59	Sydney	4.900.000
12	Toronto	6.200.000
12	Montreal	4.200.000
45	Berlin	3.350.000
45	Nuremberg	500.000

Tokens

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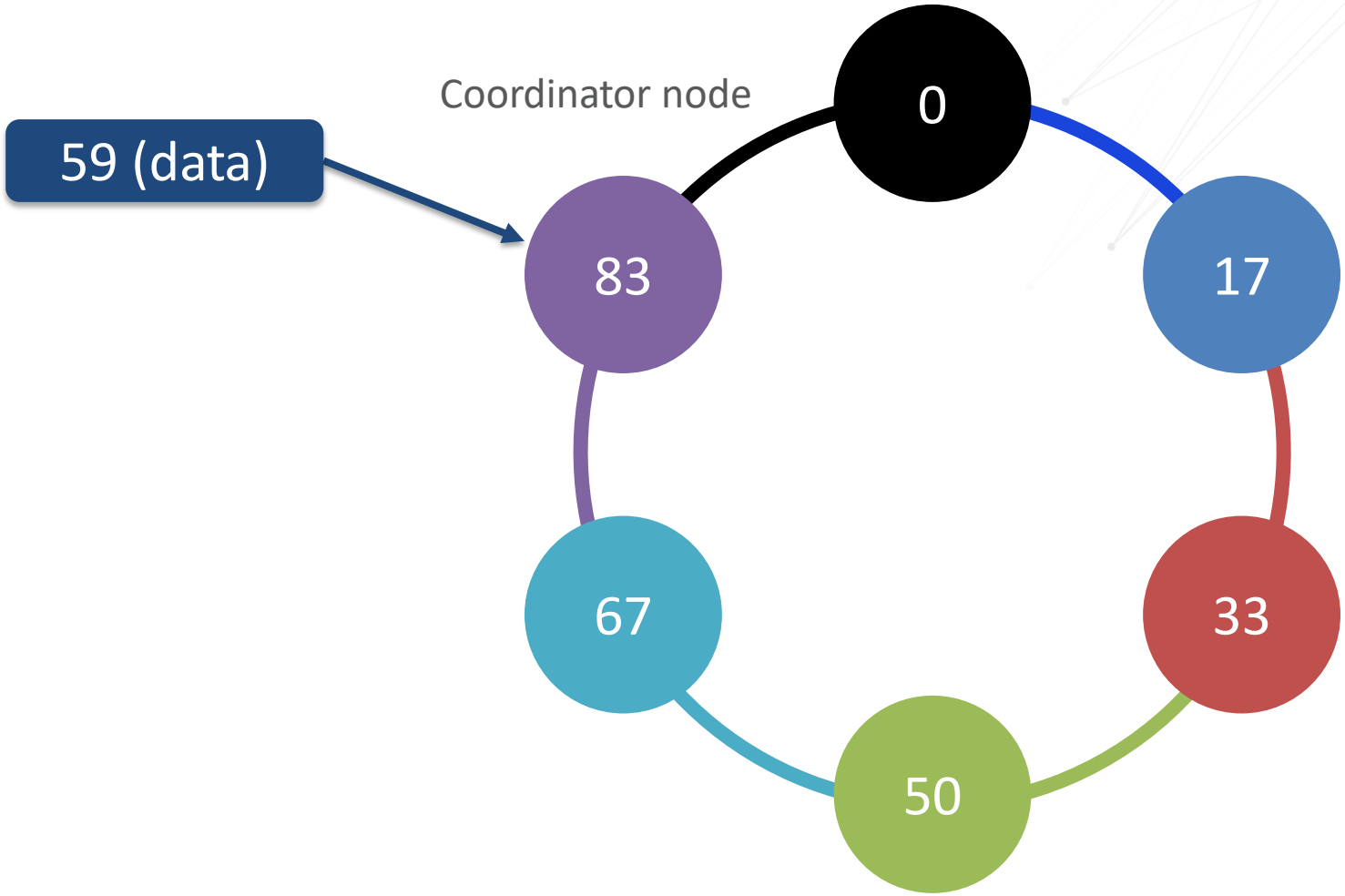
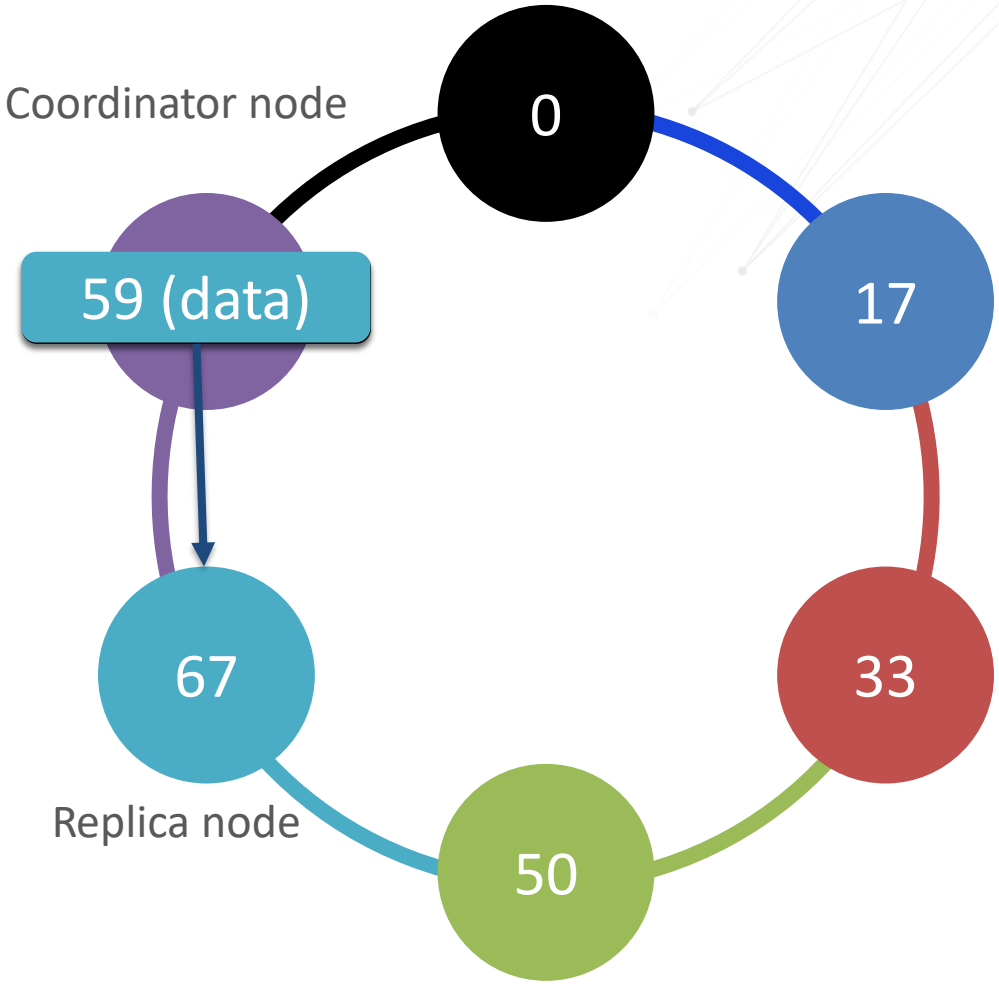
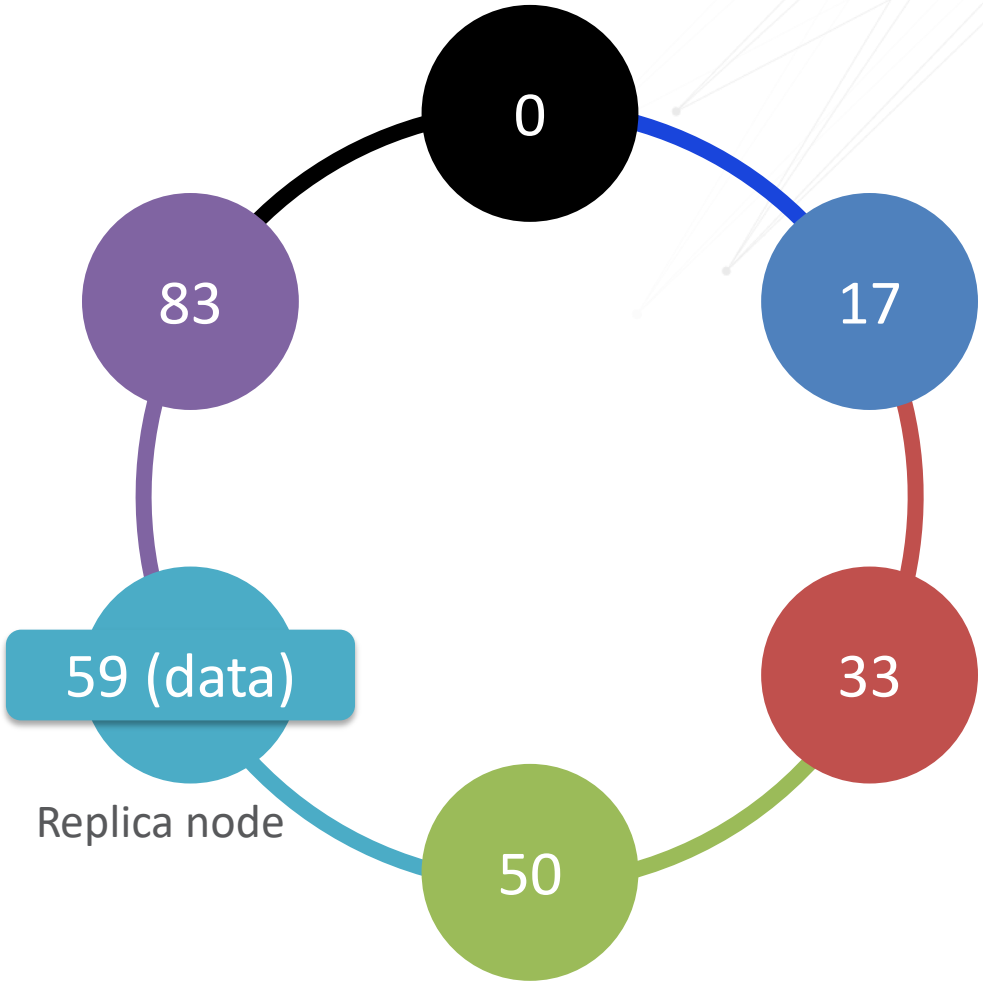
How the Ring Works



How the Ring Works

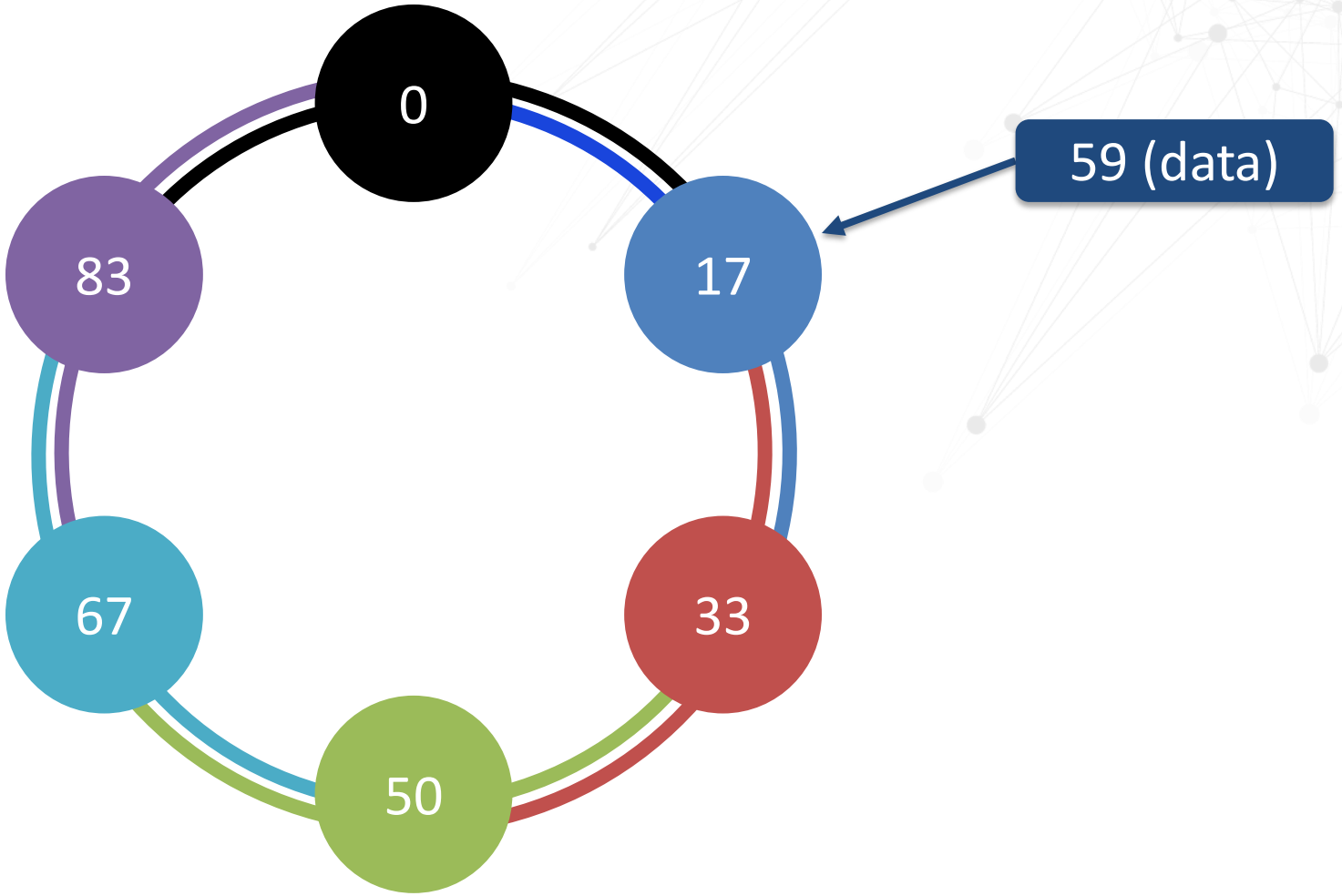


How the Ring Works



Replication within the Ring

RF = 2



Replication within the Ring

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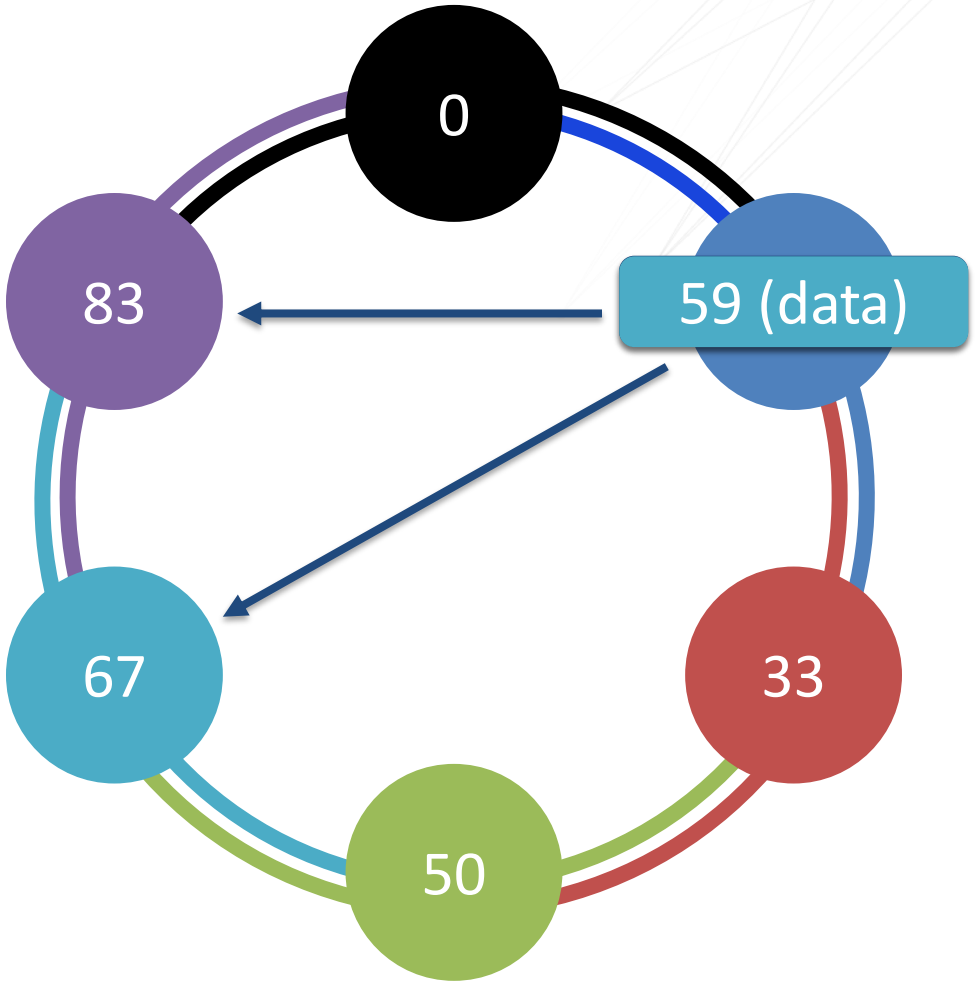
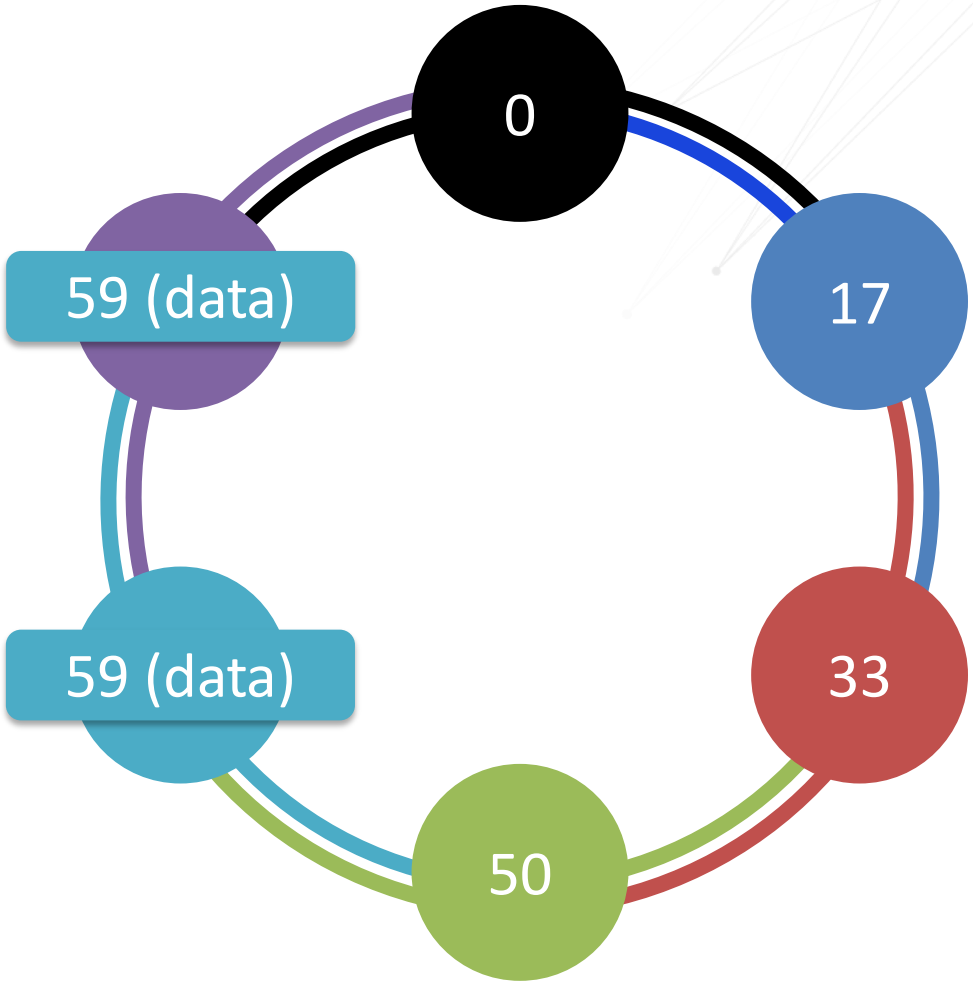


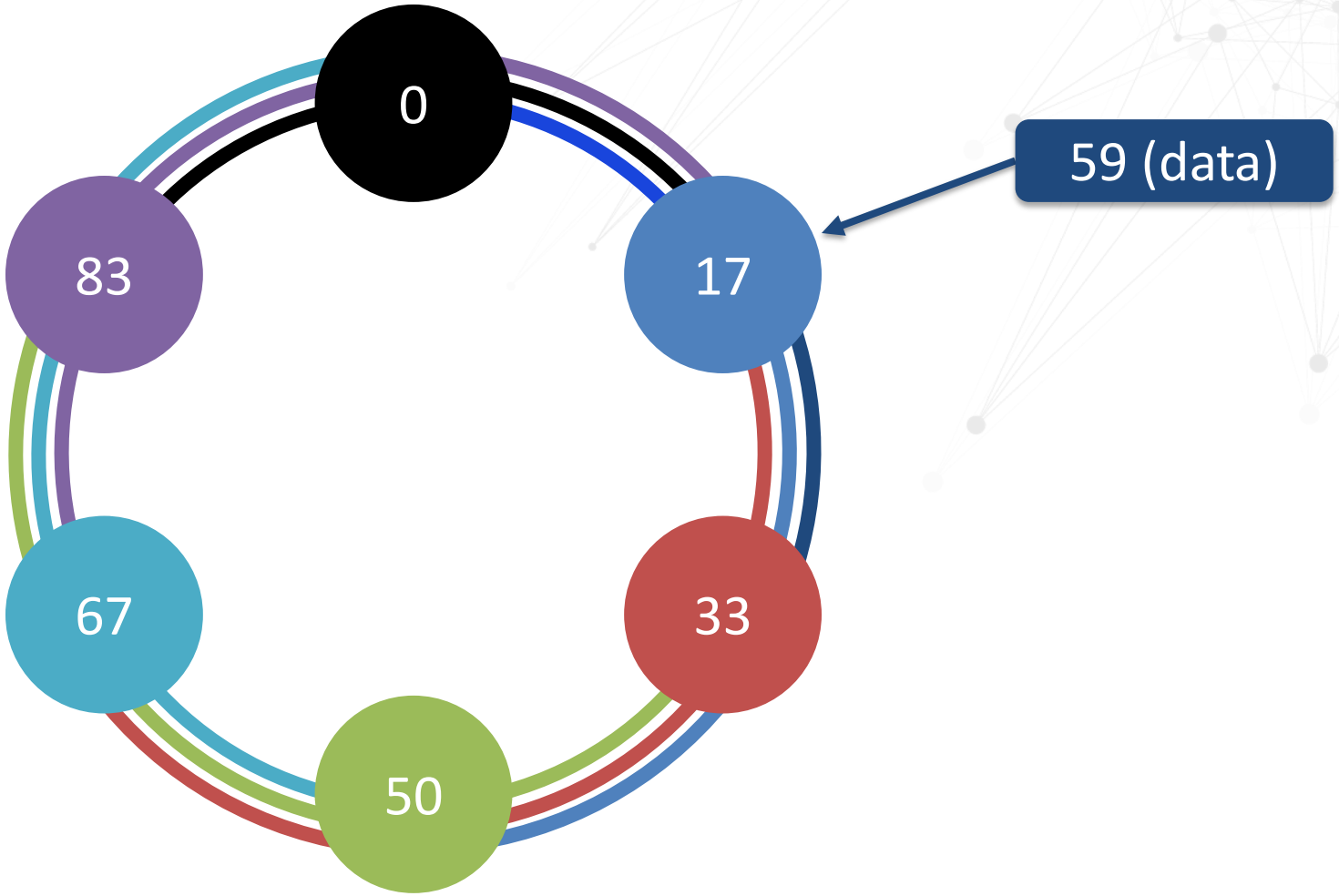
Replication within the Ring

RF = 2



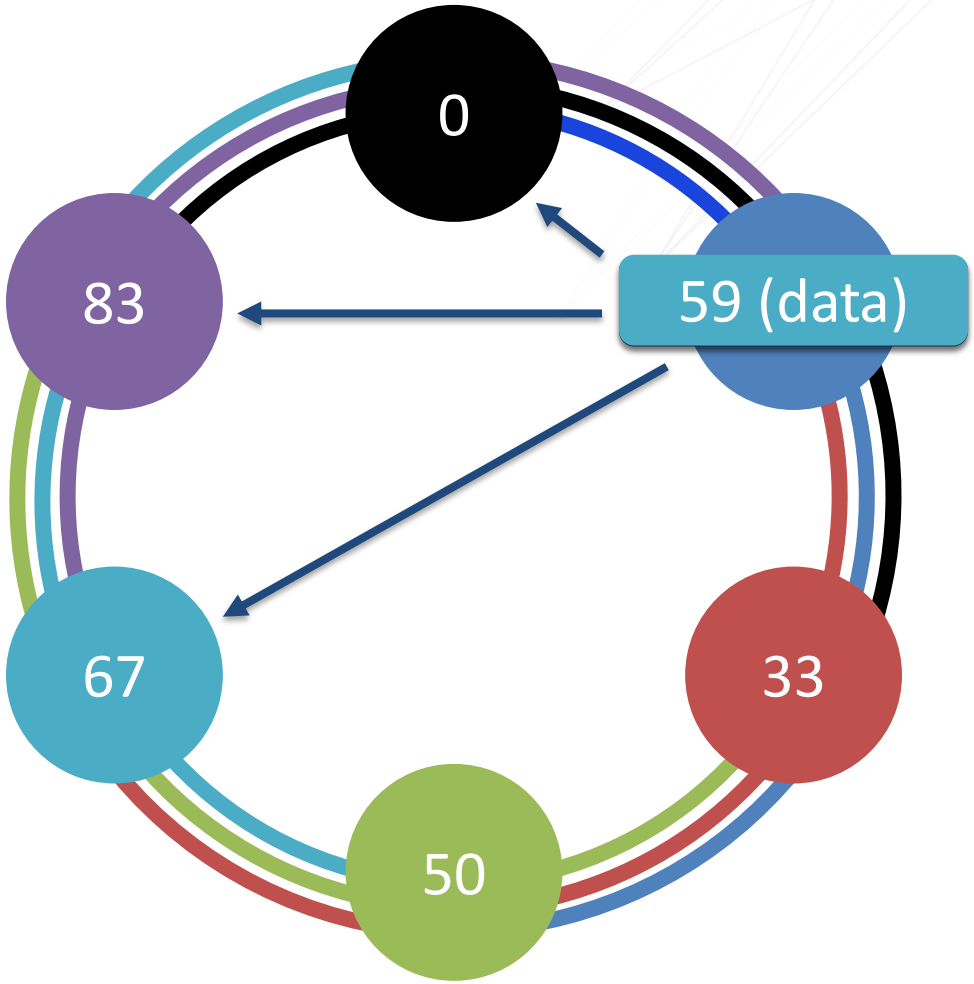
Replication within the Ring

RF = 3



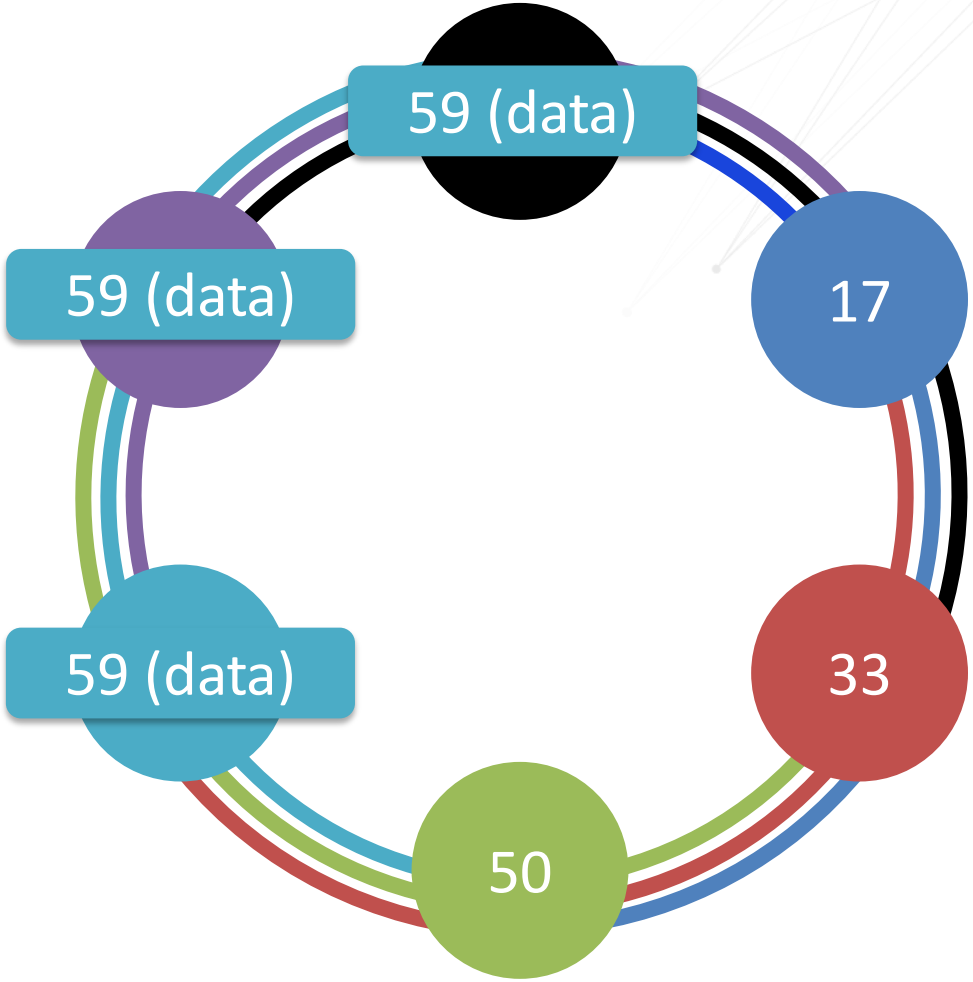
Replication within the Ring

RF = 3



Replication within the Ring

RF = 3



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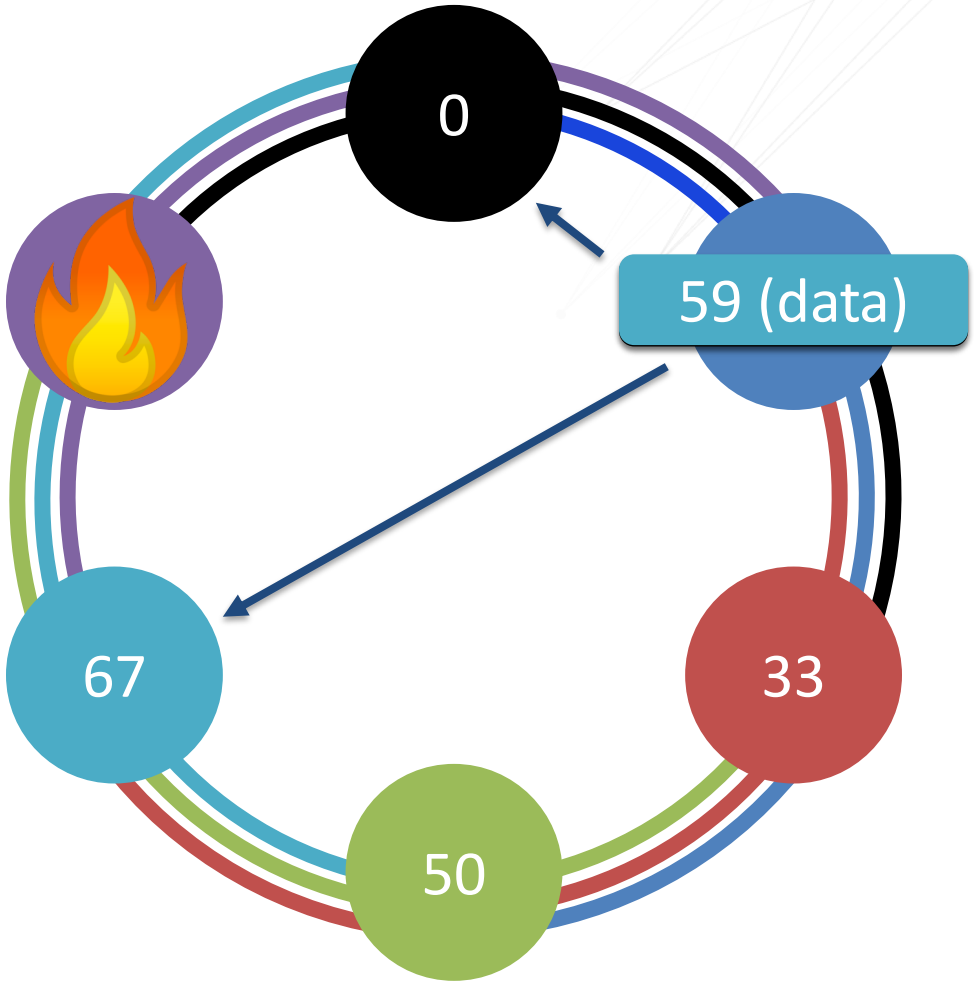
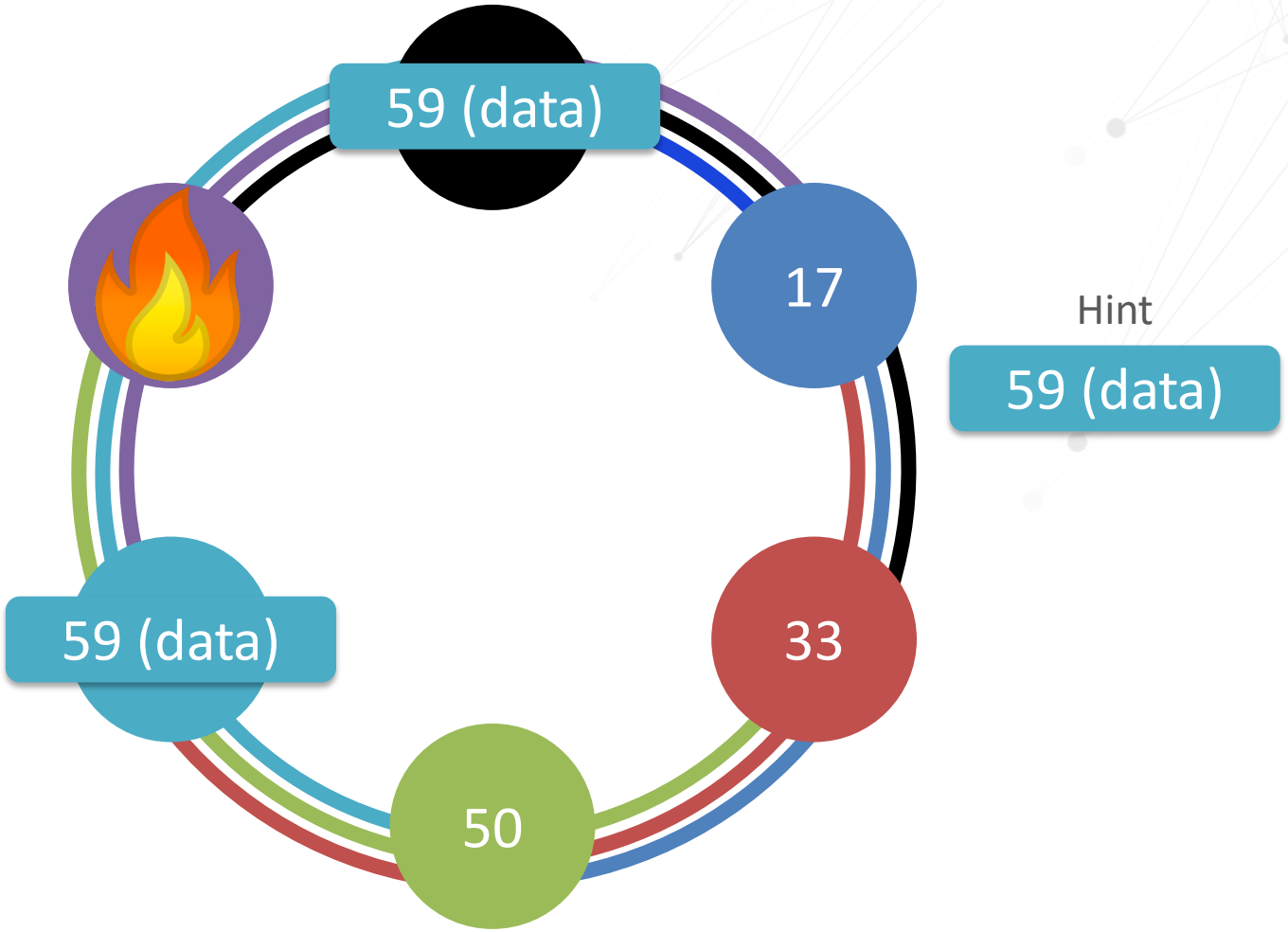
Node Failure

RF = 3



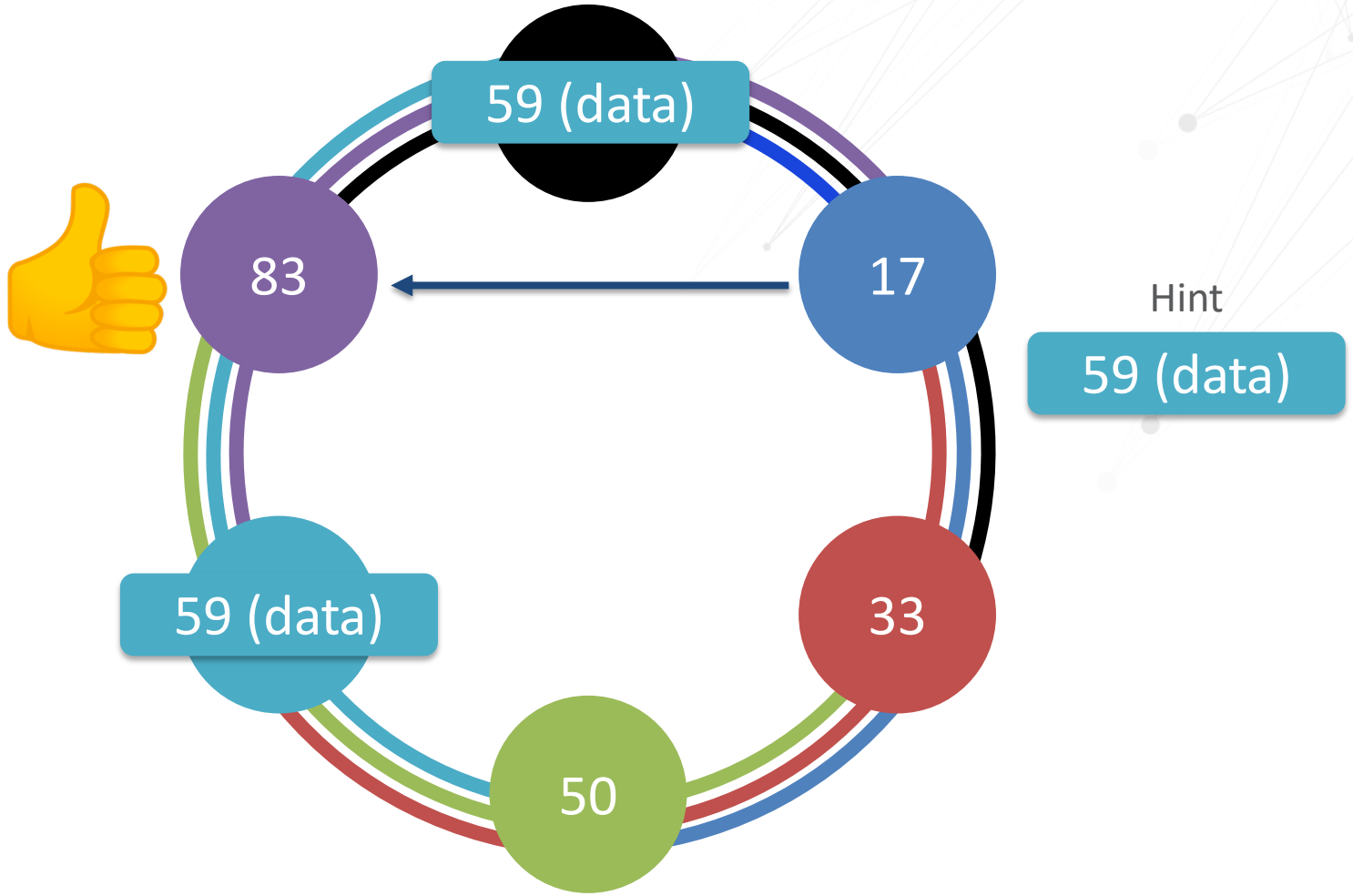
Node Failure

RF = 3



Node Failure

RF = 3

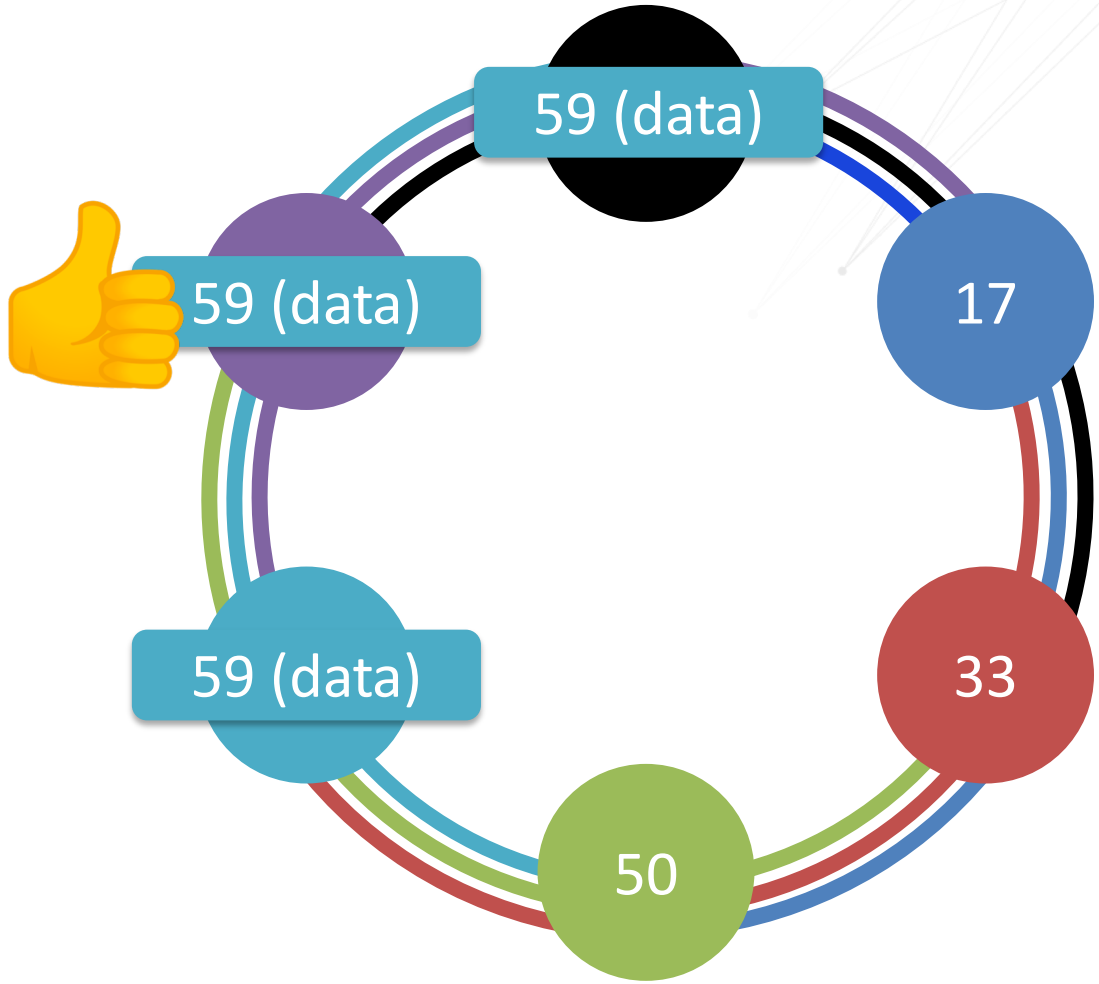


Hint

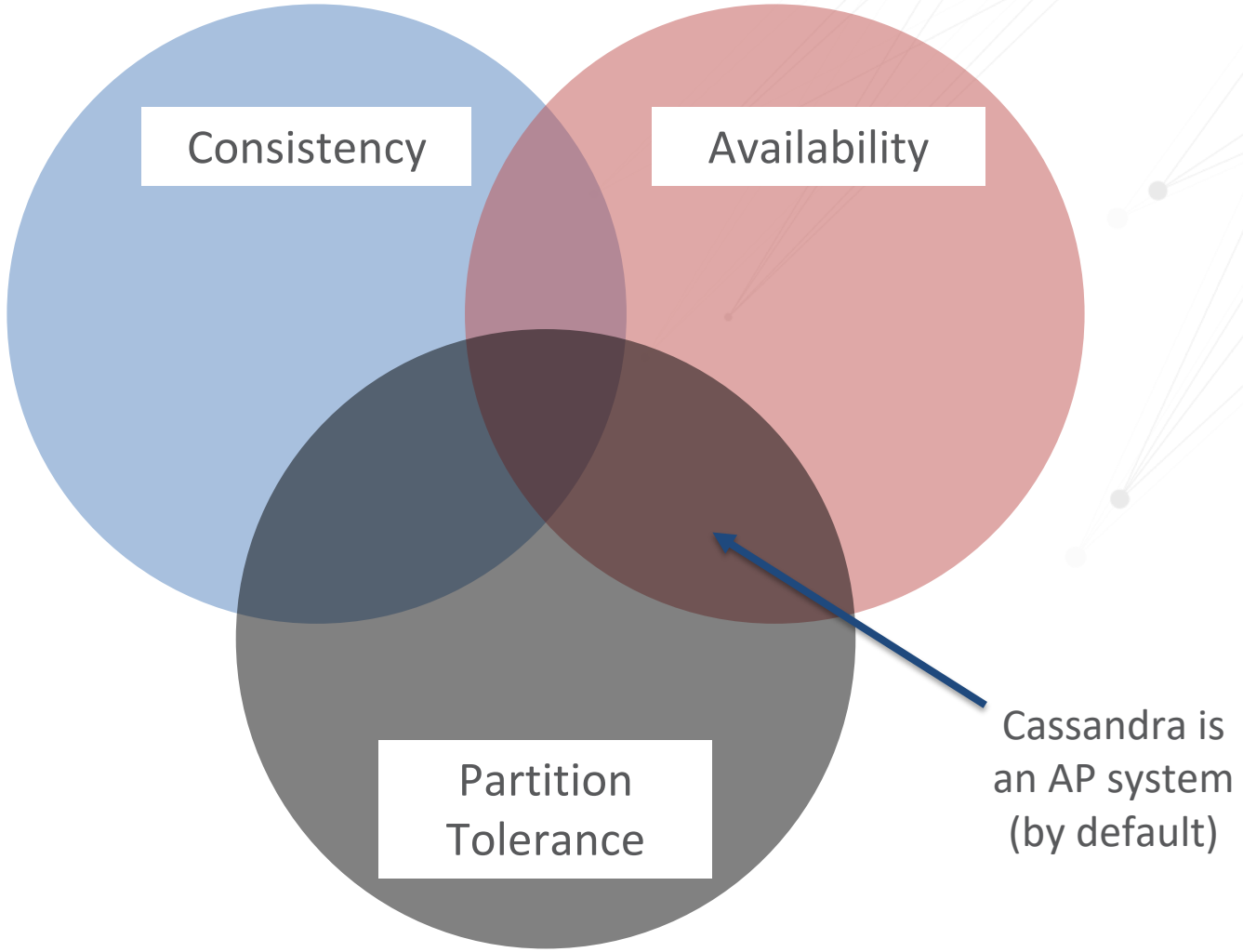
59 (data)

Node Failure – Recovered!

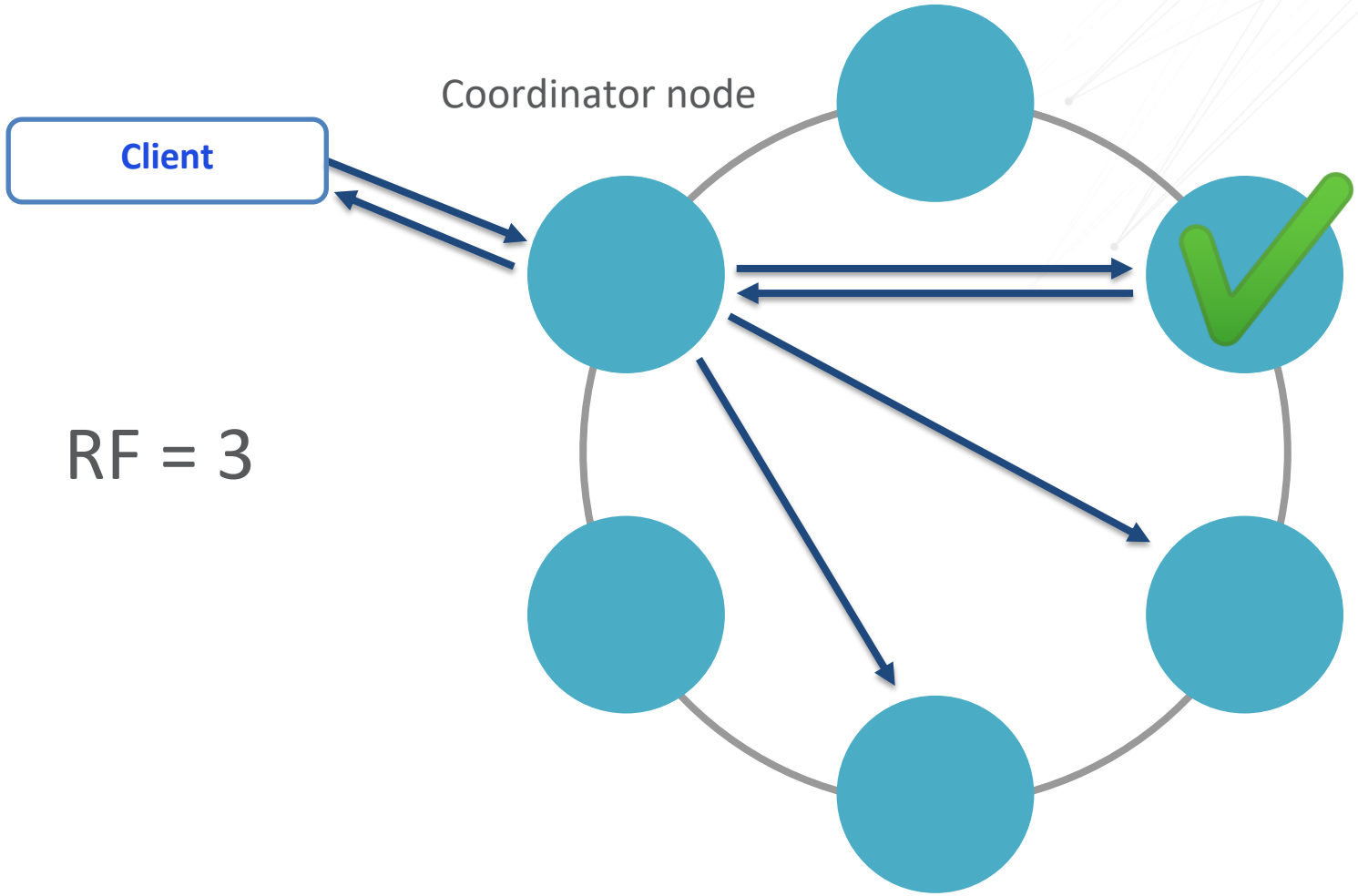
RF = 3



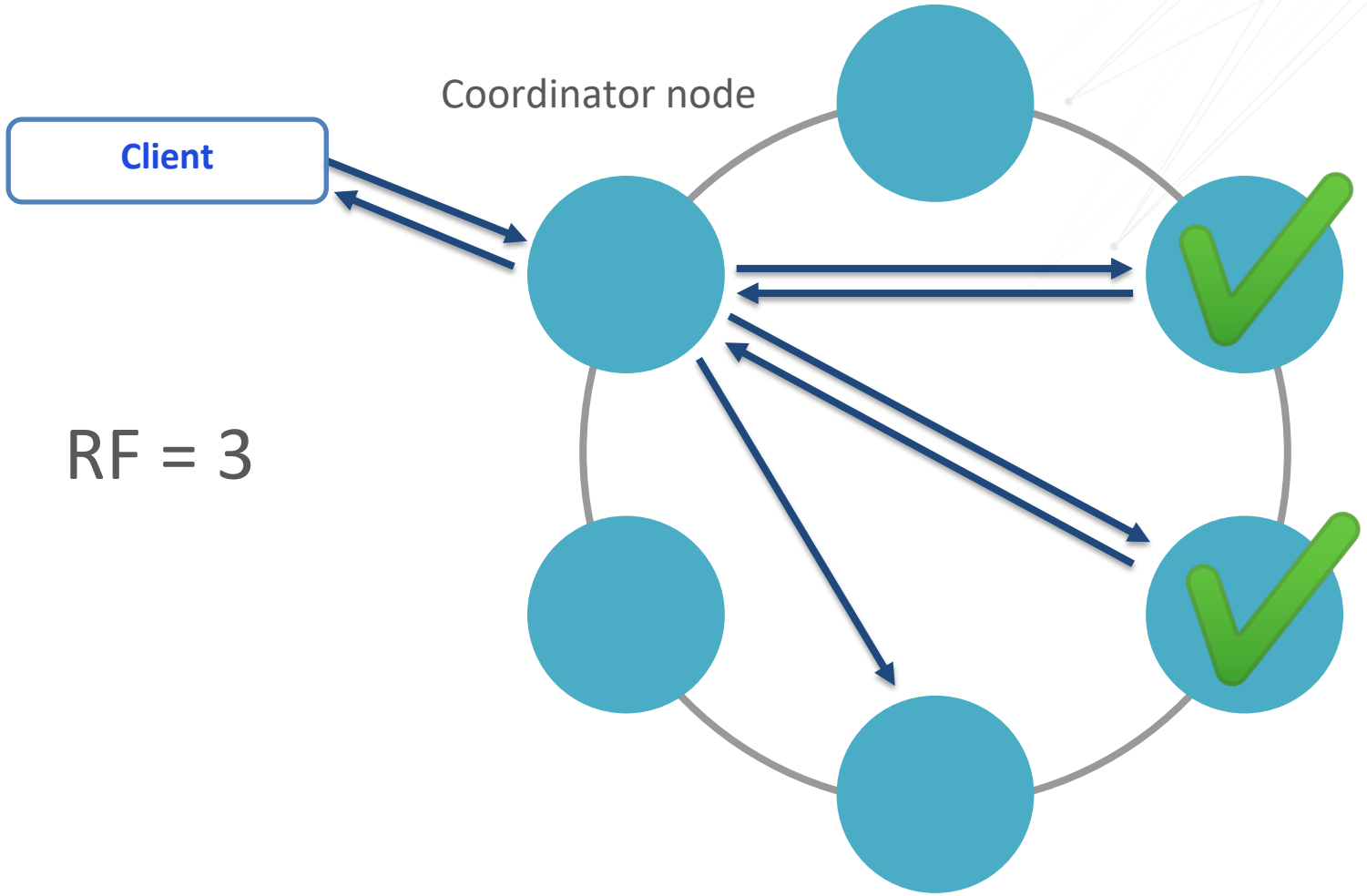
CAP Theorem


Consistency
Availability
Partition Tolerance
Cassandra is an AP system (by default)

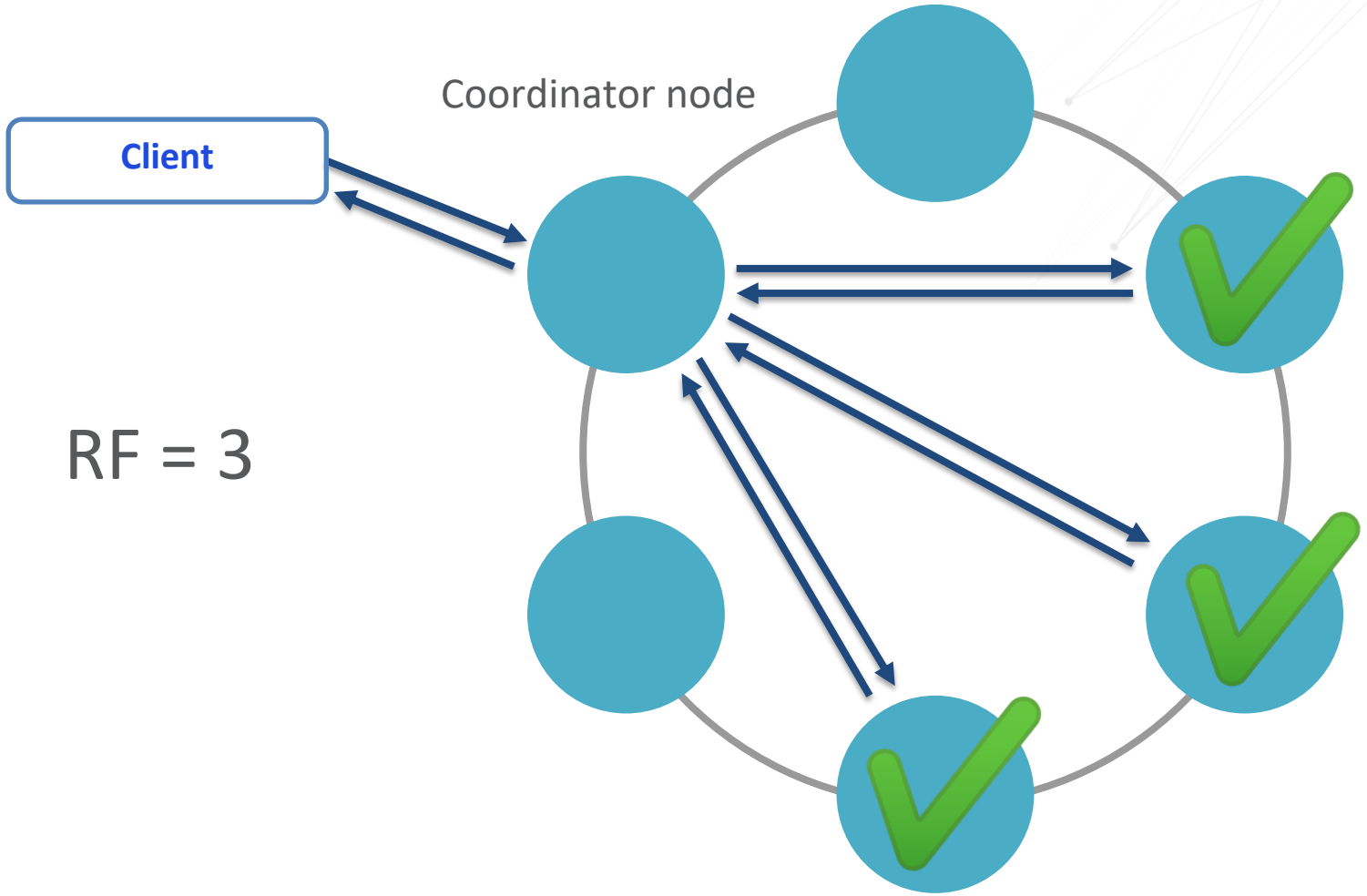
Consistency Levels



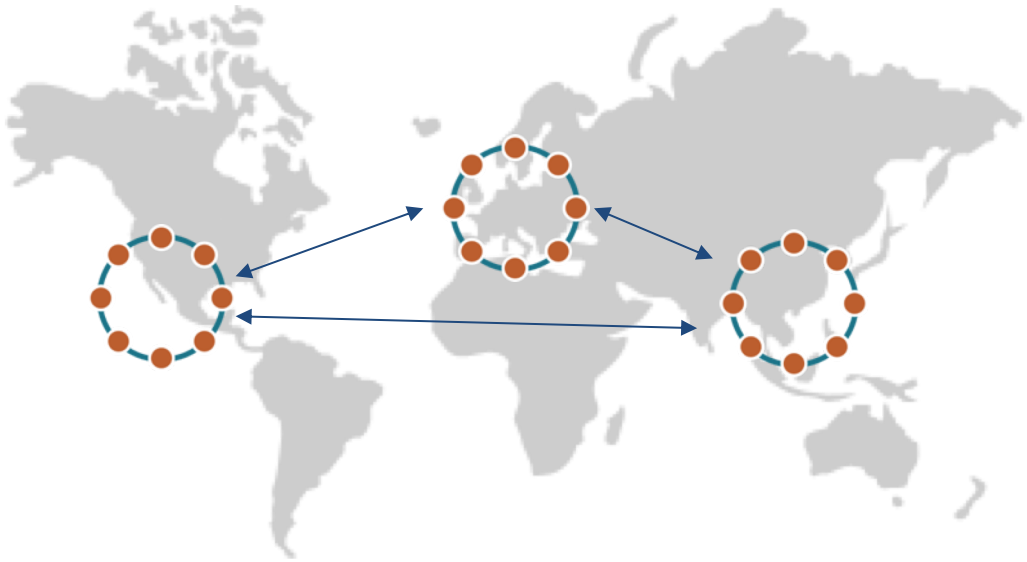
Consistency Levels

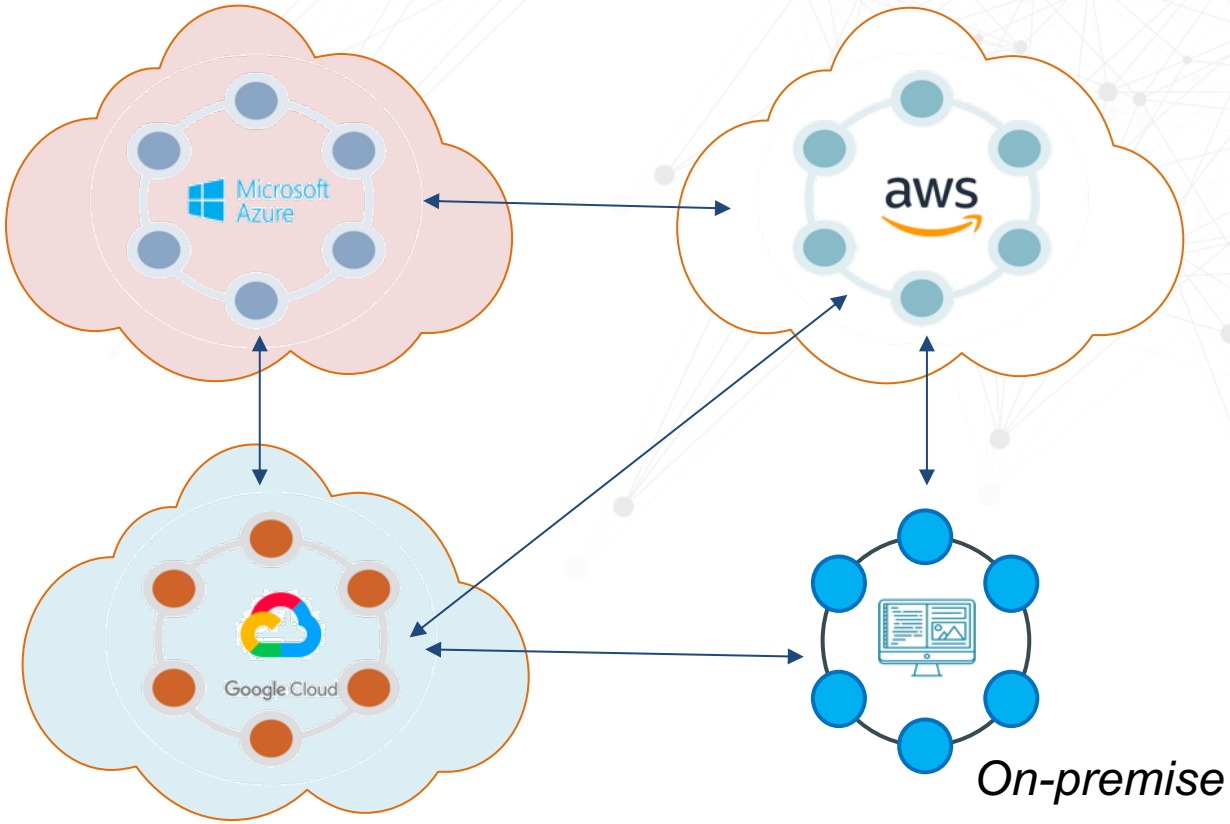


Consistency Levels



Data Distributed Everywhere



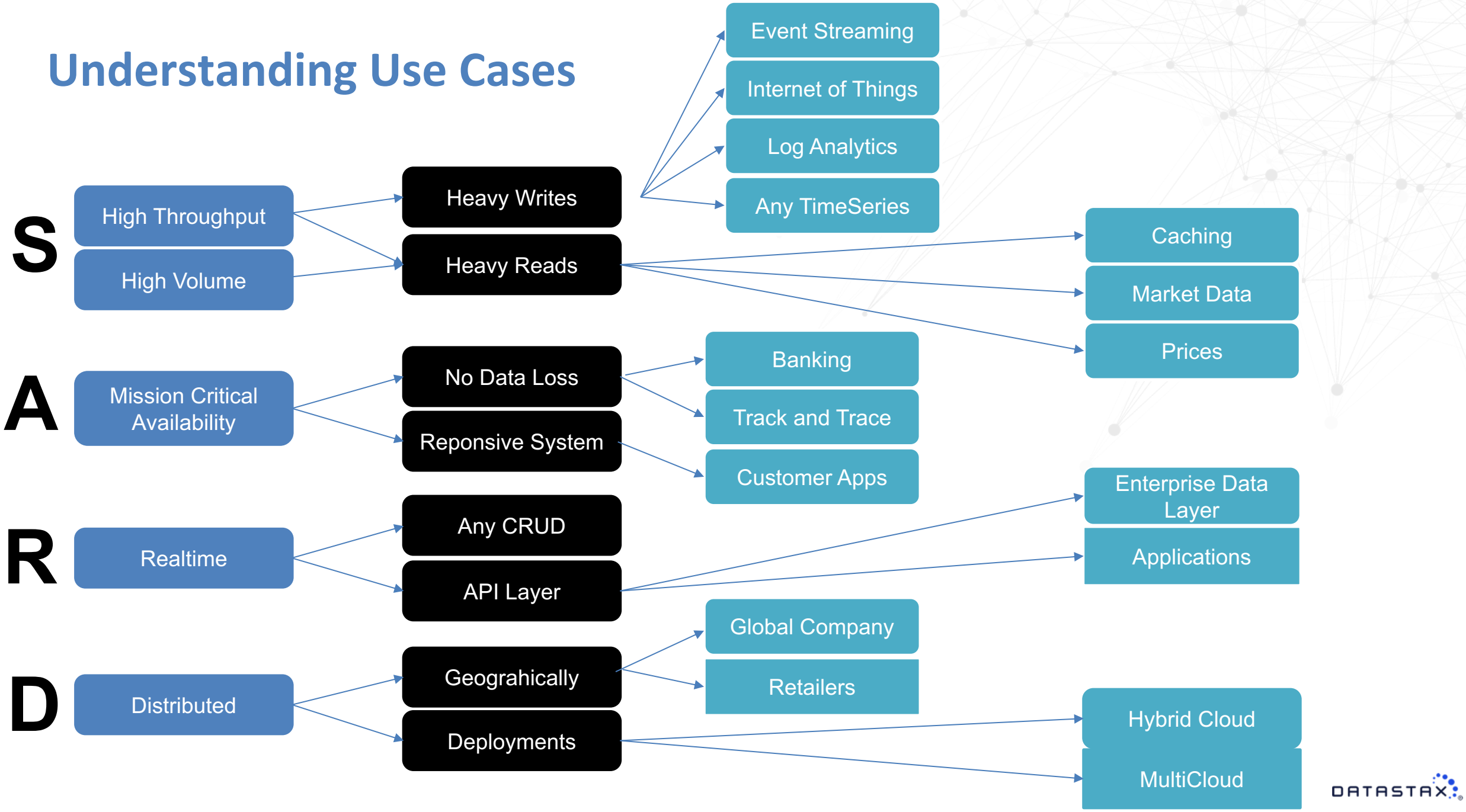


GEOGRAPHICALLY

HYBRID- MULTI CLOUD

DATASTAX

Understanding Use Cases



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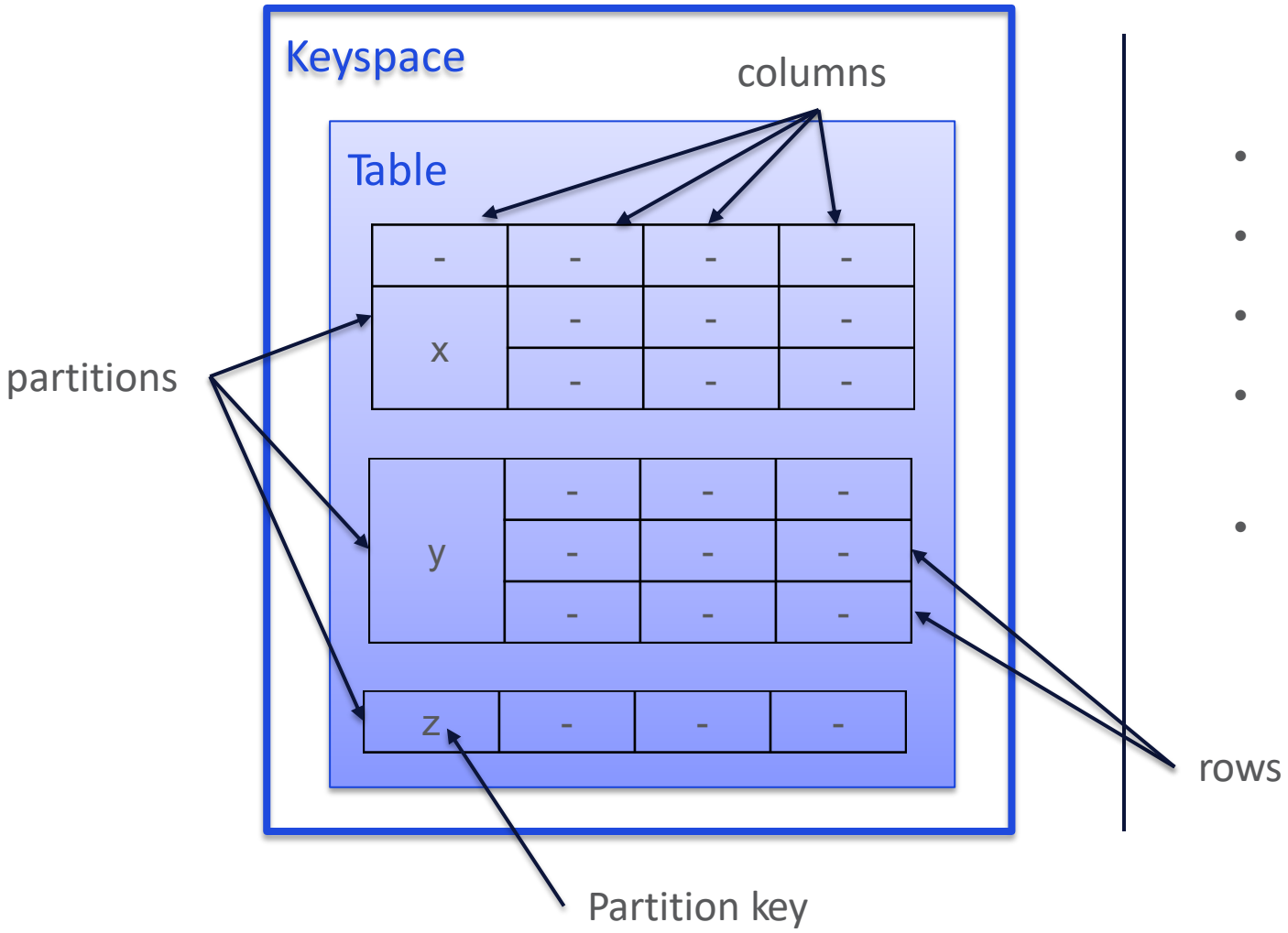
Data Modelling with Apache Cassandra™

Cassandra Structure - Partition



- 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

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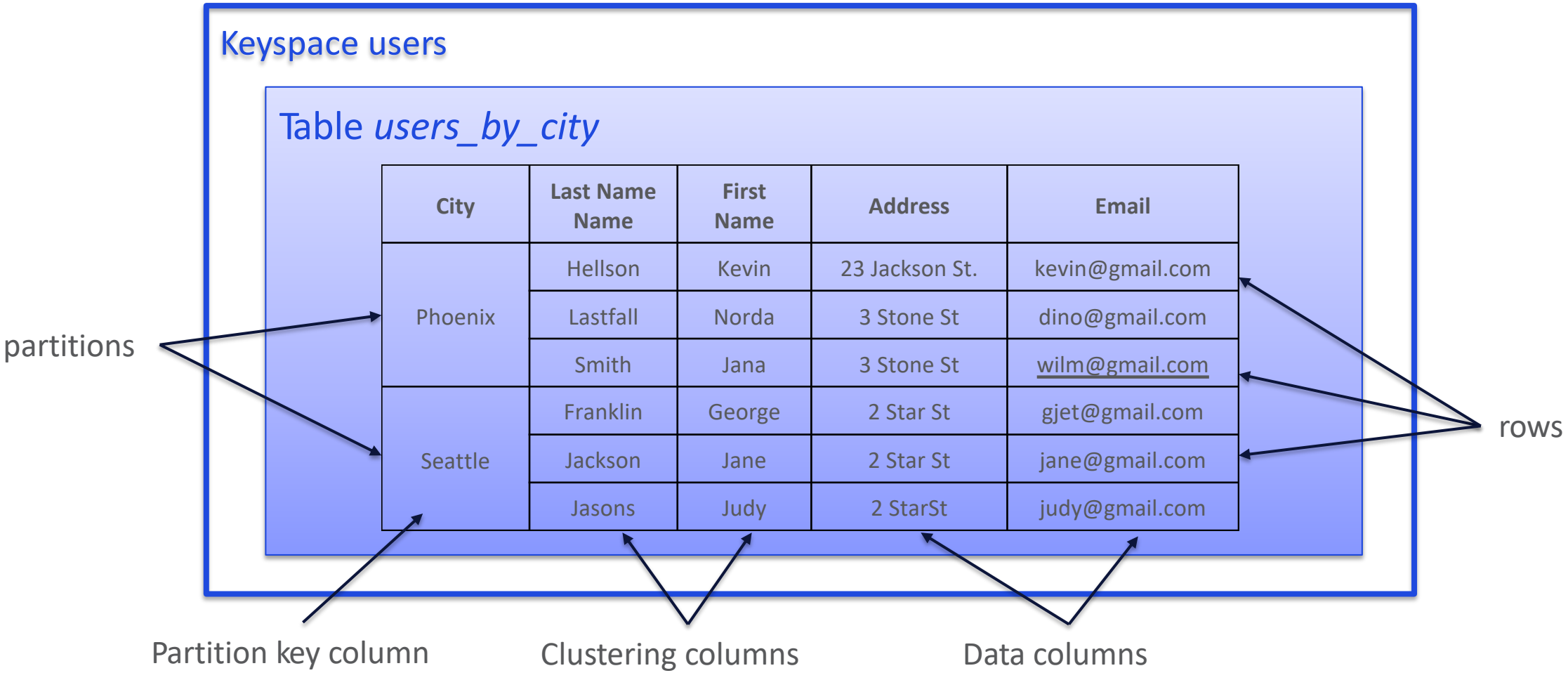
Example Data – Users organized by city



Tables Hold Many Partitions

City	Last Name Name	First Name	Address	Email
Phoenix	Hellson	Kevin	23 Jackson St.	kevin@gmail.com
	Lastfall	Norda	3 Stone St	dino@gmail.com
	Smith	Jana	3 Stone St	wilm@gmail.com

Table *users_by_city*

Tables Hold Many Partitions

City	Last Name Name	First Name	Address	Email
Seattle	Franklin	George	2 Star St	gjet@gmail.com
	Jackson	Jane	2 Star St	jane@gmail.com
	Jasons	Judy	2 StarSt	judy@gmail.com

Table *users_by_city*

City	Last Name	First Name	Address	Email
Phoenix	----	----	----	----
	----	----	----	----
	----	----	----	----

Tables Hold Many Partitions

City	Last Name Name	First Name	Address	Email
Charlotte	Azrael	Chris	5 Blue St	chris@gmail.com
	Stilson	Brainy	7 Azure ln	brain@gmail.com
	Smith	Cristina	4 Teal Cir	clu@gmail.com
	Sage	Grant	9 Royal St	grant@gmail.com
	Seterson	Peter	2 Navy Ct	peter@gmail.com

Table *users_by_city*

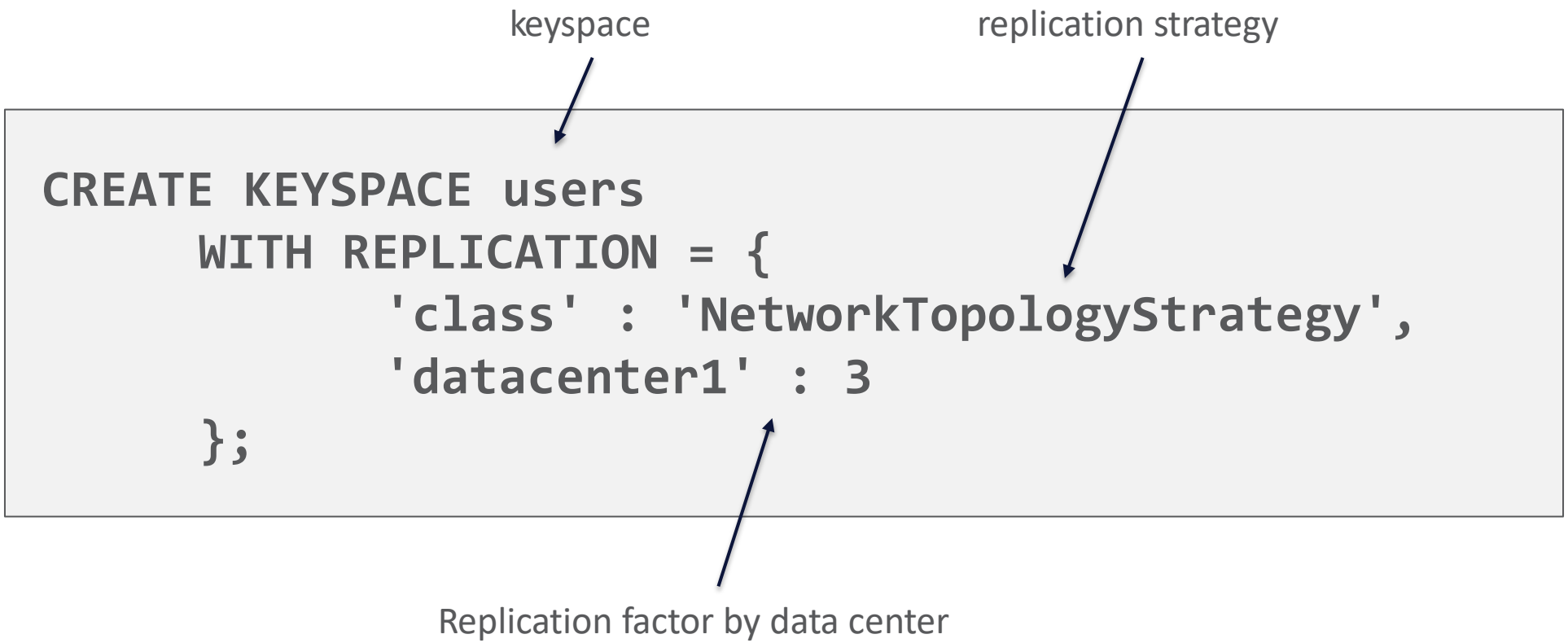
City	Last Name	First Name	Address	Email
Phoenix	----	----	----	----
	----	----	----	----
	----	----	----	----
Seattle	----	----	----	----
	----	----	----	----
	----	----	----	----

Tables Hold Many Partitions

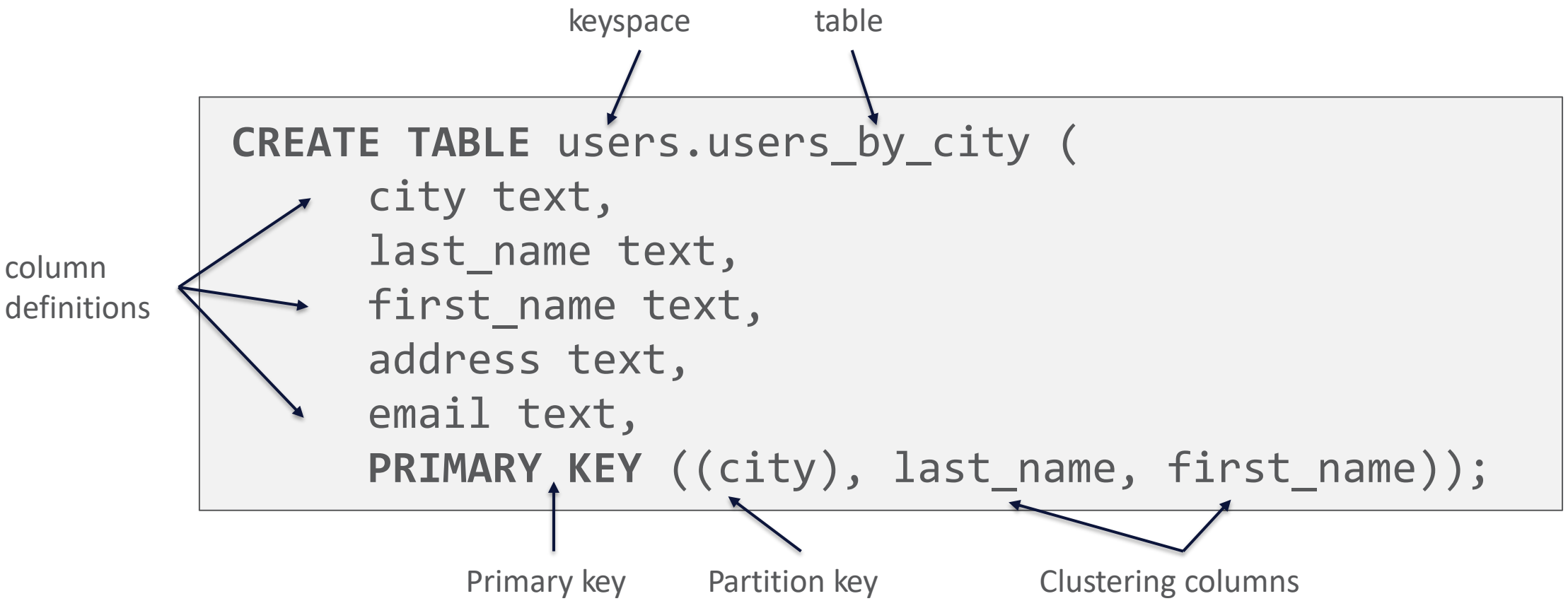
Table *users_by_city*

City	Last Name	First Name	Address	Email
Phoenix	----	----	----	----
	----	----	----	----
	----	----	----	----
Seattle	----	----	----	----
	----	----	----	----
	----	----	----	----
Charlotte	----	----	----	----
	----	----	----	----
	----	----	----	----

Creating a Keyspace in CQL



Creating a Table in CQL



Time for exercises

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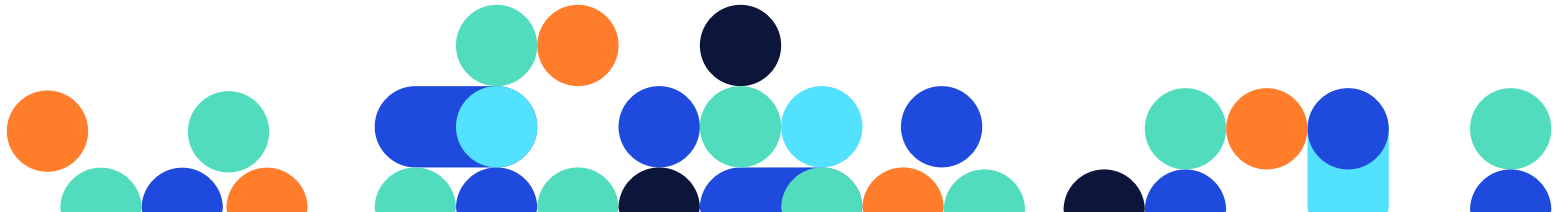
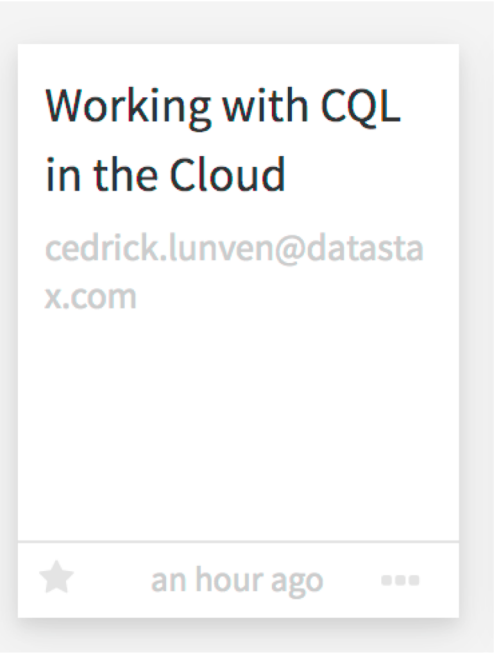
DataStax Studio



#1 – Working with CQL in the Cloud

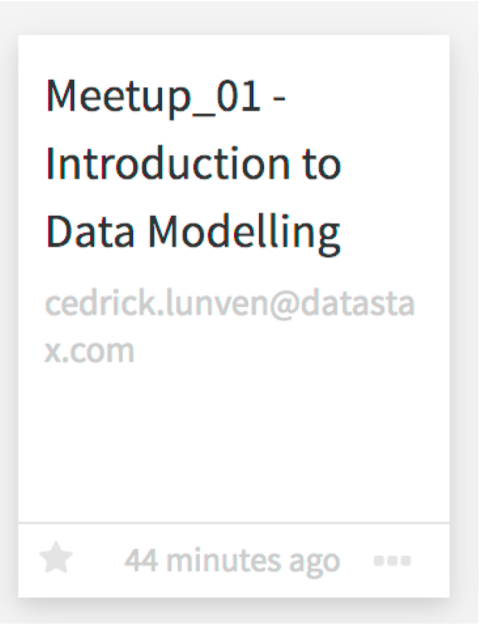
- Check that your Database is UP in Apollo
- Open DataStax Studio
- Navigate to « **Working with CQL in the Cloud** »
- Play with the Notebook



DATASTAX

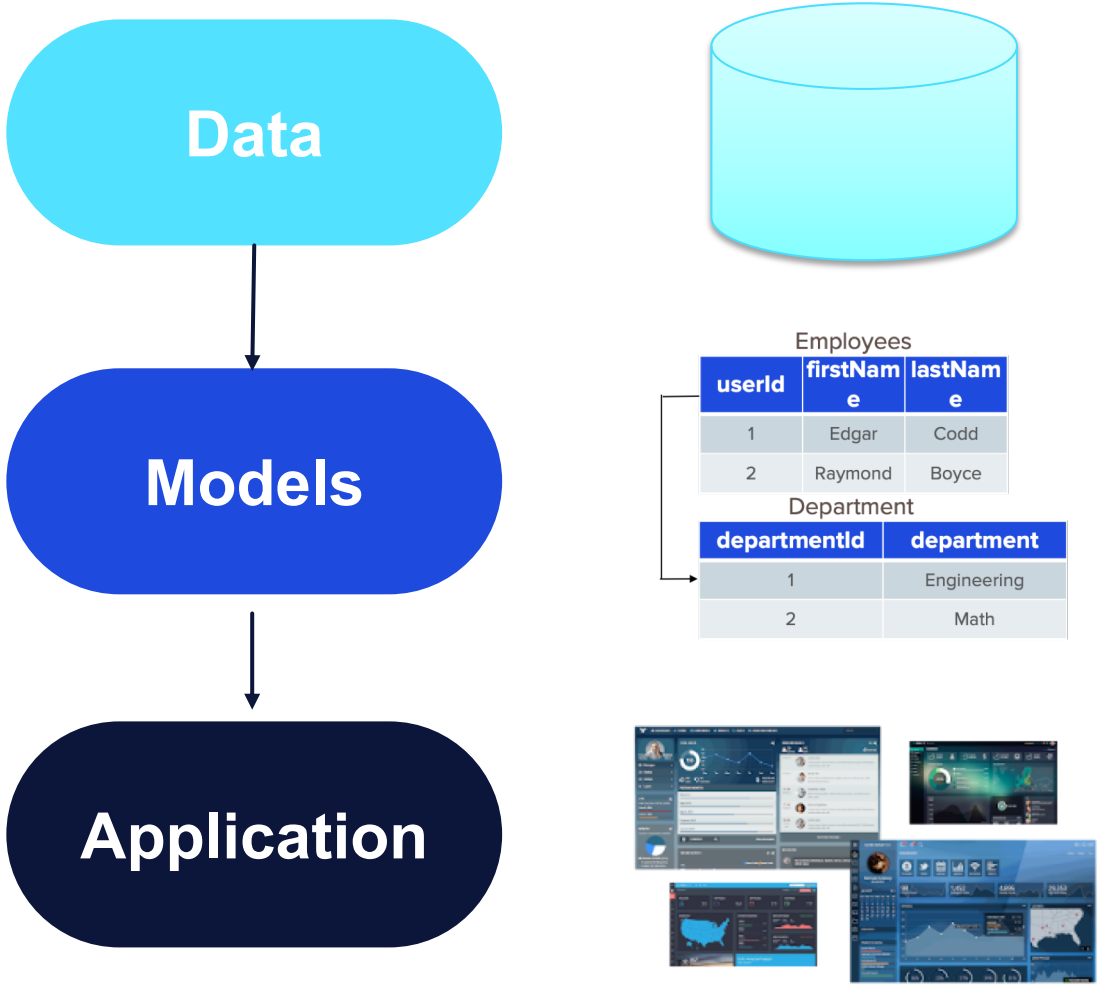
#2 – Introduction to Data Modelling

- `git clone https://github.com/clun/meetup_zero2Cloud.git`
- Locate the ”**notebooks**” the folder
- Drag and drop « **Meetup_01 - Introduction to Data Modelling** » in the Studio
- Execute the exercises in the Notebook

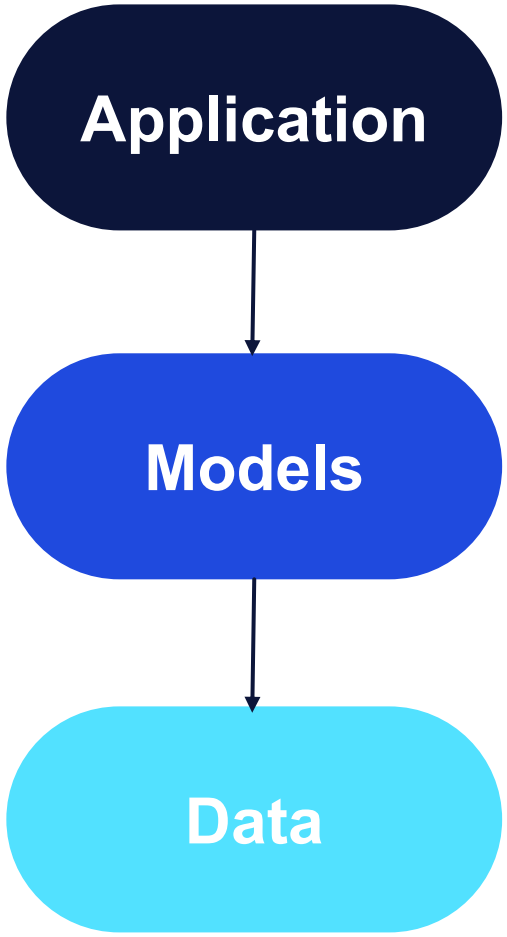


DATASTAX

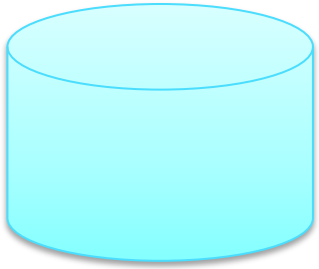
Relational Modeling



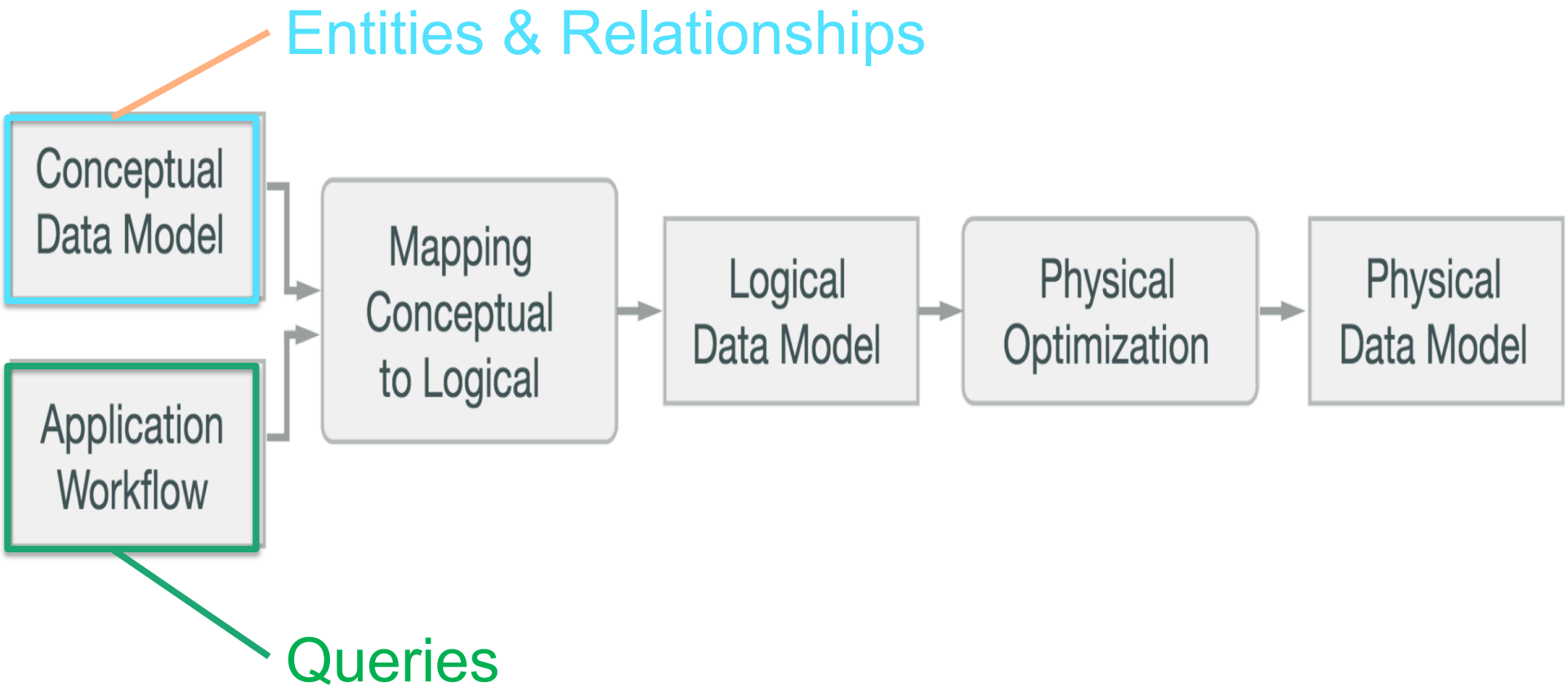
Cassandra Modeling



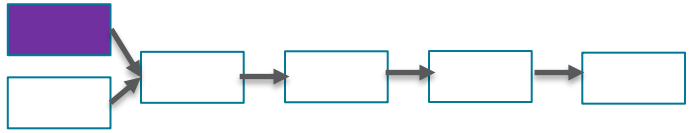
id	firstName	lastName	department
1	Edgar	Codd	Engineering
2	Raymond	Boyce	Math

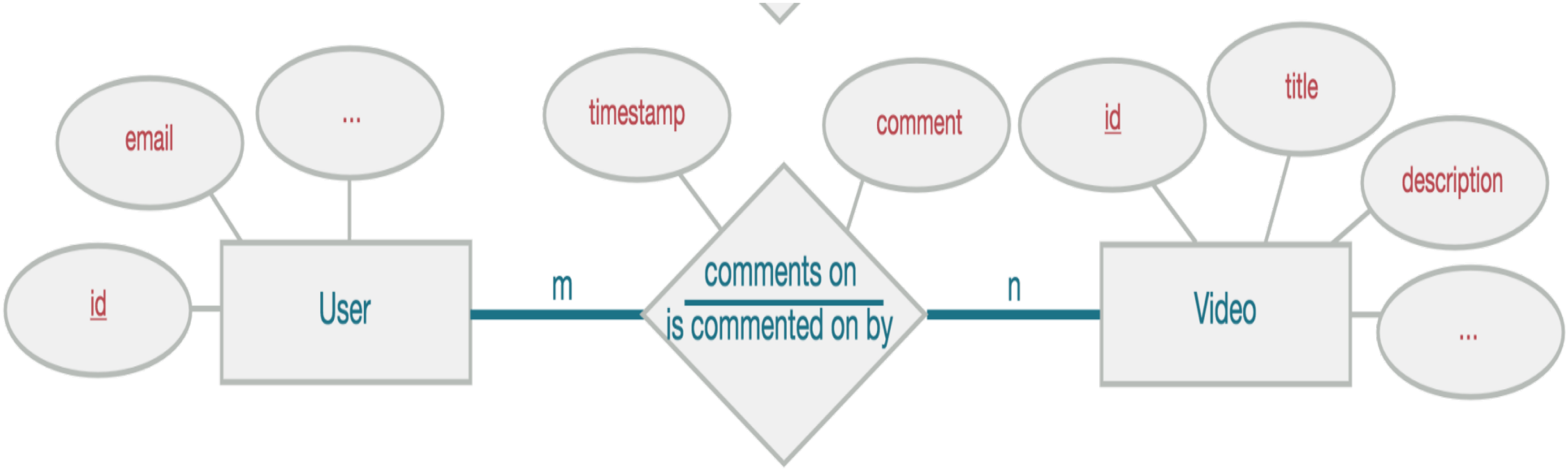


Designing Data Model

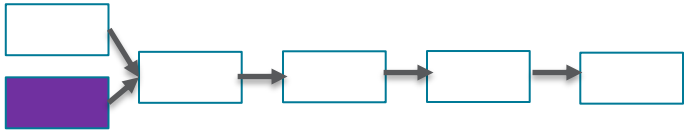


Conceptual Data Model





Application Workflow

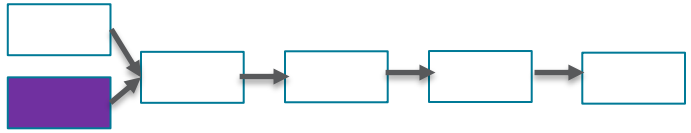


R1: Find comments related to target video using its identifier
- Get most recent first
- Implement Paging

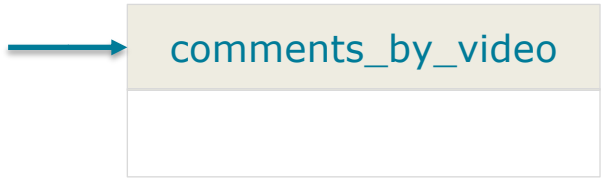
R2: Find comments related to target user using its identifier
- Get most recent first
- Implement Paging

R3: Implement CRUD operations

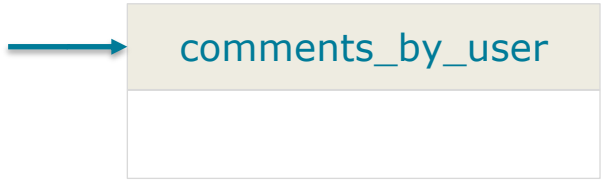
Mapping



Q1: Find comments for a video with a known id (show most recent first)

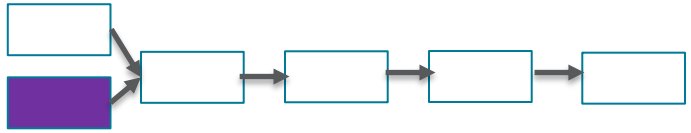


Q2: Find comments posted for a user with a known id (show most recent first)



Q3: CRUD Operations

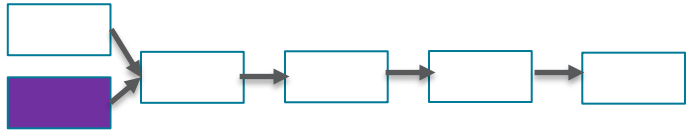
Logical Data Model



comments_by_user	
userid	K
creationdate	C ↓
commentid	C ↑
videoid	
comment	

comments_by_video	
videoid	K
creationdate	C ↓
commentid	C ↑
userid	
comment	

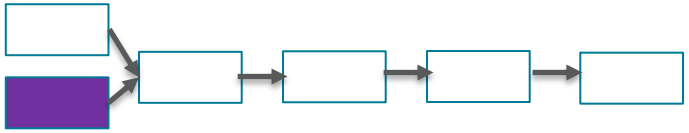
Physical Data Model



comments_by_user		
userid	UUID	K
commentid	TIMEUUID	C ↓
videoid	UUID	
comment	TEXT	

comments_by_video		
videoid	UUID	K
commentid	TIMEUUID	C ↓
userid	UUID	
comment	TEXT	

Schema DDL



```
CREATE TABLE IF NOT EXISTS comments_by_user (
    userid uuid,
    commentid timeuuid,
    videoid uuid,
    comment text,
    PRIMARY KEY ((userid), commentid)
) WITH CLUSTERING ORDER BY (commentid DESC);


CREATE TABLE IF NOT EXISTS comments_by_video (
    videoid   uuid,
    commentid timeuuid,
    userid    uuid,
    comment   text,
    PRIMARY KEY ((videoid), commentid)
) WITH CLUSTERING ORDER BY (commentid DESC);
```

Time for an exercise!

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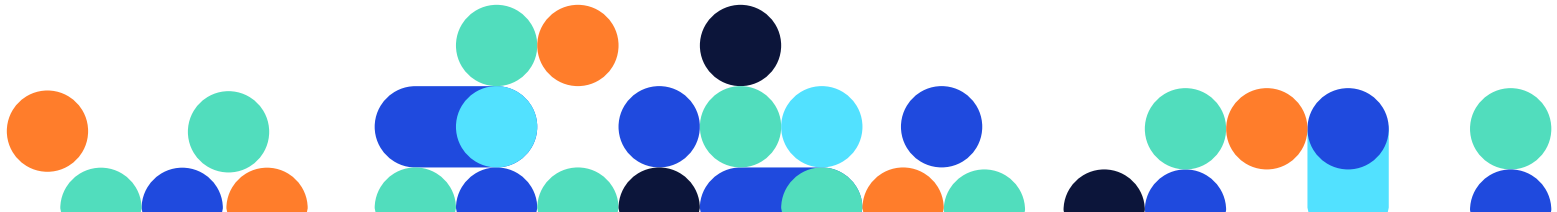
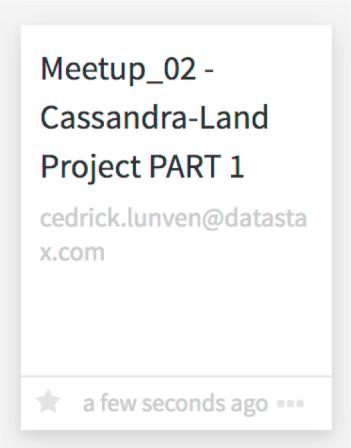
“Designing Queries” Notebook

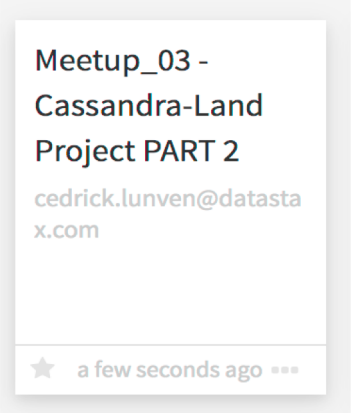


#3 – Cassandra Land

- Drag and drop « **Meetup_02 – Cassandra-Land PART 1** » in the Studio
- Execute the exercises in the Notebook



- Drag and drop « **Meetup_03 – Cassandra-Land PART 3** » in the Studio
- Execute the exercises in the Notebook



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Agenda

0 **Bootstraping**

1 **Understanding Apache Cassandra™ Use Cases**

2 **Data Modelling with Apache Cassandra™**

3 **Application Development**

4 **What's NEXT ?**

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Meetup @Stockholm

DATASTAX

Application Development

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

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Apache Maven™

- OSS Driver

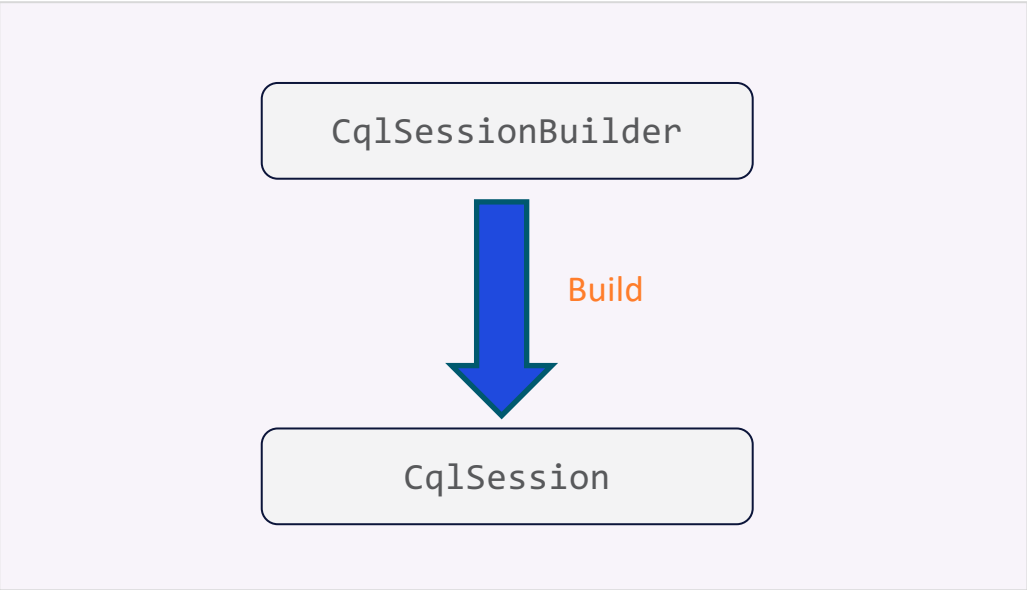
```
<dependency>
 <groupId>com.datastax.oss</groupId>
 <artifactId>java-driver-core</artifactId>
</dependency>
```

- DSE Driver

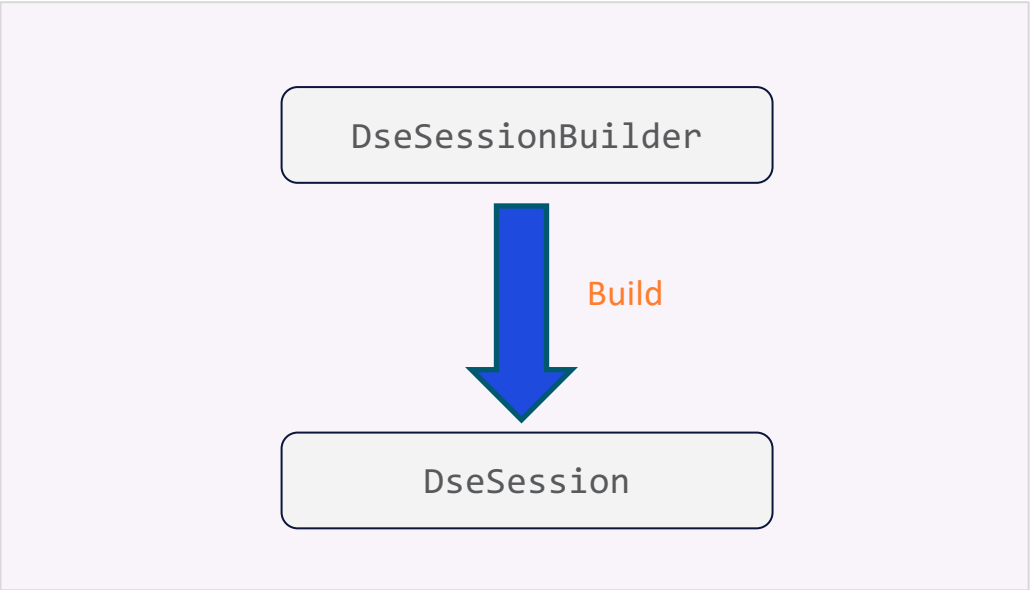
```
<<dependency>
 <groupId>com.datastax.dse</groupId>
 <artifactId>dse-java-driver-core</artifactId>
</dependency>
```

Connectivity

- OSS Driver



- DSE Driver



NB : "Cluster" concept from previous driver versions has been collapsed into "Session"

Builder

```
// Delegate all configuration to file or default
CqlSession cqlSession = CqlSession.builder().build();

// Explicit Settings
CqlSession cqlSession = CqlSession.builder()
 .withCloudSecureConnectBundle(Paths.get("/tmp/apollo.zip"))
 .withKeyspace("killrvideo")
 .withAuthCredentials("myUser", "myPassword")
 .build();
```

How to to execute queries ?

- First job of **CqlSession** is to execute queries using, well, execute method.

```
cqlSession.execute("SELECT * FROM killrvideo.users");
```

SimpleStatement

```
Statement statement = …

// (1) Explicit SimpleStatement Definition
SimpleStatement.newInstance("select * from t1 where c1 = 5");

// (2) Externalize Parameters (no name)
SimpleStatement.builder("select * from t1 where c1 = ?")
               .addPositionalValue(5);

// (3) Externalize Parameters (name)
SimpleStatement.builder("select * from t1 where c1 = :myVal")
               .addNamedValue("myVal”, 5);

cqlSession.execute(statement);
```

Prepared and Bound Statements

- Compiled once on each node automatically as needed
- Prepare each statement only once per application
- Use one of the many bind variations to create a BoundStatement

```
PreparedStatement ps = cqlSession.prepare("SELECT * from t1 where c1 = ?");

BoundStatement bound = ps.bind(5);

cqlSession.execute(bound);
```


Query
Builder

Query Builder

- Fluent API for building CQL string queries programmatically
- Contains methods to build SELECT, UPDATE, INSERT and DELETE statements
- Generates a Statement as per the earlier techniques

OSS Driver (current version 4.2.0)

```
<dependency>
 <groupId>com.datastax.oss</groupId>
 <artifactId>
  java-driver-query-builder
 </artifactId>
</dependency>
```

DSE Driver (current version 2.2.0)

```
<<dependency>
 <groupId>com.datastax.dse</groupId>
 <artifactId>
  dse-java-driver-query-builder
 </artifactId>
</dependency>
```

Query Builder

```
import static com.datastax.oss.driver.api.querybuilder.QueryBuilder.bindMarker;
import static com.datastax.oss.driver.api.querybuilder.QueryBuilder.deleteFrom;
import static com.datastax.oss.driver.api.querybuilder.QueryBuilder.selectFrom;
import static com.datastax.oss.driver.api.querybuilder.relation.Relation.column;


// Simple SELECT using QueryBuilder
Statement stmtSelect = selectFrom(”killrvideo”, ”videos_by_users”)
  .column(”userid”).column(”commentid”)
  .function(”toTimestamp”, Selector.column(”commentid”)).as("comment_timestamp")
  .where(column(”userid”).isEqualTo(bindMarker(”userid”)))
  .build()


// Simple DELETE using QueryBuilder
Statement stmtDelete = deleteFrom(”killrvideo”, ”videos_by_users”)
  .where(column(”userid”).isEqualTo(bindMarker(”userid”)))
  .build()
```

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Query Builder

- Can also use **QueryBuilder** to create **PreparedStatements** and later execute at runtime
- Note use of **bindMarker() t**o designate parameters that will be provided later

```
// Prepared QueryBuilder statiements as any statement
PreparedStatement psStmt = cqlSession.prepare(
  deleteFrom("killrvideo", "videos_by_users")
   .where(column("userid").isEqualTo(bindMarker("userid")))
   .build()));

// Binding
BoundStatement bsStmt = psStmt.bind("e7a8ac9f-c12d-415c-a526-4137815df573");

// Execute
cqlSession.execute(bsStmt);
```

ResultSet

- **ResultSet** is the object returned for executing query. It contains **ROWS** (data) and **EXECUTION INFO**.
- **ResultSet** is **iterable** and as such you can navigate from row to row.
- Results are **always paged** for you (avoiding memory and response time issues)

```
ResultSet rs = cqlSession.execute(myStatement);

// Plumbery
ExecutionInfo info = rs.getExecutionInfo();
int executionTime = info.getQueryTrace().getDurationMicros();

// Data: NOT ALL DATA RETRIEVED IMMEDIATELY (only when needed .next())
Iterator<Row> iterRow = rs.iterator();
int itemsFirstCall = rs.getAvailableWithoutFetching();
```

Parsing ResultSet

```
// We know there is a single row (eg: count)
Row singleRow = resultSet.one();

// We know there are not so many results we can get all (fetch all pages)
List<Row> allRows = resultSet.all();

// Browse iterable
for(Row myRow : resultSet.iterator()) {
   // .. Parsing rows
}

// Use Lambda
rs.forEach(row -> { row.getColumnDefinitions(); });

// Use for LWT
boolean isQueryExecuted = rs.wasApplied();
```

#4 – Application Development

- Drag and drop « **Meetup_04 – Application Development** » in the Studio
- Execute the exercises in the Notebook

- Drag and drop « **Meetup_05 – Start the Application**» in the Studio
- Execute the exercises in the Notebook

Agenda

0 **Bootstraping**

1 **Understanding Apache Cassandra™ Use Cases**

2 **Data Modelling with Apache Cassandra™**

3 **Application Development**

4 **What's NEXT ?**

Developers and Architect Resources

DATASTAX

DataStax Academy

Tell more about this section here

BACK TO AGENDA

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)

https://academy.datastax.com

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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

Developers and Architect Resources

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DataStax Community

Tell more about this section here

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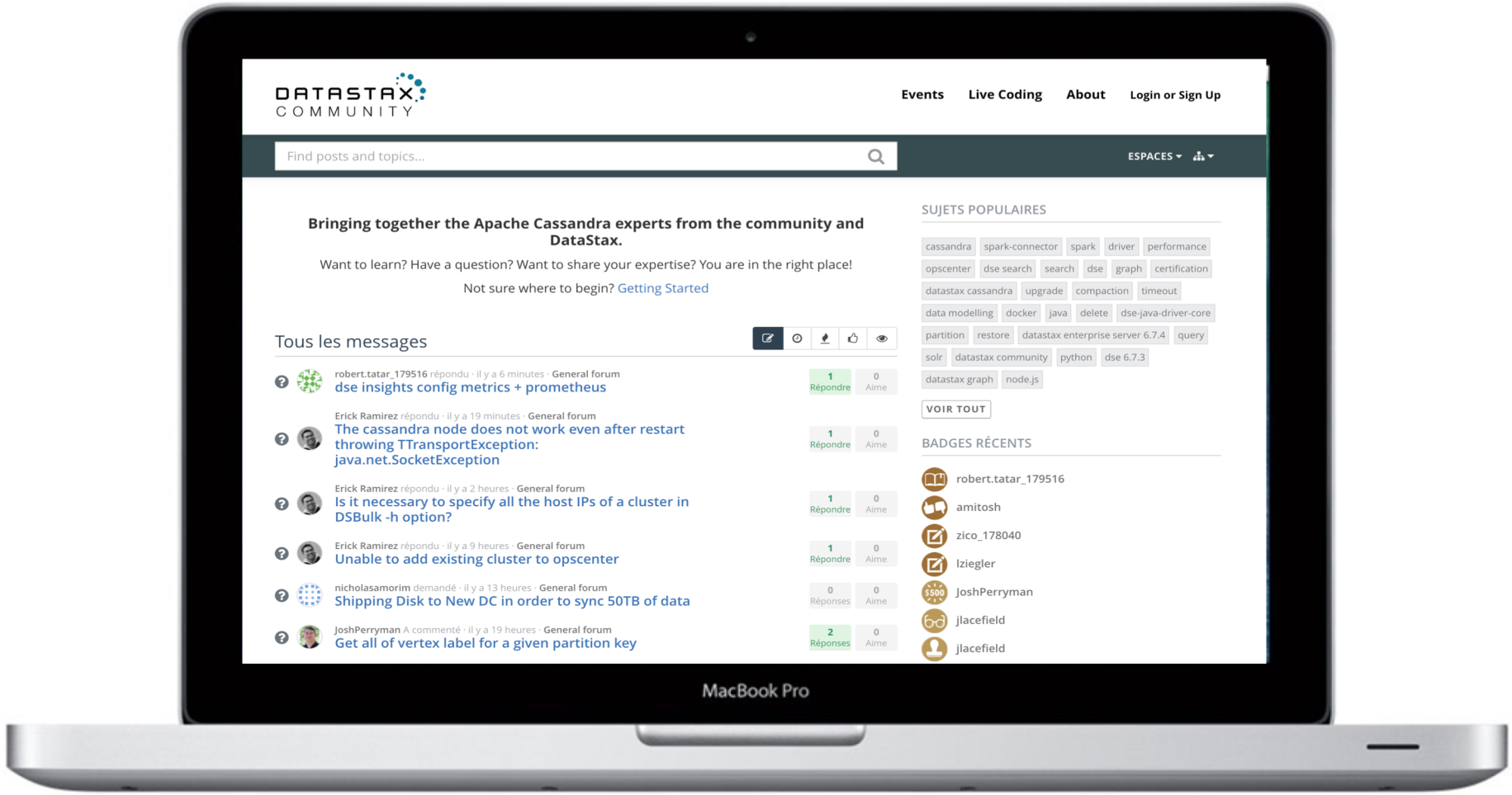
community.datastax.com



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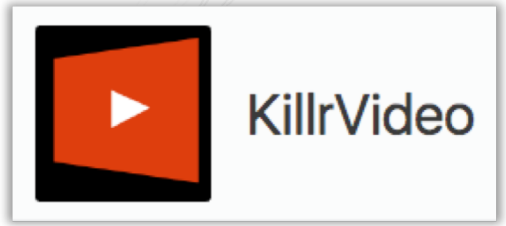
Sample Code and Reference Applications

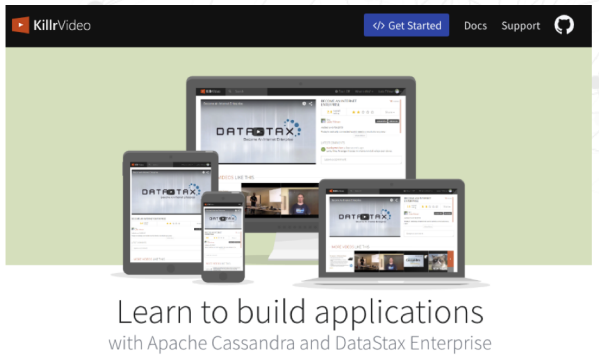
Tell more about this section here

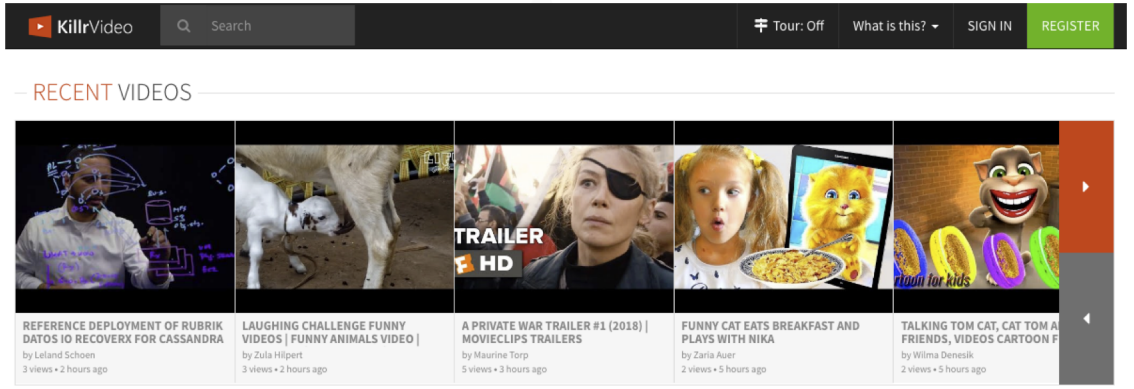
BACK TO AGENDA

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!







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Developers and Architect Resources

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Podcast, LiveStreams

Tell more about this section here

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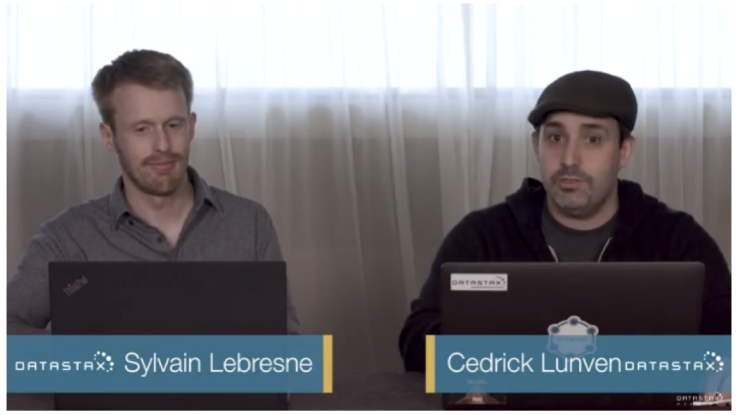
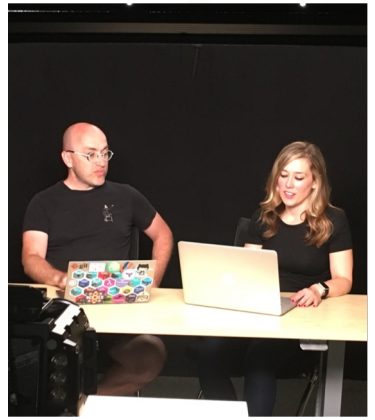
Distributed Data Show

- 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





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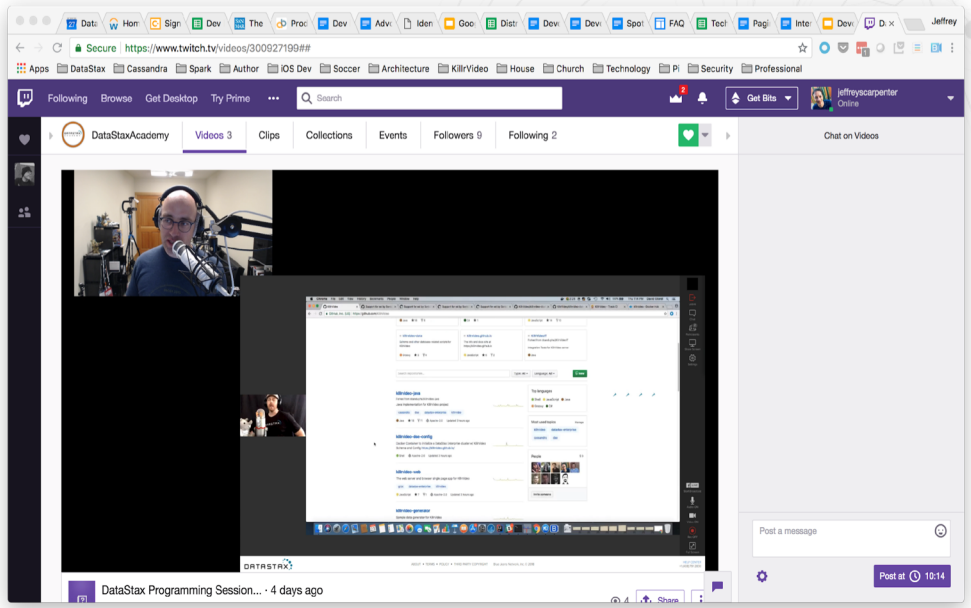
Live Coding on Twitch

- 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



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Thank You