

Big Data And Hadoop

Session 18 – Assignment 2

Problem Statement:

Perform the earlier operation using Java program.

The program should be able to check for the presence of 'customer' table.

In case the table exists, it must be dropped and recreated.

Solution:

A. Place input file in HDFS

Step 1: The input file is present on local file system at `/home/acadgild/Abhilasha/hbase` as shown below.

```
acadgild@localhost:~/Abhilasha/hbase
File Edit View Search Terminal Help
[acadgild@localhost hbase]$ pwd
/home/acadgild/Abhilasha/hbase
[acadgild@localhost hbase]$ ls -l
total 12
-rw-rw-r-- 1 acadgild acadgild 833 Sep 24 18:27 commands
-rw-rw-r-- 1 acadgild acadgild 257 Sep 24 17:55 commands~
-rw-rw-r-- 1 acadgild acadgild 60 Oct 17 22:09 customers.dat
[acadgild@localhost hbase]$
```

Name of the file is customers.dat

Step 2: We now place the file on HDFS using the **put** command at location `/abhilasha` as follows

```
acadgild@localhost:~/Abhilasha/hbase
File Edit View Search Terminal Help
[acadgild@localhost hbase]$ hadoop fs -put /home/acadgild/Abhilasha/hbase/customers.dat /abhilasha
17/10/20 15:42:59 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java cl
asses where applicable
[acadgild@localhost hbase]$
```

Step 3: On listing the directory `/abhilasha`, we find the file with name **customers.dat** placed.

```
acadgild@localhost:~/Abhilasha/hbase
File Edit View Search Terminal Help
[acadgild@localhost hbase]$ hadoop fs -ls /abhilasha
17/10/20 15:43:44 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java cl
asses where applicable
Found 5 items
drwxr-xr-x - acadgild supergroup 0 2017-08-29 21:58 /abhilasha/FlumeTitanicData
-rw-r--r-- 1 acadgild supergroup 60 2017-10-20 15:43 /abhilasha/customers.dat
drwxr-xr-x - acadgild supergroup 0 2017-09-05 16:52 /abhilasha/flume
drwxr-xr-x - acadgild supergroup 0 2017-09-17 15:18 /abhilasha/hive
drwxr-xr-x - acadgild supergroup 0 2017-08-29 22:53 /abhilasha/project12
[acadgild@localhost hbase]$
```

Step 4: We can view the content of this file using **cat** command as follows:

```
acadgild@localhost:~/Abhilasha/hbase
File Edit View Search Terminal Help
[acadgild@localhost hbase]$ hadoop fs -cat /abhilasha/customers.dat
17/10/20 15:44:21 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java cl
asses where applicable
1,Amit,IND,18
2,Sumit,PAK,20
3,Rohit,AUS,26
4,Namit,UK,24[acadgild@localhost hbase]$
```

B. Start HBase

Step 1: We first start HBase using the command **start-hbase.sh** as follows:

```
acadgild@localhost:~
File Edit View Search Terminal Help
[acadgild@localhost ~]$ start-hbase.sh
starting master, logging to /usr/local/hbase/logs/hbase-acadgild-master-localhost.localdomain.out
[acadgild@localhost ~]$
```

Step 2: Next we start the hbase shell using the command **hbase shell** as follows:

```
acadgild@localhost:~
File Edit View Search Terminal Help
[acadgild@localhost ~]$ hbase shell
2017-09-24 17:49:57,986 INFO [main] Configuration.deprecation: hadoop.native.lib is deprecated. Instead, use io.native.lib.a
vailable
HBase Shell; enter 'help<RETURN>' for list of supported commands.
Type "exit<RETURN>" to leave the HBase Shell
Version 0.98.14-hadoop2, r4e4aabb93b52f1b0fef6b66edd06ec8923014dec, Tue Aug 25 22:35:44 PDT 2015
hbase(main):001:0>
```

C. Create table

Now we create the table named **customer**. Here, **details** is the name of the column family of the table **customer**.

To create a table, we need to create an instance of HBaseAdmin and then ask it to create the table and with at least one column family name in it. To perform DDL operations, you must use HBaseAdmin class instance.

The code file required to create table is TableCreator.java

a. Use-case 1: Table did not exist already.

In the hbase shell, we use **list** command to check if the table with name **customer** already existed.

```
acadgild@localhost:~
File Edit View Search Terminal Help
```

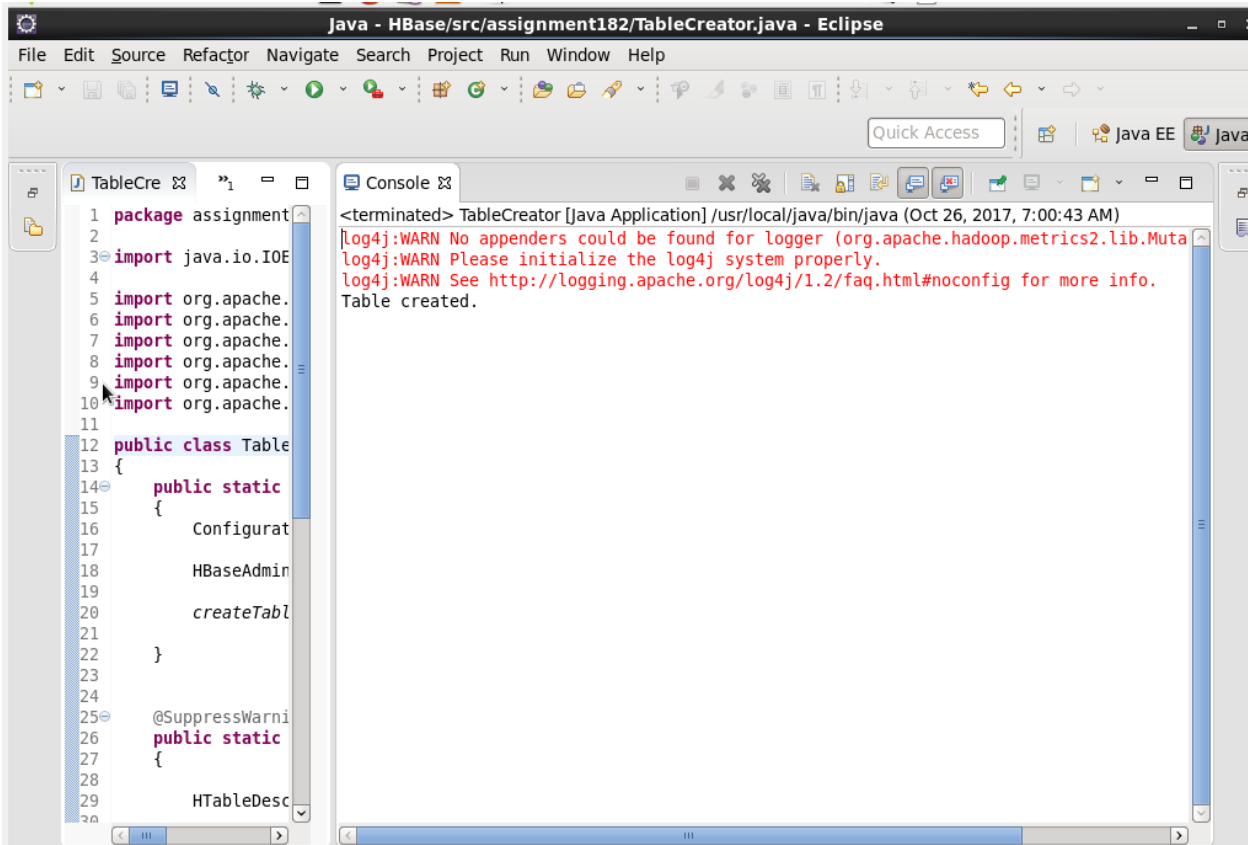
```
hbase(main):006:0> list
TABLE
clicks
htest
2 row(s) in 0.0190 seconds
```

```
=> ["clicks", "htest"]
```

```
hbase(main):007:0>
```

The screen-shot shows that table named **customer** does not exist already.

On executing our code to create table in hbase, we get the following:



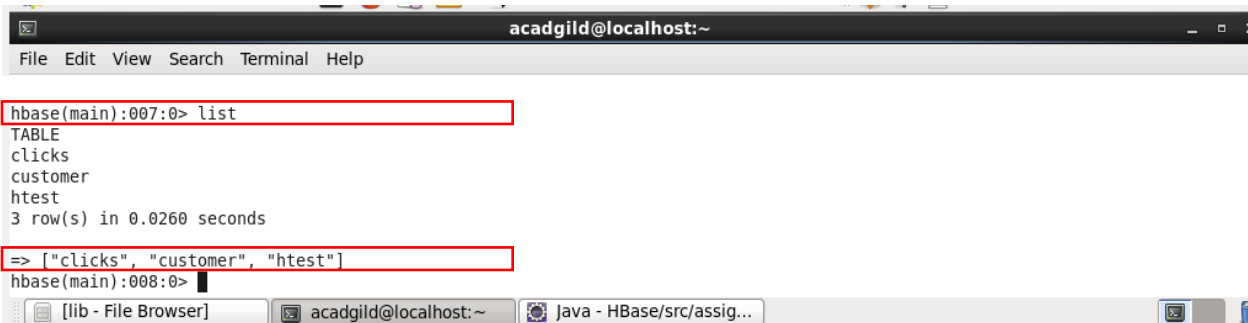
The screenshot shows the Eclipse IDE with the file `TableCreator.java` open. The code defines a `Table` class with static methods for configuration and table creation. The console output shows the execution of the program, including log4j warnings and a confirmation that the table was created.

```
Java - HBase/src/assignment182/TableCreator.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help

1 package assignment
2
3 import java.io.IOException;
4
5 import org.apache.hadoop.conf.Configuration;
6 import org.apache.hadoop.hbase.HBaseConfiguration;
7 import org.apache.hadoop.hbase.HBaseAdmin;
8 import org.apache.hadoop.hbase.TableName;
9 import org.apache.hadoop.hbase.TableNotFoundException;
10 import org.apache.hadoop.hbase.util.Bytes;
11
12 public class TableCreator {
13     {
14         public static
15         {
16             Configuration conf = HBaseConfiguration.create();
17             HBaseAdmin admin = new HBaseAdmin(conf);
18             createTable(admin, "customer");
19         }
20     }
21
22     @SuppressWarnings("deprecation")
23     public static void createTable(HBaseAdmin admin, String tableName)
24     {
25         HTableDescriptor htd = new HTableDescriptor(TableName.valueOf(tableName));
26     }
27 }
28
29 HTableDescriptor
30
```

```
<terminated> TableCreator [Java Application] /usr/local/java/bin/java (Oct 26, 2017, 7:00:43 AM)
log4j:WARN No appenders could be found for logger (org.apache.hadoop.metrics2.lib.MutableCounterLong).
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more info.
Table created.
```

The table that got created now appears in hbase as follows:



The screenshot shows a terminal window with the `hbase` shell. The `list` command is executed, and the output shows three tables: `clicks`, `customer`, and `htest`. The `customer` table is now listed alongside the others.

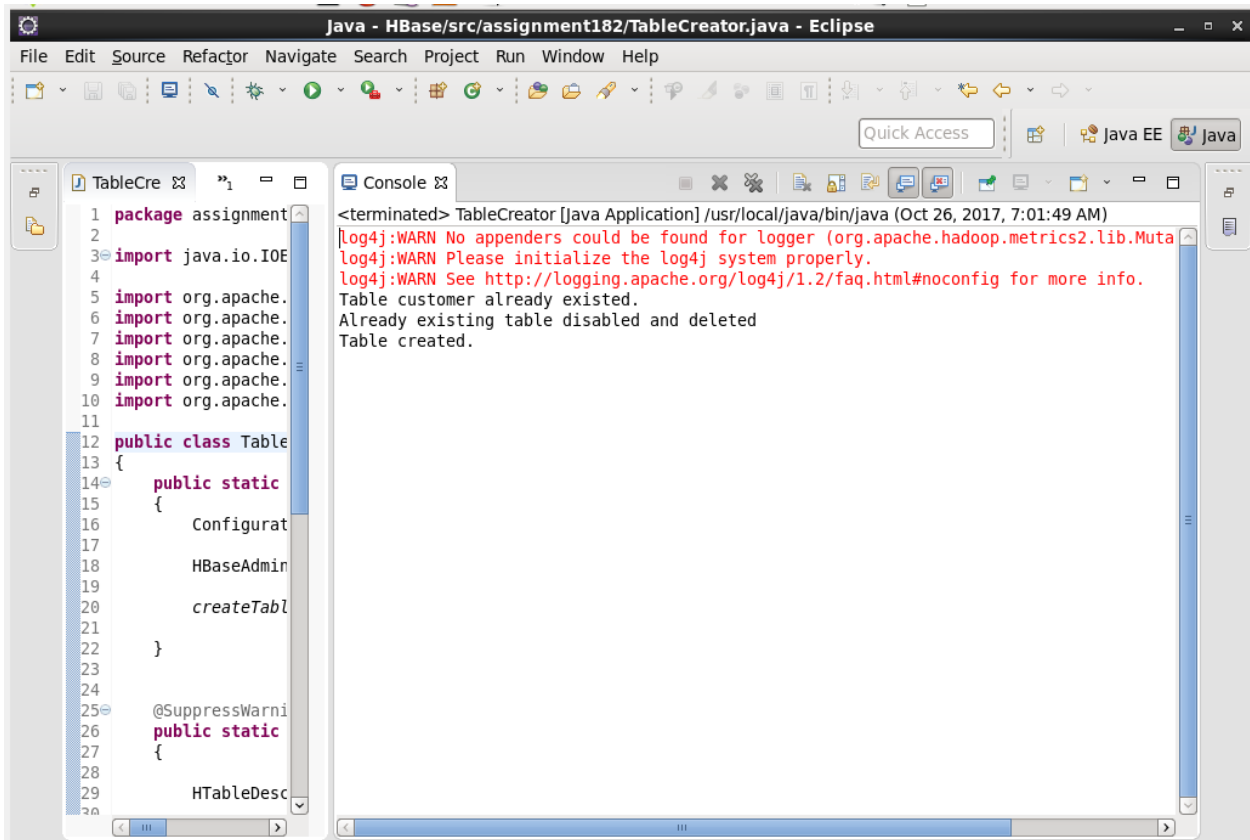
```
acadgild@localhost:~
File Edit View Search Terminal Help

hbase(main):007:0> list
TABLE
clicks
customer
htest
3 row(s) in 0.0260 seconds

=> ["clicks", "customer", "htest"]
hbase(main):008:0>
```

b. Use-case 2: The table already existed.

In this case, we disable already existing table and delete it, Then we create a new table. On executing the code, we get:



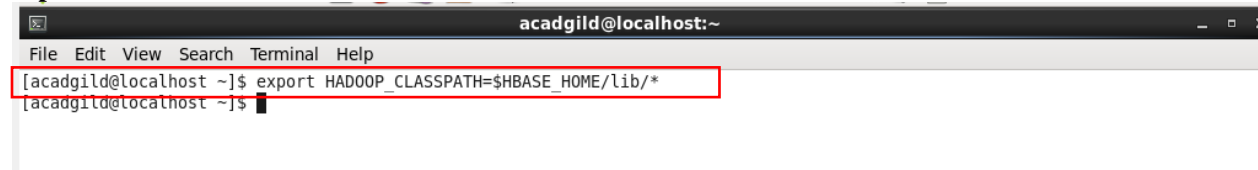
```
Java - HBase/src/assignment182/TableCreator.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access Java EE Java

TableCre
1 package assignment
2
3 import java.io.IOException;
4
5 import org.apache.hadoop.conf.Configuration;
6 import org.apache.hadoop.hbase.HBaseAdmin;
7 import org.apache.hadoop.hbase.HBaseConfiguration;
8 import org.apache.hadoop.hbase.HTableDescriptor;
9 import org.apache.hadoop.hbase.TableName;
10 import org.apache.hadoop.hbase.client.HBaseClient;
11
12 public class TableCreator {
13 {
14     public static void main(String[] args) {
15         Configuration conf = HBaseConfiguration.create();
16         HBaseAdmin admin = new HBaseAdmin(conf);
17         createTable(admin, conf);
18     }
19 }
20
21 @SuppressWarnings("deprecation")
22 public static void createTable(HBaseAdmin admin, Configuration conf) {
23     HTableDescriptor htd = new HTableDescriptor(TableName.valueOf("customer"));
24     admin.createTable(htd);
25 }
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27 }
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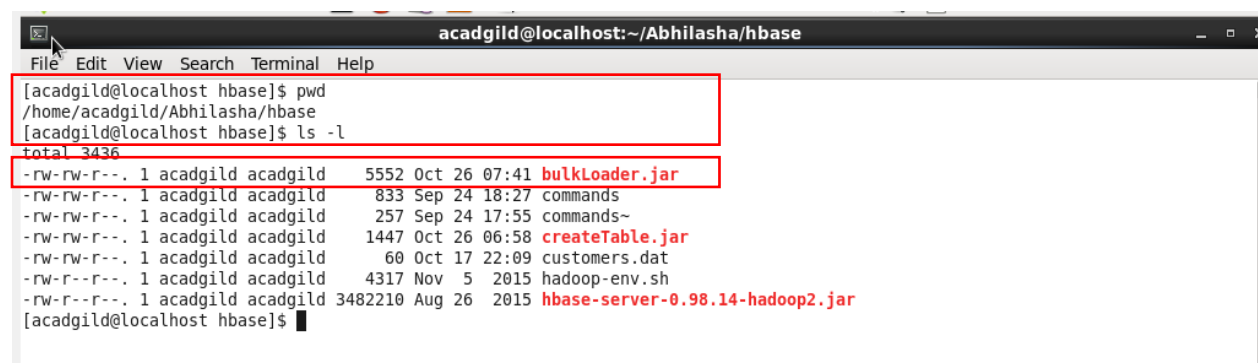
D. Bulk insert data into hbase table from a file placed in HDFS.

Step 1: We need to load the HBase library files into the Hadoop classpath this enables the Hadoop client to connect to HBase and get the number of splits. To do so, we execute the following command.

export HADOOP_CLASSPATH=\$HBASE_HOME/lib/*

A terminal window titled 'acadgild@localhost:~' with a menu bar (File, Edit, View, Search, Terminal, Help). The command 'export HADOOP_CLASSPATH=\$HBASE_HOME/lib/*' is entered and executed, with the prompt returning to '[acadgild@localhost ~]\$'.

Step 2: The code file used to perform bulk load is **BulkLoader.java**. The jar file created is named **bulkLoader.jar**. It is listed below:

A terminal window titled 'acadgild@localhost:~/Abhilasha/hbase' with a menu bar (File, Edit, View, Search, Terminal, Help). The user enters 'pwd' and 'ls -l'. The output of 'ls -l' is shown, with 'bulkLoader.jar' highlighted in red in the original image.

Permissions	Link Count	User	Group	Size	Date	Time	File Name
-rw-rw-r--	1	acadgild	acadgild	5552	Oct 26	07:41	bulkLoader.jar
-rw-rw-r--	1	acadgild	acadgild	833	Sep 24	18:27	commands
-rw-rw-r--	1	acadgild	acadgild	257	Sep 24	17:55	commands~
-rw-rw-r--	1	acadgild	acadgild	1447	Oct 26	06:58	createTable.jar
-rw-rw-r--	1	acadgild	acadgild	60	Oct 17	22:09	customers.dat
-rw-r--r--	1	acadgild	acadgild	4317	Nov 5	2015	hadoop-env.sh
-rw-r--r--	1	acadgild	acadgild	3482210	Aug 26	2015	hbase-server-0.98.14-hadoop2.jar

Step 3: Now, run the MapReduce job by following below command to generate the HFiles.

hadoop jar bulkLoader.jar /abhilasha/customers.dat customer /abhilasha/BulkLoadOutput

The jar is placed at /home/acadgild/Abhilasha/bulkLoader.jar

The map-reduce job takes three input parameters:

- i. Input File HDFS path : /abhilasha/customers.dat
- ii. Table Name : customer
- iii. Output Folder HDFS path : /abhilasha/BulkLoadOutput

The execution of the above command is shown as follows:

```
acadgild@localhost:~/Abhilasha/hbase
File Edit View Search Terminal Help
[acadgild@localhost hbase]$ hadoop jar bulkLoader.jar /abhilasha/customers.dat customer /abhilasha/BulkLoadOutput
SLF4J: Class path contains multiple SLF4J bindings.
SLF4J: Found binding in [jar:file:/usr/local/hbase/lib/slf4j-log4j12-1.6.4.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: Found binding in [jar:file:/usr/local/hadoop-2.6.0/share/hadoop/common/lib/slf4j-log4j12-1.7.5.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: See http://www.slf4j.org/codes.html#multiple_bindings for an explanation.
17/10/26 07:16:17 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
17/10/26 07:16:17 INFO zookeeper.RecoverableZooKeeper: Process identifier=hconnection-0x6af93788 connecting to ZooKeeper ensemble=localhost:2181
17/10/26 07:16:17 INFO zookeeper.ZooKeeper: Client environment:zookeeper.version=3.4.6-1569965, built on 02/20/2014 09:09 GMT
17/10/26 07:16:17 INFO zookeeper.ZooKeeper: Client environment:host.name=localhost
17/10/26 07:16:17 INFO zookeeper.ZooKeeper: Client environment:java.version=1.8.0_65
17/10/26 07:16:17 INFO zookeeper.ZooKeeper: Client environment:java.vendor=Oracle Corporation
17/10/26 07:16:17 INFO zookeeper.ZooKeeper: Client environment:java.home=/usr/local/java/jre
17/10/26 07:16:17 INFO zookeeper.ZooKeeper: Client environment:java.class.path=/usr/local/hbase/lib/hadoop-client-2.2.0.jar:/usr/local/hbase/lib/grizzly-http-servlet-2.1.2.jar:/usr/local/hbase/lib/commons-codec-1.7.jar:/usr/local/hbase/lib/jersey-json-1.8.jar:/usr/local/hbase/lib/hbase-thrift-0.98.14-hadoop2.jar:/usr/local/hbase/lib/commons-digester-1.8.jar:/usr/local/hbase/lib/jetty-sslengine-6.1.26.jar:/usr/local/hbase/lib/junit-4.11.jar:/usr/local/hbase/lib/httpcore-4.1.3.jar:/usr/local/hbase/lib/hbase-client-0.98.14-hadoop2.jar:/usr/local/hbase/lib/jsp-api-2.1-6.1.14.jar:/usr/local/hbase/lib/jetty-6.1.26.jar:/usr/local/hbase/lib/jsch-0.1.42.jar:/usr/local/hbase/lib/grizzly-http-2.1.2.jar:/usr/local/hbase/lib/slf4j-api-1.6.4.jar:/usr/local/hbase/lib/jsr305-1.3.9.jar:/usr/local/hbase/lib/paranamer-2.3.jar:/usr/local/hbase/lib/hadoop-mapreduce-client-shuffle-2.2.0.jar:/usr/local/hbase/lib/libthrift-0.9.0.jar:/usr/local/hbase/lib/hadoop-yarn-common-2.2.0.jar:/usr/local/hbase/lib/avro-1.7.4.jar:/usr/local/hbase/lib/hbase-server-0.98.14-hadoop2-tests.jar:/usr/local/hbase/lib/zookeeper-3.4.6.jar:/usr/local/hbase/lib/snappy-java-1.0.4.1.jar:/usr/local/hbase/lib/jersey-test-framework-grizzly2-1.9.jar:/usr/local/hbase/lib/management-api-3.0.0-b012.jar:/usr/local/hbase/lib/jackson-jaxrs-1.8.8.jar:/usr/local/hbase/lib/hbase-protocol-0.98.14-hadoop2.jar:/usr/local/hbase/lib/commons-io-2.4.jar:/usr/local/hbase/lib/hadoop-mapreduce-client-core-2.2.0.jar:/usr/local/hbase/lib/grizzly-rcm-2.1.2.jar:/usr/local/hbase/lib/jersey-server-1.8.jar:/usr/local/hbase/lib/hbase-testing-util-0.98.14-hadoop2.jar:/usr/local/hbase/lib/jaxb-impl-2.2.3-1.jar:/usr/local/hbase/lib/jersey-grizzly2-1.9.jar:/usr/local/hbase/lib/xz-1.0.jar:/usr/local/hbase/lib/guava-12.0.1.jar:/usr/local/hbase/lib/commons-configuration-1.6.jar:/usr/local/hbase/lib/hbase-resource-bundle-0.98.14-hadoop2.jar:/usr/local/hbase/lib/commons-daemon-1.0.13.jar:/usr/local/hbase/lib/jasper-runtime-5.5.23.jar:/usr/local/hbase/lib/hbase-common-0.98.14-hadoop2.jar:/usr/local/hbase/lib/isp-2.1-6.1.14.jar:/usr/local/hbase/lib/javax.servlet-api-3.0.1.jar:/usr
```

After the job execution, we find the output folder created as follows:

```
acadgild@localhost:~/Abhilasha/hbase
File Edit View Search Terminal Help
[acadgild@localhost hbase]$ hadoop fs -ls /abhilasha
SLF4J: Class path contains multiple SLF4J bindings.
SLF4J: Found binding in [jar:file:/usr/local/hbase/lib/slf4j-log4j12-1.6.4.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: Found binding in [jar:file:/usr/local/hadoop-2.6.0/share/hadoop/common/lib/slf4j-log4j12-1.7.5.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: See http://www.slf4j.org/codes.html#multiple_bindings for an explanation.
17/10/26 07:17:34 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
Found 6 items
drwxr-xr-x - acadgild supergroup 0 2017-10-26 07:16 /abhilasha/BulkLoadOutput
drwxr-xr-x - acadgild supergroup 0 2017-08-29 21:58 /abhilasha/FlumeTitanicData
-rw-r--r-- 1 acadgild supergroup 60 2017-10-20 15:43 /abhilasha/customers.dat
drwxr-xr-x - acadgild supergroup 0 2017-09-05 16:52 /abhilasha/flume
drwxr-xr-x - acadgild supergroup 0 2017-09-17 15:18 /abhilasha/hive
drwxr-xr-x - acadgild supergroup 0 2017-08-29 22:53 /abhilasha/project12
[acadgild@localhost hbase]$
```

The content of this output folder is as follows:

```
acadgild@localhost:~/Abhilasha/hbase
File Edit View Search Terminal Help
[acadgild@localhost hbase]$ hadoop fs -ls /abhilasha/BulkLoadOutput
SLF4J: Class path contains multiple SLF4J bindings.
SLF4J: Found binding in [jar:file:/usr/local/hbase/lib/slf4j-log4j12-1.6.4.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: Found binding in [jar:file:/usr/local/hadoop-2.6.0/share/hadoop/common/lib/slf4j-log4j12-1.7.5.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: See http://www.slf4j.org/codes.html#multiple_bindings for an explanation.
17/10/26 07:45:08 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
Found 2 items
-rw-r--r-- 1 acadgild supergroup          0 2017-10-26 07:43 /abhilasha/BulkLoadOutput/_SUCCESS
drwxr-xr-x - acadgild supergroup          0 2017-10-26 07:43 /abhilasha/BulkLoadOutput/details
[acadgild@localhost hbase]$
```

details folder will contain the a folder with the name of column column and this folder will in turn contain the HFile as follows:

```
acadgild@localhost:~/Abhilasha/hbase
File Edit View Search Terminal Help
[acadgild@localhost hbase]$ hadoop fs -ls /abhilasha/BulkLoadOutput/details
SLF4J: Class path contains multiple SLF4J bindings.
SLF4J: Found binding in [jar:file:/usr/local/hbase/lib/slf4j-log4j12-1.6.4.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: Found binding in [jar:file:/usr/local/hadoop-2.6.0/share/hadoop/common/lib/slf4j-log4j12-1.7.5.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: See http://www.slf4j.org/codes.html#multiple_bindings for an explanation.
17/10/26 07:45:49 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
Found 1 items
-rw-r--r-- 1 acadgild supergroup      1509 2017-10-26 07:43 /abhilasha/BulkLoadOutput/details/d0598b0136e5445c87cd8832aff65f1c
[acadgild@localhost hbase]$
```

Here, name of the column family is **details**.

The content of the HFile can be seen as follows:

The input parameters for complete bulk load are:

- i. Output directory HDFS path where HFile resides : /abhilasha/BulkLoadOutput/
- ii. Table name : customer

The execution of the above command is shown as follows:

```
acadgild@localhost:~/Abhilasha/hbase
File Edit View Search Terminal Help
[acadgild@localhost hbase]$ hadoop jar /home/acadgild/Abhilasha/hbase/hbase-server-0.98.14-hadoop2.jar completebulkload /abhilasha/BulkLoadOutput customer
SLF4J: Class path contains multiple SLF4J bindings.
SLF4J: Found binding in [jar:file:/usr/local/hbase/lib/slf4j-log4j12-1.6.4.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: Found binding in [jar:file:/usr/local/hadoop-2.6.0/share/hadoop/common/lib/slf4j-log4j12-1.7.5.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: See http://www.slf4j.org/codes.html#multiple_bindings for an explanation.
17/10/26 07:29:31 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
17/10/26 07:29:31 INFO zookeeper.RecoverableZooKeeper: Process identifier=hconnection-0x13f17eb4 connecting to ZooKeeper ensemble=localhost:2181
17/10/26 07:29:32 INFO zookeeper.ZooKeeper: Client environment:zookeeper.version=3.4.6-1569965, built on 02/20/2014 09:09 GMT
17/10/26 07:29:32 INFO zookeeper.ZooKeeper: Client environment:host.name=localhost
17/10/26 07:29:32 INFO zookeeper.ZooKeeper: Client environment:java.version=1.8.0_65
17/10/26 07:29:32 INFO zookeeper.ZooKeeper: Client environment:java.vendor=Oracle Corporation
17/10/26 07:29:32 INFO zookeeper.ZooKeeper: Client environment:java.home=/usr/local/java/jre
17/10/26 07:29:32 INFO zookeeper.ZooKeeper: Client environment:java.class.path=/usr/local/hbase/lib/hadoop-client-2.2.0.jar:/usr/local/hbase/lib/grizzly-http-servlet-2.1.2.jar:/usr/local/hbase/lib/commons-codec-1.7.jar:/usr/local/hbase/lib/jersey-json-1.8.jar:/usr/local/hbase/lib/hbase-thrift-0.98.14-hadoop2.jar:/usr/local/hbase/lib/commons-digester-1.8.jar:/usr/local/hbase/lib/jetty-sslengine-6.1.26.jar:/usr/local/hbase/lib/junit-4.11.jar:/usr/local/hbase/lib/httpcore-4.1.3.jar:/usr/local/hbase/lib/hbase-client-0.98.14-hadoop2.jar:/usr/local/hbase/lib/jsp-api-2.1-6.1.14.jar:/usr/local/hbase/lib/jetty-6.1.26.jar:/usr/local/hbase/lib/jsch-0.1.42.jar:/usr/local/hbase/lib/grizzly-http-2.1.2.jar:/usr/local/hbase/lib/slf4j-api-1.6.4.jar:/usr/local/hbase/lib/jsr305-1.3.9.jar:/usr/local/hbase/lib/paranamer-2.3.jar:/usr/local/hbase/lib/hadoop-mapreduce-client-shuffle-2.2.0.jar:/usr/local/hbase/lib/libthrift-0.9.0.jar:/usr/local/hbase/lib/hadoop-yarn-common-2.2.0.jar:/usr/local/hbase/lib/avro-1.7.4.jar:/usr/local/hbase/lib/hbase-server-0.98.14-hadoop2-tests.jar:/usr/local/hbase/lib/zookeeper-3.4.6.jar:/usr/local/hbase/lib/snappy-java-1.0.4.1.jar:/usr/local/hbase/lib/jersey-test-framework-grizzly2-1.9.jar:/usr/local/hbase/lib/management-api
```

Output of the execution of the above command is the content of the HFile getting loaded into given hbase table as follows:

```
acadgild@localhost:~
File Edit View Search Terminal Help
hbase(main):011:0> scan 'customer'
ROW COLUMN+CELL
0 row(s) in 0.0710 seconds

hbase(main):012:0> scan 'customer'
ROW COLUMN+CELL
1 column=details:age, timestamp=1508984037908, value=18
1 column=details:location, timestamp=1508984037908, value=IND
1 column=details:name, timestamp=1508984037908, value=Amit
2 column=details:age, timestamp=1508984037908, value=20
2 column=details:location, timestamp=1508984037908, value=PAK
2 column=details:name, timestamp=1508984037908, value=Sumit
3 column=details:age, timestamp=1508984037908, value=26
3 column=details:location, timestamp=1508984037908, value=AUS
3 column=details:name, timestamp=1508984037908, value=Rohit
4 column=details:age, timestamp=1508984037908, value=24
4 column=details:location, timestamp=1508984037908, value=UK
4 column=details:name, timestamp=1508984037908, value=Namit
4 row(s) in 0.1160 seconds

hbase(main):013:0>
```