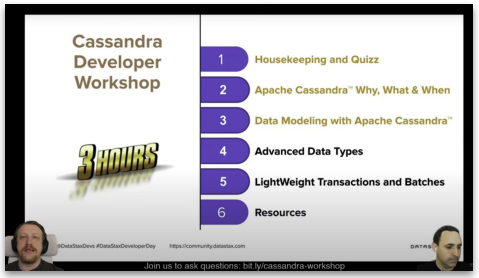
Welcome

Intro to Cassandra for Developers

The Crew

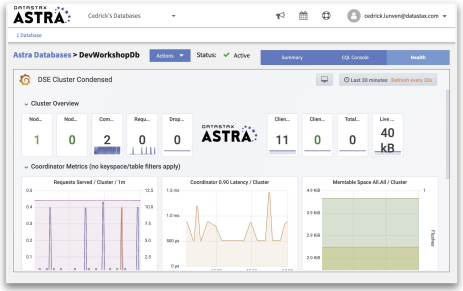
Courses: youtube.com/DataStaxDevs



YouTube

Twitch

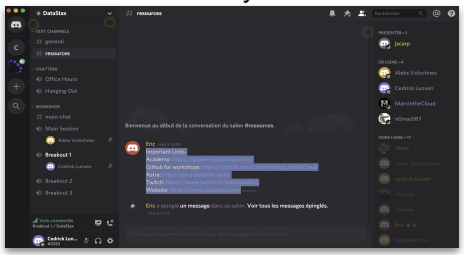
Runtime: dtsx.io/workshop



cassandra

DATASTAX ASTRA

Questions: bit.ly/cassandra-workshop

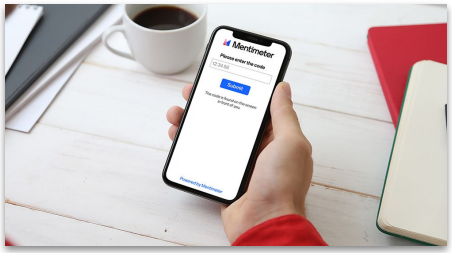


Discord

YouTube

Available on the iPhone App Store

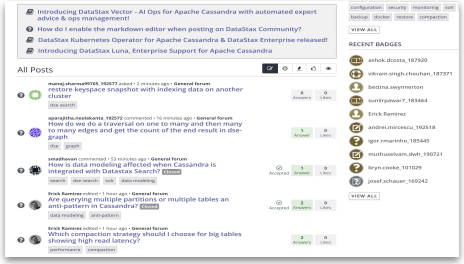
Quizz: menti.com



Mentimeter

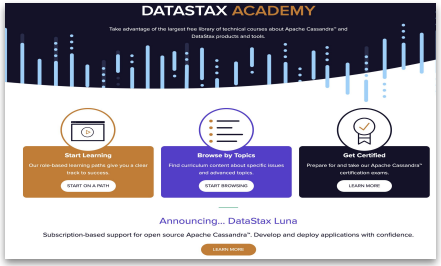
GET IT ON Google play

Forum: community.datastax.com



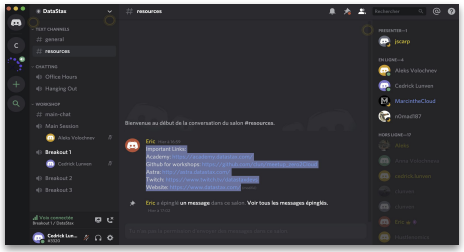
DATASTAX COMMUNITY

Training: academy.datastax.com



DATASTAX ACADEMY

Chat: bit.ly/cassandra-workshop



Discord

DATASTAX ASTRA == cassandra

Fully managed Cassandra
Without the ops!

DataStax Astra

Global Scale
Put your data where you need it without compromising performance, availability, or accessibility.

No Operations
Eliminate the overhead to install, operate, and scale Cassandra.

10 Gig Free Tier
Launch a database in the cloud with a few clicks, no credit card required.


menti.com
84 22 83 0
Mentimeter
What is the most desirable feature of your ideal workplace?
Flexible time
Social factor
Big paycheck
Available on the iPhone App Store
GET IT ON Google play

Exercise

https://github.com/DataStax-Academy/Intro-to-Cassandra-for-Developers

Intro to Cassandra for Developers

- ➔ Tables, Partitions
- ➔ The Art of Data Modelling
- ➔ What's NEXT?

- ➔ Tables, Partitions
- ➔ The Art of Data Modelling
- ➔ What's NEXT?

Data Structure: a Cell

An intersection of a row
and a column, stores data.

Data Structure: a Row

A single, structured data item in a table.

1	John	Doe	Wizardry

Data Structure: a Partition

A group of rows having the same partition token, a base unit of access in Cassandra.

IMPORTANT: stored together, all the rows are guaranteed to be neighbours.

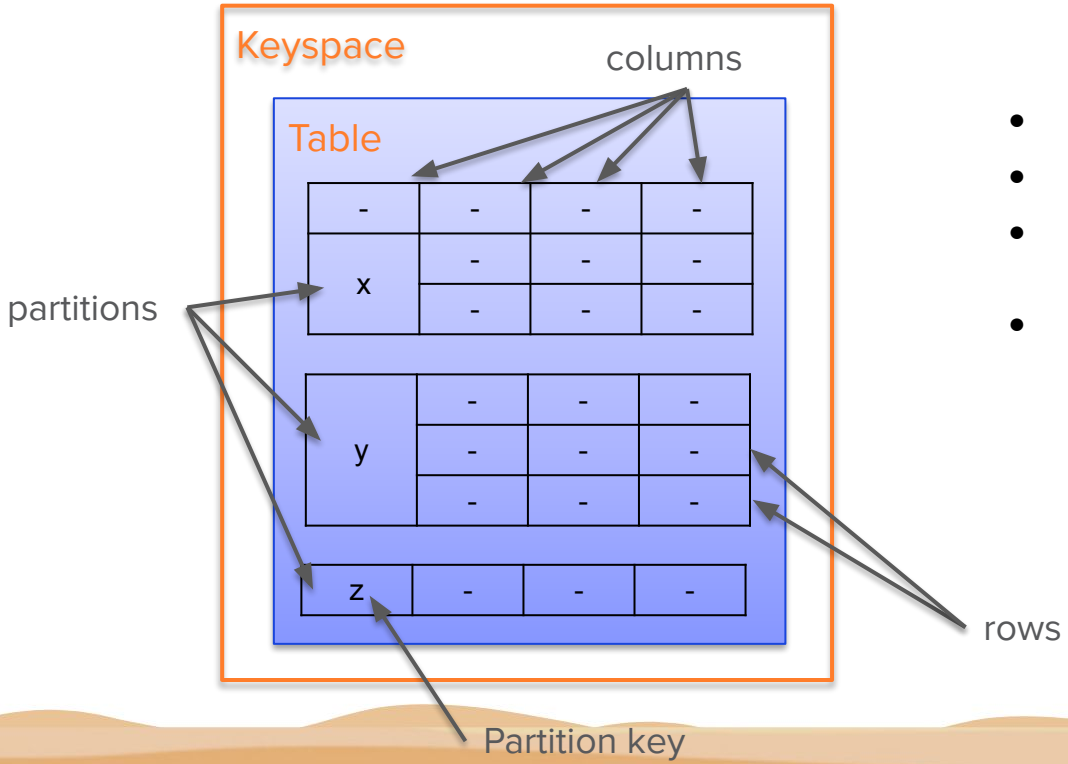
ID	First Name	Last Name	Department
1	John	Doe	Wizardry
399	Marisha	Chapez	Wizardry
415	Maximus	Flavius	Wizardry

Data Structure: a Table

A group of columns and rows storing partitions.

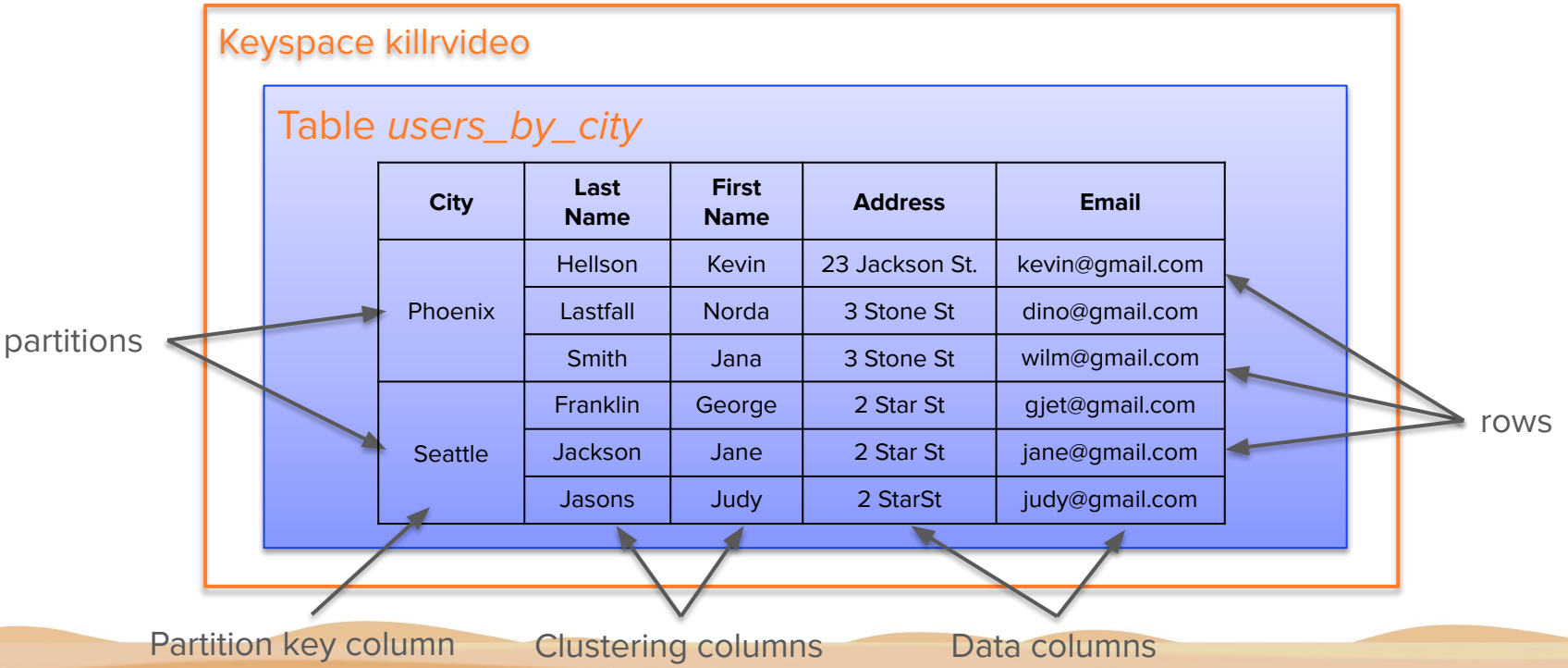
ID	First Name	Last Name	Department
1	John	Doe	Wizardry
2	Mary	Smith	Dark Magic
3	Patrick	McFadin	DevRel

Data Structure: Overall



- Tabular data model, with one twist
- *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: Users organized by city



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

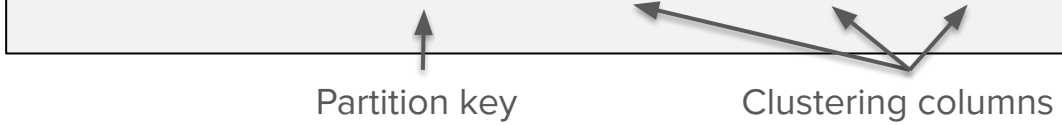
Creating a Table in CQL

Primary Key

An identifier for a row. Consists of at least one Partition Key and zero or more Clustering Columns.

MUST ENSURE UNIQUENESS.
MAY DEFINE SORTING.

```
CREATE TABLE killrvideo.users_by_city (
      city text,
      last_name text,
      first_name text,
      address text,
      email text,
      PRIMARY KEY ((city), last_name, first_name, email));
```



Good Examples:

```
PRIMARY KEY ((city), last_name, first_name, email);
```

```
PRIMARY KEY (user_id);
```

Bad Example:

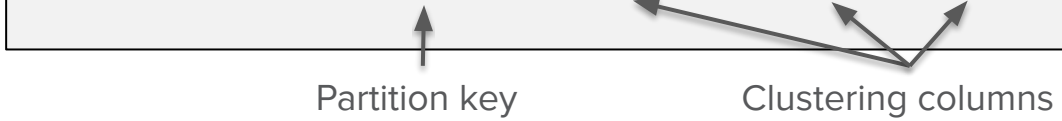
```
PRIMARY KEY ((city), last_name, first_name);
```

Partition Key

An identifier for a partition.
Consists of at least one column, may have more if needed

PARTITIONS ROWS.

```
CREATE TABLE killrvideo.users_by_city (
      city text,
      last_name text,
      first_name text,
      address text,
      email text,
      PRIMARY KEY ((city), last_name, first_name, email));
```



Good Examples:

```
PRIMARY KEY (user_id);
```

```
PRIMARY KEY ((video_id), comment_id);
```

Bad Example:

```
PRIMARY KEY ((sensor_id), logged_at);
```

Clustering Column(s)

Used to ensure uniqueness and sorting order. Optional.

```
CREATE TABLE killrvideo.users_by_city (
      city text,
      last_name text,
      first_name text,
      address text,
      email text,
      PRIMARY KEY ((city), last_name, first_name, email));
```

Partition key

Clustering columns

```
PRIMARY KEY ((city), last_name, first_name);
```

✗ Not Unique

```
PRIMARY KEY ((city), last_name, first_name, email);
```

✓

```
PRIMARY KEY ((video_id), comment_id);
```

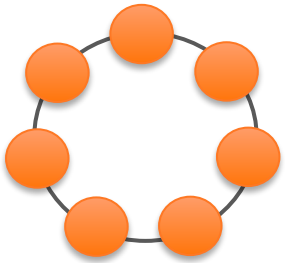
✗ Not Sorted

```
PRIMARY KEY ((video_id), created_at, comment_id);
```

✓

Partition: The Beginning

```
CREATE TABLE killrvideo.users_by_city (
     city text,
     last_name text,
     first_name text,
     address text,
     email text,
     PRIMARY KEY ((city), last_name, first_name, email));
```



- Every node is responsible for a range of tokens (0-100500, 100501-201000...)
- INSERT a new row, we get the value of its Partition Key (can't be null!)
- We hash this value using MurMur3 hasher http://murmurhash.shorelabs.com/
  "Seattle" becomes 2466717130 **Partition Key** = Seattle, **Partition Token** = 2466717130
- This partition belongs to the node[s] responsible for this token
- The INSERT query goes to the nodes storing this partition

Rules of a Good Partition

The Slide of the Year Award!

- Store together what you retrieve together
- Avoid big partitions
- Avoid hot partitions

```
PRIMARY KEY (user_id);
```

```
PRIMARY KEY ((video_id), comment_id);
```

```
PRIMARY KEY ((country), user_id);
```

Rules of a Good Partition

The Slide of the Year Award!

- **Store together what you retrieve together**
- Avoid big partitions
- Avoid hot partitions

Example: open a video? Get the comments in a single query!

```
PRIMARY KEY ((video_id), created_at, comment_id);
```

```
PRIMARY KEY ((comment_id), created_at);
```

Rules of a Good Partition

The Slide of the Year Award!

- Store together what you retrieve together
- **Avoid big partitions**
- Avoid hot partitions

```
PRIMARY KEY ((video_id), created_at, comment_id);
```

```
PRIMARY KEY ((country), user_id);
```

- No technical limitations, but…
- Up to ~100k rows in a partition
- Up to ~100MB in a Partition

Rules of a Good Partition

The Slide of the Year Award!

- Store together what you retrieve together
- **Avoid big partitions?**
- Avoid hot partitions

Example: a huge IoT infrastructure, hardware all over the world, different sensors reporting their state every 10 seconds. Every sensor reports its UUID, timestamp of the report, sensor's value.

- Sensor ID: UUID
- Timestamp: Timestamp
- Value: float

```
PRIMARY KEY ((sensor_id), reported_at);
```

Rules of a Good Partition

The Slide of the Year Award!

- Store together what you retrieve together
- **Avoid big and constantly growing partitions!**
- Avoid hot partitions

Example: a huge IoT infrastructure, hardware all over the world, different sensors reporting their state every 10 seconds. Every sensor reports its UUID, timestamp of the report, sensor's value.

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```
PRIMARY KEY ((sensor_id), reported_at);
```

Rules of a Good Partition

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- **Avoid big and constantly growing partitions!**
- Avoid hot partitions

Example large IoT infrastructure hardware all over the world, different sensors reporting their state every 10 seconds. Every sensor reports its UUID, timestamp of the report, sensor's value

Sensor's UUID
Timestamp:
Value: float

BUCKETING

```
PRIMARY KEY ((sensor_id), reported_at);
```

```
PRIMARY KEY ((sensor_id, _____), reported_at);
```

Rules of a Good Partition

The Slide of the Year Award!

- Store together what you retrieve together
- **Avoid big and constantly growing partitions!**
- Avoid hot partitions

Example: a huge IoT infrastructure, hardware all over the world, different sensors reporting their state every 10 seconds. Every sensor reports its UUID, timestamp of the report, sensor's value.

```
PRIMARY KEY ((sensor_id), reported_at);
```

```
PRIMARY KEY ((sensor_id, month_year), reported_at);
```

BUCKETING

- Sensor ID: UUID
- **MonthYear**: Integer or String
- Timestamp: Timestamp
- Value: float

Rules of a Good Partition

The Slide of the Year Award!

- Store together what you retrieve together
- Avoid big partitions
- **Avoid hot partitions**

```
PRIMARY KEY (user_id);
```

```
PRIMARY KEY ((video_id), created_at, comment_id);
```

```
PRIMARY KEY ((country), user_id);
```

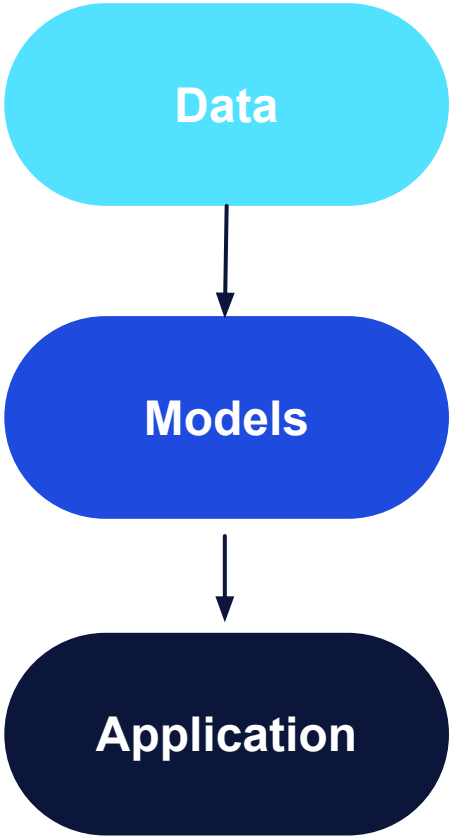
Exercise

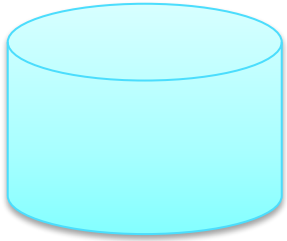
https://github.com/DataStax-Academy/Intro-to-Cassandra-for-Developers#2-create-a-table

- ➔ Tables, Partitions
- ➔ The Art of Data Modelling
- ➔ What's NEXT?

Relational Data Modelling

1. Analyze raw data
2. Identify entities, their properties and relations
3. Design tables, using normalization and foreign keys.
4. Use JOIN when doing queries to join denormalized data from multiple tables





Employees

userId	firstName	lastName
1	Edgar	Codd
2	Raymond	Boyce

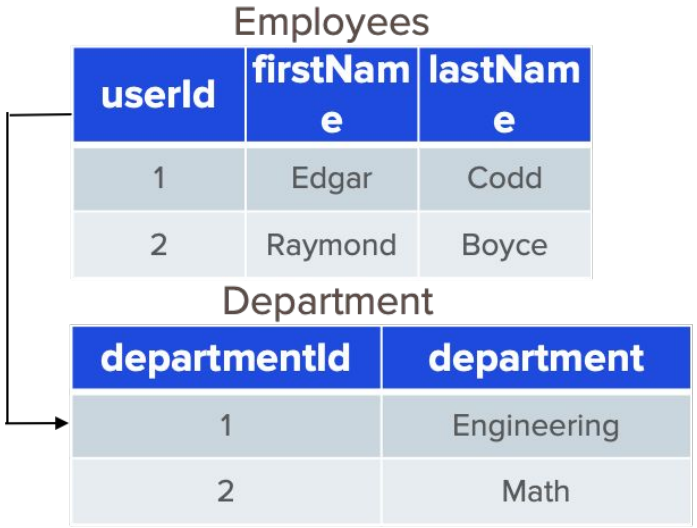
Department

departmentId	department
1	Engineering
2	Math

Normalization

“Database normalization is the process of structuring a relational database in accordance with a series of so-called normal forms in order to reduce data redundancy and improve data integrity. It was first proposed by Edgar F. Codd as part of his relational model.”

PROS: Simple write, Data Integrity
CONS: Slow read, Complex Queries



Denormalization

“Denormalization is a strategy used on a database to increase performance. In computing, denormalization is the process of trying to improve the read performance of a database, at the expense of losing some write performance, by adding redundant copies of data”

PROS: Quick Read, Simple Queries
CONS: Multiple Writes, Manual Integrity

Employees

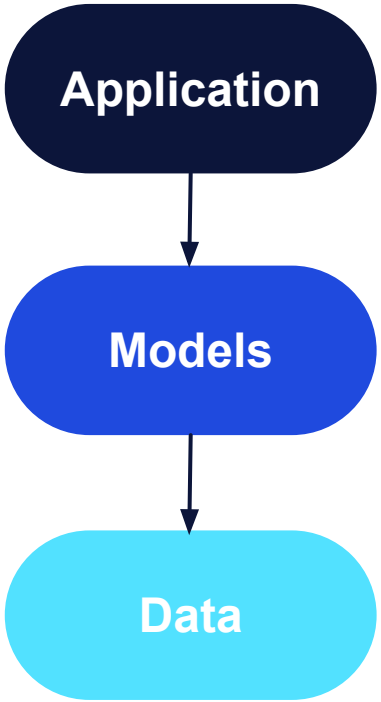
userId	firstName	lastName	department
1	Edgar	Codd	Engineering
2	Raymond	Boyce	Math

Department

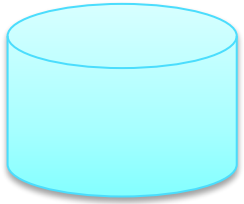
departmentId	department
1	Engineering
2	Math

NoSQL Data Modelling

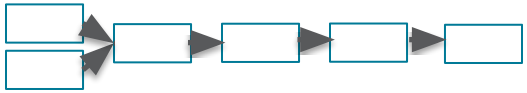
1. Analyze user behaviour (customer first!)
2. Identify workflows, their dependencies and needs
3. Define Queries to fulfill these workflows
4. Knowing the queries, design tables, using denormalization.
5. Use BATCH when inserting or updating denormalized data of multiple tables

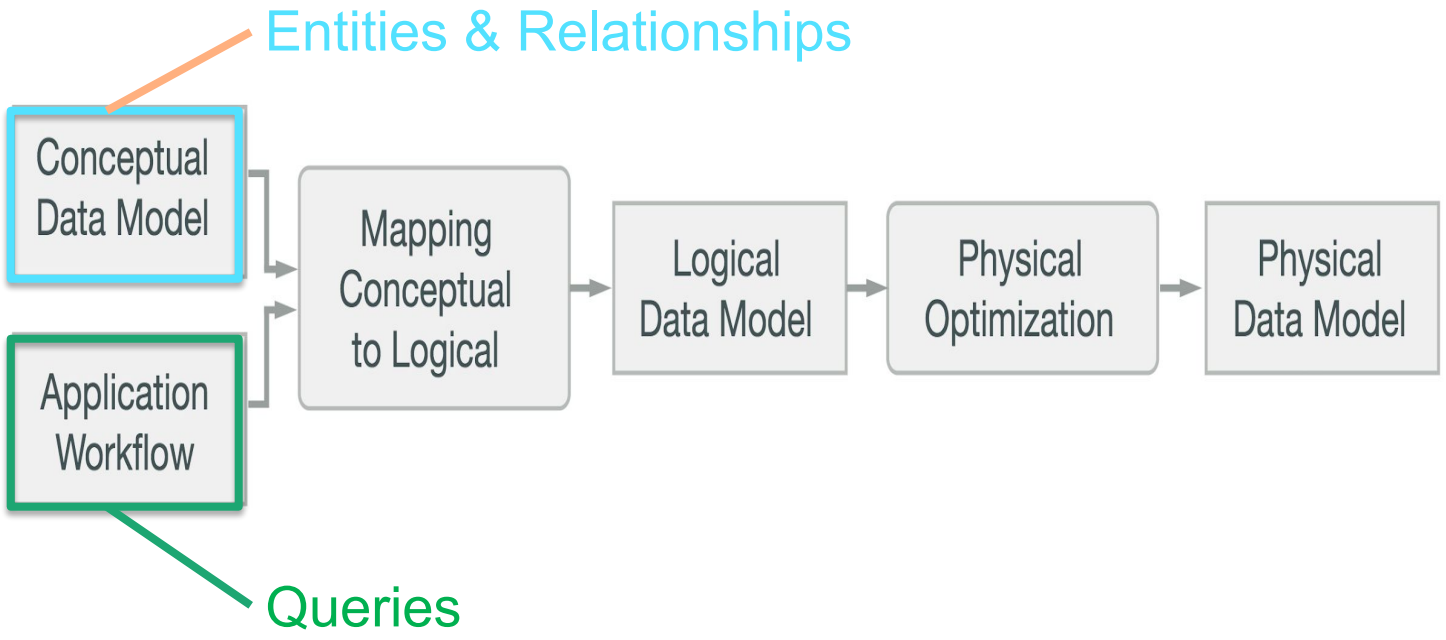


id	firstName	lastName	department
1	Edgar	Codd	Engineering
2	Raymond	Boyce	Math

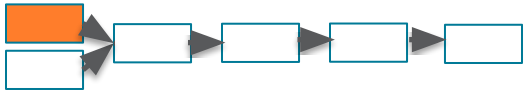


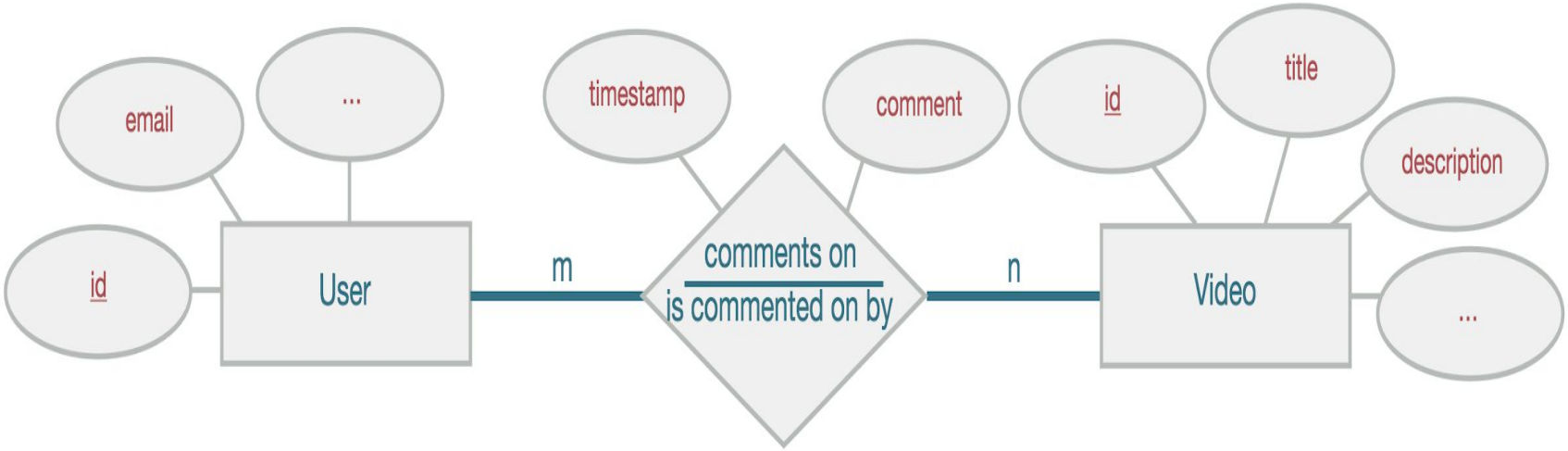
Designing Process: Step by Step



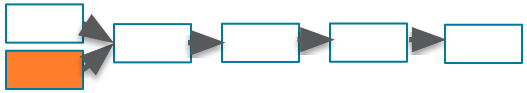


Designing Process: Conceptual Data Model





Designing Process: Application Workflow



Use-Case I:

- A User opens a Video Page

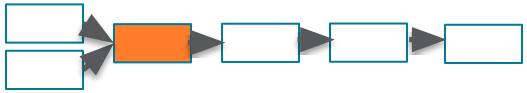
WF1: Find comments related to target video using its identifier, most recent first

Use-Case II:

- A User opens a Profile

WF2: Find comments related to target user using its identifier, get most recent first

Designing Process: Mapping



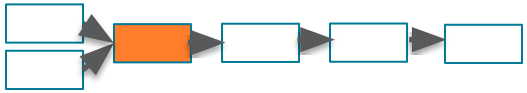
Query I: Find comments posted for a user with a known id (show most recent first)

→ comments_by_user

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

→ comments_by_video

Designing Process: Mapping



```
SELECT * FROM comments_by_user
WHERE userid = <some UUID>
```

→ comments_by_user

```
SELECT * FROM comments_by_video
WHERE videoid = <some UUID>
```

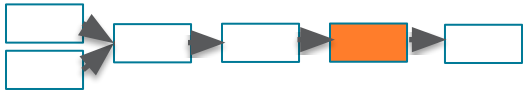
→ comments_by_video

Designing Process: 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	

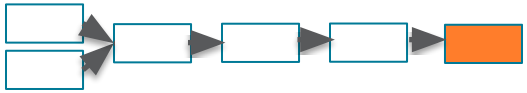
Designing Process: Physical Data Model



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	

Designing Process: 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);
```

Exercise

https://github.com/DataStax-Academy/Intro-to-Cassandra-for-Developers#3-execute-crud-operations


menti.com
84 22 83 0
Mentimeter
What is the most desirable feature of your ideal workplace?
Flexible time
Social factor
Big paycheck
Available on the iPhone App Store
GET IT ON Google play

- ➔ Tables, Partitions
- ➔ The Art of Data Modelling
- ➔ What's NEXT?

MORE LEARNING!!!!

Developer site: datastax.com/dev

- Developer Stories
- New hands-on learning scenarios with Katacoda
  - Try it Out
  - Cassandra Fundamentals
  - New Data Modeling course in progress, sneak preview at https://katacoda.com/datastax/courses/cassandra-data-modeling

Classic courses still available at DataStax Academy

Katacoda

Developer Resources

LEARN	New hands-on learning at www.datastax.com/dev Classic courses available at DataStax Academy
ASK/SHARE	Join community.datastax.com Ask/answer community user questions - share your expertise
CONNECT	Follow us We are on Youtube - Twitter - Twitch!
MATERIALS	Slides and code for this course are available at https://github.com/DataStax-Academy/cassandra-workshop-series

Walk through of /dev

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Thank You