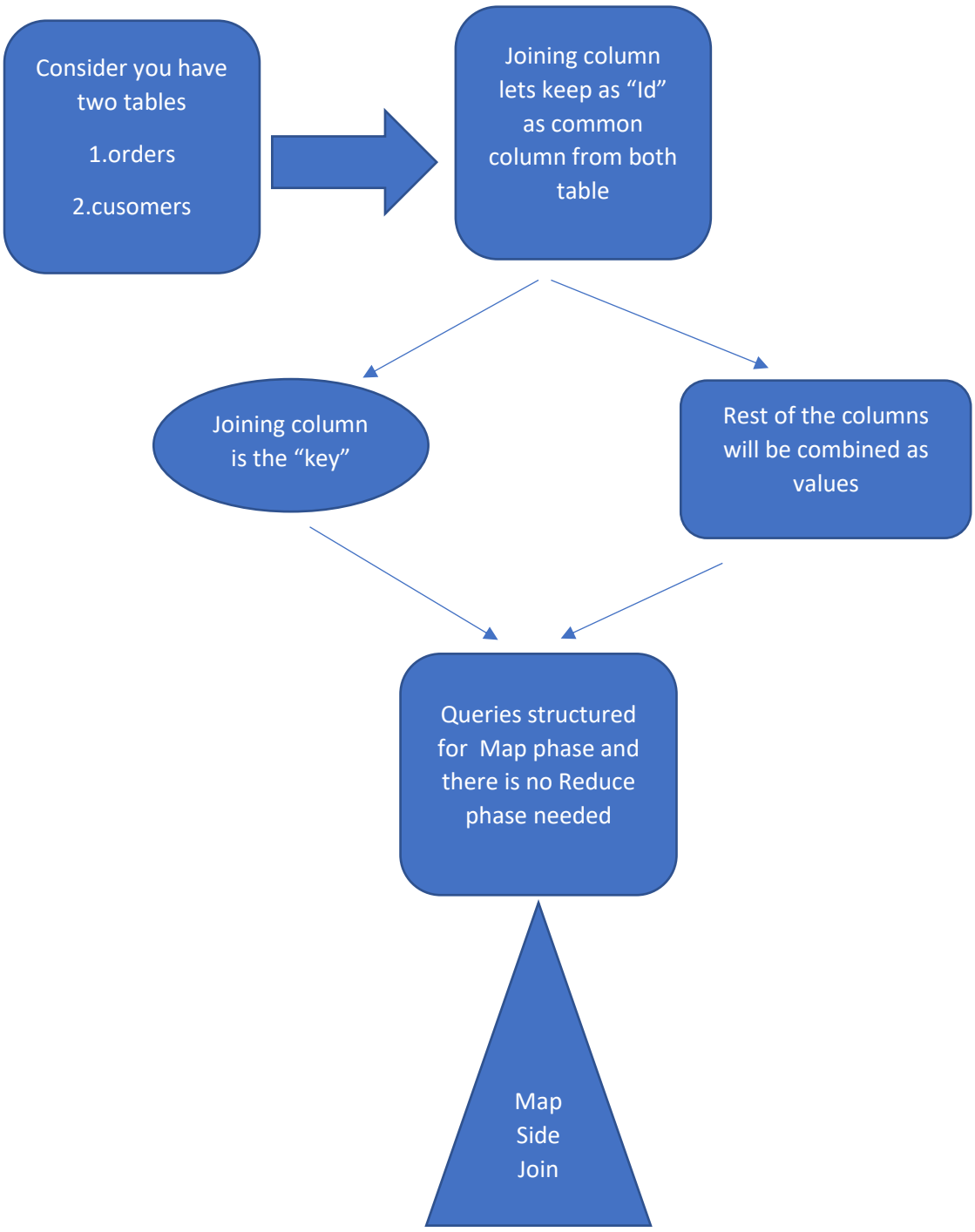
Hive Joins [Advance Concepts]:

- 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


emp_data.txt


employee_data.txt

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:

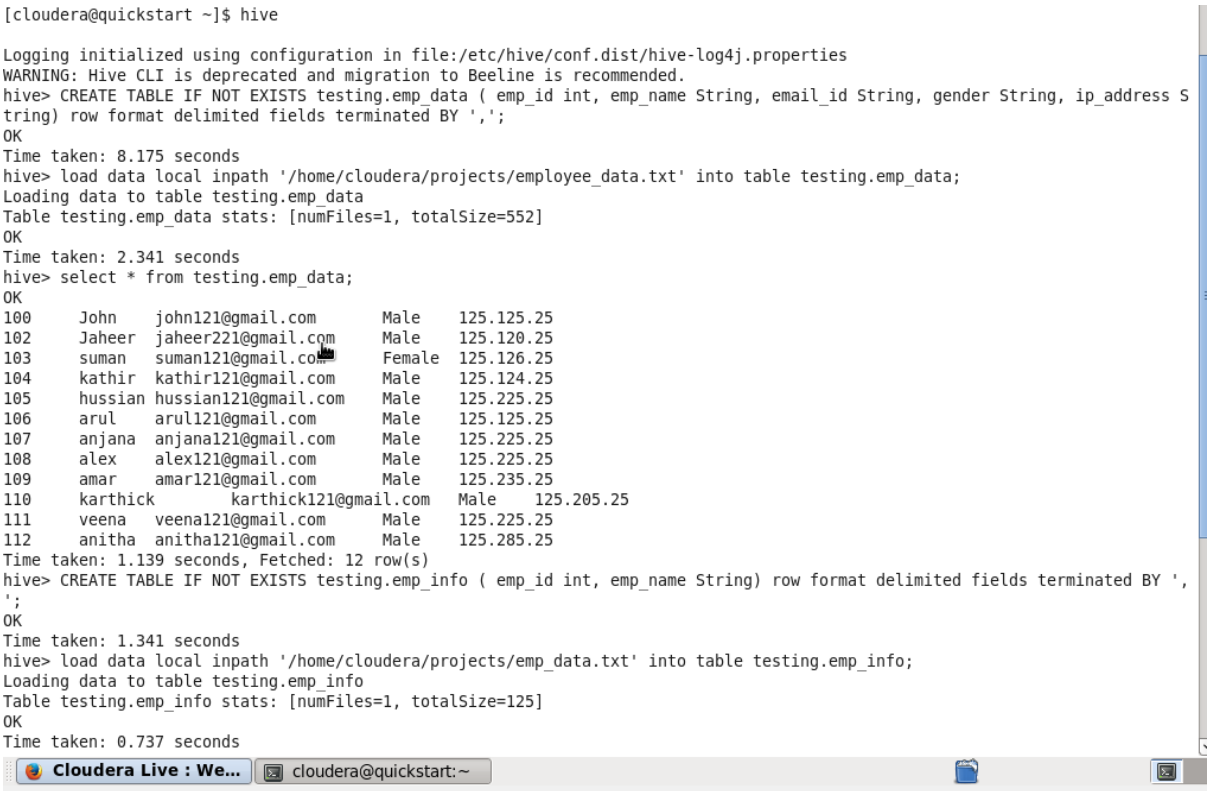
CREATE TABLE IF NOT EXISTS testing.emp_data (emp_id int, emp_name String, email_id String, gender String, ip_address String) row format delimited fields terminated BY ',';

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 ',';

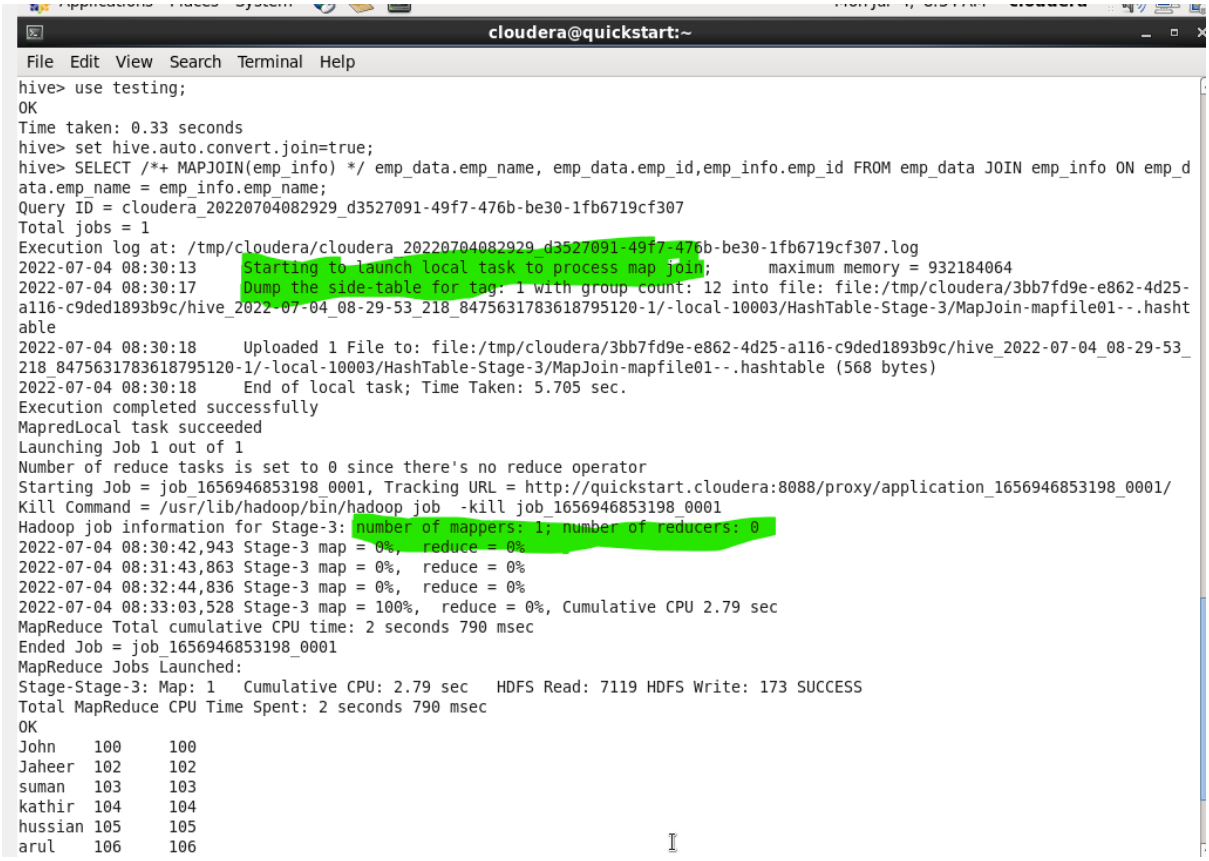
load data local inpath '/home/cloudera/projects/emp_data.txt' into table testing.emp_info;



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;



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 ',' ;
OK
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%, Cumulative CPU 1.54 sec
MapReduce Total cumulative CPU time: 1 seconds 540 msec
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/empdata1_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
OK
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
2022-07-04 08:45:42     Starting to launch local task to process map join;      maximum memory = 932184064
2022-07-04 08:45:46     Dump the side-table for tag: 1 with group count: 12 into file: file:/tmp/cloudera/3bb7fd9e-e862-4d25-
a116-c9ded1893b9c/hive_2022-07-04_08-45-32_136_3431632920043678693-1/-local-10003/HashTable-Stage-3/MapJoin-mapfile11--.hasht
able
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-mapfile11--.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
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%, Cumulative CPU 1.93 sec
MapReduce Total cumulative CPU time: 1 seconds 930 msec
Ended Job = job_1656946853198_0004
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
OK
John    100     100
Jaheer  102     102
suman   103     103
kathir  104     104
hussian 105     105
```

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;

```
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_20220704091212_a5665c1a-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     Dump the side-table for tag: 1 with group count: 12 into file: 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--.hasht
able
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%, Cumulative CPU 1.9 sec
MapReduce Total cumulative CPU time: 1 seconds 900 msec
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
OK
Jaheer  102     102
John    100     100
alex    108     108
amar    109     109
anitha  112     112
anjana  107     107
arul    106     106
hussian 105     105
karthick        110     110
```