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Intro to Cassandra

eSolutions Grup

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Big Data Engineer

Advantages

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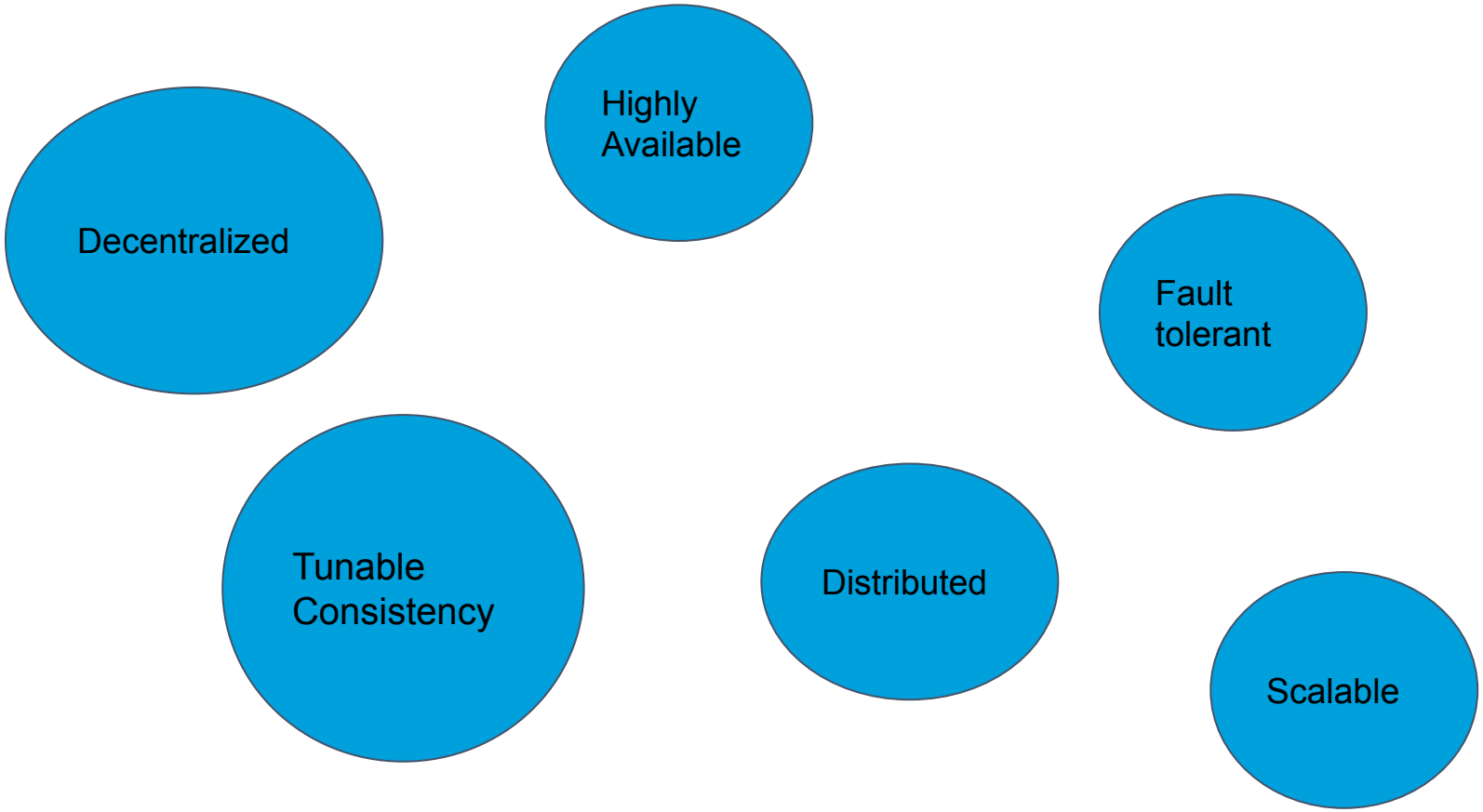

SQL vs NoSQL

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Relational (normalized)

Data tables -> Models -> Application

+ Simple read, Data Integrity
- Slow read, Complex Query

SQL vs NoSQL

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NoSql (denormalized) - No JOIN!!

1 Query = 1 table

Application (customer first!) -> Models -> Data tables

+ Quick read, Simple Query
- Multiple Writes, Manual Integrity

Schema details

Keyspace (RF ex 3)

Create / Alter / Drop / Use / Describe

Table

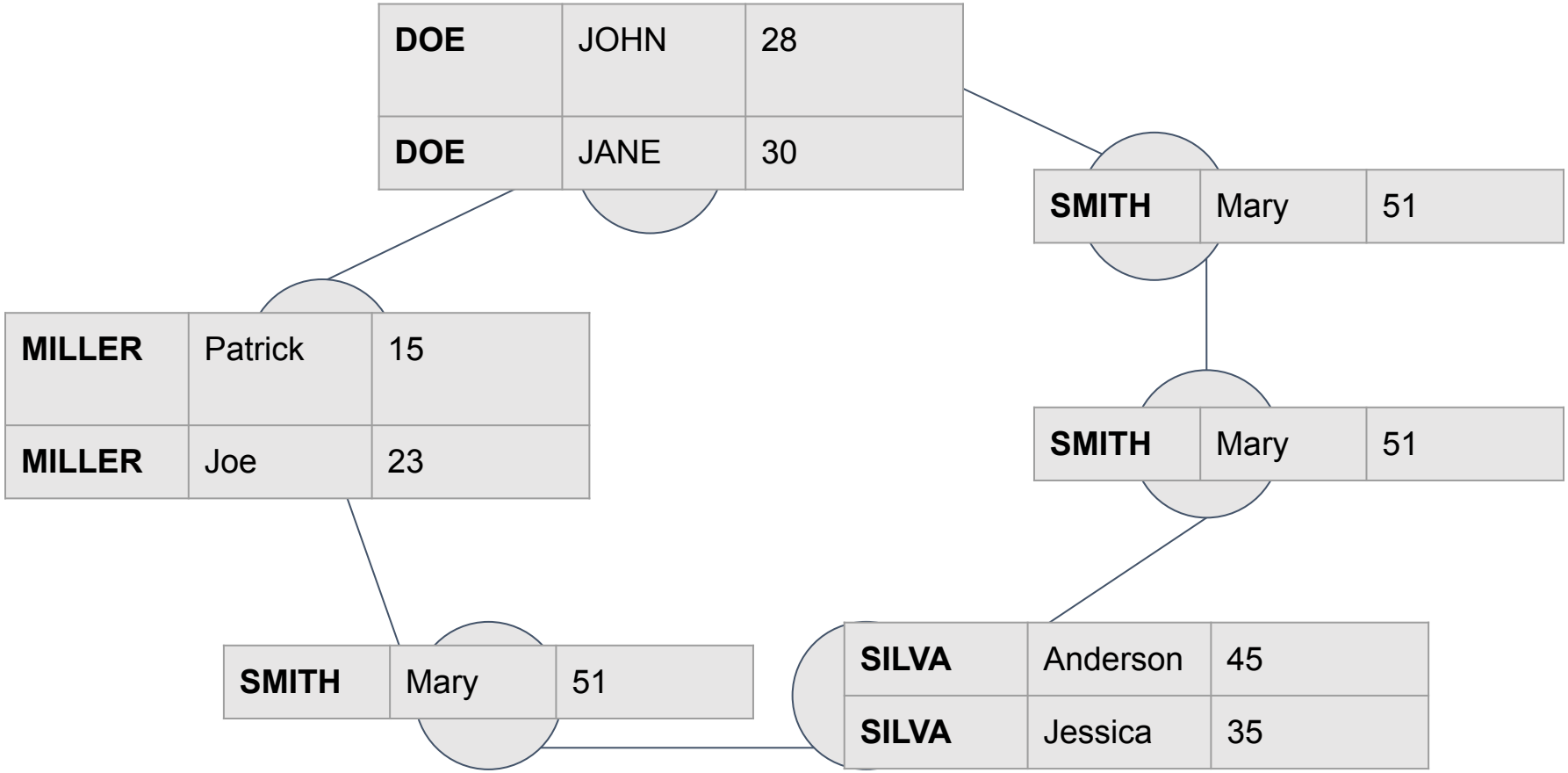
Create / Alter / Drop / Truncate / Describe

Columns

Name, Value, Timestamp, TTL

Keyspace -> Table -> Partition -> Row

Partitioned data across cluster



Data structure

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Overall

Tables are rows and columns

Related rows are partitions stored on the same node(nodes)

Each row has a partition key (>=1 column that are hashed to determine which node stores that data)

users_by_city

City	Last Name	First Name	Address	Email
Iasi	Ionescu	Vasile	23 First St	vasile@gmail.com
Iasi	George	Dumitru	2 First St	dumitru@gmail.com
Bucharest	Popescu	Virgil	2 First St	virgil@gmail.com
Bucharest	Popescu	Virgil	2 First St	virgil2@gmail.com

Table creation

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```
CREATE TABLE bdwvideo.users_by_city(
        city text,
        last_name text,
        first_name text,
        address text,
        email text,
        PRIMARY KEY ((city), last_name, first_name, email))
WITH CLUSTERING ORDER BY (last_name ASC, first_name ASC, email ASC);
```

Tunable Consistency

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ALL: highest consistency and the lowest availability

LOCAL_QUORUM: used in multiple data center clusters and maintain consistency locally

ONE, TWO, THREE: checks closest nodes to the coordinator

ANY: provides low latency and a guarantee that a write never fails

Exercises

1. docker-compose up -d

https://github.com/eSolutionsGrup/cassandra-intro

docker exec -ti bdw_node01_1 cqlsh

CREATE KEYSPACE bdwvideo WITH replication = {'class': 'SimpleStrategy', 'replication_factor': '1'} AND durable_writes = true;

use bdwvideo;

2. https://astra.datastax.com
   a. Register demo account
   b. Create database **bdwvideo** (in any Area ex West Europe)
   c. Go to Dashboard/bdwvideo then go to CQL console

TODO: create bdwvideo.users_by_city table

desc tables; // to see the tables created

Pain Points

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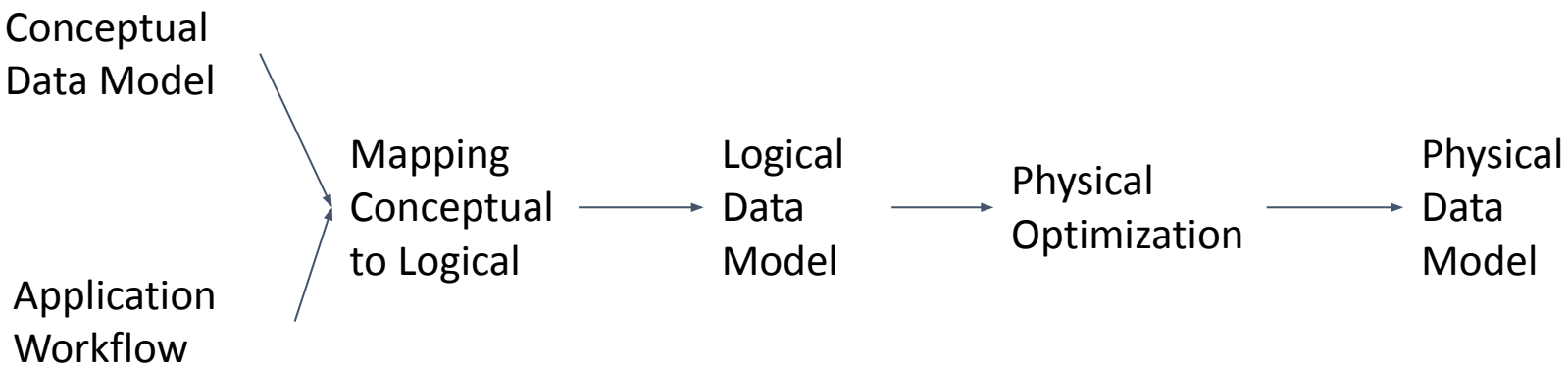
- Mandatory Partition Key
- No arbitrary where conditions (only Primary Key columns)
- No Joins
- No grouping/aggregation

Data Modeling: Schematics



Video platform bdwvideo

Entity-Relationship diagram

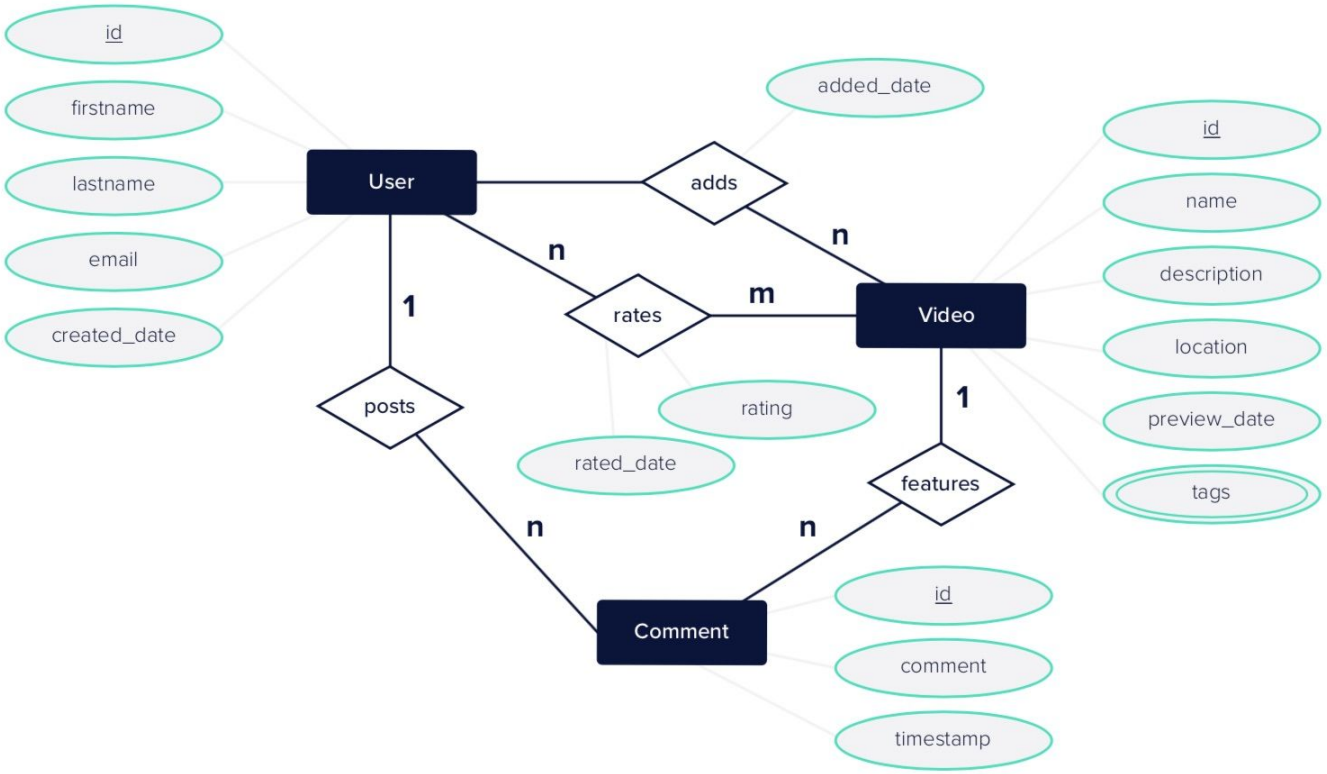


Fig 1

https://www.datastax.com/blog/five-steps-awesome-data-model

Application workflow

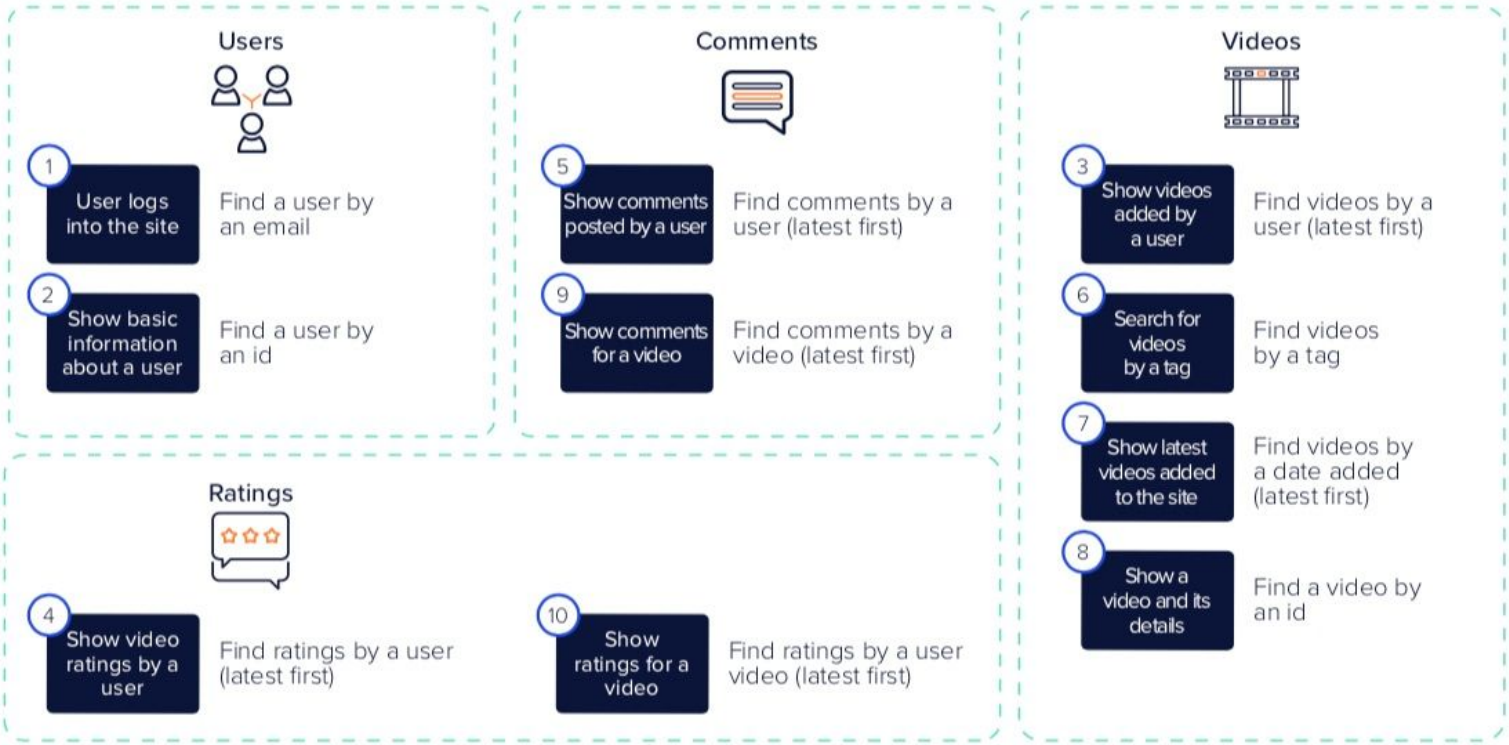


Fig 2

https://www.datastax.com/blog/five-steps-awesome-data-model

Access patterns (Users)

User by email (login)?

```
create table user_credentials(
        email text,
        password text,
        userid uuid,
        primary key (email)
);
```

User by id (user profile)?

```
create table users(
        userid uuid,
        firstname text,
        lastname text,
        email text,
        created_date timestamp,
        primary key (userid)
);
```

Access patterns inserts(Users)

```
insert INTO users (userid , firstname , lastname , email , created_date) VALUES  (
uuid(),'john','doe','john@doe', '2021-10-09');
```

```
select uuid from users;
```

```
update users set lastname='Johnson' where userid = ;
```

```
select userid from users;
```

```
update users set lastname='Johnson' where userid =
a62485ed-f11d-485e-bd24-14b25a5ba0ff;
```

Access patterns (Video)

Video by id (for details)?

```
create table videos(
        videoid uuid,
        userid uuid,
        name text,
        description text,
        location text,
        location_type int,
        preview_image_location text,
        tags set<text>,
        added_date timestamp,
        primary key (videoid)
);
```

Video by user_id (latest)

```
create table user_videos(
        userid uuid,
        added_date timestamp,
        videoid uuid,
        name text,
        preview_image_location text,
        primary key (userid, added_date,
videoid)
) with clustering order by (
added_date desc,
videoid asc);
```

Duplicating data problems

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How frequently does the data change?

Do I have all I need to update duplicates and maintain consistency?

A:

```
BEGIN BATCH
INSERT INTO videos ...
INSERT INTO user_videos ...
APPLY BATCH;
```

Access patterns (Video latest)

Latest videos ?

```
create table latest_videos(
        video_date text,
        added_date timestamp,
        videoid uuid,
        name text,
        preview_image_location text,
        primary key (video_date, added_date, videoid))
         with clustering order by (added_date desc, videoid asc);
```

```
insert into latest_videos ( video_date , added_date , videoid , name , preview_image_location ) VALUES ( '2021-10-12', toTimestamp(now()), uuid(),'best name','best preview');
```

```
insert into latest_videos ( video_date , added_date , videoid , name , preview_image_location ) VALUES ( '2021-10-12', toTimestamp(now()), uuid(),'best name','best preview');
```

```
insert into latest_videos ( video_date , added_date , videoid , name , preview_image_location ) VALUES ( '2021-10-12', toTimestamp(now()), uuid(),'best name','best preview');
```

Access patterns (Video latest)

Latest videos ?

```
create table latest_videos_bucketed(
        video_date text,
        bucket int,
        added_date timestamp,
        videoid uuid,
        name text,
        preview_image_location text,
        primary key ((video_date, bucket), added_date, videoid))
         with clustering order by (added_date desc, videoid asc);
```

```
insert into latest_videos_bucketed ( video_date ,bucket, added_date , videoid , name , preview_image_location ) VALUES ( '2021-10-12',1, toTimestamp(now()), uuid(),'best name','best preview');
```

```
insert into latest_videos_bucketed ( video_date ,bucket, added_date , videoid , name , preview_image_location ) VALUES ( '2021-10-12',1, toTimestamp(now()), uuid(),'best name','best preview');
```

Query?

Best Practices

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Store in the same place what you want to retrieve together

Avoid Big Partitions (max 100K rows,max 100 MB)

Avoid Hot Partitions

users -> PRIMARY KEY (user_id)

comments_by_video -> PRIMARY KEY ((video_id), comment_id)

users_by_country -> PRIMARY KEY ((country), user_id)

Best Practices

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Store in the same place what you want to retrieve together

Avoid Big Partitions (max 100K rows,max 100 MB)

Avoid Hot Partitions

users -> PRIMARY KEY (user_id) ✅

comments_by_video -> PRIMARY KEY ((video_id), comment_id) ✅

users_by_country -> PRIMARY KEY ((country), user_id)⛔

Good scaling model?

Load/Performance Tests

cassandra-stress (.yml)

https://cassandra.apache.org/doc/latest/cassandra/tools/cassandra_stress.html

Scalability

2 Nodes -> 100K ops/sec

4 Nodes -> 200K ops/sec

8 Nodes -> 400K ops/sec

16 Nodes -> 800K ops/sec

Final thought

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Thank you!

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- eSolutions academy (https://academy.esolutions.ro/)
- Datastax Academy (https://academy.datastax.com/)
- Git (https://github.com/eSolutionsGrup/cassandra-intro)

Let's keep in touch
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