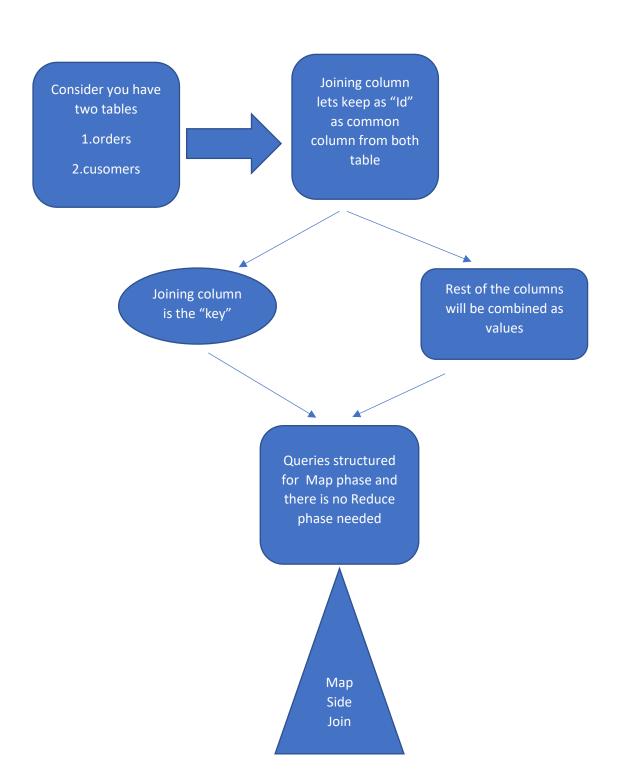
# Hive Joins [Advance Concepts]:

- One join column = 1 map reduce
- If you made join with two columns in your query then 2 MR jobs will run
- Minimizing the MR jobs will improve the performance of Jobs to run it faster



# Sample files





## **Normal Join:**

When we perform a normal join, the job is sent to a Map-Reduce task which splits the main task into 2 stages – "Map stage" and "Reduce stage". The Map stage interprets the input data and returns output to the red uce stage in the form of key-value pairs. This next goes through the shuffle stage where they are sorted and combined. The reducer takes this sorted value and completes the join job.

## **Map side Joins:**

A table can be loaded into the memory completely within a mapper without using the Map/Reducer process. It reads the data from the smaller table and stores it in an in-memory hash table and then serializes it to a hash memory file, thus substantially reducing the time. It is also known as Map Side Join in Hive. Basically, it involves performing joins between 2 tables by using only the Map phase and skipping the Reduce phase.

- Map operations only
- Faster processing time
- Reduce operations such as shuffle and sort between Map & reduce phases
- It Reduces the data transfer between machines in the cluster.
- A left join is possible to be done to a map join only when the right table size is small.
- A right join can be done to a map join only when the left table size is small and Map join query cannot convert Full outer joins into the map side join

#### Configuration:

hive.auto.convert.join=true;

#### keyword:

/\*+ MAPJOIN(c) \*/ \*

#### Table creation DDL:

#### Table1:

CREATE TABLE IF NOT EXISTS testing.emp\_data ( emp\_id int, emp\_name String, email\_id String, gender String, ip\_address String) row format delimited fields terminated BY ',';

load data local inpath '/home/cloudera/projects/employee\_data.txt' into table testing.emp data;

#### Table 2:

CREATE TABLE IF NOT EXISTS testing.emp\_info ( emp\_id int, emp\_name String) row format delimited fields terminated BY ',';

load data local inpath '/home/cloudera/projects/emp data.txt' into table testing.emp info;

```
[cloudera@quickstart ~]$ hive
Logging initialized using configuration in file:/etc/hive/conf.dist/hive-log4j.properties
WARNING: Hive CLI is deprecated and migration to Beeline is recommended.
hive> CREATE TABLE IF NOT EXISTS testing.emp data ( emp id int, emp name String, email id String, gender String, ip address S
tring) row format delimited fields terminated BY ',
Time taken: 8.175 seconds
hive> load data local inpath '/home/cloudera/projects/employee_data.txt' into table testing.emp_data;
Loading data to table testing.emp_data
Table testing.emp_data stats: [numFiles=1, totalSize=552]
Time taken: 2.341 seconds
hive> select * from testing.emp data;
0K
100
         John
                  john121@gmail.com
                                            Male
                                                     125.125.25
        Jaheer jaheer221@gmail.com
suman suman121@gmail.com
102
                                            Male
                                                      125.120.25
                                            Female 125.126.25
103
104
         kathir kathir121@gmail.com
105
        hussian hussian121@gmail.com
                                            Male
                                                      125,225,25
106
                arul121@gmail.com
                                             Male
                                                      125.125.25
        arul
107
        anjana anjana121@gmail.com
                                             Male
108
        alex
                 alex121@gmail.com
                                            Male
                                                      125.225.25
                                            Male
                                                      125.235.25
109
        amar
                 amar121@gmail.com
110
         karthick
                           karthick121@gmail.com
                                                     Male
                                                              125.205.25
        veena veena121@gmail.com
anitha anitha121@gmail.com
                                                      125.225.25
111
                                            Male
112
                                            Male
                                                     125.285.25
Time taken: 1.139 seconds, Fetched: 12 row(s)
hive> CREATE TABLE IF NOT EXISTS testing.emp_info ( emp_id int, emp_name String) row format delimited fields terminated BY ',
0K
hive> load data local inpath '/home/cloudera/projects/emp_data.txt' into table testing.emp_info;
Loading data to table testing.emp_info
Table testing.emp_info stats: [numFiles=1, totalSize=125]
Time taken: 0.737 seconds
Cloudera Live : We... ☐ cloudera@quickstart:~
```

#### Sample query:

SELECT /\*+ MAPJOIN(c) \*/ \* FROM tablename1 t1 JOIN tablename2 t2 ON (t1.emp\_id = t2.emp\_id);

SELECT /\*+ MAPJOIN(emp\_info) \*/ emp\_data.emp\_name, emp\_data.emp\_id,emp\_info.emp\_id FROM emp\_data JOIN emp\_info ON emp\_data.emp\_name = emp\_info.emp\_name;

```
cloudera@quickstart:~
 File Edit View Search Terminal Help
hive> use testing:
Time taken: 0.33 seconds
hive> set hive.auto.convert.join=true;
hive> SELECT /*+ MAPJOIN(emp_info) */ emp_data.emp_name, emp_data.emp_id,emp_info.emp_id FROM emp_data JOIN emp_info ON emp_d
ata.emp_name = emp_info.emp_name;
Query ID = cloudera_20220704082929_d3527091-49f7-476b-be30-1fb6719cf307
Total jobs = 1
al16-c9ded1893b9c/hive_2022-07-04_08-29-53_218_8475631783618795120-1/-local-10003/HashTable-Stage-3/MapJoin-mapfile01--.hasht
2022-07-04 08:30:18
                            Uploaded 1 File to: file:/tmp/cloudera/3bb7fd9e-e862-4d25-a116-c9ded1893b9c/hive 2022-07-04 08-29-53
218_8475631783618795120-1/-local-10003/HashTable-Stage-3/MapJoin-mapfile01--.hashtable (568 bytes) 2022-07-04 08:30:18 End of local task; Time Taken: 5.705 sec.
Execution completed successfully
MapredLocal task succeeded
Launching Job 1 out of 1
Number of reduce tasks is set to 0 since there's no reduce operator
Starting Job = job_1656946853198_0001, Tracking URL = http://quickstart.cloudera:8088/proxy/application_1656946853198_0001/
Kill Command = /usr/lib/hadoop/bin/hadoop job -kill job_1656946853198_0001
Hadoop job information for Stage-3: number of mappers: 1; number of reducers: 0
2022-07-04 08:30:42,943 Stage-3 map = 0
2022-07-04 08:31:43,863 Stage-3 map = 0%, reduce = 0%
2022-07-04 08:32:44,836 Stage-3 map = 0%, reduce = 0%
                                                   reduce = 0%
2022-07-04 08:33:03,528 Stage-3 map = 100%, reduce = 0%, Cumulative CPU 2.79 sec
MapReduce Total cumulative CPU time: 2 seconds 790 msec Ended Job = job_1656946853198_0001
MapReduce Jobs Launched:
Stage-Stage-3: Map: 1 Cumulative CPU: 2.79 sec HDFS Read: 7119 HDFS Write: 173 SUCCESS Total MapReduce CPU Time Spent: 2 seconds 790 msec
John
                   100
Jaheer 102
                   102
kathir 103
                   104
hussian 105
                   105
                                                                                    I
```

Note: One should be a larger file, and one should be a smaller one.

# **Bucket Map Join**

- Bucket map join can be done on 2 big tables
- Both tables should be bucketed on Join Column
- Number of buckets in each table should be integral multiple of another table
- Only required number of buckets will get loaded into memory

CREATE TABLE IF NOT EXISTS empdata1\_buk (emp\_id int, emp\_name String, email\_id String, gender String, ip\_address String) clustered by(emp\_name) into 4 buckets row format delimited fields terminated BY ',';

CREATE TABLE IF NOT EXISTS empdata2\_buk ( emp\_id int, emp\_name String) clustered by(emp\_name) into 8 buckets row format delimited fields terminated BY ',';

insert overwrite table testing.empdata1\_buk select \* from testing.emp\_data; insert overwrite table testing.empdata2\_buk select \* from testing.emp\_info;

```
hive> CREATE TABLE IF NOT EXISTS empdata2_buk ( emp_id int, emp_name String) clustered by(emp_name) into 8 buckets row format delimited fields terminated BY ',';
Time taken: 0.209 seconds
hive> insert overwrite table testing.empdata1 buk select * from testing.emp data;
Query ID = cloudera_20220704083939_515cc308-ae42-4f42-bc61-591519d804fd
Total jobs = 3
Launching Job 1 out of 3
Number of reduce tasks is set to 0 since there's no reduce operator
Starting Job = job 1656946853198_0002, Tracking URL = http://quickstart.cloudera:8088/proxy/application_1656946853198_0002/
Kill Command = /usr/lib/hadoop/bin/hadoop job -kill job_1656946853198_0002
Hadoop job information for Stage-1: number of mappers: 1; number of reducers: 0
2022-07-04 08:40:17,934 Stage-1 map = 0%, reduce = 0% 2022-07-04 08:40:41,027 Stage-1 map = 100%, reduce = 0% MapReduce Total cumulative CPU time: 1 seconds 540 msec
                                                              reduce = 0%, Cumulative CPU 1.54 sec
Ended Job = job_1656946853198_0002
Stage-4 is selected by condition resolver
Stage-3 is filtered out by condition resolver.
Stage-5 is filtered out by condition resolver.
Moving data to: hdfs://quickstart.cloudera:8020/user/hive/warehouse/testing.db/empdatal_buk/.hive-staging hive 2022-07-04 08-
39-57_819_9101769132594159827-1/-ext-10000
Loading data to table testing.empdata1_buk
Table testing.empdata1 buk stats: [numFiles=1, numRows=12, totalSize=552, rawDataSize=540]
MapReduce Jobs Launched:
Stage-Stage-1: Map: 1
                                Cumulative CPU: 1.54 sec
                                                                      HDFS Read: 4750 HDFS Write: 629 SUCCESS
Total MapReduce CPU Time Spent: 1 seconds 540 msec
Time taken: 48.705 seconds
hive> insert overwrite table testing.empdata2_buk select * from testing.emp_info;
Query ID = cloudera_20220704084141_caa6dab1-0cff-4982-be4c-61f3286d3245
Total jobs = 3
Launching Job 1 out of 3
Number of reduce tasks is set to 0 since there's no reduce operator
Starting Job = job_1656946853198_0003, Tracking URL = http://quickstart.cloudera:8088/proxy/application_1656946853198_0003/
Kill Command = /usr/lib/hadoop/bin/hadoop job -kill job_1656946853198_0003
Hadoop job information for Stage-1: number of mappers: 1; number of reducers: 0
```

### **Queries & configuration to Run Bucket Map join Query:**

set hive.optimize.bucketmapjoin = true;

```
SELECT /*+ MAPJOIN(empdata2_buk) */
empdata1_buk.emp_name,empdata1_buk.emp_id, empdata2_buk.emp_id
FROM empdata1_buk JOIN empdata2_buk ON empdata1_buk.emp_name =
empdata2_buk.emp_name;
```

```
hive> set hive.optimize.bucketmapjoin = true;
hive> SELECT /*+ MAPJOIN(empdata2_buk) */ empdata1_buk.emp_name,empdata1_buk.emp_id, empdata2_buk.emp_id FROM empdata1_buk JO
IN empdata2_buk ON empdata1_buk.emp_name = empdata2_buk.emp_name ;
Query ID = cloudera_20220704084545_007b0290-dd58-47bf-a2a3-80ba59f10ee8
Total jobs = 1
Execution log at: /tmp/cloudera/cloudera 20220704084545 007b0290-dd58-47bf-a2a3-80ba59f10ee8.log
                                   Starting to launch local task to process map join; maximum memory = 932184064

Dump the side-table for tag: 1 with group count: 12 into file: file:/tmp/cloudera/3bb7fd9e-e862-4d25-
2022-07-04 GB:45:42
2022-07-04 08:45:46
al16-c9dedl893b9c/hive 2022-07-04 08-45-32 136 3431632920043678693-1/-local-10003/HashTable-Stage-3/MapJoin-mapfile11--.hasht
2022-07-04 08:45:46
                                    Uploaded 1 File to: file:/tmp/cloudera/3bb7fd9e-e862-4d25-a116-c9ded1893b9c/hive 2022-07-04 08-45-32
136_3431632920043678693-1/-local-10003/HashTable-Stage-3/MapJoin-mapfilell--.hashtable (568 bytes) 2022-07-04 08:45:46 End of local task; Time Taken: 3.784 sec.
Execution completed successfully
MapredLocal task succeeded
Launching Job 1 out of 1
Number of reduce tasks is set to 0 since there's no reduce operator
Starting Job = job_1656946853198_0004, Tracking URL = http://quickstart.cloudera:8088/proxy/application_1656946853198_0004/
Kill Command = /usr/lib/hadoop/bin/hadoop job -kill job_1656946853198_0004
Hadoop job information for Stage-3: number of mappers: 1; number of reducers: 0
Taddoop Job Information for Stage-3: number of mappers: 2022-07-04 08:46:02,621 Stage-3 map = 0%, reduce = 0% 2022-07-04 08:46:17,737 Stage-3 map = 100%, reduce = 0% MapReduce Total cumulative CPU time: 1 seconds 930 msec Ended Job = job_1656946853198_0004
                                                                 reduce = 0%, Cumulative CPU 1.93 sec
MapReduce Jobs Launched:
Stage-Stage-3: Map: 1 Cumulative CPU: 1.93 sec HDFS Read: 7321 HDFS Write: 173 SUCCESS Total MapReduce CPU Time Spent: 1 seconds 930 msec
John
Jaheer 102
                        102
            103
                        103
suman
```

# **SORT Merge Join or SMB**

- SMB merge join can be done on 2 big tables
- Both tables should be bucketed on Join Column
- Both tables should be sorted on join column
- Number of buckets in each table should be exactly equal in both tables
- There should be one to one mapping between buckets in both tables and quick joining can be performed as both the buckets have sorted data.

#### **Configuration:**

Set Hive.input.format = org.apache.hadoop.hive.ql.io.BucketizedHiveInputFormat; set hive.optimize.bucketmapjoin = true; set hive.optimize.bucketmapjoin.sortedmerge = true;

```
hive> set Hive.input.format = org.apache.hadoop.hive.ql.io.BucketizedHiveInputFormat;
hive> set hive.optimize.bucketmapjoin = true;
hive> set hive.optimize.bucketmapjoin.sortedmerge = true;
```

#### Create table statement with Equal buckets for two tables:

CREATE TABLE IF NOT EXISTS empdata1\_buk (emp\_id int, emp\_name String, email\_id String, gender String, ip\_address String) clustered by(emp\_name) into 4 buckets row format delimited fields terminated BY ',';

CREATE TABLE IF NOT EXISTS empdata3\_buk ( emp\_id int, emp\_name String) clustered by(emp\_name) into 4 buckets row format delimited fields terminated BY ',';

#### **Sort by Emp Name for both tables:**

insert overwrite table testing.empdata1\_buk select \* from testing.emp\_data sort by emp\_name;

insert overwrite table testing.empdata3\_buk select \* from testing.emp\_info sort by emp\_name;

```
five> SELECT /*+ MAPJOIN(empdata2_buk) */ empdata1_buk.emp_name,empdata1_buk.emp_id, empdata2_buk.emp_id FROM empdata1_buk JO
IN empdata2 buk ON empdata1 buk.emp name = empdata2 buk.emp name ;
Query ID = cloudera_20220704091212_a5665cla-7436-4c50-8aa8-b4aacffbc212
Total jobs = 1
Execution log at: /tmp/cloudera/cloudera_20220704091212_a5665c1a-7436-4c50-8aa8-b4aacffbc212.log 2022-07-04 09:12:45 Starting to launch local task to process map join; maximum memory = 932184064
2022-07-04 09:13:03
                             Uploaded 1 File to: file:/tmp/cloudera/3bb7fd9e-e862-4d25-a116-c9ded1893b9c/hive 2022-07-04 09-12-36
894_4633324346211696486-1/-local-10003/HashTable-Stage-3/MapJoin-mapfile21--.hashtable (568 bytes)
2022-07-04 09:13:03
                             End of local task; Time Taken: 17.635 sec.
Execution completed successfully
MapredLocal task succeeded
Launching Job 1 out of 1
Number of reduce tasks is set to 0 since there's no reduce operator
Starting Job = job_1656946853198_0007, Tracking URL = http://quickstart.cloudera:8088/proxy/application_1656946853198_0007/
Kill Command = /usr/lib/hadoop/bin/hadoop job -kill job_1656946853198_0007
Hadoop job information for Stage-3: number of mappers: 1; number of reducers: 0
2022-07-04 09:13:24,471 Stage-3 map = 0%, reduce = 0% 2022-07-04 09:13:42,695 Stage-3 map = 100%, reduce = 0% MapReduce Total cumulative CPU time: 1 seconds 900 msec
                                                       reduce = 0%, Cumulative CPU 1.9 sec
Ended Job = job_1656946853198_0007
MapReduce Jobs Launched:
Stage-Stage-3: Map: 1 (
                             Cumulative CPU: 1.9 sec
                                                             HDFS Read: 7404 HDFS Write: 173 SUCCESS
Total MapReduce CPU Time Spent: 1 seconds 900 msec
0K
Jaheer
                    102
John
          100
                    100
alex
          108
                    108
amar
          109
                    109
anitha 112
                    112
anjana 107
arul
          106
                    106
hussian 105
                    105
karthick
                    110
                              110
```