DataStax Hands-On Modelling

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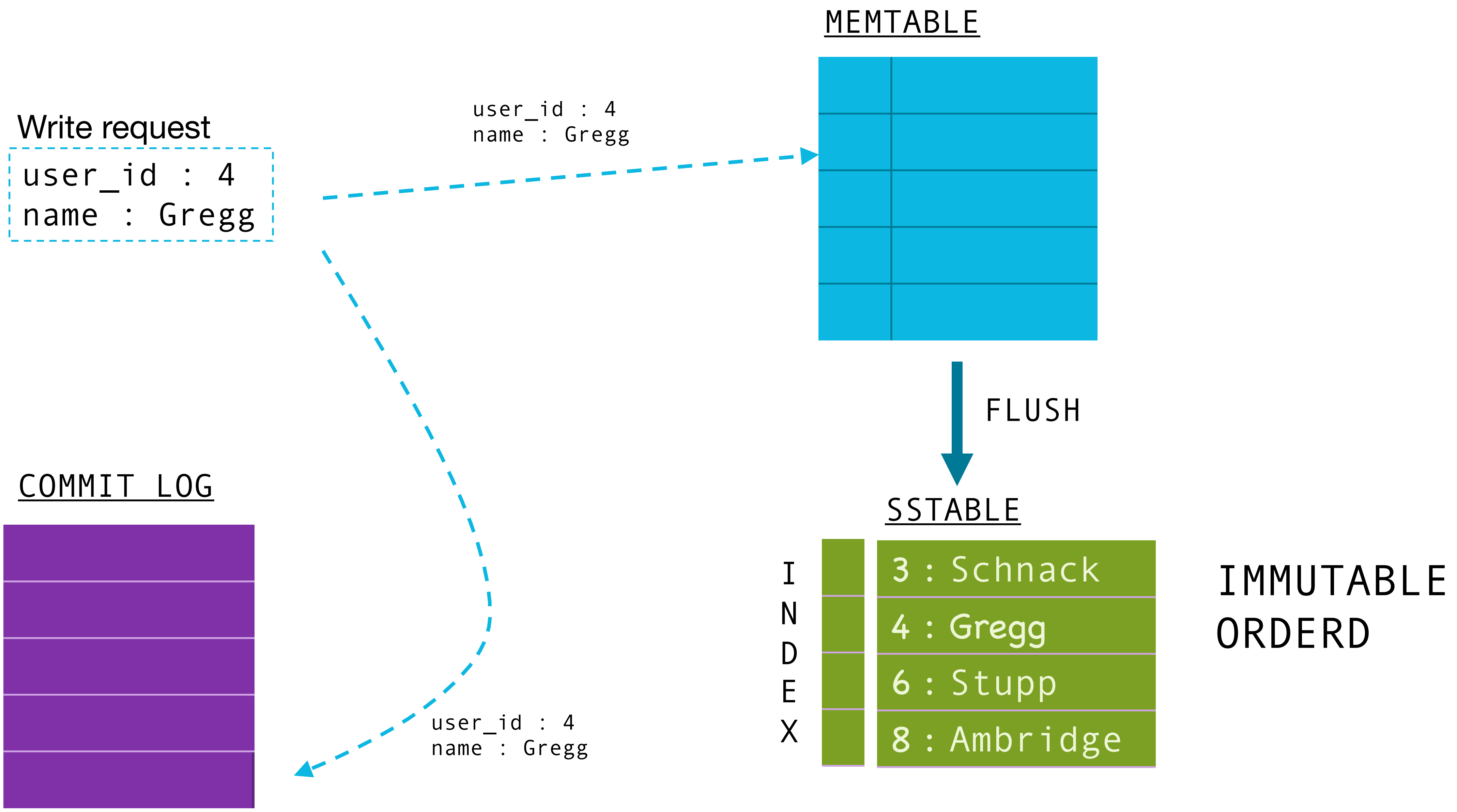
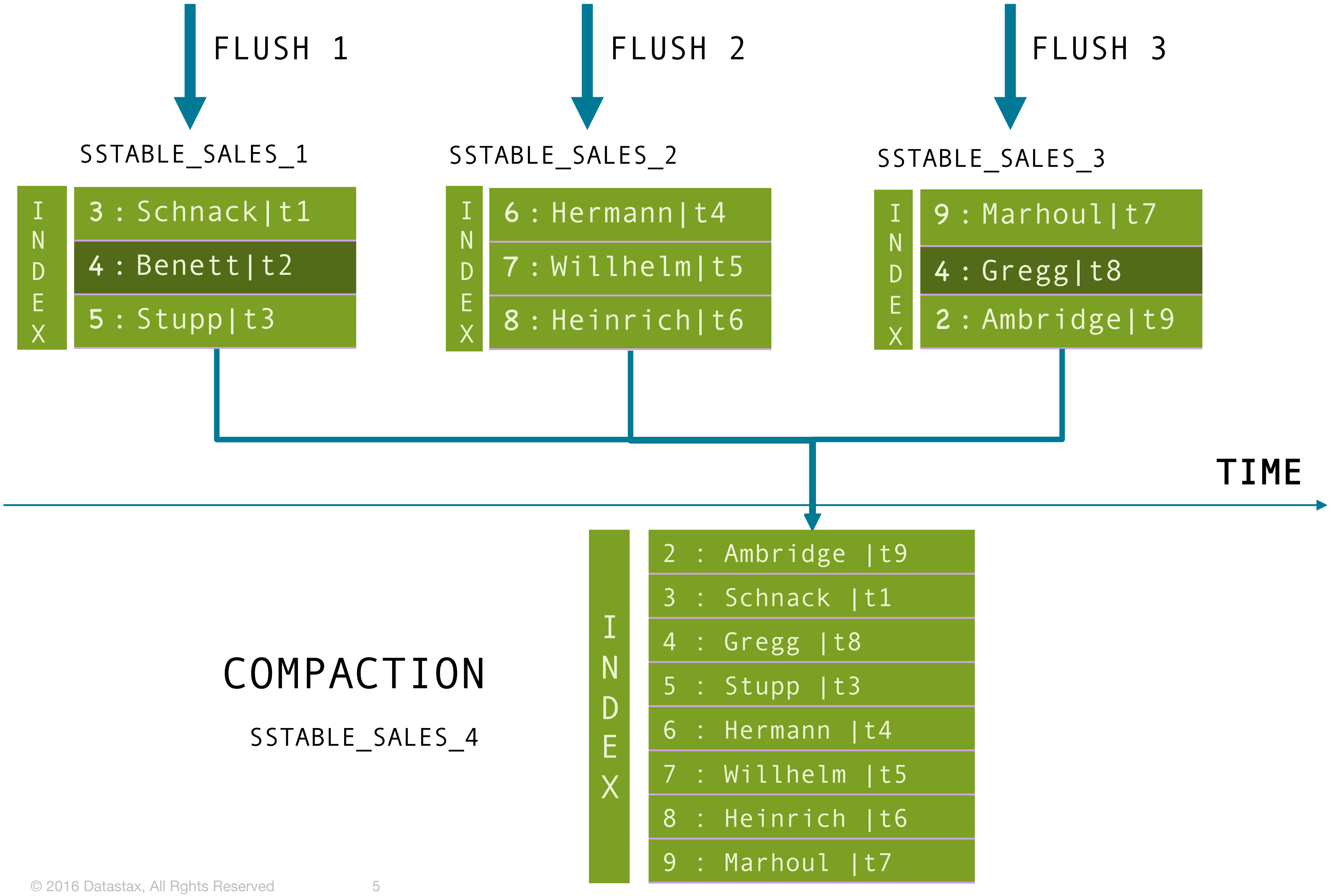
Agenda

1	Storing data in DSE C*
2	Data Modelling, CQL basics
3	Lab 3: Hands-On Primary Keys

Storing data in DSE C*


Write request
user_id : 4
name : Gregg
user_id : 4
name : Gregg
MEMTABLE
FLUSH
SSTABLE
I N D E X
3 : Schnack
4 : Gregg
6 : Stupp
8 : Ambridge
IMMUTABLE
ORDERD
COMMIT LOG
user_id : 4
name : Gregg


FLUSH 1
FLUSH 2
FLUSH 3
SSTABLE_SALES_1
SSTABLE_SALES_2
SSTABLE_SALES_3
INDEX
3 : Schnack|t1
4 : Benett|t2
5 : Stupp|t3
INDEX
6 : Hermann|t4
7 : Willhelm|t5
8 : Heinrich|t6
INDEX
9 : Marhoul|t7
4 : Gregg|t8
2 : Ambridge|t9
TIME
COMPACTION
SSTABLE_SALES_4
INDEX
2 : Ambridge |t9
3 : Schnack |t1
4 : Gregg |t8
5 : Stupp |t3
6 : Hermann |t4
7 : Willhelm |t5
8 : Heinrich |t6
9 : Marhoul |t7

Data Modeling Objectives

Data modeling objectives

1. Get your data out of DSE
2. Reduce query latency, make your queries faster
3. Avoid disaster in production

Data modeling methodology

Design by query

- first, know your functional queries
- design the table(s) for direct access
- just denormalize if necessary
- Spread data evenly around the cluster
- Minimize the number of partitions read

Output of design phase = schema.cql

Then start coding

Know your functional queries

```
Query:
find users by id group by region and ordered by join date
```

- Grouping by an attribute
- Ordering by an attribute
- Filtering based on some set of conditions
- Enforcing uniqueness in the result set

The partition key

Role

Partition key

- main entry point for query (INSERT/SELECT …)
- help distribute/locate data on the cluster

No partition key = full cluster scan

How to choose correct partition key ?

Good partition column

- choose functional identifier
- high cardinality (lots of distinct values)

Query:

Find all sales by sales representative?

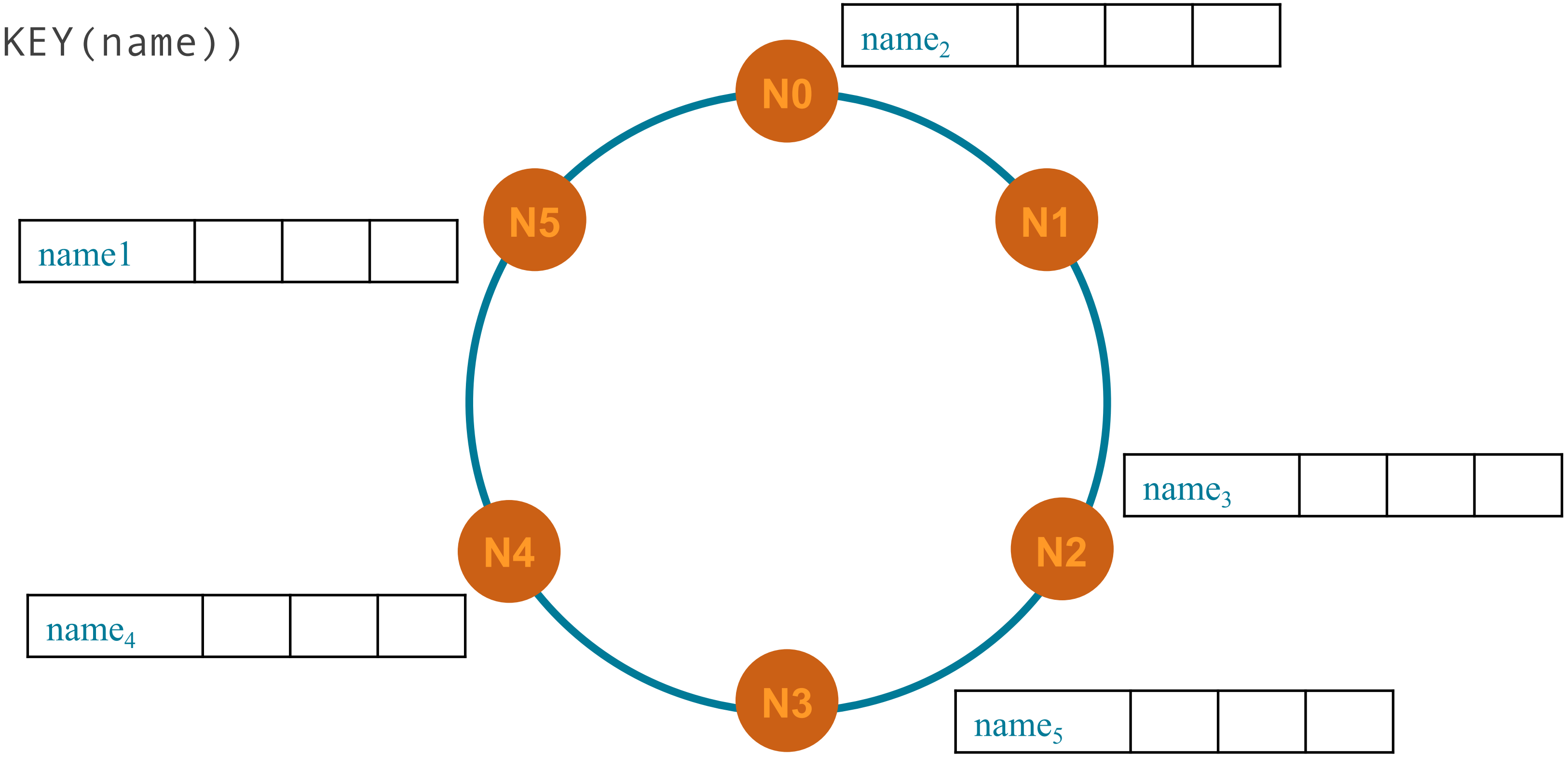
```
CREATE TABLE sales_by_repname (
    name text,
    sdate tuuid,
    item text,
    price double,
    …,
    PRIMARY KEY(name));
```

partition key (#partition)

DATASTAX

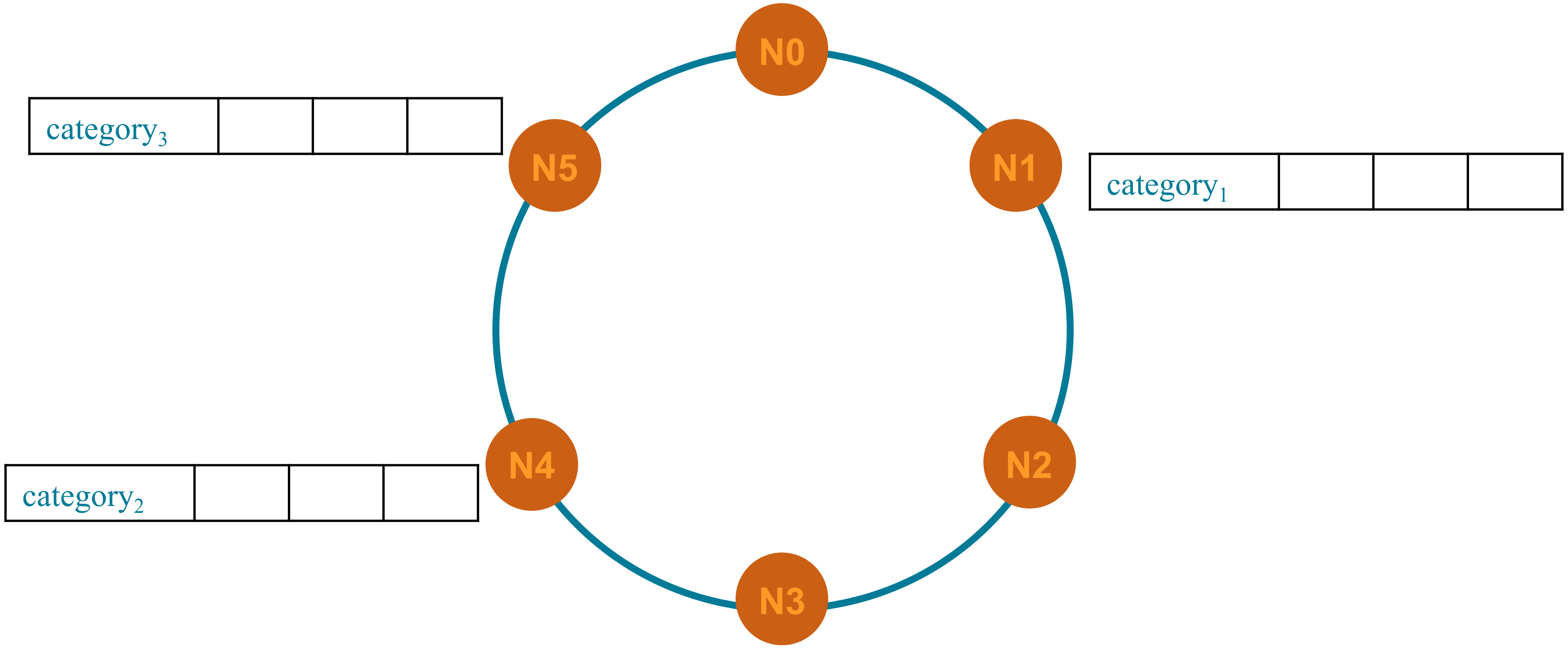
Example of good partition key

```
CREATE TABLE sales_by_repname(
    name text,
    …,
    PRIMARY KEY(name))
```



Example of bad partition key

```
CREATE TABLE sales_by_cat(
    category text,
    …,
    PRIMARY KEY(category))
```



DATASTAX

CRUD operations

```
INSERT INTO sales(name, item, price) VALUES(‘Gregg’, ‘iPhone7’, 799);

UPDATE sales SET qty = 1 WHERE name = Gregg;

DELETE qty FROM sales WHERE name = Gregg;

SELECT rev FROM sales WHERE name = Gregg;
```

No Clustering Columns

PRIMARY KEY (name) // no duplicate primary keys

name	dt	item	qty	price	rev
Gregg	20160101	PlayStation4	1	500	500
~~Schnack~~	~~20160102~~	~~IPhone 7~~	~~2~~	~~799~~	~~1598~~
Schnack	20160103	IPhone 7	1	799	799

```
SELECT * FROM sales_by_repname WHERE name = ‘Schnack’;
```

Composite partition key

Multiple columns for partition key

- always known in advance (INSERT/SELECT …)
- are hashed together to the same token value

```
CREATE TABLE sales_by_name_and_date(
   name  text,
   dt    date,
   item  text,
   …,
   PRIMARY KEY((name,sdate))
```

```
SELECT * FROM sales WHERE name = … AND dt = …
```

```
SELECT * FROM sales WHERE name = … AND dt IN (xxx, yyy …)
```


Compound Partition Key

PRIMARY KEY ((name,dt)) // hash(name,dt) ➔ token

name	dt	item	qty	price	rev
Gregg	20160101	PlayStation4	1	500	500
Schnack	20160102	IPhone 7	2	799	1598
Schnack	20160103	IPhone 7	1	799	799

```
SELECT * FROM sales WHERE name = ‘Schnack’ AND date = ‘1/2/2016’;
```

The clustering column(s)

Role

Clustering column(s)

- simulate 1 – N relationship
- and sort data (logically & on disk)

Clustered table (1 – N)

```
CREATE TABLE sales(
    name  text,
    dt    date,
    item  text,
    qty   int,
    rev   int,
    PRIMARY KEY((name), dt));
```

partition key

clustering column
(sorted)

uniqueness

Recommended syntax

```
PRIMARY KEY((sensor_id), date))
```

Clustering Columns Create Wide Rows

PRIMARY KEY (name,dt) // default sort and range queries

name	dt		
Schnack	20160102		
	iPhone7, 2, 1598		
Gregg	20160101	20160102	20160103
	iPhone7, 2, 1598	iPhone6, 2, 1899	SonyPlaystation 4, 1, 399

```
SELECT * FROM sales WHERE name = 'Gregg' and dt > '1/1/2016';
```

What’s Stored With Each Column?

name	dt		
Schnack	20160102		
	'Microsoft Xbox', 1, 299.00		
Gregg	20160101	20160102	20160103
	’Sony Playstation 4', 1, 399.00	‘Apple Watch', 1, 499.00	‘Mac Book Pro', 1, 2300.00

column name : “item”
column value : “Sony Playstation 4”
timestamp : 1353890782373000
TTL : 3600

Columns relationship and ordering

```
CREATE TABLE sales (
    name  text,
    dt    date,
    item  text,
    qty   integer,
    price double,
    rev   double,
PRIMARY KEY((name), dt))
WITH CLUSTERING ORDER BY (dt DESC)
```

name (1) <------------> (N) dt

dt (1) <---------> (1) (item, qty, price, rev)

name	dt		
Schnack	20160102		
	iPhone7, 2, 1598		
Gregg	20160101	20160102	20160103
	iPhone7, 2, 1598	iPhone6, 2, 1899	SonyPlaystation 4, 1, 399

```
SELECT * FROM sales WHERE name = ‘Gregg’ and dt > ‘1/1/2016’;
```


DATASTAX

Multiple clustering columns

```
CREATE TABLE sales (
   name  text,
   cat   text,
   dt    date,
   item  text,
   qty   integer,
   price double,
   rev   double,
PRIMARY KEY((name), cat, dt))
WITH CLUSTERING ORDER BY (cat ASC, dt DESC)
```

cat (1) <---------> (N) date

name	cat,dt		
Schnack	Apple		
	20160102		
	iPhone7, 2, 1598		
Gregg	Apple	Apple	Sony
	20160101	20160102	20160103
	iPhone7, 2, 1598	iPhone6, 2, 1899	SonyPlaystation 4, 1, 399

```
SELECT * FROM sales
   WHERE name = Gregg’ AND
   cat = ‘Apple’ AND dt >= 1/2/16 AND dt <= 1/3/16;
```

Primary key summary

```
PRIMARY KEY((name), cat, dt))
```

$\underbrace{\texttt{(name), cat, dt}}_{\text{Provides uniqueness}}$

Primary key summary

```
PRIMARY KEY((name), cat, dt))
```

$\underbrace{\texttt{(name)}}$

Used to locate node in the cluster
Used to locate partition in the node

DATASTAX

Primary key summary

```
PRIMARY KEY((name), cat, dt))
```

Used to lookup rows in a partition
Used for data sorting and range queries

Other critical details

Huge partitions

```
PRIMARY KEY((sensor_id), dt))
```

Data for the same sensor stay in the same partition on disk

Huge partitions

```
PRIMARY KEY((sensor_id), dt))
```

Data for the same sensor stay in the same partition on disk

If insert rate = 100/sec, how big is my partition after 1 year ?

→ 100 x 3600 x 24 x 365= 3 153 600 000 cells on disks

Huge partitions

```
PRIMARY KEY((sensor_id), dt))
```

Theorical limit of # cells for a partition = 2×10^9

Practical limit for a partition on disk

- 100Mb
- 100 000 – 1000 000 cells

Reasons ? Make maintenance operations easier

- compaction
- repair
- bootstrap …

Sub-partitioning techniques

```
PRIMARY KEY((sensor_id, day), dt))
```

→ 100 x 3600 x 24 = 8 640 000 cells on disks ✔

Sub-partitioning techniques

```
PRIMARY KEY((sensor_id, day), dt))
```

→ 100 x 3600 x 24 = 8 640 000 cells on disks ✔

But impact on queries:

- need to provide sensor_id & day for any query
- how to fetch data across N days ?

Data deletion and tombstones

```
DELETE FROM sensor_data
   WHERE sensor_id = .. AND dt = …
```

Logical deletion of data but:

- new physical "tombstone" column on disk
- disk space usage will increase !

The "tombstone" columns will be purged later by compaction process …

Lab 3 : Hands-on Primary Keys

Thank You!