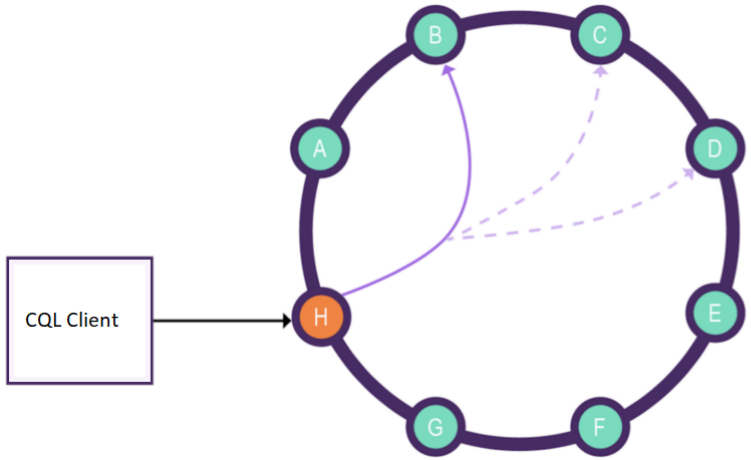
Cassandra

A distributed NoSQL Database

- Open source + Enterprice versions exists
- =Amazon DynamoDB + Google Bigtable
- NoSQL: Lacks full ACID transaction support; Lightweight transactions, f.ex no Joins. Row-atomic updates.
- Configurable replication & availability strategy
- No special master node (multimaster db replication)
- Partitioned key-oriented queries
- Gossip protocol
- Runtime network topology changes & recovery

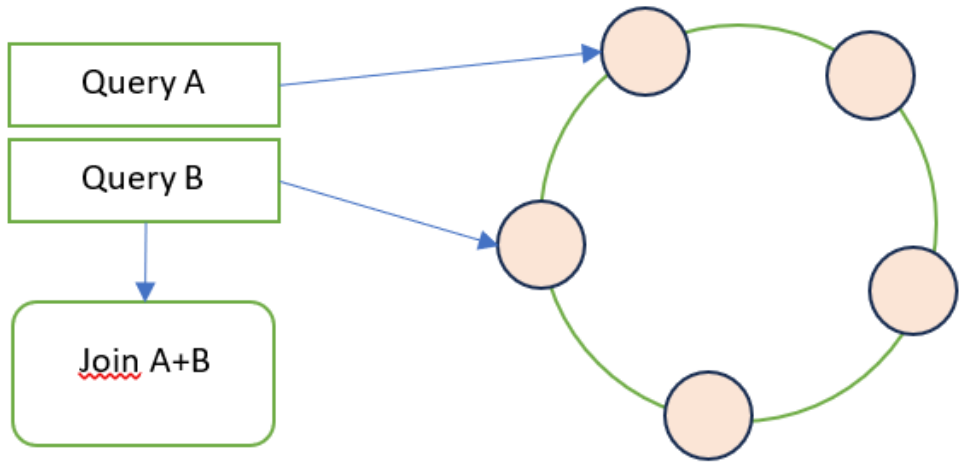
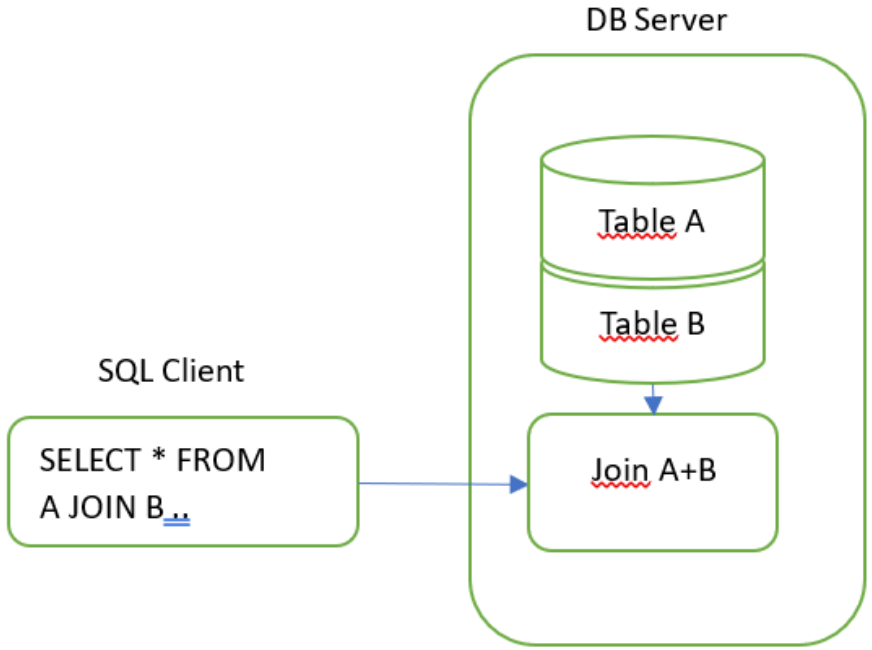


(https://cassandra.apache.org/doc/latest/cassandra/architecture/overview.html)

Cassandra CQL	vs **SQL**
CREATE **KEYSPACE** myDatabase WITH replication = {'class': 'SimpleStrategy', 'replication_factor': 1};	CREATE **DATABASE** myDatabase;
USE myDatabase;	--"--
CREATE TABLE IF NOT EXISTS myTable (id INT PRIMARY KEY); -- (synonyms in cql: COLUMNFAMILY=TABLE) **NB table need primary key** in CQL.	--"--
ALTER TABLE myTable ADD myField INT;	--"--
CREATE INDEX myIndex ON myTable (myField);	--"--
INSERT INTO myTable (id, myField) VALUES (1, 7);	--"--
SELECT * FROM myTable WHERE myField = 7;	--"--
SELECT COUNT(*) FROM myTable;	--"--
DELETE FROM myTable WHERE myField = 7;	--"--

CQL	SQL
- No support for things like **JOIN, GROUP BY, or FOREIGN KEY**. Leaving these features out is important because it makes writing and retrieving data from Cassandra much more efficient.	**JOIN, GROUP BY, FOREIGN KEY**
Writes are cheap. Write everything the way you want to read it. CQL does not perform a read while inserting. Without a read, there is no way to know if the data being inserted is replacing an existing record. This means that both inserts and updates are extremely fast.	
UPDATE myTable SET myField = 2 WHERE id = 6; - However, if the row does not exist, it will still get created. Similarly as unintuitive, an INSERT statement will actually replace data if it exists. In where-clause, only primary key column can be used. Under the hood, INSERT and UPDATE are treated the same by Cassandra ("Upserts"), except for Counter columns/tables. Both INSERT and UPDATE require complete PRIMARY KEY.	--"--
Transaction Control Language (TCL) - **Not in CQL**	COMMIT – It saves the work done SAVEPOINT – It identifies a point in a transaction to which you can later roll back ROLLBACK – It restores database to original since the last COMMIT
Data Retrieval/Query Language (DRL/DQL): **Simple transactions** (Relation between database objects is not possible): - Where clause: only on primary key or secondary indexes! - Can use only AND operator, There are no OR and NOT operators.	Data Retrieval/Query Language (DRL/DQL): **Full transactions.**

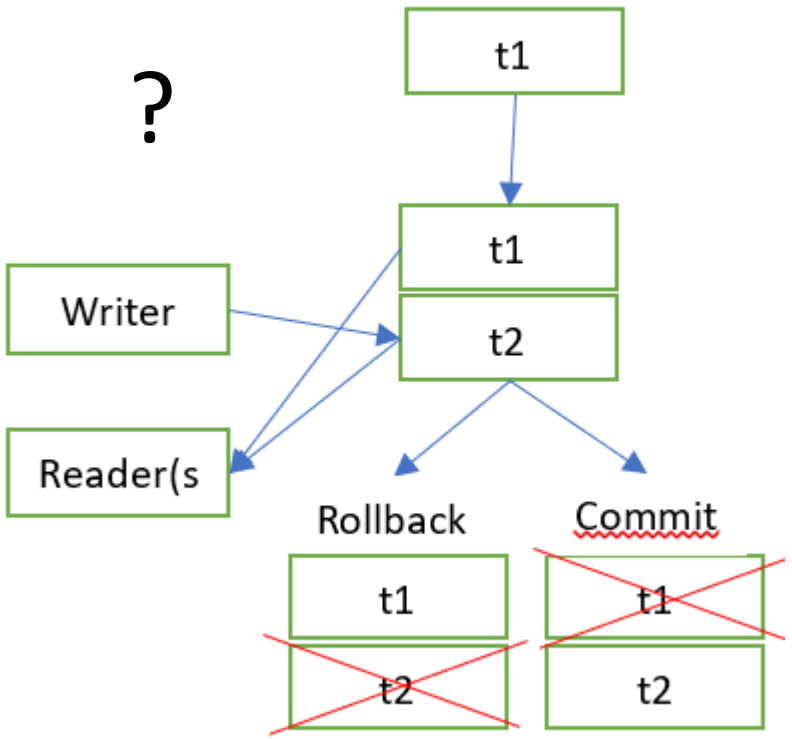
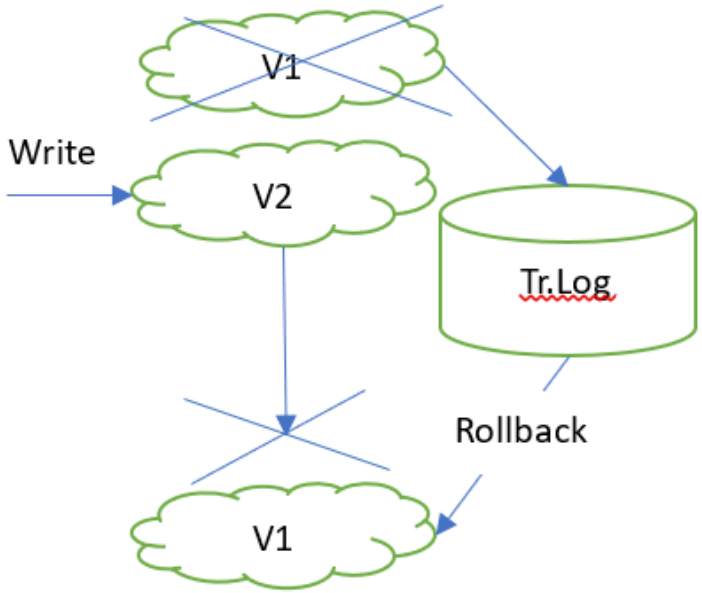
Join?

CQL	SQL
	

Query A
Query B
Join A+B

DB Server
Table A
Table B
SQL Client
SELECT * FROM
A JOIN B..
Join A+B

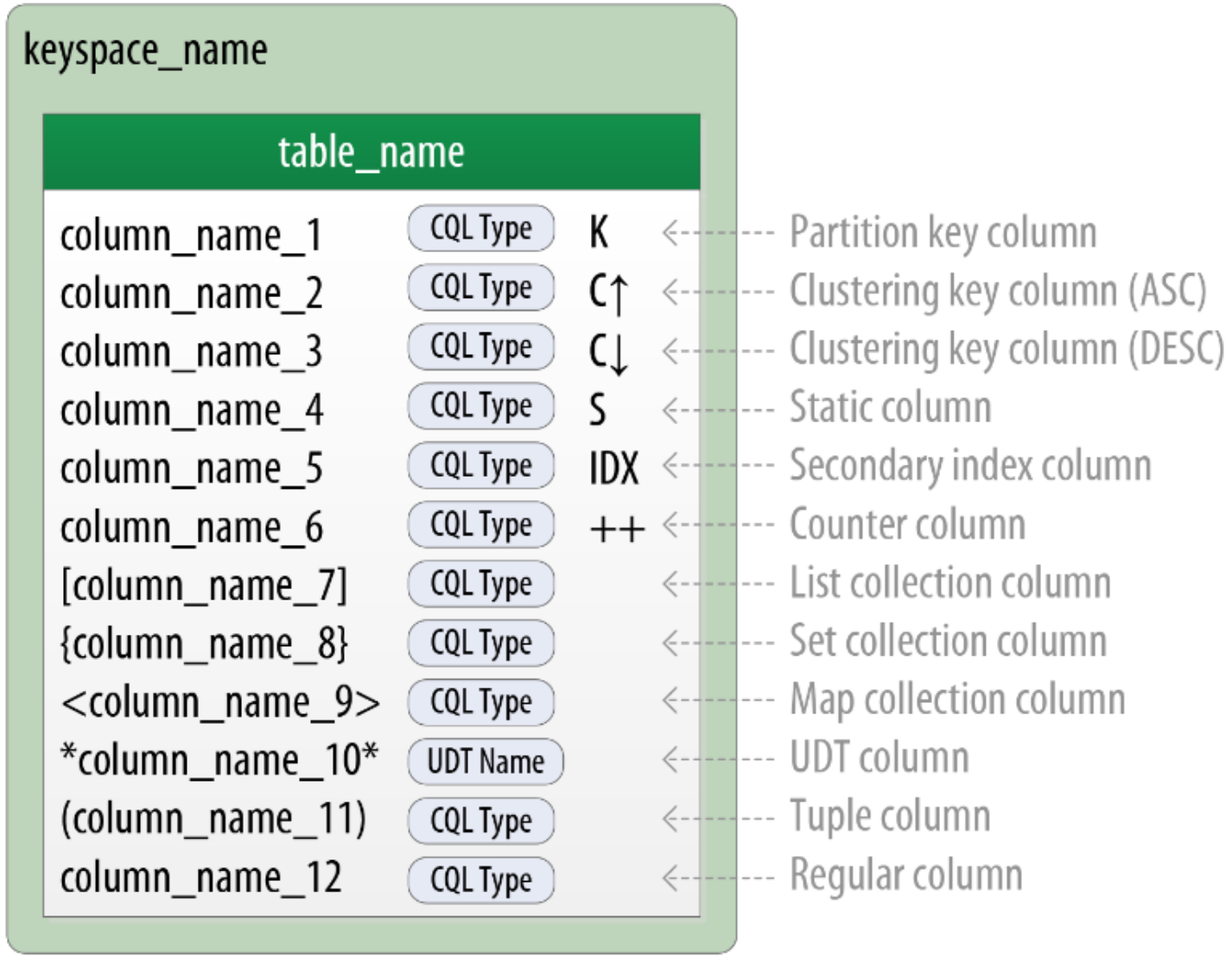
Rollback?

CQL	SQL
	

CQL Primary Key

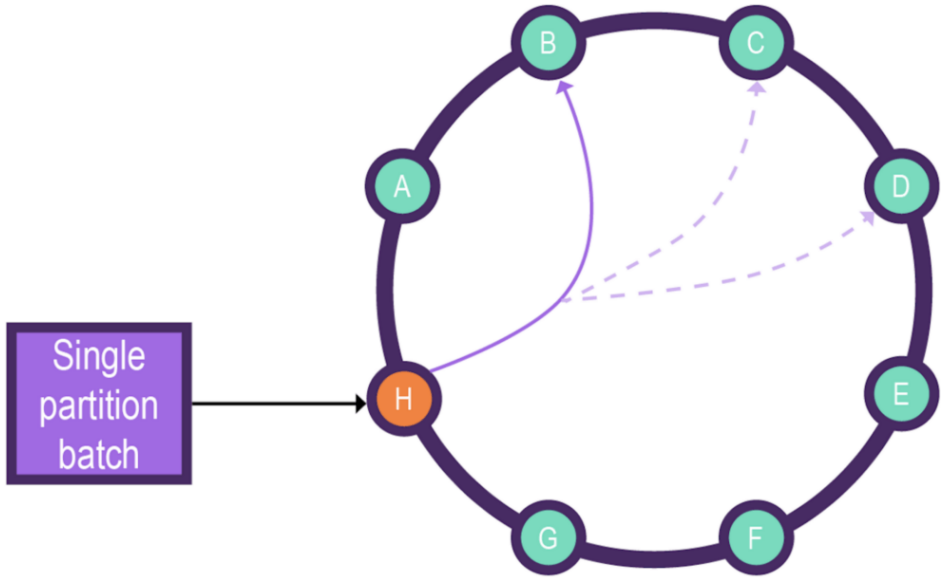
```
CREATE TABLE pk_table(
        p1 <type>, -- partition key
        p2 .., -- partition kay
        c ..,    -- cluster key
        f ..,     -- cluster key
        f ..,     -- non-key column
        PRIMARY KEY ((p1,p2), c, f)
    );
```

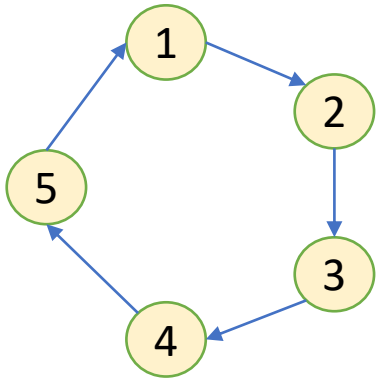
- Key order matters! Left-to-right priority
- Partition keys required.


keyspace_name
table_name
column_name_1
CQL Type
K
Partition key column
column_name_2
CQL Type
C↑
Clustering key column (ASC)
column_name_3
CQL Type
C↓
Clustering key column (DESC)
column_name_4
CQL Type
S
Static column
column_name_5
CQL Type
IDX
Secondary index column
column_name_6
CQL Type
++
Counter column
[column_name_7]
CQL Type
List collection column
{column_name_8}
CQL Type
Set collection column
<column_name_9>
CQL Type
Map collection column
column_name_10
UDT Name
UDT column
(column_name_11)
CQL Type
Tuple column
column_name_12
CQL Type
Regular column

Single partition operation

The **single partition batch operations are unlogged by default** and thus, do not suffer from performance penalties due to logging.
The below diagram depicts the single partition batch request flow from the coordination node *H* to the partition node *B* and its replication nodes *C*, *D*:
https://www.baeldung.com/java-cql-cassandra-batch





Nodes →

Partition# = hash(PrimKey)

	1	2	3	4	5
1	SE	SE	SE		
2		DE UK	DE UK	DE UK	
3			NO	NO	NO
4	DK			DK	DK
5	UK	UK			UK

Replicas:3

Keyspace->

	1	2	3	4
1	SE			
2		DE UK		
3			NO	
4				DK

Replicas:1

	1	2
1	SE	SE
2	DE UK	DE UK
3	NO	NO
4	DK	DK

Replicas:2

	1	2
1	SE	
2		DE UK
3	NO	
4		DK

Replicas:1

	1
1	SE
2	DE UK
3	NO
4	DK

Replicas:1

	1	2	3	4
1	SE, DE UK	SE, DE UK		
2		NO, DK	NO, DK	

userid	firstname	lastname	email
3b4c48a7-13b5-4aba-9f0a-dc75ded08a99	Barney	Rubble	rubble@hotmail.com
2506535a-4999-438d-8682-d5a739596343	Fred	Flinstone	fred@gmail.com
31e24f9d-0d27-4143-82b1-fa1a4268d028	Joe	Rockhead	joer@yahoo.com
57bae20b-3694-4975-a274-db5e856d24ab	Wilma	Flinstone	wilma@bedrock.com

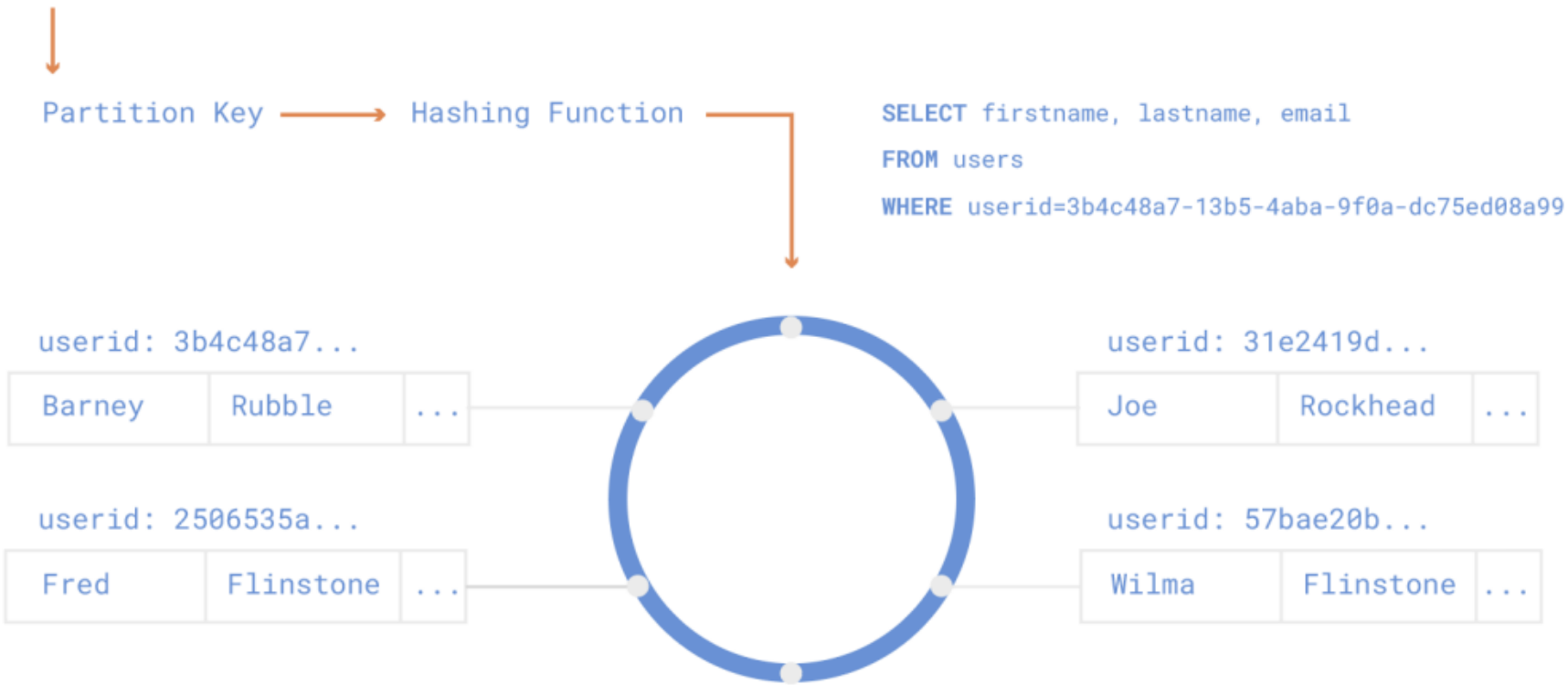


FIGURE 1 How Cassandra stores data