EXPERIMENT-1

AIM: Hadoop HDFS Practical

A. HDFS Basics, Hadoop Ecosystem Tools Overview.

B. Installing Hadoop.

C. Copying File to Hadoop.

D. Copy from Hadoop File system and delete file.

E. Moving and displaying files in HDFS.

F. Programming exercises on Hadoop

THEORY:

The Apache Hadoop software library is a framework that allows for the distributed processing of large data sets across clusters of computers using simple programming models. It is designed to scale up from single servers to thousands of machines, each offering local computation and storage. Rather than rely on hardware to deliver high-availability, the library itself is designed to detect and handle failures at the application layer, so delivering a highly-available service on top of a cluster of computers, each of which may be prone to failures.

IMPLEMENTATION:

INSTALLATION OF HADOOP (CLOUDERA) IN VM

Setup Hadoop Virtual Environment:

To setup a single node cluster, on your laptop, you need following software:

* Oracle Virtual Box software to install one or more virtual machines. Get this software from https://www.virtualbox.org/ Cloudera VM-this software acts as a virtual machine. By default, Cloudera consists of

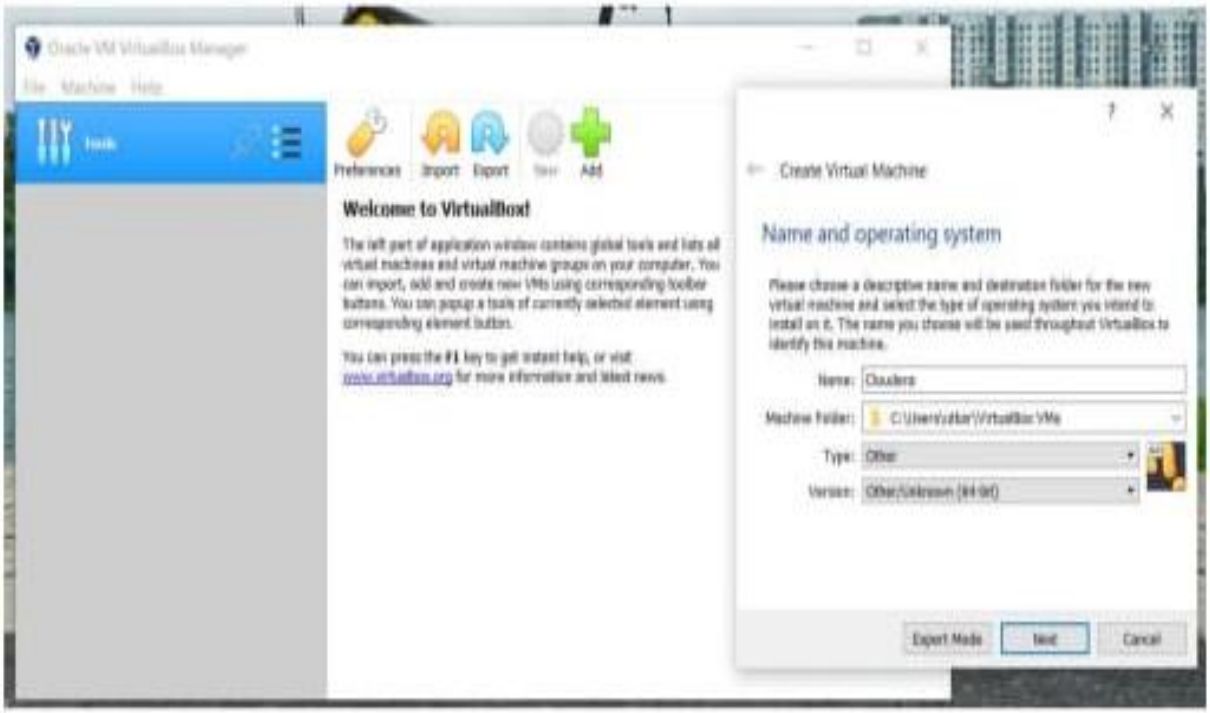
packages of most of the cloud computing frameworks like Hadoop, Spark, Hive, Pig, etc. Download Cloudera QuickStart VM for Virtual Box platform, Go get this software, go to http://www.cloudera.com/ Select Get Started Select Try Now Select Download Now inside QuickStarts box Select a platform as Virtual Box. Fill a form that pops up after this step and download Cloudera.. Alternatively, download it directly from here

STEP 1: Download VirtualBox from https://www.virtualbox.org/wiki/Downloads, install it and open

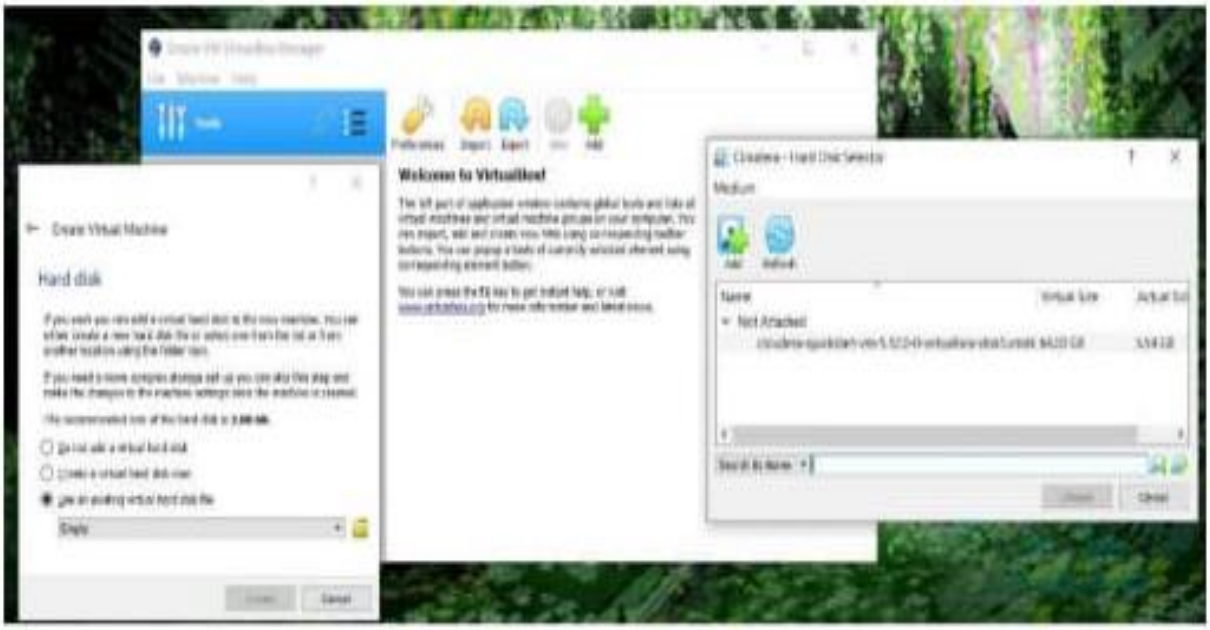
STEP 2: Create a new VM for cloudera and with the help of the following snapshots

STEP 3: Give your VM a name, TYPE: Other and VERSION: Unknown 64-bit

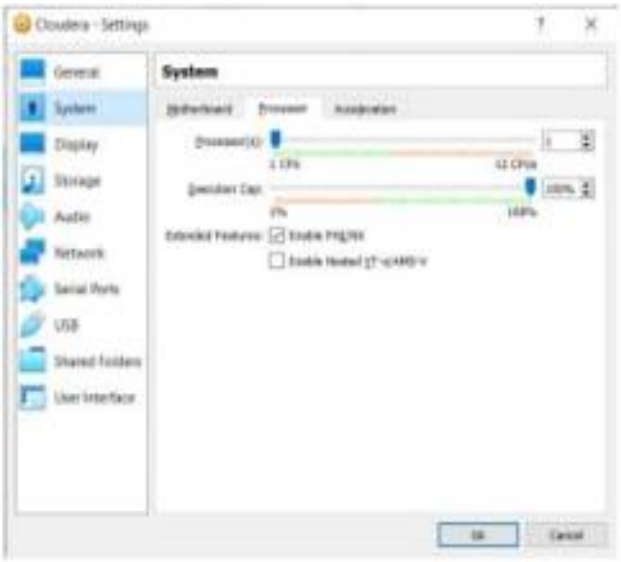
STEP 4: Give at least 4096 MB of RAM to the VM



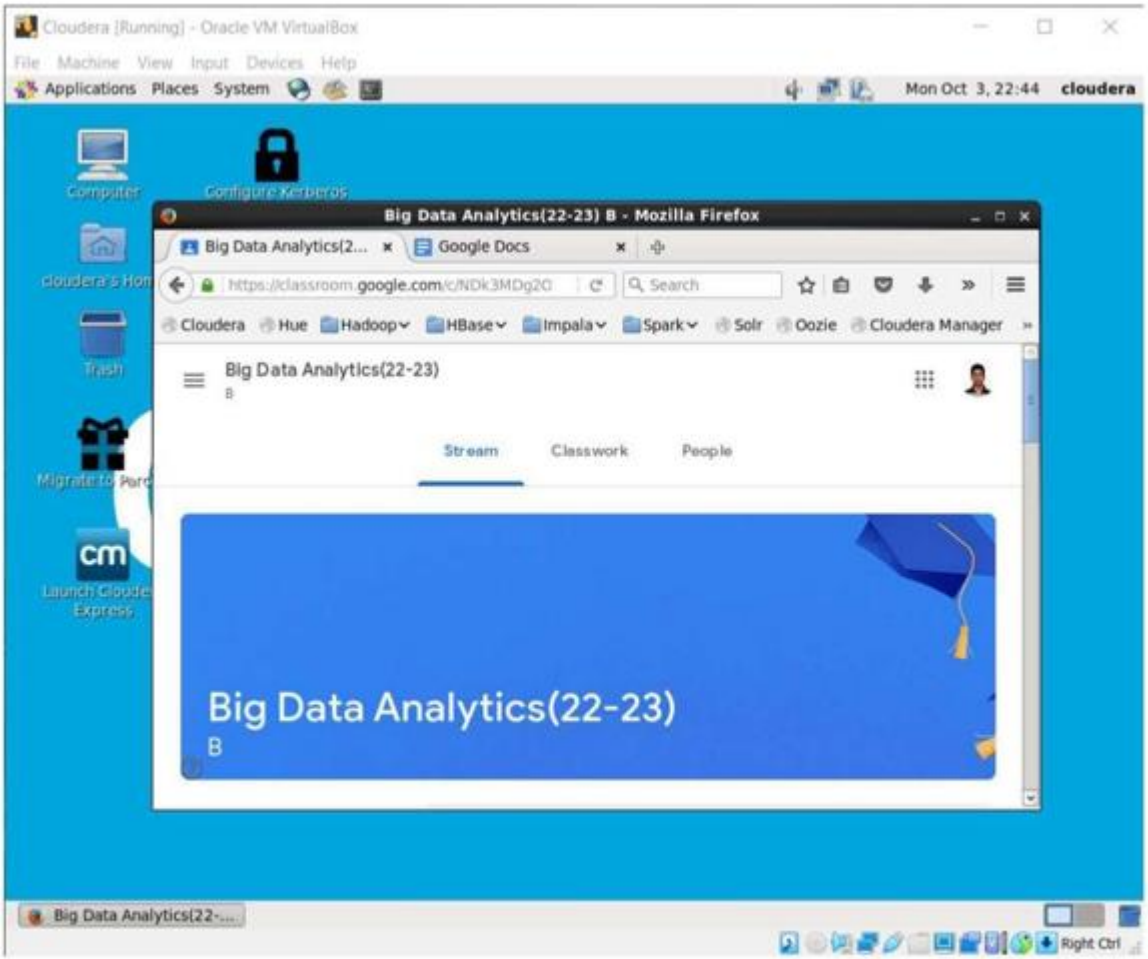
STEP 5: Select the option use an existing virtual hard disk file and click the browse link and then browse and select the downloaded vmdk file, click open and click on create.



STEP 6: Select the following settings



START the Virtual Machine and wait for all configurations to set up.



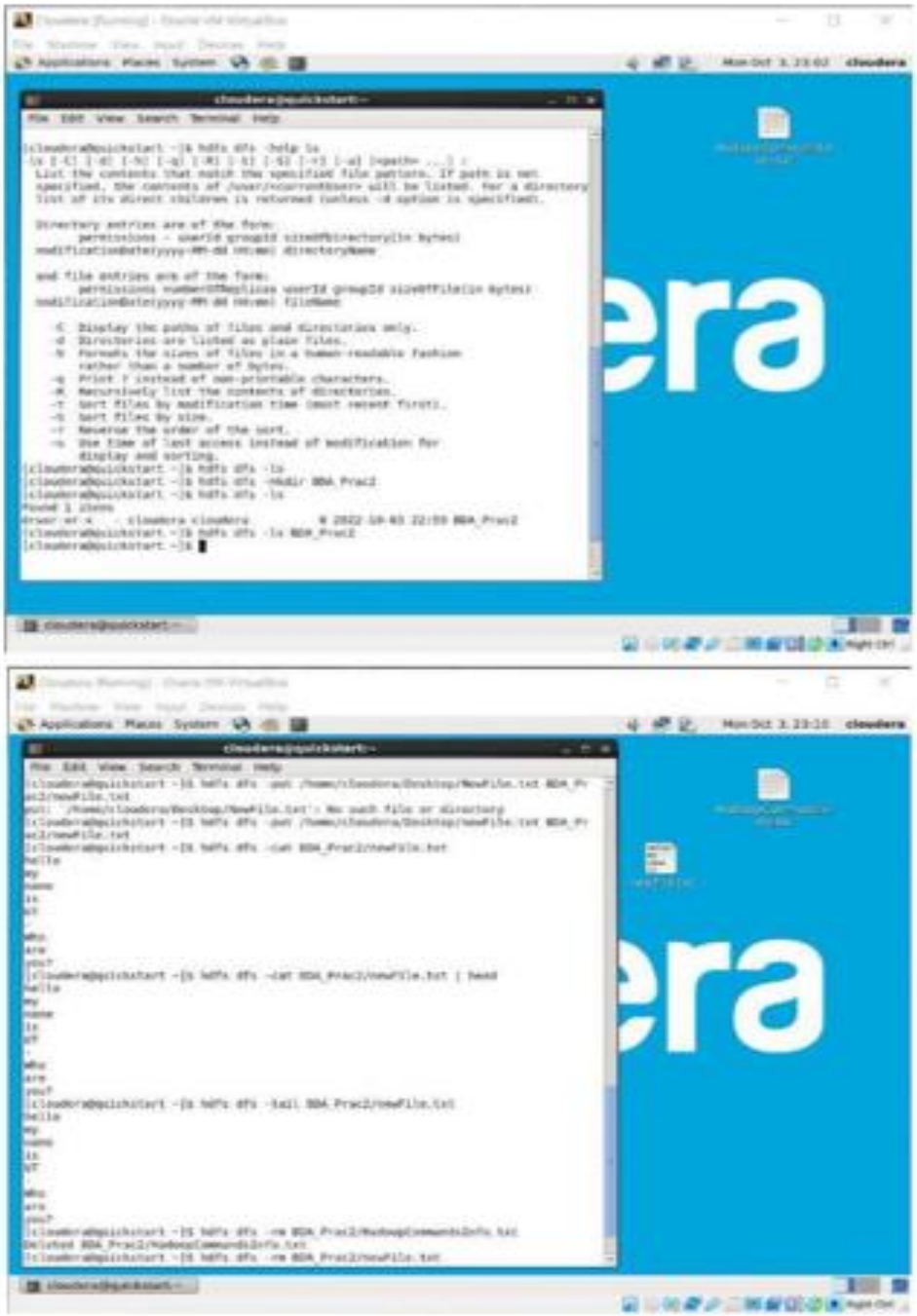
CONCLUSION:

We have successfully installed Cloudera VM on our VirtualBox and have understood the steps to do so as well.

Hadoop Commands Execution

Sr No	Description	Commands
1	Help	[cloudera@quickstart ~]$ hdfs dfs –help ls
2	For listing of files	[cloudera@quickstart ~]$ hdfs dfs –ls /
3	For making/creating new directory	[cloudera@quickstart ~]$ hdfs dfs –mkdir Input
4	For listing files in root directory	[cloudera@quickstart ~]$ hdfs dfs –ls Input
5	For listing files and directories recursively	[cloudera@quickstart ~]$ hdfs dfs -ls -R /
6	Copying files from local system into HDFS	[cloudera@quickstart ~]$ hdfs dfs –put /home/cloudera/Desktop/StudentInfo.txt Input/StuentInfo.txt
7	Retrieving files from HDFS – copies file from HDFS to current working directory. - Display file - Display head- first few lines of text file - Display tail – last few lines of text file	[cloudera@quickstart ~]$ hdfs dfs –get Input/StudentInfo.txt home/cloudera/Desktop/StudentInfo1.txt [cloudera@quickstart ~]$hdfs dfs – cat Input/StudentInfo.txt [cloudera@quickstart ~]$ hdfs dfs –cat Input/StudentInfo.txt | head [cloudera@quickstart ~]$ hdfs dfs –tail Input/StudentInfo.txt
8	Deleting files from HDFS	[cloudera@quickstart~]$ hdfs dfs –rm Input/StudentInfo.txt [cloudera@quickstart ~]$hdfs dfs –rm /Input

IMPLEMENTATION / EXECUTION:



CONCLUSION: We have successfully gained knowledge about various Hadoop commands and have also executed some of them.

EXPERIMENT - 3

AIM; To install and configure MongoDB/ Cassandra/ HBase/ Hypertable to execute NoSQL commands

THEORY:

HBASE =>

The objective of this lab is to get you started with the HBase shell and perform CRUD operations to create a HBase Table, put data into the table, retrieve data from the table and delete data from the table.

HBase Shell

HBase is the Hadoop database, which provides random, realtime read/write access to very large data. See the references on HBase for more information.

The HBase Shell is a ruby script that helps in interacting with the HBase system using a command line interface. This shell supports creating, deleting and altering tables and also performing other operations like inserting, listing, deleting data and to interact with HBase. You can get help with the shell commands here:

Sr No.	Description	Commands
1	**Change the directory to hbase**	**$ cd training_materials/hbase**
2	**Start Hbase Shell**	**$ hbase shell**
	o/p	*[training@localhost hbase]$* ***hbase shell*** *15/12/31 01:28:47 WARN conf.Configuration: hadoop.native.lib is deprecated. Instead, use io.native.lib.available* *HBase Shell; enter 'help<RETURN>' for list of supported commands. Type "exit<RETURN>" to leave the HBase Shell* *Version 0.92.1-cdh4.1.1, rUnknown, Tue Oct 16 11:44:19* *PDT 2012* **hbase(main):001:0>**
3	**To Get help**	**hbase(main):001:0> help**

o/p *COMMAND GROUPS:*

Group name: general

Commands: status, version, whoami

Group name: ddl

Commands: alter, alter_async, alter_status, create, describe, disable, disable_all, drop, drop_all, enable, enable_all, exists, is_disabled, is_enabled, list, show_filters

Group name: dml

Commands: count, delete, deleteall, get, get_counter, incr, put, scan, truncate
Group name: tools

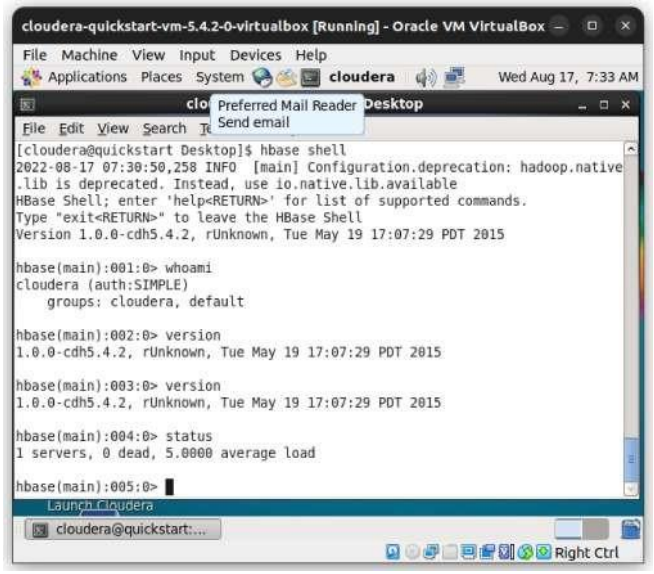
		Commands: assign, balance_switch, balancer, close_region, compact, flush, hlog_roll, major_compact, move, split, unassign, zk_dump ***Group name: replication*** *Commands: add_peer, disable_peer, enable_peer, list_peers, remove_peer, start_replication, stop_replication* ***Group name: security*** *Commands: grant, revoke, user_permission*
4	***Perform CRUD operations*** *with HBase shell*	The goal of this exercise is to create a table **'customer'** with the data for **Column Families address**, **order** and columns –**(city, state) and (date,order)** for as shown below using HBase shell commands.
5	*Create a table* ***in your current directory*** ***o/p***	**create 'customer', {NAME=>'addr'}, {NAME=>'order'}** *hbase(main):005:0>* ***create 'customer','addr','order'*** *0 row(s) in 1.0420 seconds*
6	*Use 'describe'* ***to get the description of the table.*** *o/p*	**hbase(main):006:0> describe 'customer'** *DESCRIPTION ENABLED* *{NAME => 'customer', FAMILIES => [{NAME =>* *'addr', true* *BLOOMFILTER => 'NONE', REPLICATION_SCOPE* *=> '0', VE* *RSIONS => '3', COMPRESSION => 'NONE',* *MIN_VERSIONS => '0', TTL => '2147483647',* *BLOCKSIZE => '65536',* *IN_MEMORY => 'false', BLOCKCACHE => 'true'}, {NAME* *=> 'order', BLOOMFILTER => 'NONE',* *REPLICATION_SCOP E => '0', VERSIONS => '3',* *COMPRESSION => 'NONE', M* *IN_VERSIONS => '0', TTL => '2147483647', BLOCKSIZE* *=> '65536', IN_MEMORY => 'false', BLOCKCACHE => 'tr* *ue'}]}* *1 row(s) in 0.0360 seconds*
7	**Put some data** into the table	hbase(main):001:0> **put** 'customer','sujata','addr:city','chembur'
8	**Use get to**	hbase(main):002:0> **get** 'customer','sujata'

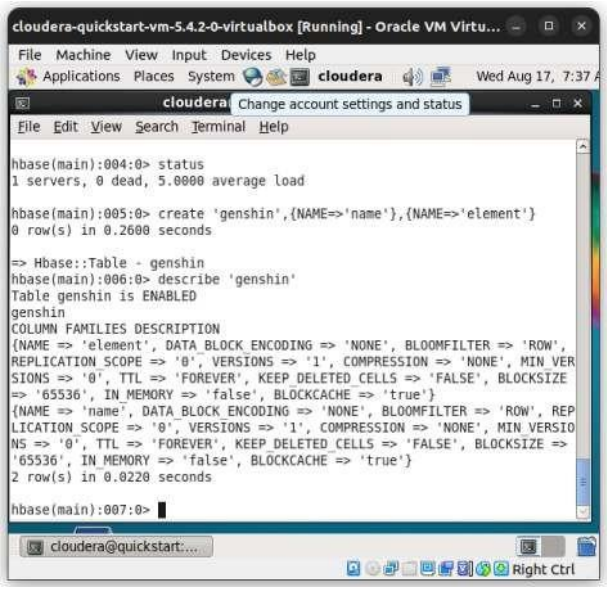
	retrieve the data for 'sujata'	

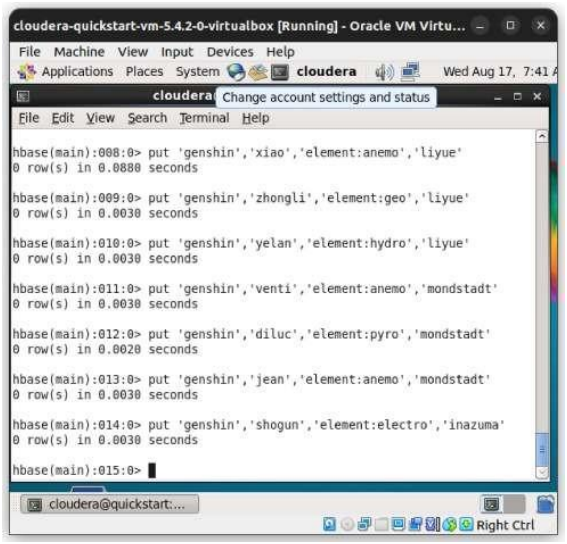
	o/p - This gets all the data for the row. How can we limit	COLUMN CELL addr:city timestamp=1451545949223, value=chembur 1 row(s) in 0.0300 seconds
	this to only one column family ? Ans :see **step 10**	
9	**Put some more data** into table	hbase(main):003:0> put 'customer','sujata','order:numb', '1234' 0 row(s) in 0.0450 seconds hbase(main):004:0> put 'customer','sujata','order:numb', '1235' 0 row(s) in 0.0080 seconds hbase(main):005:0> put 'customer','sujata','order:numb', '1236' 0 row(s) in 0.0200 seconds
10	**Get the data about column family** order for specific customer	hbase(main):006:0> get 'customer','sujata',{COLUMNS=>['order:numb']}
11	**Ouput: NOTE This only return one record (latest according to timestamp)** **Note that you are getting the data for only one version per cell. How can you get more versions?** **Output:**	*COLUMN CELL* *order:numb timestamp=1451546824151, value=1236 1 row(s) in 0.0280 seconds* hbase(main):007:0> get 'customer','sujata', {COLUMNS=>['order:numb'],VERSIONS =>5} *COLUMN CELL* *order:numb timestamp=1451546824151, value=1236* *order:numb timestamp=1451546805834, value=1235* *order:numb timestamp=1451546787681, value=1234 3 row(s) in 0.0250 seconds*

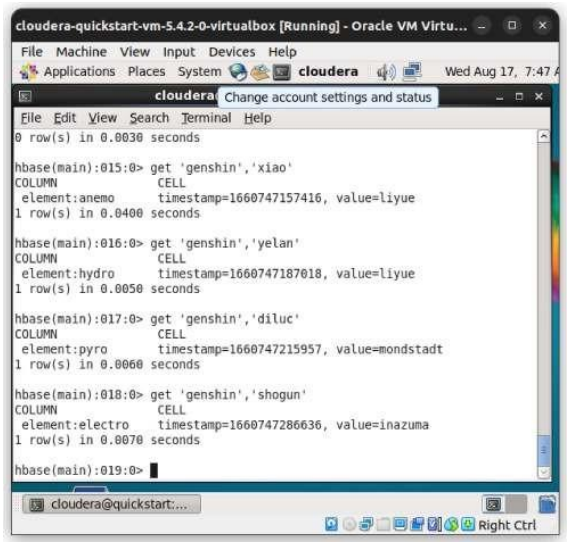
17	**Use 'count' to retrieve the number of rows in the table.**	hbase(main):002:0> count 'customer'
18	**o/p** **Delete data from the table.**	hbase(main):002:0> count 'customer' 2 row(s) in 0.3160 seconds **Delete a column** hbase(main):001:0> delete 'customer', 'jhon','addr:city' 0 row(s) in 0.3120 seconds
19	**Delete a column family**	hbase(main):001:0> delete 'customer','jhon','addr:' 0 row(s) in 0.3180 seconds
20	**Retrieve rows with rowkey starting with 'sujata', addr column family**	hbase(main):008:0> scan 'customer', {STARTROW=>'sujata',COLUMNS=>['addr']}
	o/p	hbase(main):008:0> scan 'customer',{STARTROW=>'sujata',COLUMNS=>['addr']} ROW COLUMN+CELL sujata column=addr:city, timestamp=1451545949223, value=chembur sujata column=addr:state, timestamp=1451547606929, value=MH\xOA 1 row(s) in 0.0130 seconds

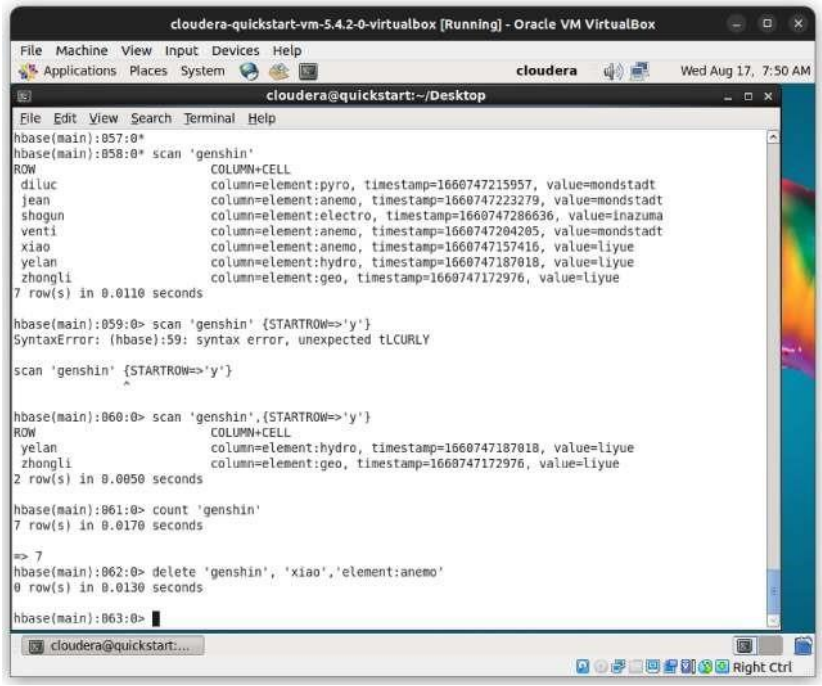
Implementation :











CONCLUSION:

In this experiment, we have understood how to configure HBase in our Hadoop VM and saw various HBase commands and have also executed them.

EXPERIMENT - 4

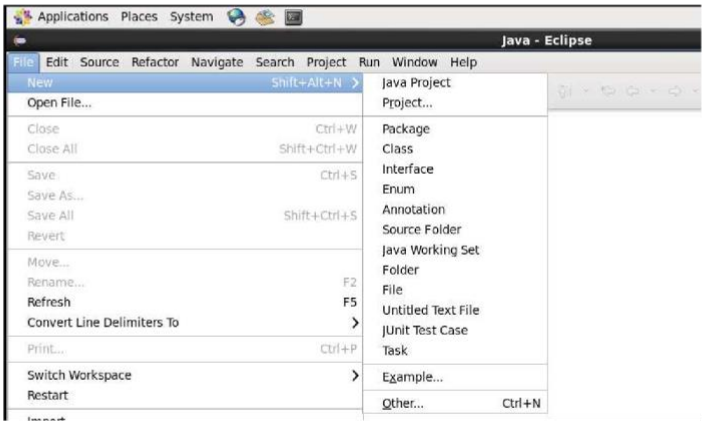
AIM: Experiment on Hadoop Map-Reduce: Write a program to implement a word count program using MapReduce.

THEORY:

One of the three components of Hadoop is Map Reduce. The first component of Hadoop, that is, Hadoop Distributed File System (HDFS) is responsible for storing the file. The second component that is, Map Reduce is responsible for processing the file.
MapReduce also uses Java but it is very easy if you know the syntax on how to write it. It is the basis of MapReduce. So here are the steps which show how to write a MapReduce code for Word Count.

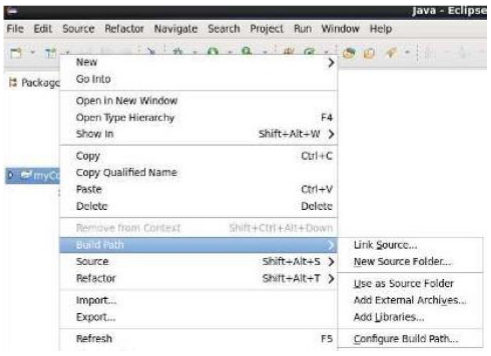
STEPS =>

1. Open Eclipse → then select File → New → Java Project → Name it WordCount → then Finish

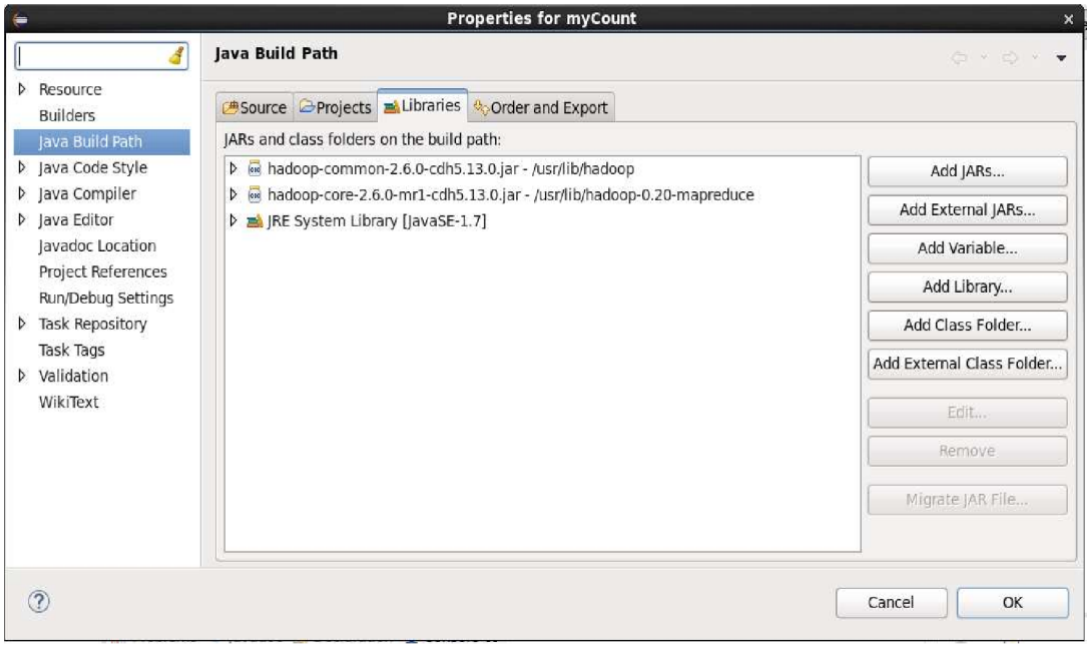


2. Create 3 Java Classes into the project. Name them WCDriver(having the main function), WCMapper, WCReducer.

3. You have to include two Reference Libraries for that: Right Click on Project -> then select Build Path-> Click on Configure Build Path
4. In the figure below, you can see the Add External JARs option on the Right Hand Side. Click on it and add the below mentioned files. You can find these files in /usr/lib/



a. /usr/lib/hadoop-0.20-mapreduce/hadoop-core-2.6.0-mr1-cdh5.13.0.jar
b. /usr/lib/hadoop/hadoop-common-2.6.0-cdh5.13.0.jar



Mapper Code:

```
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.MapReduceBase;
import org.apache.hadoop.mapred.Mapper;
import org.apache.hadoop.mapred.OutputCollector;
import org.apache.hadoop.mapred.Reporter;

public class WCMapper extends MapReduceBase implements Mapper<LongWritable,Text, Text,
IntWritable> {
        public void map(LongWritable key, Text value, OutputCollector<Text,IntWritable> output,
Reporter rep) throws IOException
        {
                String line = value.toString();
                for (String word : line.split(" ")){
                        if (word.length() > 0){
                                output.collect(new Text(word), new IntWritable(1));
                        }
```

Reducer Code:

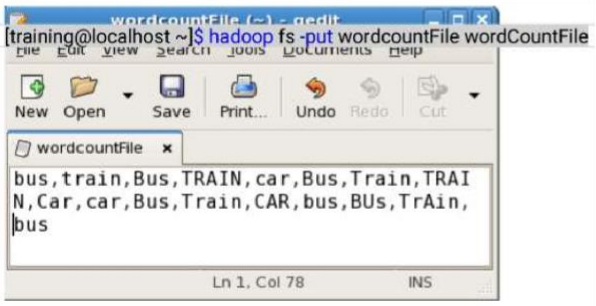
```
import java.io.IOException;
import java.util.Iterator;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.MapReduceBase;
import org.apache.hadoop.mapred.OutputCollector;
import org.apache.hadoop.mapred.Reducer;
import org.apache.hadoop.mapred.Reporter;

public class WCReducer extends MapReduceBase implements Reducer<Text,IntWritable, Text,
IntWritable> {
        public void reduce(Text key, Iterator<IntWritable> value,OutputCollector<Text, IntWritable>
output,Reporter rep) throws IOException
        {
                int count = 0;
                while (value.hasNext()){
                        IntWritable i = value.next();
                        count += i.get();
                }
                output.collect(key, new IntWritable(count));
}
```

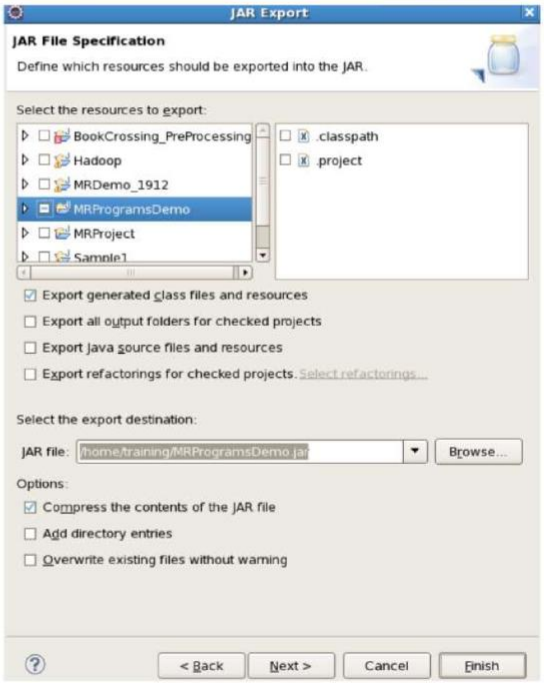
Driver Code:

```
import java.io.IOException;
import org.apache.hadoop.conf.Configured;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.FileInputFormat;
import org.apache.hadoop.mapred.FileOutputFormat;
import org.apache.hadoop.mapred.JobClient;
import org.apache.hadoop.mapred.JobConf;
import org.apache.hadoop.util.Tool;
import org.apache.hadoop.util.ToolRunner;

public class WCDriver extends Configured implements Tool {
        public int run(String args[]) throws IOException {
                if (args.length < 2) {
                        System.out.println("Please give valid inputs");
                        return -1;
```

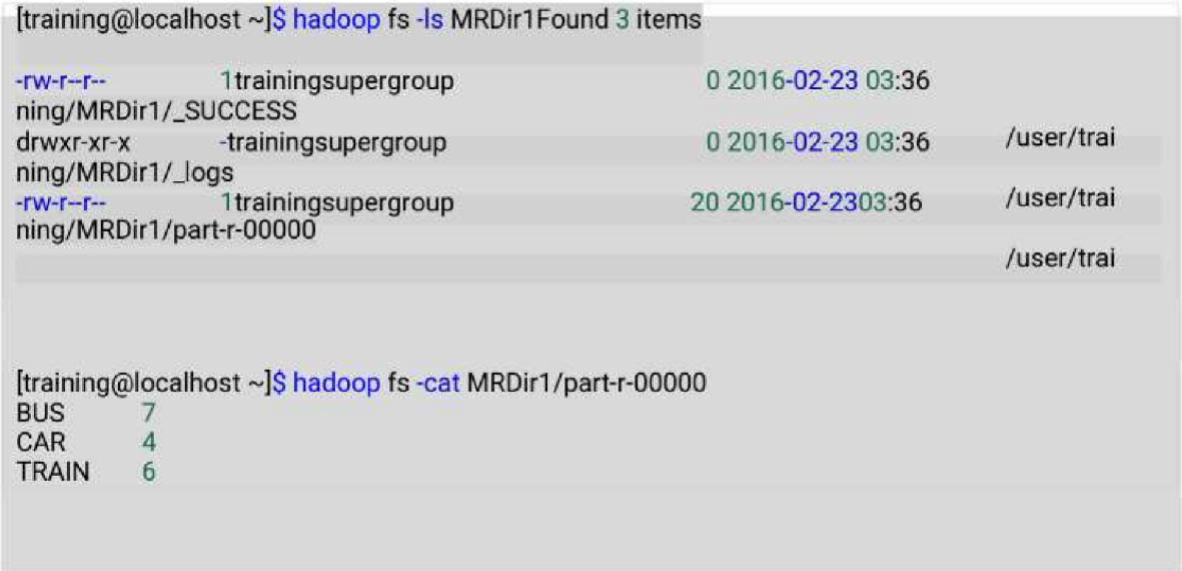
```
        }
        JobConf conf = new JobConf(WCDriver.class);
        FileInputFormat.setInputPaths(conf, new Path(args[0]));
        FileOutputFormat.setOutputPath(conf, new Path(args[1]));
        conf.setMapperClass(WCMapper.class);
        conf.setReducerClass(WCReducer.class);
        conf.setMapOutputKeyClass(Text.class);
        conf.setMapOutputValueClass(IntWritable.class);
        conf.setOutputKeyClass(Text.class);
        conf.setOutputValueClass(IntWritable.class);
        JobClient.runJob(conf);
        return 0;
}
public static void main(String args[]) throws Exception {
        int exitCode = ToolRunner.run(new WCDriver(), args);
        System.out.println(exitCode);

    }
```

5. Now you have to make a jar file. Right Click on Project-> Click on Export-> Select export destination as Jar File-> Name the jar File(WordCount.jar) -> Click on next -> at last Click on Finish. Now copy this file into the Workspace directory of Cloudera
6. Open the terminal on CDH and change the directory to the workspace. You can do this by using the ***"cd workspace/"*** command. Now, Create a text file(WCFile.txt) and move it to HDFS. Open the terminal and write this code(remember you should be in the same directory as the jar file you have created just now).
7. Now, run this command to copy the file input file into the HDFS "***hadoop fs -put WCFile.txt WCFile.txt"***





8. Run Jar File: (Hadoopjarjarfilename.jarpackageName.ClassNamePathToInputTextFile PathToOutputDirectory)
9. After Executing the code, you can see the result in the WCOutput file or by writing the following command on terminal. ***"hadoop fs -cat WCOutput/part-00000"***



CONCLUSION:

In this experiment, we have understood about the MapReduce in Hadoop and have also implemented the "WORD COUNT" program using it.

EXPERIMENT - 5

AIM; Experiment on Hadoop Map-Reduce: Implementing simple algorithms in Map-Reduce: Matrix multiplication, Aggregates, Joins, Sorting, Searching, etc

THEORY:

MapReduce is a programming paradigm that enables massive scalability across hundreds or thousands of servers in a Hadoop cluster. As the processing component, MapReduce is the heart of Apache Hadoop. The term "MapReduce" refers to two separate and distinct tasks that Hadoop programs perform.

The first is the map job, which takes a set of data and converts it into another set of data, where individual e ements are broken down into tuples (key/value pairs).

The reduce job takes the output from a map as input and combines those data tuples into a smaller set of tuples. As the sequence of the name MapReduce implies, the reduce job is always performed after the map job.

IMPLEMENTATION:

Let us consider the matrix multiplication example to visualize MapReduce. Consider the following matrix:

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \times \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$

taking two matrix of 2x2

2×2 matrices A and B

Here matrix A is a 2×2 matrix which means the number of rows(i)=2 and the number of columns(j)=2. Matrix B is also a 2×2 matrix where number of rows(j)=2 and number of columns(k)=2. Each cell of the matrix is labelled as Aij and Bij. Ex. element 3 in matrix A is called A21 i.e. 2nd-row 1st column. Now One step matrix multiplication has 1 mapper and 1 reducer. The Formula is:

Mapper for Matrix A (k, v)=((i, k), (A, j, Aij)) for all k

Mapper for Matrix B (k, v)=((i, k), (B, j, Bjk)) for all i

Therefore computing the mapper for Matrix A:

k, i, j computes the number of times it occurs.
Here all are 2, therefore when k=1, i can have
2 values 1 & 2, each case can have 2 further
values of j=1 and j=2. Substituting all values
in formula

k=1 i=1 j=1 ((1, 1), (A, 1, 1))
j=2 ((1, 1), (A, 2, 2))
i=2 j=1 ((2, 1), (A, 1, 3))
j=2 ((2, 1), (A, 2, 4))

k=2 i=1 j= ((1, 2), (A, 1, 1))
j=2 ((1, 2), (A, 2, 2))
i=2 j=1 ((2, 2), (A, 1, 3))
j=2 ((2, 2), (A, 2, 4))

Computing the mapper for Matrix B

i=1 j=1 k=1 ((1, 1), (B, 1, 5))
k=2 ((1, 2), (B, 1, 6))
j=2 k=1 ((1, 1), (B, 2, 7))
j=2 ((1, 2), (B, 2, 8))

i=2 j=1 k=1 ((2, 1), (B, 1, 5))
k=2 ((2, 2), (B, 1, 6))
j=2 k=1 ((2, 1), (B, 2, 7))
k=2 ((2, 2), (B, 2, 8))

The formula for Reducer is:

Reducer(k, v)=(i, k)=>Make sorted Alist and Blist
(i, k) => Summation (Aij * Bjk)) for j
Output =>((i, k), sum)

Therefore computing the reducer:

We can observe from Mapper computation
that 4 pairs are common (1, 1), (1, 2),

(2, 1) and (2, 2)
Make a list separate for Matrix A &
B with adjoining values taken from
Mapper step above:

(1, 1) =>Alist ={(A, 1, 1), (A, 2, 2)}
Blist ={(B, 1, 5), (B, 2, 7)}
Now Aij x Bjk: [(1*5) + (2*7)] =19 -------(i)

(1, 2) =>Alist ={(A, 1, 1), (A, 2, 2)}
Blist ={(B, 1, 6), (B, 2, 8)}
Now Aij x Bjk: [(1*6) + (2*8)] =22 -------(ii)

(2, 1) =>Alist ={(A, 1, 3), (A, 2, 4)}
Blist ={(B, 1, 5), (B, 2, 7)}
Now Aij x Bjk: [(3*5) + (4*7)] =43 -------(iii)

(2, 2) =>Alist ={(A, 1, 3), (A, 2, 4)}
Blist ={(B, 1, 6), (B, 2, 8)}
Now Aij x Bjk: [(3*6) + (4*8)] =50 -------(iv)

From (i), (ii), (iii) and (iv) we conclude that
((1, 1), 19)
((1, 2), 22)
((2, 1), 43)
((2, 2), 50)

OUTPUT:

$$\begin{bmatrix} 19 & 22 \\ 43 & 50 \end{bmatrix}$$

CONCLUSION:

In this experiment, we have understood about the MapReducer and how we can perform Matric Multiplication using it.

EXPERIMENT - 6

AIM: Create Hive Database and Descriptive analytics-basic statistics

THEORY:

Hive is a data warehouse infrastructure tool to process structured data in Hadoop. It resides on top of Hadoop to summarize Big Data, and makes querying and analyzing easy.

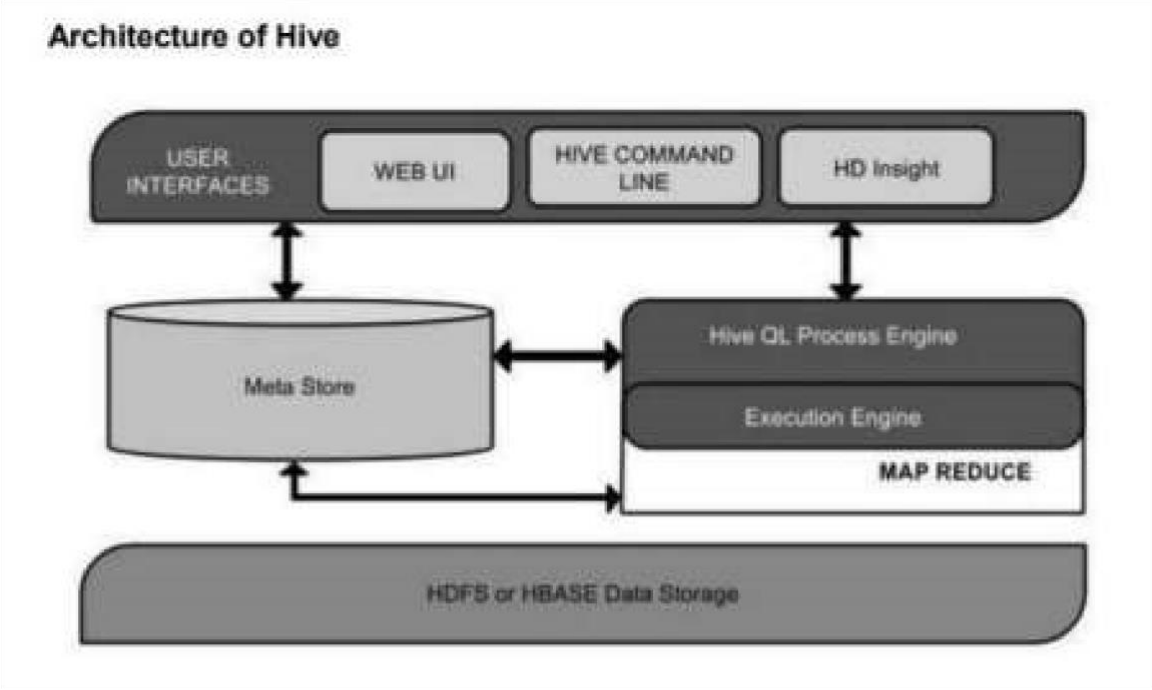
Hadoop is an open-source framework to store and process Big Data in a distributed environment. It contains two modules, one is MapReduce and another is Hadoop Distributed File System (HDFS). The Hadoop ecosystem contains different sub-projects (tools) such as Sqoop, Pig, and Hive that are used to help Hadoop modules.

Hive is a data warehouse infrastructure tool to process structured data in Hadoop. It resides on top of Hadoop to summarize Big Data, and makes querying and analyzing easy. Initially Hive was developed by Facebook, later the Apache Software Foundation took it up and developed it further as an open source under the name Apache Hive. It is used by different companies.

For example, Amazon uses it in Amazon Elastic MapReduce. Hive provides the functionality of reading, writing, and managing large datasets residing in distributed storage.
It runs SQL like queries called HQL (Hive query language) which gets internally converted to MapReduce jobs. Using Hive, we can skip the requirement of the traditional approach of writing complex MapReduce programs.
Hive supports Data Definition Language (DDL), Data Manipulation Language (DML), and User Defined Functions (UDF).

Features of Hive

· It stores schema in a database and processed data into HDFS
.· It is designed for OLAP.
· It provides SQL type language for querying called HiveQL or HQL.
· It is familiar, fast, scalable, and extensible.



Limitations of Hive commands:

1. Hive doesn't support sub queries.
2. Hive surely supports over-writing, but unfortunately, it doesn't support deletion and updates. 3. Hive is not designed for OLTP, but it is used for it.

Basic Hive Commands

1. Create: This will create the new database in the Hive.

create database database_name;

2. Show: show command will show all the databases residing in the Hive. show databases;
3. Use: The command to use the database.

use database_name;

4. Drop: The drop will remove a table from Hive

Drop table_name;

5. Create table: This command creates the table.

create table table_name (column names and types);

6. Alter: Alter command will help you rename the table or table columns. alter table table_name rename to new_table_name;

For renaming column name, replace table name with column name.

7. Describe: Describe command will help you with the information about the schema of the table.

describe table name;

8. LOAD, INSERT: The Load operation is used to move the data into corresponding Hive table.

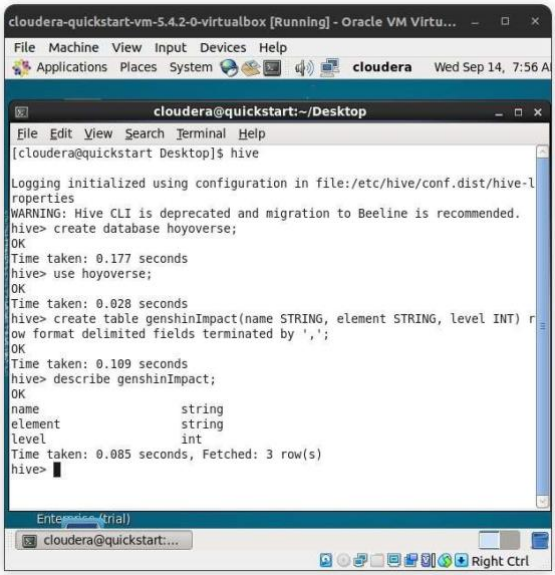
LOAD data inpath into table [tablename];

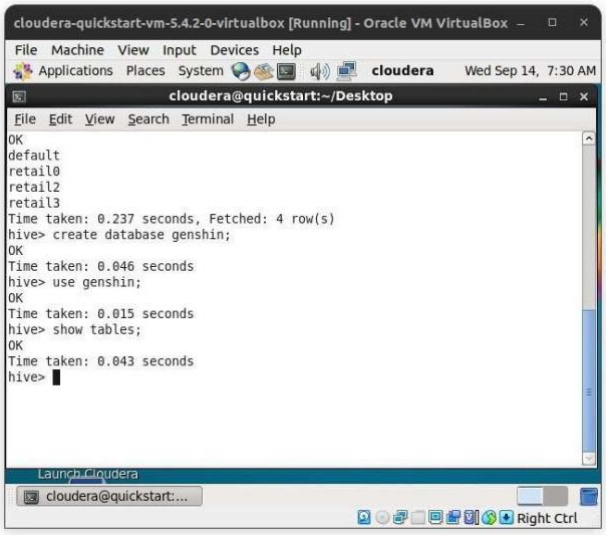
S.No.	Description	Commands
1	Start HIVE	$ hive

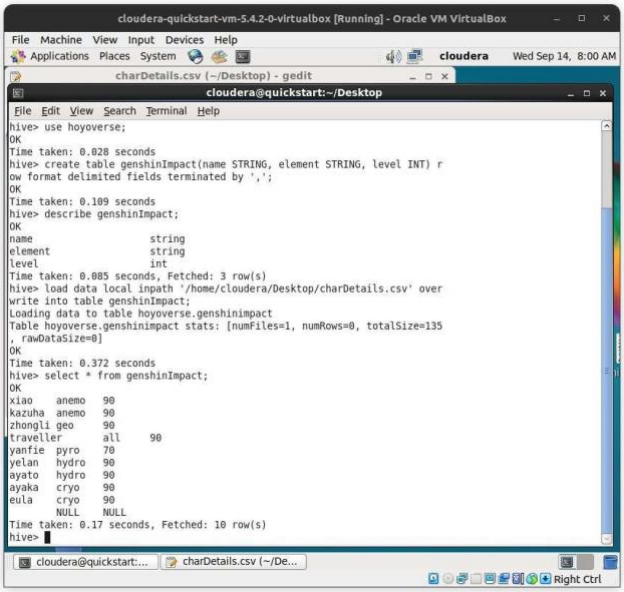
	o/p	Logging initialized using configuration in file:/etc/hive/conf.dist/hive-log4j.properties WARNING: Hive CLI is deprecated and migration to Beeline is recommended.
2	Create database	hive> create database retail;
	o/p	OK Time taken: 0.709 seconds
3	Show database	hive> show databases
	o/p	OK default retail Time taken: 0.284 seconds, Fetched: 2 row(s)
4	Use database	hive> use retail;
	o/p	OK Time taken: 0.087 seconds
5	Create table	hive> create table txnrecords(txnno INT, txndate STRING, custno INT,amount DOUBLE,category STRING, product STRING, state STRING,spendby STRING)row format delimited fields terminated by ',' stored as textfile;
	o/p	OK
		Time taken: 0.418 seconds
6	Describe table	hive> use retail; hive> describe txnrecords;
	o/p	OK txnno int txndate string custno int amount double category string product string state string spendby string Time taken: 0.165 seconds, Fetched: 8 row(s)
7	Create table	hive> use retail; hive> create table student(id INT, name STRING)row format delimited fields terminated by ',' ;
	o/p	OK Time taken: 0.081 seconds

8	Loading data	hive> load data local inpath '/home/cloudera/Desktop/BE_A.csv' overwrite into table student;
	o/p	Loading data to table retail.student Table retail.student stats: [numFiles=1, numRows=0, totalSize=26, rawDataSize=0] OK Time taken: 0.887 seconds
9	Fetching all rows	hive> select * from student;
	o/p	OK NULL name 1 XYZ
		2 ABC 3 LMN Time taken: 0.516 seconds, Fetched: 4 row(s)

OUTPUT:







CONCLUSION: We have successfully executed various Hive Queries using Hive in Cloudera

EXPERIMENT - 7

AIM: Social Network Analysis using R

THEORY:

Social Network Analysis in R, Social Network Analysis (SNA) is the process of exploring the social structure by using graph theory.
It is mainly used for measuring and analyzing the structural properties of the network.
It helps to measure social network relationships (Facebook, Twitter likes comments following etc..), Email connectivity, flows between groups, organizations, and other connected entities.
We will be using a small network that indicates a connection between the two columns' information.
Please make commonly used words in social network analysis.
A network is represented as a graph, which shows links (if any) between each vertex (or node) and its neighbors.
Edge: – A-line indicating a link between vertices.
Component: – A group of vertices that are mutually reachable by following edges on the graph.
Path: -The edges followed from one vertex to another are called a path.

IMPLEMENTATION:

Load Library: *library(igraph)*
Getting Data: *data <- read.csv("D:/RStudio/SocialNetworkAnalysis/socialnetworkdata.csv", header=T)*
The same dataset you can avail from gitHub click here
y <- data.frame(data$first, data$second)

Create network

```
net <- graph.data.frame(y, directed=T)
V(net)
+ 52/52 vertices, named, from 4c03f50:
 [1] AA AB AF DD CD BA CB CC BC ED AE CA EB BF BB AC DC BD DB CF DF BE EA CE
EE EF FF FD GB GC GD AD KA KF LC DA EC FA FB DE FC FE GA GE KB KC KD KE LB
LA LD LE
E(net)
290/290 edges from 4c03f50 (vertex names):
 [1] AA->DD AB->DD AF->BA DD->DA CD->EC DD->CE CD->FA CD->CC BA->AF
CB->CA CC->CA CD->CA BC->CA DD->DA ED->AD AE->AC AB->BA CD->EC CA->CC
```

[20] EB->CC BF->CE BB->CD AC->AE CC->FB DC->BB BD->CF DB->DA DD->DA DB->DD BC->AF CF->DE DF->BF CB->CA BE->CA EA->CA CB->CA CB->CA CC->CA

[39] CD->CA BC->CA BF->CA CE->CA AC->AD BD->BE AE->DF CB->DF AC->DF AA->DD AA->DD AA->DD CD-

.....

.....

[153] CA->CC CD->CC CA->CC BB->CC DF->CE CA->CE AE->GA DC->ED BB->ED CD->ED BF->ED DF->ED CC->KB AD->EA EF->EA CF->KC EE->BB CC->BB BC->BB

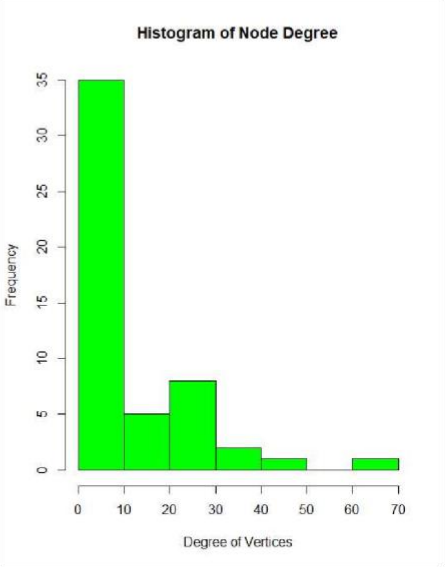
[172] CD->KD AE->CF DF->AC DF->AC ED->AC KA->CA BB->CA CB->CA CC->CA EB->CA BE->CC BE->CD CB->CD CB->KE ED->AB AB->KF BA->AF CC->AF CA->AF + ... omitted several edges

We got 52 vertices and 290 edges. Let's assign the labels.

```
V(net)$label <- V(net)$name
V(net)$degree <- degree(net)
```

Histogram of node degree

```
hist(V(net)$degree,
    col = 'green',
    main = 'Histogram of Node Degree',
    ylab = 'Frequency',
    xlab = 'Degree of Vertices')
```

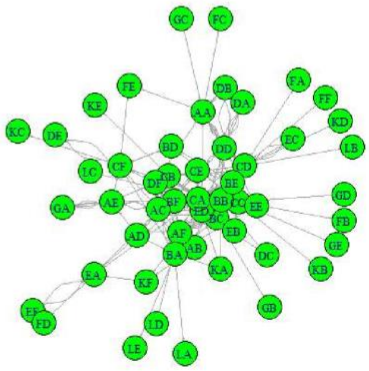


Around 35 nodes with less than 10 degree and some nodes with high degree (60 to 70 connections) also.

It indicates that there are many nodes with few connections and few nodes with many connections.

Network diagram

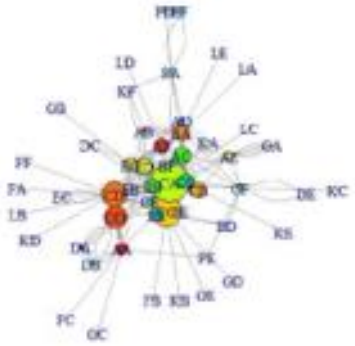
```
set.seed(222)
plot(net,
    vertex.color = 'green',
    vertext.size = 2,
    edge.arrow.size = 0.1,
```



vertex.label.cex = 0.8)

Highlighting degrees & layouts

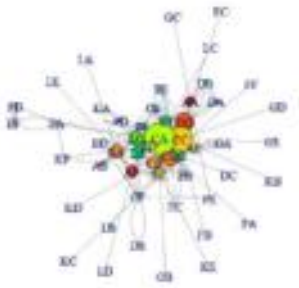
```
plot(net,
    vertex.color = rainbow(52),
    vertex.size = V(net)$degree*0.4,
    edge.arrow.size = 0.1,
    layout=layout.fruchterman.reingold)
```



CA has the highest degree followed by others.

```
plot(net,
    vertex.color = rainbow(52),
    vertex.size = V(net)$degree*0.4,
    edge.arrow.size = 0.1,
    layout=layout.graphopt)
```

```
plot(net,
    vertex.color = rainbow(52),
    vertex.size = V(net)$degree*0.4,
    edge.arrow.size = 0.1,
    layout=layout.kamada.kawai)
```



You can try out different layouts and you can use for best one suited to your requirements.

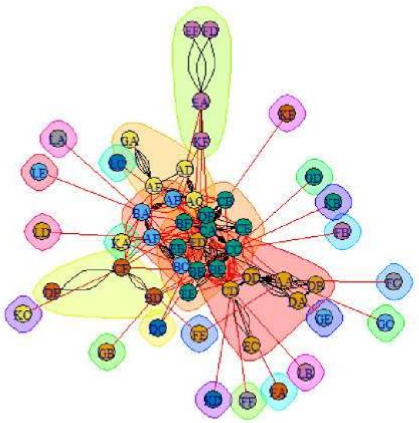
Hub and Authorities

```
hs <- hub_score(net)$vector
as <- authority.score(net)$vector
set.seed(123)
plot(net,
    vertex.size=hs*30,
    main = "Hubs",
    vertex.color = rainbow(52),
    edge.arrow.size=0.1,
    layout = layout.kamada.kawai)
```

Community Detection

To detect densely connected nodes

```
net <- graph.data.frame(y, directed = F)
cnet <- cluster_edge_betweenness(net)
plot(cnet,
    net,
    vertex.size = 10,
    vertex.label.cex = 0.8)
```



Now you can see within the groups there are dense connections and between the groups with sparse connections.

CONCLUSION:

We have successfully performed the Social Network Analysis using R.

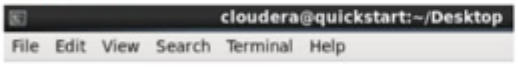
Experiment No. 2

Aim : Sqoop Installation

Sqoop installation

Create file using vi editor

Insert data in file




```
1, test1
2, test2
3, test3
~
```

Exit editor with ctrl+[and type :wq and enter

Check contents of file using following command

```
[cloudera@quickstart Desktop]$ cat file.csv

1, test1
2, test2
3, test3
[cloudera@quickstart Desktop]$
```

Move file from local file system to hdfs

```
[cloudera@quickstart Desktop]$ hadoop fs -put file.csv /user/cloudera/export_fol
der/
```

```
[cloudera@quickstart Desktop]$ hadoop fs -cat /user/cloudera/export_folder/file.
csv

1, test1
2, test2
3, test3
[cloudera@quickstart Desktop]$
```

Write sqoop command to export content of file to sql table

```
[cloudera@quickstart Desktop]$ sqoop export --connect jdbc:mysql://localhost/tes
t_db --username root --password cloudera --table test1 --export-dir /user/cloude
ra/export_folder -m 1
```

Check Mysql table to check if data is exported

```
mysql> select * from test1;
+---------+-----------+
| test_no | test_text |
+---------+-----------+
|       1 | test1     |
|       2 | test2     |
|       3 | test3     |
+---------+-----------+
3 rows in set (0.00 sec)

mysql>
```