
# DataStax Hands-On Modelling

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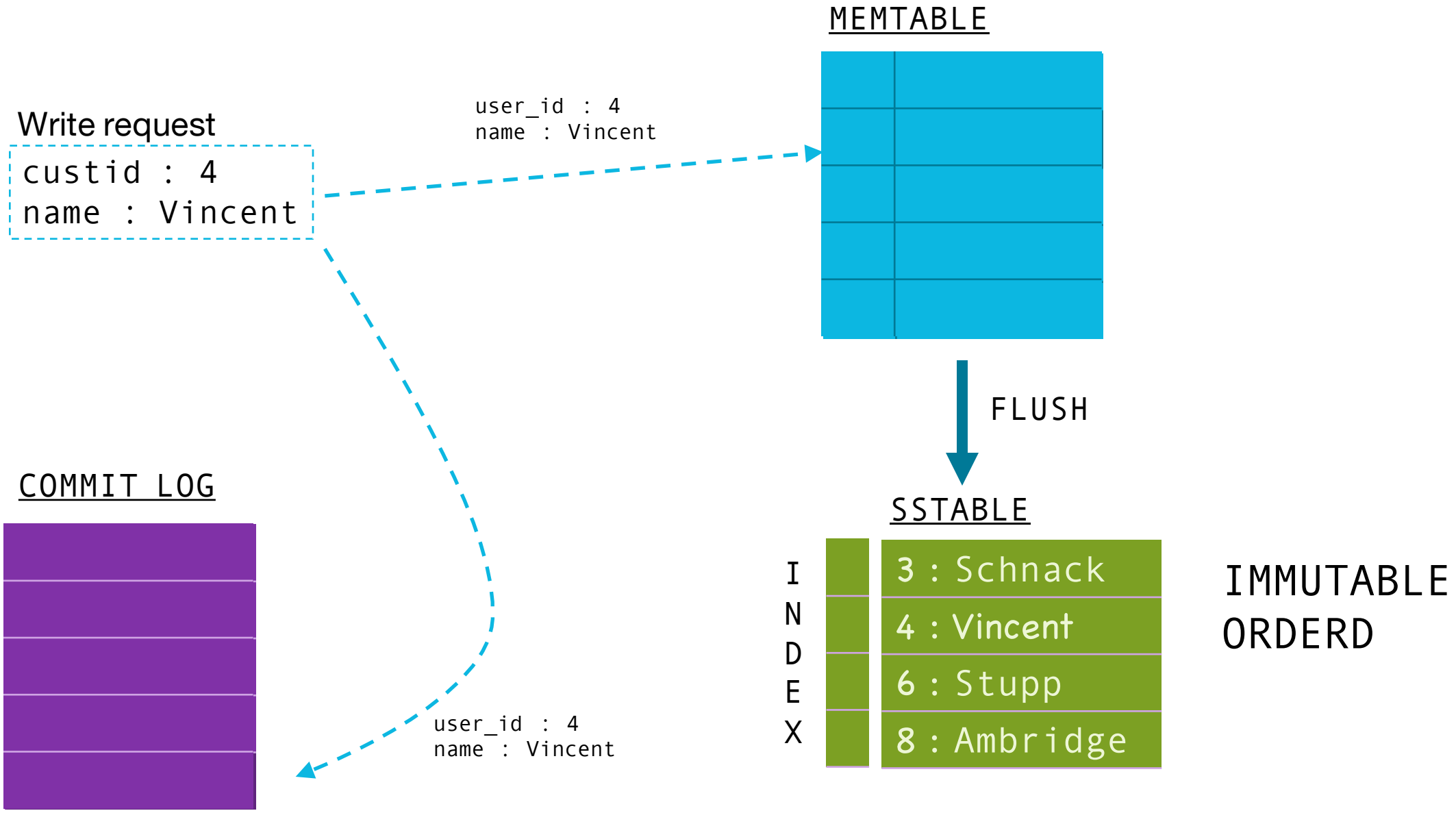
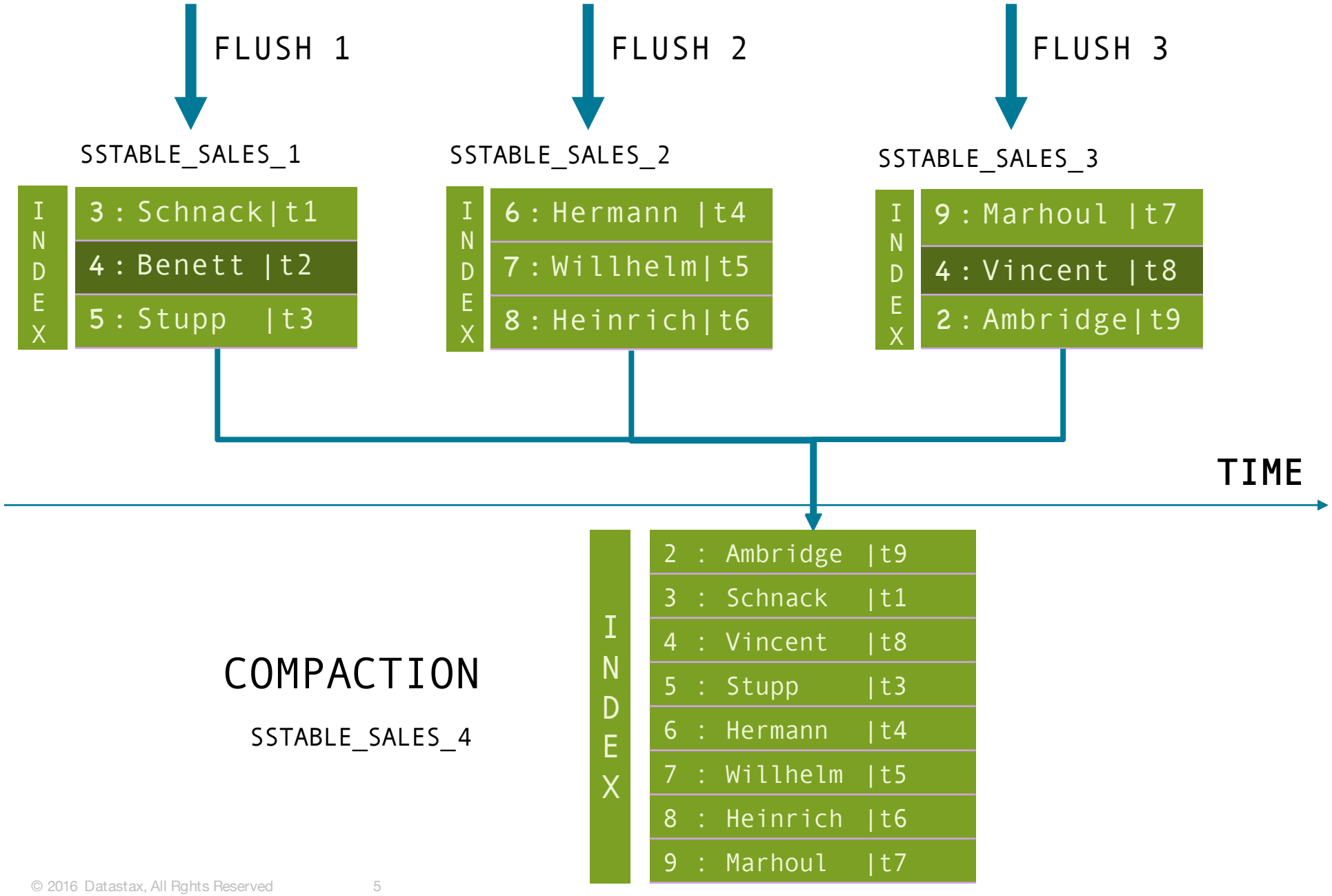
# Agenda

| | |
|---|---|
| 1 | Storing data in Cassandra |
| 2 | Data Modelling, CQL basics |
| 3 | Hands-On Primary Keys |

# Storing data in Cassandra









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# Data Modeling Objectives

# Data modeling objectives

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

# Data modeling methodology

Design by query

- first, know your functional queries
- then design the table(s) for direct access
- just denormalize if necessary
- Spread data evenly around the cluster
- Minimize the number of partitions read
- Make sure to take your read/update ratio into account when designing your schema

Output of design phase = schema.cql

Then start coding

# Know your functional queries

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

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




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# 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 sales by session?

```
CREATE TABLE sales_by_customer (
    custid  int,
    salesdt  date,
    revenue  double,
    discount double,
    comment  txt,
    PRIMARY KEY(custid));
```

partition key (#partition)




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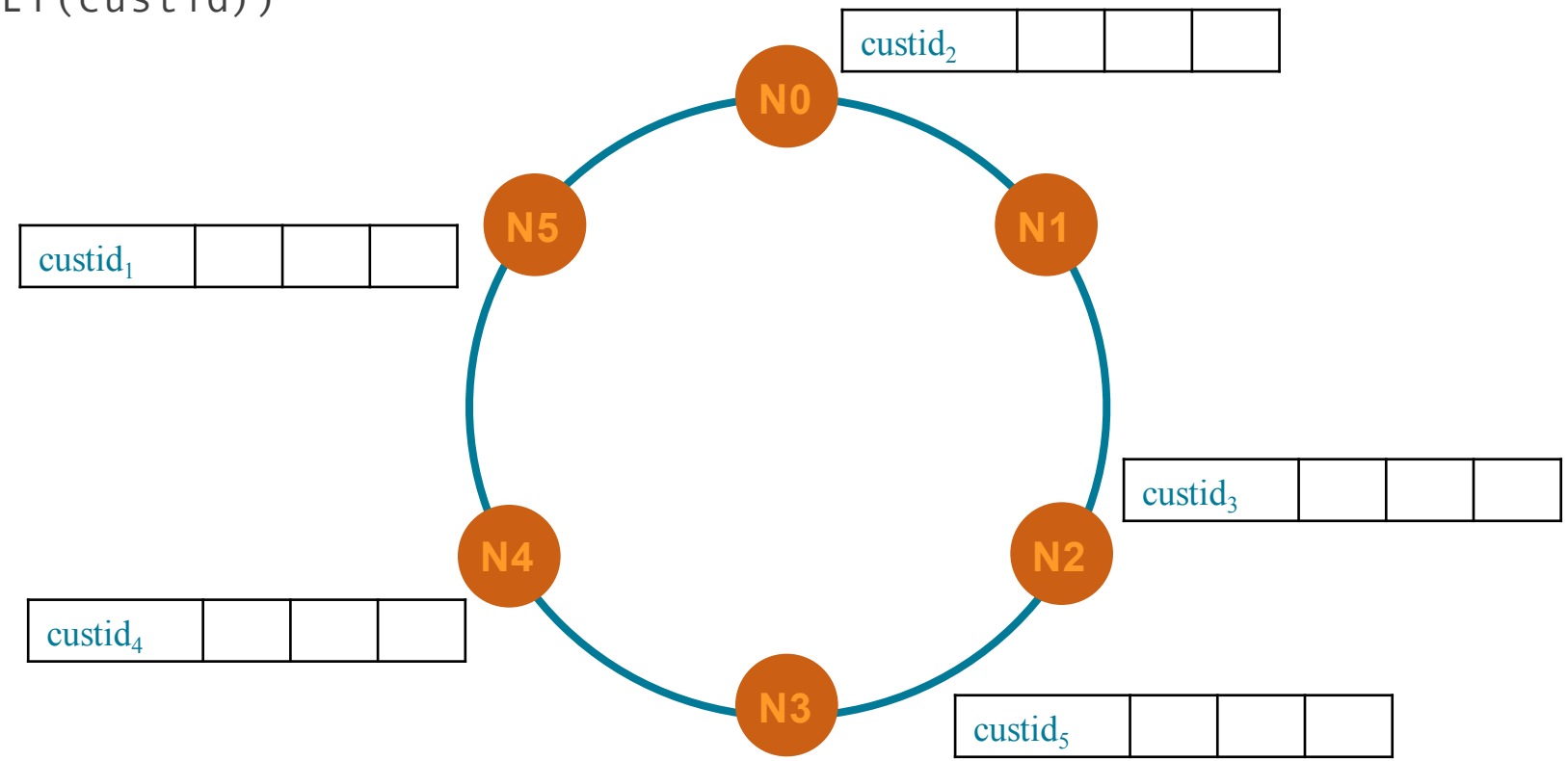
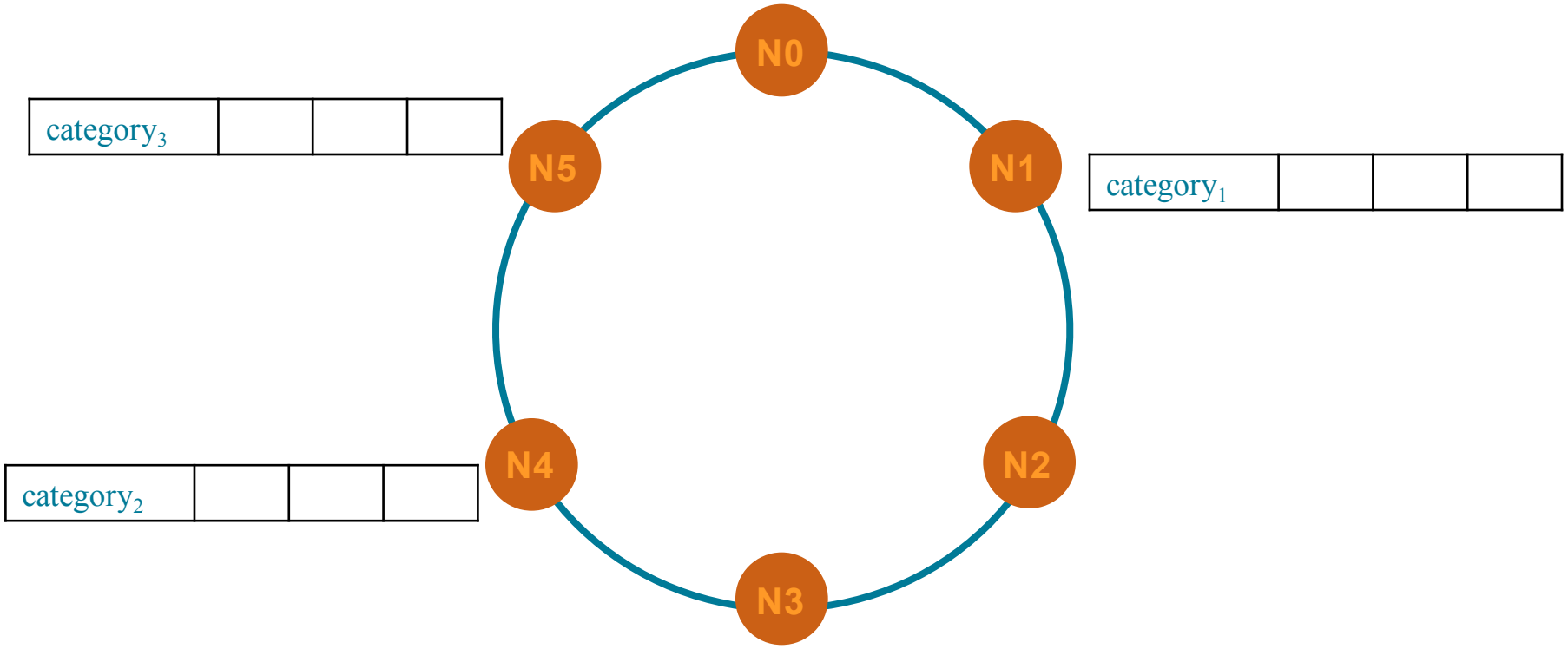
# Example of good partition key

```
CREATE TABLE sales_by_order(
   custid int,
   …,
   PRIMARY KEY(custid))
```



# Example of bad partition key

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



# CRUD operations

```
INSERT INTO sales_by_customer (custid, salesdt, revenue) VALUES('1', '20160103', 799);

UPDATE sales_by_customer SET discount = 10 WHERE custid = 1;

DELETE sales_by_customer FROM sales_by_order WHERE custid = 1;

SELECT revenue FROM sales_by_customer WHERE custid = 1;
```

# No Clustering Columns

PRIMARY KEY (custid) // no duplicate primary keys

| custid | salesdt | revenue | discount | comment |
|---|---|---|---|---|
| 1 | 20160101 | 300 | 10 | PlayStation4 |
| ~~2~~ | ~~20160102~~ | ~~699~~ | ~~25~~ | ~~IPhone 7~~ |
| 2 | 20160103 | 750 | 10 | IPhone 7 |

```
SELECT * FROM sales_by_customer WHERE custid = '2';
```

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# 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_customer (
       custid  int,
       salesdt  date,
       revenue  double,
       discount double,
       comment  txt,
       PRIMARY KEY(custid, salesdt));
```

```
SELECT * FROM sales_by_customer WHERE custid = … AND salesdt = …
```

```
SELECT * FROM sales_by_customer  WHERE custid = … AND salesdt IN (xxx, yyy …)
```




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# Compound Partition Key

PRIMARY KEY ((custid, salesdt))  // hash(custid, salesdt) ➔ token

| custid | salesdt | revenue | discount | comment |
|---|---|---|---|---|
| 1 | 20160101 | 300 | 10 | PlayStation4 |
| 2 | 20160102 | 699 | 25 | IPhone 7 |
| 2 | 20160103 | 750 | 10 | IPhone 7 |

```
SELECT * FROM sales_by_customer WHERE custid = 2 AND salesdt = '1/2/2016';
```

# The clustering column(s)

# Role

Clustering column(s)

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




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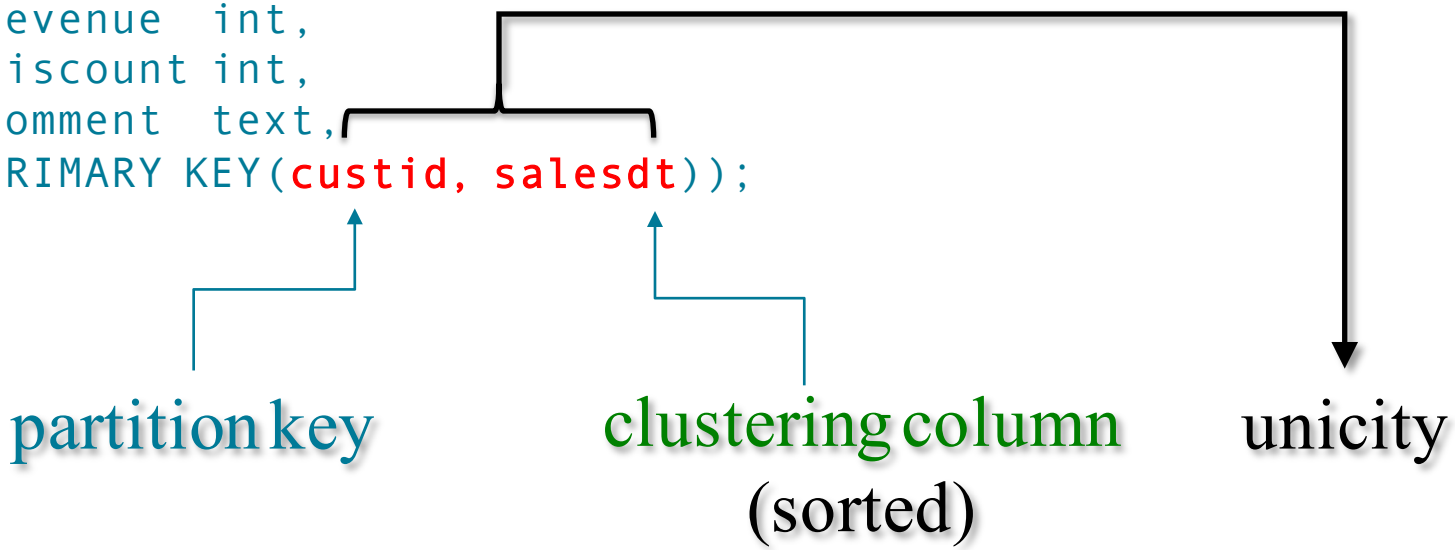
# Clustered table (1 – N)

```
CREATE TABLE sales_by_customer (
    custid   int,
    salesdt  date,
    revenue  int,
    discount int,
    comment  text,
    PRIMARY KEY(custid, salesdt));
```




Recommended syntax

```
PRIMARY KEY((custid), salesdt);
```

# Clustering Columns Create Wide Rows

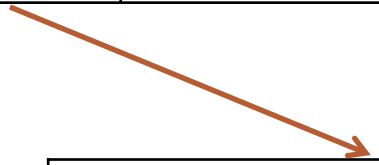
PRIMARY KEY ((custid),salesdt) // default sort and range queries

| custid | salesdt | | |
|---|---|---|---|
| 1 | 20160102 | | |
| | 719, 10, new customer iPhone7 | | |
| 2 | 20160101 | 20160102 | 20160103 |
| | 719, 10, new customer iPhone7 | 45, 50, marketing campaign xyz | 187, 10, sonyplaystation 3 |

```
SELECT * FROM sales_by_customer WHERE custid = 1 and salesdt > '1/1/2016';
```

# What's Stored With Each Column?

| custid | salesdt | | |
|---|---|---|---|
| 1 | 20160102 | | |
| | 719, 10, new customer iPhone7 | | |
| 2 | 20160101 | 20160102 | 20160103 |
| | 719, 10, new customer iPhone7 | 45, 50, marketing campaign xyz | 187, 10, sonyplaystation 3 |



| column name : "comment" |
|---|
| column value : "new customer iPhone7" |
| timestamp : 1353890782373000 |
| TTL : 3600 |

# Columns relationship and ordering

```
CREATE TABLE sales_by_customer (
   custid   int,
   salesdt  date,
   revenue  int,
   discount int,
   comment  text,
PRIMARY KEY((custid), salesdt))
WITH CLUSTERING ORDER BY (dt ASC)
```

custid(1) <----------> (N) salesdt

salesdt (1) <---------> (1) (revenue, discount, comment)

| custid | salesdt | | |
|---|---|---|---|
| 1 | 20160102 | | |
| | 719, 10, new customer iPhone7 | | |
| 2 | 20160101 | 20160102 | 20160103 |
| | 719, 10, new customer iPhone7 | 45, 50, marketing campaign xyz | 187, 10, sonyplaystation 3 |

```
SELECT * FROM sales_by_customer WHERE custid = 1 and salesdt > '1/1/2016';
```

# Multiple clustering columns

```
CREATE TABLE sales_by_cust (
   custid   int,
   salesch  text,
   salesdt  date,
   revenue  int,
   discount int,
   comment  text,
PRIMARY KEY((custid), salesch, salesdt))
WITH CLUSTERING ORDER BY (salesch ASC, salesdt DESC)
```


| custid | salesch, salesdt | | |
|---|---|---|---|
| 1 | online | | |
| | 20160102 | | |
| | 719, 10, new customer iPhone7 | | |
| 2 | online | online | store |
| | 20160101 | 20160102 | 20160103 |
| | 719, 10, new customer iPhone7 | 45, 50, marketing campaign xyz | 187, 10, sonyplaystation 3 |

```
SELECT * FROM sales_by_customer
   WHERE custid = 1 AND
   salesch = "online" AND salesdt >= 1/2/16 AND salesdt <= 1/3/16;
```

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# Primary key summary

```
PRIMARY KEY((custid), salesch, salesdt)
```

Unicity of (custid, salesch, salesdt)

# Primary key summary

```
PRIMARY KEY((custid), salesch, salesdt)
```

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




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# Primary key summary

```
PRIMARY KEY((custid), salesch, salesdt)
```

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




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# Lab 3 : Hands-on Primary Keys

# Other critical details

# Huge partitions

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

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




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# 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 = $2 \times 10^9$

Practical limit for a partition on disk

- 100Mb
- 100 000 – 1000 000 cells

Reasons ? Make maintenance operations easier

- compaction
- repair
- bootstrap …




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# 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

Vielen Dank!