

Apache Cassandra

Introduction

- Apache Cassandra is a **free, open source**, distributed data storage system that differs sharply from relational database management systems.
- Cassandra was created to power the Facebook Inbox Search
- Facebook open-sourced Cassandra in 2008 and became an Apache Incubator project
- In 2010, Cassandra graduated to a top-level project, regular update and releases followed.
- Designed to **handle large amount of data** across multiple servers
- Easy to **implement** and **deploy**
- Mimics traditional relational database systems, but with **triggers** and **lightweight transactions**
- Raw, simple data structures
- *Cassandra is being used by some of the biggest companies such as Facebook, Twitter, Cisco, Rackspace, ebay, Netflix, and more*

Data Model : *Key-Value Model*

- Cassandra is a column oriented NoSQL system
- Table is a multi dimensional map indexed by key (row key).
- Column families: sets of key-value pairs
 - column family as a table and key-value pairs as a row (using relational database analogy)
- A row is a collection of columns labeled with a name, value, timestamp

Key-Value Model

keyspace

settings

column family

settings

column

name

value

timestamp

Example

A single column

Name	colA	value1	Value
------	------	--------	-------

A single row

key	columns					
a	colA	value1	colFoo	aval	milk	white

Rows	a	colA	value1	colFoo	aval	milk	white				
	❖	colA	value1	long col name		foo	♠ piece				
	✂	🔪	🎵	8	μ	♠	⊕	🕒	🐼	ℙ	ℝ

Column family

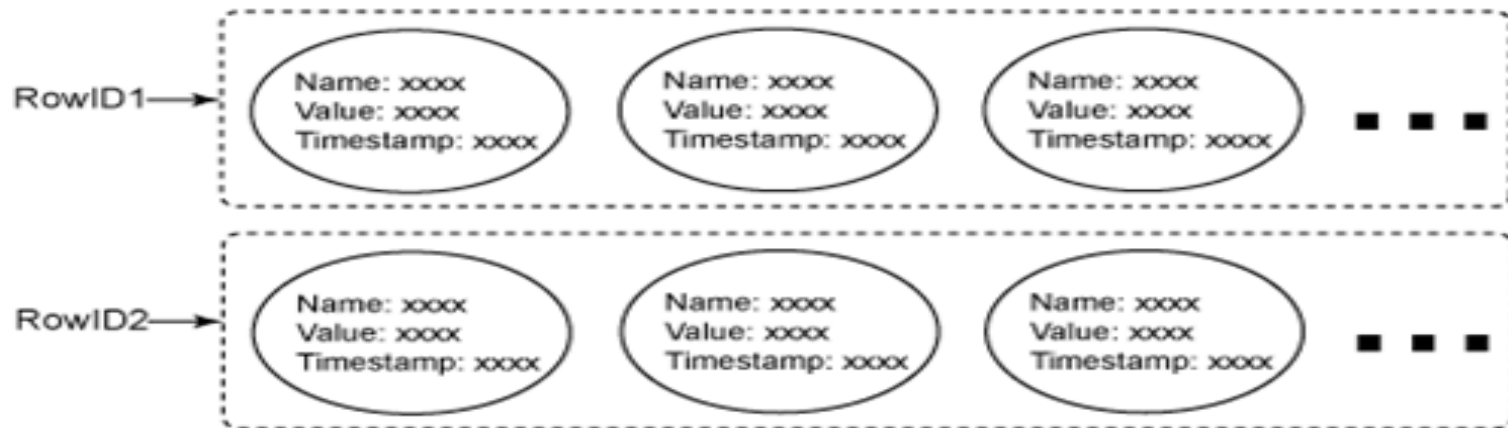
Color Key

- Keys
- Column Names
- Column Values

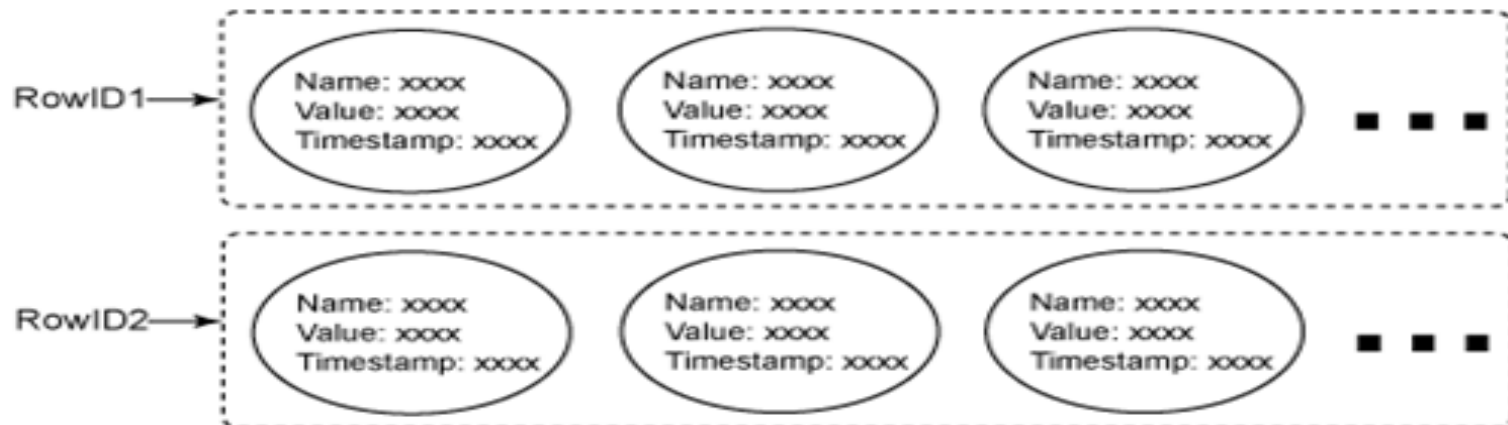
Example

KeySpace 1

Column family 1

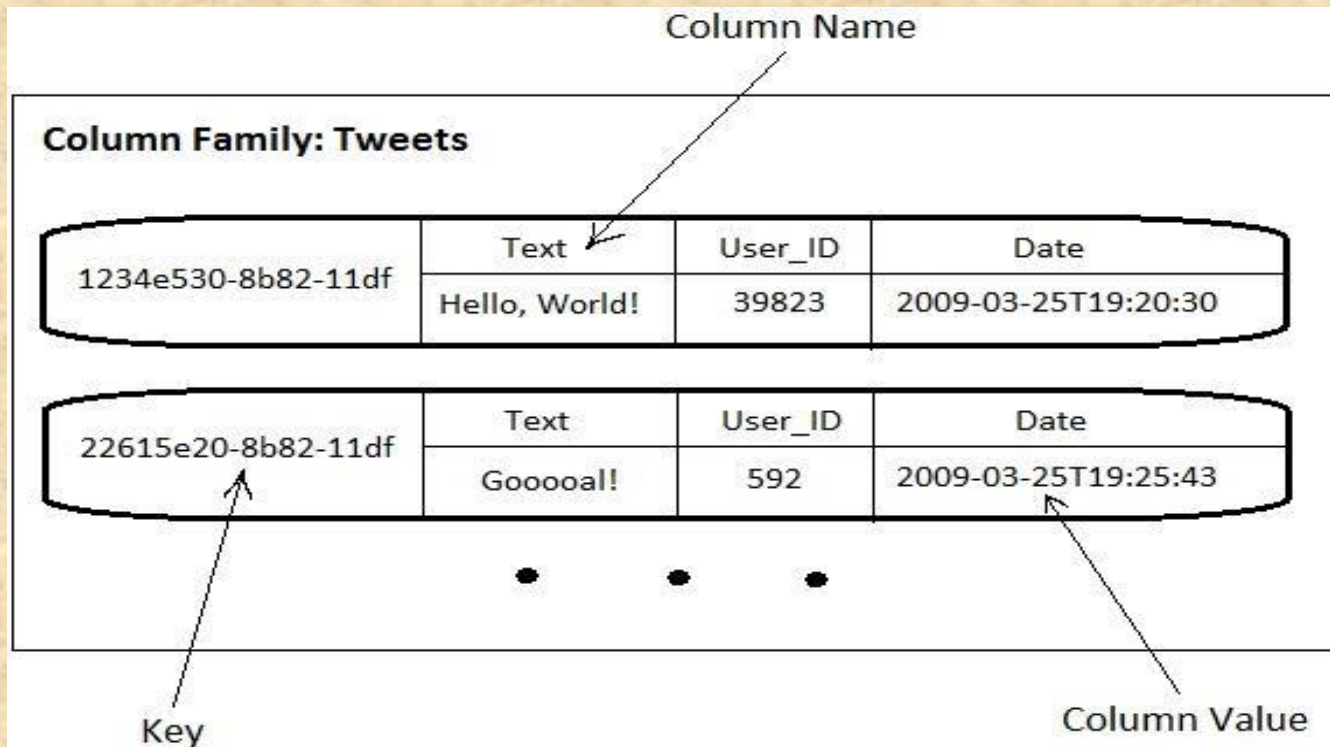


Column family 2



Cassandra Row

- the value of a row is itself a sequence of key-value pairs
- such nested key-value pairs are *columns*
- key = column name
- a row must contain at least 1 column



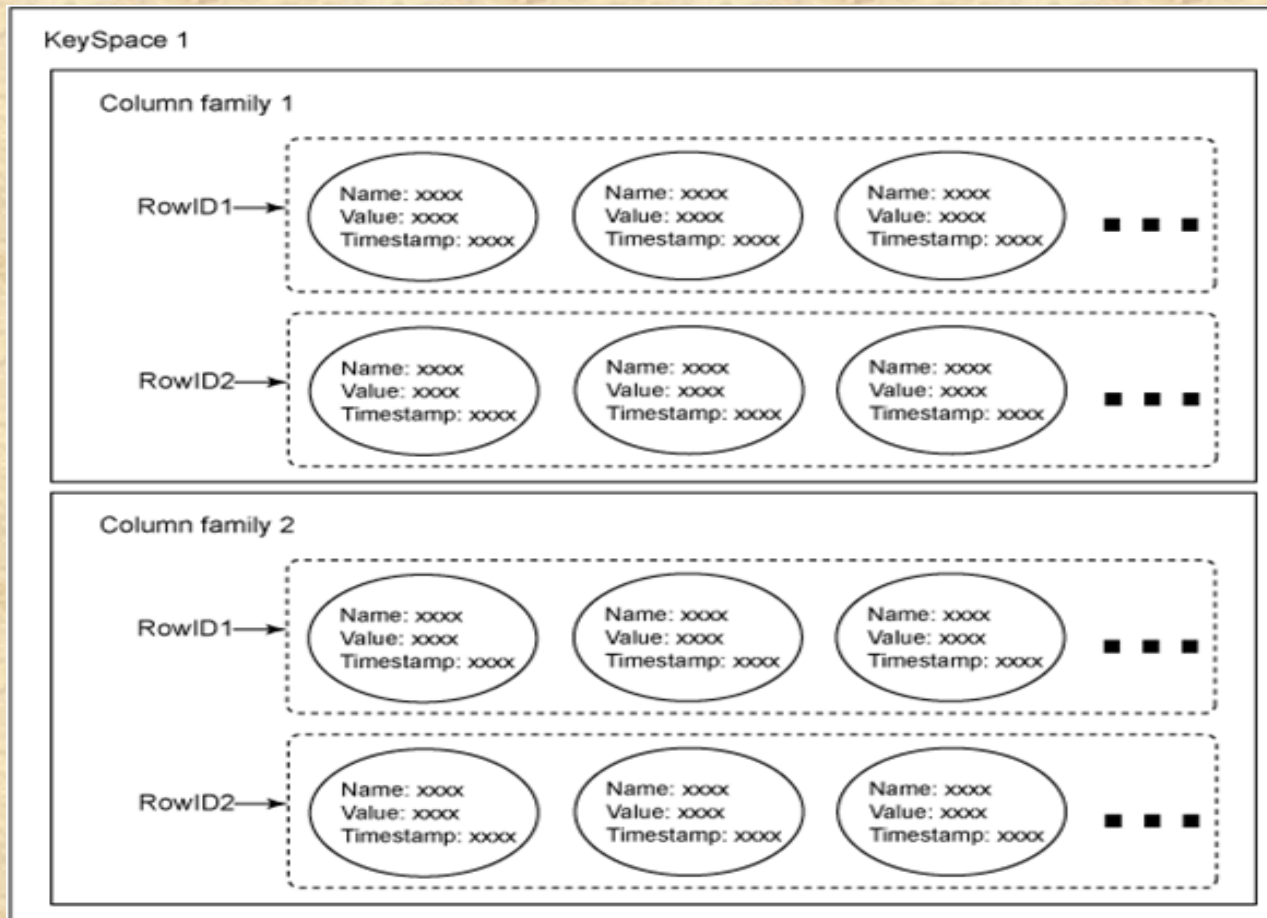
Column names storing values

- key: User ID
- column names store tweet ID values
- values of all column names are set to “-” (empty byte array) as they are not used

Column Family: User_Timelines			
39823	cef7be80-8b88-11df	1234e530-8b82-11df	...
	-	-	...
592	f0137940-8b8a-11df	22615e20-8b82-11df	...
	-	-	...
...			

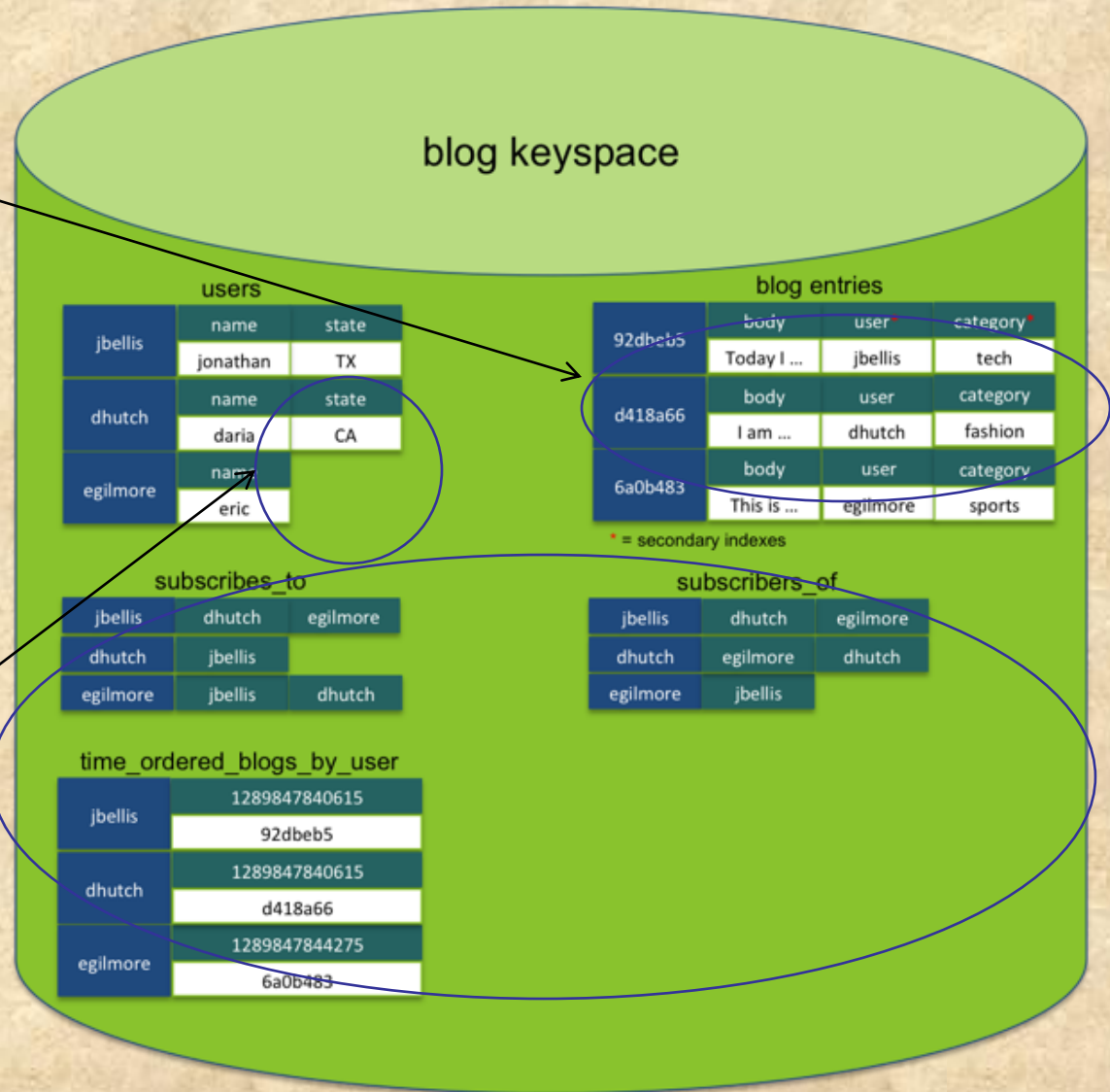
Key Space

- A Key Space is a group of column families together
- It is only a logical grouping of column families and provides an isolated scope for names



Cassandra Data : Storage

- **Column Families:**
 - Like SQL tables
 - but may be unstructured (client-specified)
 - Can have index tables
- **“column-oriented databases”/“NoSQL”**
 - No schemas
 - Some columns missing from some entries
 - “Not Only SQL”
 - Supports get(key) and put(key, value) operations
 - Often write-heavy workloads



Cassandra Query Language - CQL

- creating a *keyspace* - namespace of tables

```
CREATE KEYSPACE demo
```

```
WITH replication = {'class': 'SimpleStrategy',  
  'replication_factor': 3};
```

- to use namespace:

```
USE demo;
```

Cassandra Query Language - CQL

- creating tables

```
CREATE TABLE users(  
email varchar,  
bio varchar,  
birthday timestamp,  
active boolean,  
time_posted));  
PRIMARY KEY (email));
```

```
CREATE TABLE tweets(  
email varchar,  
time_posted timestamp,  
tweet varchar,  
PRIMARY KEY (email,
```

- inserting data

```
INSERT INTO users (email, bio, birthday, active)  
VALUES ('john.doe@bti360.com', 'BT360 Teammate', 516513600000, true);
```

*** timestamp fields are specified in milliseconds since epoch*

- querying tables

SELECT expression reads one or more records from Cassandra column family and returns a result-set of rows

```
SELECT * FROM users;
```

```
SELECT email FROM users WHERE active = true;
```


Data Models of Cassandra and RDBMS

RDBMS	Cassandra
RDBMS deals with structured data.	Cassandra deals with unstructured data.
It has a fixed schema.	Cassandra has a flexible schema.
In RDBMS, a table is an array of arrays. (ROW x COLUMN)	In Cassandra, a table is a list of "nested key-value pairs". (ROW x COLUMN key x COLUMN value)
Database is the outermost container that contains data corresponding to an application.	Keyspace is the outermost container that contains data corresponding to an application.
Tables are the entities of a database.	Tables or column families are the entity of a keyspace.
Row is an individual record in RDBMS.	Row is a unit of replication in Cassandra.
Column represents the attributes of a relation.	Column is a unit of storage in Cassandra.
RDBMS supports the concepts of foreign keys, joins.	Relationships are represented using collections.