NoSQL Database HBase - Truck IoT Data

1 NoSQL and HBase

1.1 NoSQL - Column Family Database

Column family databases are best known because of Google's BigTable implementation. They are very similar on the surface to a relational database, but they have critical conceptual differences. You will not be able to apply the same sort of solutions that you used in a relational database to a column database.

That is because column databases are not relational; they do not have what an RDBMS would recognize as a table.

Each row consists of a collection of columns/value pairs in column-family databases. A collection of similar rows then makes up a column family. (This would be equivalent to a collection of rows making up a table in a relational database.) The main difference is that rows do not have to contain the same columns in a column-family database.

RDBMS imposes a high cost of schema change for the low cost of query change. Column families impose little to no cost in schema change, for slightly more cost in query change.

1.2 Why HBase:

HBase is a column-oriented database that prides itself on consistency and scaling out. It is based

on BigTable, a high-performance, proprietary database developed by Google and described in the 2006 white paper "Bigtable: A Distributed Storage System for Structured Data."1 Initially

created for natural language processing, HBase started life as a contrib package for Apache Hadoop. Since then, it has become a top-level Apache project.

2 Starting the HBase shell

The HBase shell is a JRuby-based command-line program we can use to interact with HBase. In

the shell, we can add and remove tables, alter table schema, add or delete data, and do many other tasks. Later we'll explore other means of connecting to HBase, but the shell will now be our home.

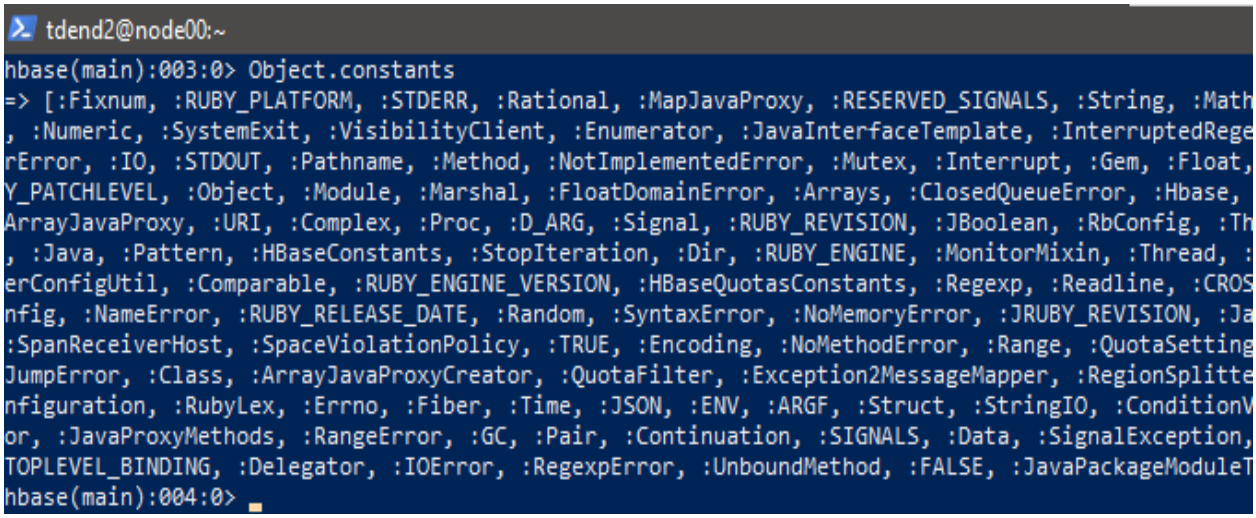
Typed 'hbase shell' to start the HBase shell.

Helpcommand:

```
tdend2@node00:~
hbase(main):002:0> help
HBase Shell, version 2.1.0-cdh6.3.2, rUnknown, Fri Nov  8 05:44:07 PST 2019
Type 'help "COMMAND"', (e.g. 'help "get"' -- the quotes are necessary) for help on a specific command.
Commands are grouped. Type 'help "COMMAND_GROUP"', (e.g. 'help "general"') for help on a command group.

COMMAND GROUPS:
  Group name: general
  Commands: processlist, status, table_help, version, whoami

  Group name: ddl
  Commands: alter, alter_async, alter_status, clone_table_schema, create, describe, disable, disable_all, drop, drop_all,
list_regions, locate_region, show_filters

  Group name: namespace
  Commands: alter_namespace, create_namespace, describe_namespace, drop_namespace, list_namespace, list_namespace_tables

  Group name: dml
  Commands: append, count, delete, deleteall, get, get_counter, get_splits, incr, put, scan, truncate, truncate_preserve

  Group name: tools
  Commands: assign, balance_switch, balancer, balancer_enabled, catalogjanitor_enabled, catalogjanitor_run, catalogjanito
h, clear_block_cache, clear_compaction_queues, clear_deadservers, close_region, compact, compact_rs, compaction_state, fl
ion, move, normalize, normalizer_enabled, normalizer_switch, split, splitormerge_enabled, splitormerge_switch, stop_maste

  Group name: replication
  Commands: add_peer, append_peer_exclude_namespaces, append_peer_exclude_tableCFs, append_peer_namespaces, append_peer_t
able_replication, get_peer_config, list_peer_configs, list_peers, list_replicated_tables, remove_peer, remove_peer_exclud
ove_peer_tableCFs, set_peer_bandwidth, set_peer_exclude_namespaces, set_peer_exclude_tableCFs, set_peer_namespaces, set_p
Fs, update_peer_config

  Group name: snapshots
  Commands: clone_snapshot, delete_all_snapshot, delete_snapshot, delete_table_snapshots, list_snapshots, list_table_snap

  Group name: configuration
  Commands: update_all_config, update_config

  Group name: quotas
  Commands: list_quota_snapshots, list_quota_table_sizes, list_quotas, list_snapshot_sizes, set_quota

  Group name: security
  Commands: grant, list_security_capabilities, revoke, user_permission

  Group name: procedures
  Commands: list_locks, list_procedures

  Group name: visibility labels
  Commands: add_labels, clear_auths, get_auths, list_labels, set_auths, set_visibility

  Group name: rsgroup
  Commands: add_rsgroup, balance_rsgroup, get_rsgroup, get_server_rsgroup, get_table_rsgroup, list_rsgroups, move_namespa
```

Last half of result:

```
tdend2@node00:~
  Commands: add_peer, append_peer_exclude_namespaces, append_peer_exclude_tableCFs, append_peer_namespa
able_replication, get_peer_config, list_peer_configs, list_peers, list_replicated_tables, remove_peer,
ove_peer_tableCFs, set_peer_bandwidth, set_peer_exclude_namespaces, set_peer_exclude_tableCFs, set_peer
Fs, update_peer_config

  Group name: snapshots
  Commands: clone_snapshot, delete_all_snapshot, delete_snapshot, delete_table_snapshots, list_snapshot

  Group name: configuration
  Commands: update_all_config, update_config

  Group name: quotas
  Commands: list_quota_snapshots, list_quota_table_sizes, list_quotas, list_snapshot_sizes, set_quota

  Group name: security
  Commands: grant, list_security_capabilities, revoke, user_permission

  Group name: procedures
  Commands: list_locks, list_procedures

  Group name: visibility labels
  Commands: add_labels, clear_auths, get_auths, list_labels, set_auths, set_visibility

  Group name: rsgroup
  Commands: add_rsgroup, balance_rsgroup, get_rsgroup, get_server_rsgroup, get_table_rsgroup, list_rsgr
e_servers_tables_rsgroup, move_tables_rsgroup, remove_rsgroup, remove_servers_rsgroup

SHELL USAGE:
Quote all names in HBase Shell such as table and column names.  Commas delimit
command parameters.  Type <RETURN> after entering a command to run it.
Dictionaries of configuration used in the creation and alteration of tables are
Ruby Hashes. They look like this:

  {'key1' => 'value1', 'key2' => 'value2', ...}

and are opened and closed with curley-braces.  Key/values are delimited by the
'=>' character combination.  Usually keys are predefined constants such as
NAME, VERSIONS, COMPRESSION, etc.  Constants do not need to be quoted.  Type
'Object.constants' to see a (messy) list of all constants in the environment.

If you are using binary keys or values and need to enter them in the shell, use
double-quote'd hexadecimal representation. For example:

  hbase> get 't1', "key\x03\x3f\xcd"
  hbase> get 't1', "key\003\023\011"
  hbase> put 't1', "test\xef\xff", 'f1:', "\x01\x33\x40"

The HBase shell is the (J)Ruby IRB with the above HBase-specific commands added.
For more on the HBase Shell, see http://hbase.apache.org/book.html
hbase(main):003:0>
```



3.2 Data Definition Language (DDL) commands in HBase

3.2.1 Namespace

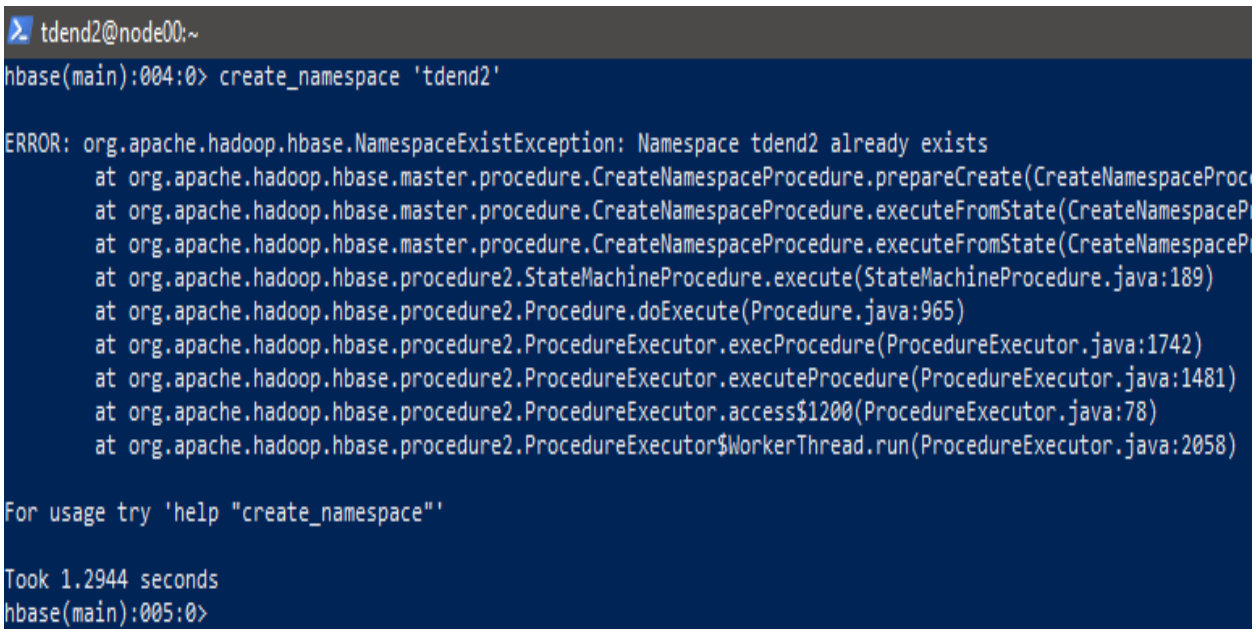
A namespace is a logical grouping of tables analogous to a database in relational database systems. This abstraction lays the groundwork for multi-tenancy-related features:

• Quota Management (HBASE-8410) - Restrict the amount of resources (e.g., regions, tables) a namespace can consume.

• Namespace Security Administration (HBASE-9206) - provide another level of security administration for tenants.

• Region server groups (HBASE-6721) - A namespace/table can be pinned onto a subset of regionservers thus guaranteeing a course level of isolation.

create_namespace 'tdend2'



3.2.2 Create a table

When you create a table, you should add your namespace in front of your table name
create '<your-namespace>:safe_table', 'will_NOT_be_deleted'
create 'tdend2:safe_table', 'will_NOT_be_deleted'

```
tdend2@node00:~
hbase(main):005:0> create 'tdend2:safe_table', 'will_NOT_be_deleted'
Created table tdend2:safe_table
Took 0.7960 seconds
=> Hbase::Table - tdend2:safe_table
hbase(main):006:0>
```

'list' command is you will see all the tables in the HBase. If 30 users create 5 tables per user, you will see 150 tables.

```
tdend2@node00:~
hbase(main):006:0> list
TABLE
abeer:del_table
abeer:mytable2_tbl
abeer:mytable_tbl
abeer:truck_event
ibiga2:truck_event
mkhal44:mytable2_tbl
mkhal44:mytable_tbl
mkhal44:truck_event
nhasa29:mytable_tbl
nhasa29:truck_event
operv2:mytable2_tbl
operv2:mytable_tbl
operv2:truck_event
spisa3:truck_event
sslee777:table4compress
sslee777:table4compress_c
sslee777:truck_event
tdend2:safe_table
vkond9:truck_event
19 row(s)
Took 0.0292 seconds
=> ["abeer:del_table", "abeer:mytable2_tbl", "abeer:mytable_tbl", "abeer:truck_event", "ibiga2:tr
ble_tbl", "nhasa29:truck_event", "operv2:mytable2_tbl", "operv2:mytable_tbl", "operv2:truck_event
k_event", "tdend2:safe_table", "vkond9:truck_event"]
hbase(main):007:0>
```

The syntax to create a table in HBase is create '<table_name>','<column_family_name>'.
Let's create a table called 'mytable_tbl' with a column family of name 'mycolfam_cf'. Run the following command:
create '<your-namespace>:mytable_tbl', 'mycolfam_cf'
create 'tdend2:mytable_tbl', 'mycolfam_cf'

```
tdend2@node00:~
hbase(main):007:0>  create 'tdend2:mytable_tbl', 'mycolfam_cf'
Created table tdend2:mytable_tbl
Took 0.7410 seconds
=> Hbase::Table - tdend2:mytable_tbl
hbase(main):008:0>
```

The table is currently empty; it has no rows and thus no columns. Unlike a relational database, in HBase a column is specific to the row that contains it. It is only when adding rows that columns are created to store data.
Checked the table we've just created, typed the following command in the HBase shell

```
tdend2@node00:~
hbase(main):008:0> list
TABLE
abeer:del_table
abeer:mytable2_tbl
abeer:mytable_tbl
abeer:truck_event
ibiga2:truck_event
mkhal44:mytable2_tbl
mkhal44:mytable_tbl
mkhal44:truck_event
nhasa29:mytable_tbl
nhasa29:truck_event
operv2:mytable2_tbl
operv2:mytable_tbl
operv2:truck_event
spisa3:truck_event
sslee777:table4compress
sslee777:table4compress_c
sslee777:truck_event
tdend2:mytable_tbl
tdend2:safe_table
vkond9:truck_event
20 row(s)
Took 0.0118 seconds
=> ["abeer:del_table", "abeer:mytable2_tbl", "abeer:mytable_tbl", "abeer:truck_event", "ibiga2:tr
ble_tbl", "nhasa29:truck_event", "operv2:mytable2_tbl", "operv2:mytable_tbl", "operv2:truck_event
k_event", "tdend2:mytable_tbl", "tdend2:safe_table", "vkond9:truck_event"]
hbase(main):009:0>
```

'List_namespace_tables' displays only tables under a particular namespace will be show up.
list_namespace_tables '<your-namespace>'
list_namespace_tables 'tdend2'

```
tdend2@node00:~
hbase(main):009:0> list_namespace_tables 'tdend2'
TABLE
mytable_tbl
safe_table
2 row(s)
Took 0.0300 seconds
=> ["mytable_tbl", "safe_table"]
hbase(main):010:0>
```

3.2.3 Delete tables
If you want to delete/drop tables, use drop command. But we need to disable the tables first disable 'del_table'. I tried to create a table, disabled and deleted as shown below:

```
tdend2@node00:~
hbase(main):001:0> create 'tdend2:del_tbl', 'mycolfam_cf'

ERROR: Table already exists: tdend2:del_tbl!

For usage try 'help "create"'

Took 1.3579 seconds
hbase(main):002:0> disable 'tdend2:del_tbl', 'mycolfam_cf'

ERROR: wrong number of arguments (2 for 1)

For usage try 'help "disable"'

Took 0.0065 seconds
hbase(main):003:0> disable 'tdend2:del_tbl'
Took 1.0012 seconds
hbase(main):004:0> drop 'tdend2:del_tbl'
Took 0.2314 seconds
hbase(main):005:0> list_namespace_tables 'tdend2'
TABLE
mytable_tbl
safe_table
2 row(s)
Took 0.0234 seconds
=> ["mytable_tbl", "safe_table"]
hbase(main):006:0>
```

3.3 Data Manipulation Language (DML) commands in HBase

3.3.1 Inserting and Reading Data: put and get/scan commands

First, we will use the put command to add data to an HBase table.

put '<your-namespace>:mytable_tbl', 'myrowkey_key','mycolfam_cf:mycolname_col', 'Welcome to My HBase!'

put 'tdend2:mytable_tbl', 'myrowkey_key', 'mycolfam_cf:mycolname_col', 'Welcome to My HBase!'

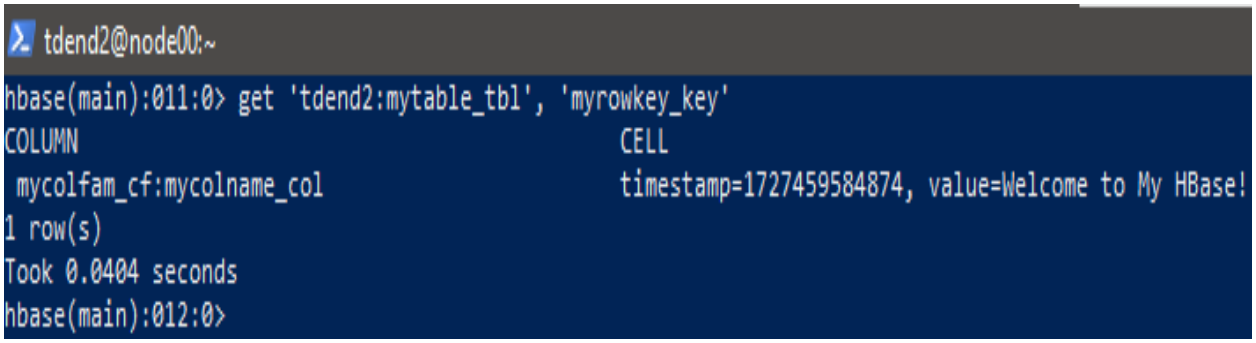
```
tdend2@node00:~
hbase(main):006:0> put 'tdend2:mytable_tbl', 'myrowkey_key', 'mycolfam_cf:mycolname_col', 'Welcome to My HBase!'
Took 0.1063 seconds
hbase(main):007:0>
```

This command inserts a new row into the ‘mytable_tbl’ table with the key 'myrowkey_key', adding 'Welcome to My HBase!' to the column (column family+column name/qualifier) called 'mycolfam_cf:mycolname_col'.

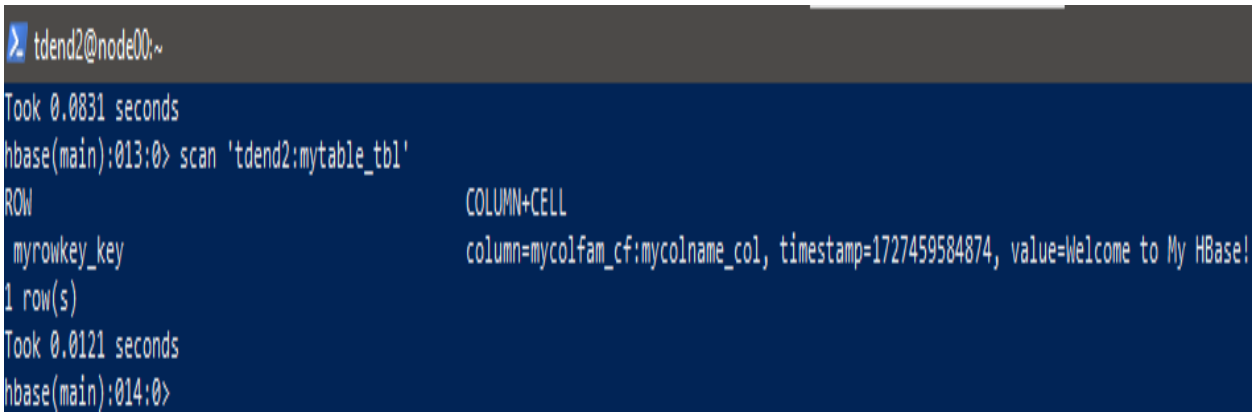
We can query the data for the 'myrowkey_key' row using get, which requires two parameters: the table name and the row key.

We can also use ‘scan’ command.

Get command:
get tdend2:mytable_tbl', 'myrowkey_key'



Scan - command:



Notice the timestamp field in the output. HBase stores an integer timestamp for all data values, representing time in milliseconds since the epoch (00:00:00UTC on January 1, 1970). When a new value is written to the same cell, the old value will be retained, indexed by its timestamp. This is a great feature. Most databases require you to specifically handle historical data explicitly, but in HBase, versioning is automatic. If we do not want the timestamp to be in MSE, the put and get commands allow to specify a timestamp explicitly by inserting an integer value of your choice. This gives an extra dimension to work with if we need it. If we don't explicitly specify a timestamp, HBase will use the current time when inserting, and it will return the most recent version when reading.

—----------

3.4 Loading/populate data using HBase utility

This utility should be called outside the HBase shell—means in Linux shell.

3.4.1 Trucking IoT Data

It's time to get started with some real data. For this hands-on exercise, you'll make use of the Trucking IoT Data.

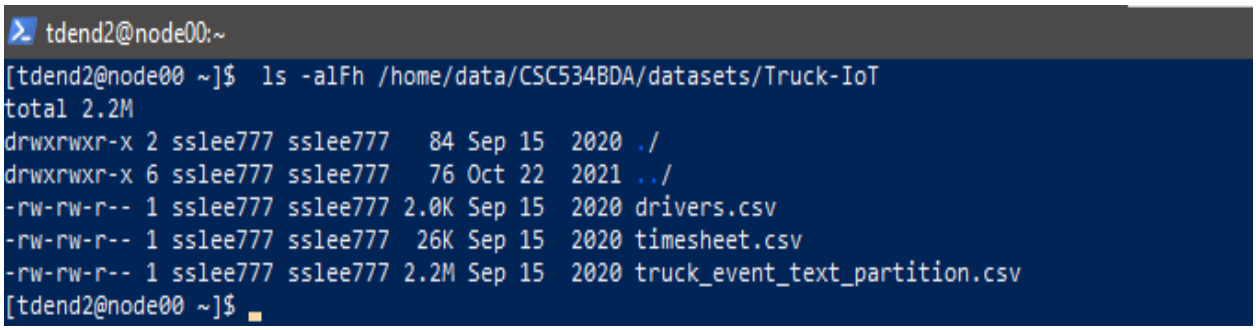
• Dataset:
https://www.cloudera.com/content/dam/www/marketing/tutorials/beginnersguide-to-apache-pig/assets/driver_data.zip

• Related GitHub project: https://github.com/hortonworks-gallery/iot-truck-streaming

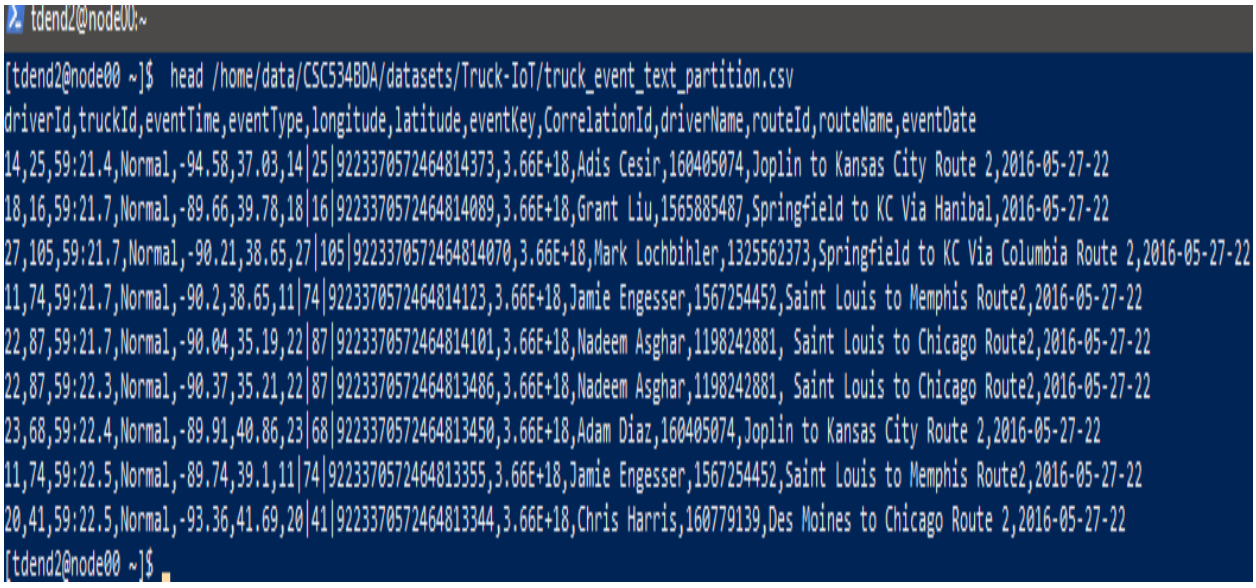
We are looking at a use case where we have a truck fleet. Each truck has been equipped to log

location and event data. These events are streamed back to a datacenter where we will be processing the data. The company wants to use this data to better understand risk.
The dataset, Trucking IoT, contains the following files:
• drivers.csv
o This has driver information. It contains records showing driverId, name, ssn, location, certified, and wage-plan.
• timesheet.csv
o This contains records showing driverId, week, hours-logged, and miles-logged.
• truck_event_text_partition.csv
o This contains records showing driverId, truckId, eventTime, eventType, longitude, latitude, eventKey, CorrelationId, driverName, routeId, routeName, and eventDate

The dataset is located in /home/data/CSC534BDA/datasets/Truck-IoT of Linux file system (Not in the HDFS) of the cluster.

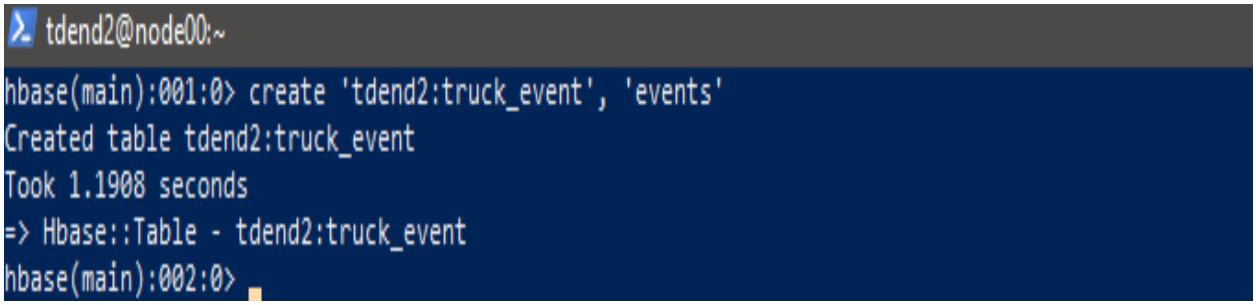


We will use truck_event_text_partition.csv file for this exercise.
To see the first 10 rows of truck_event_text_partition.csv, use ‘head’ Linux commands.
head /home/data/CSC534BDA/datasets/Truck-IoT/truck_event_text_partition.csv



3.4.2 Creating a table
Created a table, truck_event, with column family name ‘events’

create 'tdend2:truck_event', 'events'



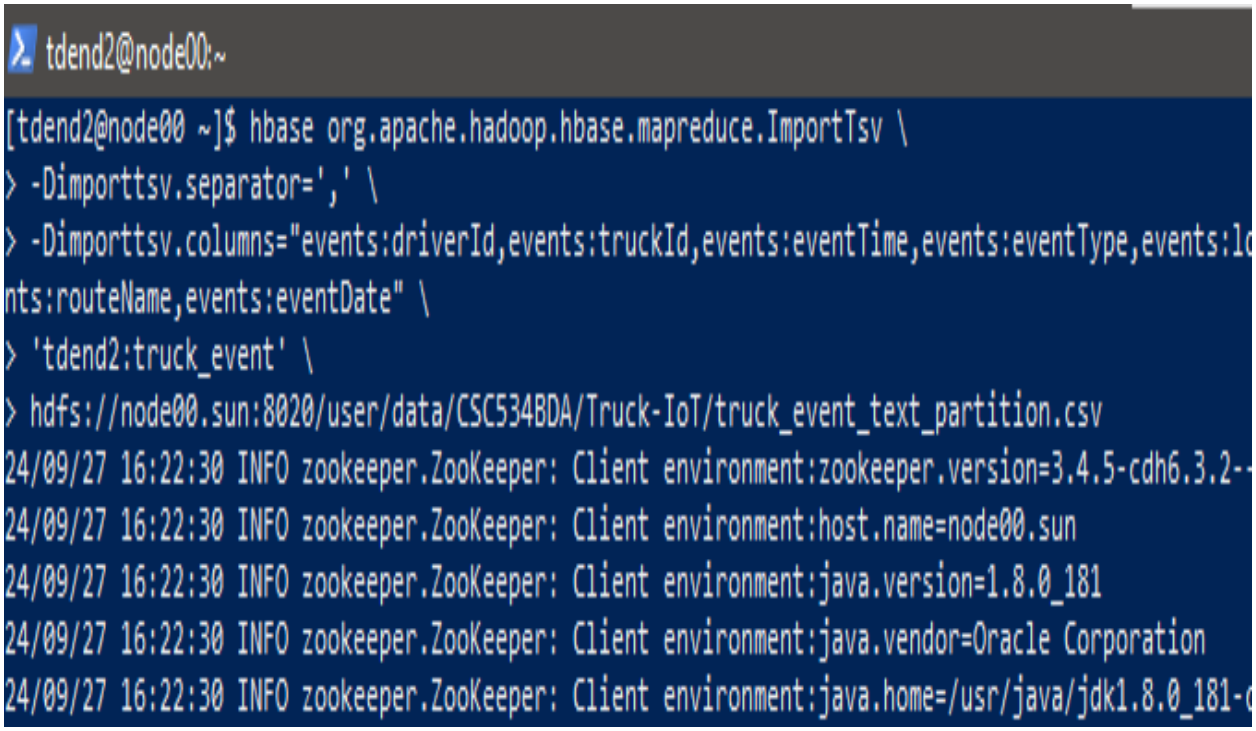
3.4.3 Load/populate data

The data is already loaded to HDFS and can be found in /user/data/CSC534BDA/Truck-IoT/ in HDFS. We will use

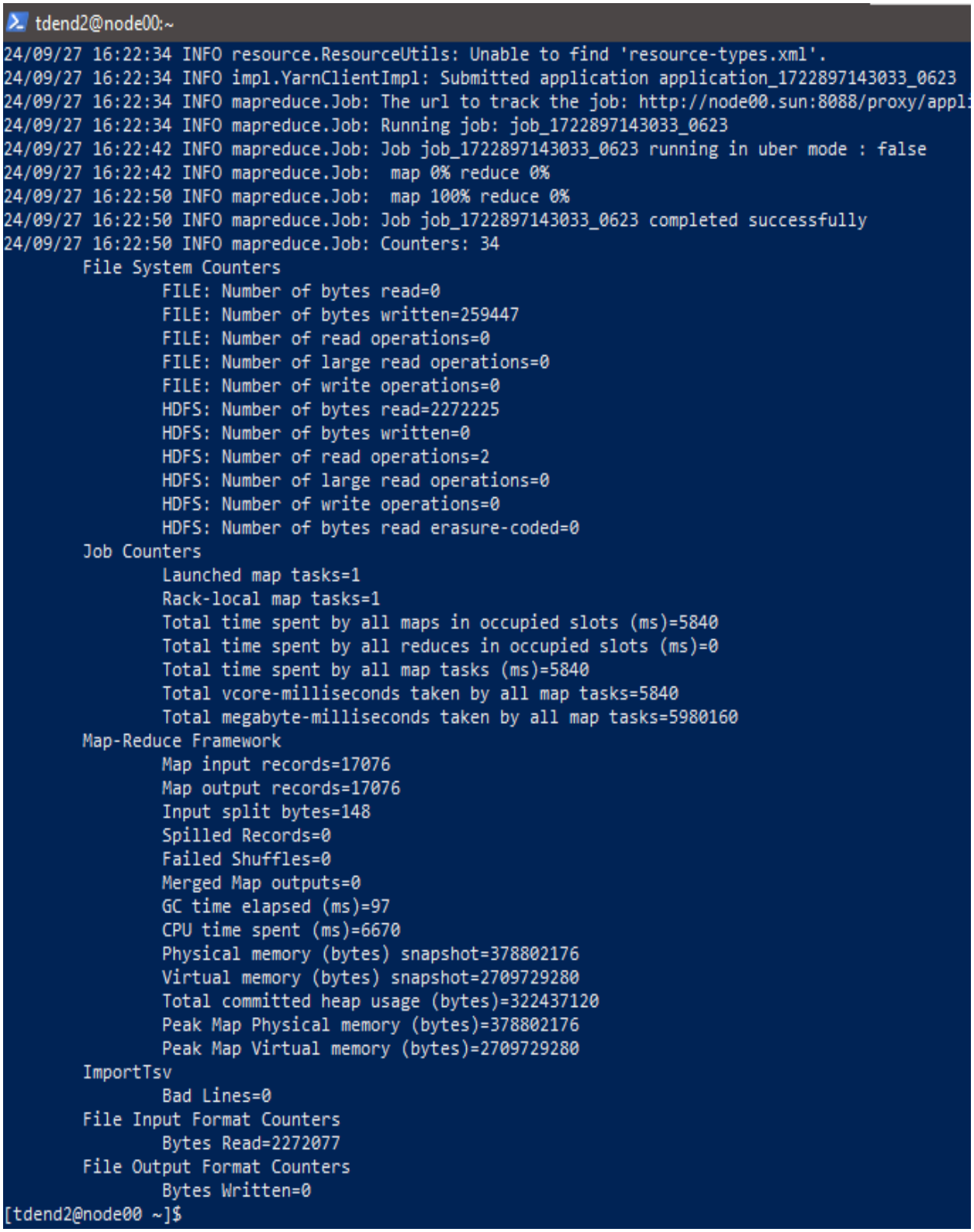
'eventKey' column as a RowKey (similar to the primary key in RDBMS) of the table, so 'eventKey' column is replaced by HBASE_ROW_KEY. For more detail, see ImportTsv utility reference guide in HBase: http://hbase.apache.org/book.html#importtsv

Note: Typing below codes is recommended! You may not be able to copy below codes perfectly, because PDF conversion is not good at long texts. Don't forget to use your namespace.

hbase org.apache.hadoop.hbase.mapreduce.ImportTsv -Dimporttsv.separator=, -Dimporttsv.columns="events:driverId,events:truckId,events::eventTime,events:eventType,events:longitude,events:latitude,HBASE_ROW_KEY,events:CorrelationId,events:driverName,events:routeId,eve nts:routeName,events:eventDate" 'tdend2:truck_event' hdfs://node00.sun:8020/user/data/CSC534BDA/Truck-IoT/truck_event_text_partition.csv



Last half of output after loading the data:



17076 as Map input records and output records and no bad lines (Bad Lines = 0). The import job was successful. However, double-checked the row count of the table by submitting another MR job, RowCounter.

hbase org.apache.hadoop.hbase.mapreduce.RowCounter 'tdend2:truck_event'

```
tdend2@node00:~
[tdend2@node00 ~]$ hbase org.apache.hadoop.hbase.mapreduce.RowCounter 'tdend2:truck_event'
24/09/27 16:29:13 INFO client.RMProxy: Connecting to ResourceManager at node00.sun/10.0.0.10:8032
24/09/27 16:29:14 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /user/td
24/09/27 16:29:16 INFO zookeeper.ZooKeeper: Client environment:zookeeper.version=3.4.5-cdh6.3.2--
24/09/27 16:29:16 INFO zookeeper.ZooKeeper: Client environment:host.name=node00.sun
24/09/27 16:29:16 INFO zookeeper.ZooKeeper: Client environment:java.version=1.8.0_181
24/09/27 16:29:16 INFO zookeeper.ZooKeeper: Client environment:java.vendor=Oracle Corporation
24/09/27 16:29:16 INFO zookeeper.ZooKeeper: Client environment:java.home=/usr/java/jdk1.8.0_181-c
24/09/27 16:29:16 INFO zookeeper.ZooKeeper: Client environment:java.class.path=/opt/cloudera/parc
```

scan 'tdend2:truck_event', {'LIMIT' => 2}

```
tdend2@node00:~
hbase(main):001:0> scan 'tdend2:truck_event', {'LIMIT' => 2}
ROW                                    COLUMN+CELL
 10|23|9223370572126391280             column=events:correlationId, timestamp=1727472149999, value=1000
 10|23|9223370572126391280             column=events:driverId, timestamp=1727472149999, value=10
 10|23|9223370572126391280             column=events:driverName, timestamp=1727472149999, value=George Vetticaden
 10|23|9223370572126391280             column=events:eventDate, timestamp=1727472149999, value=2016-06-02-20
 10|23|9223370572126391280             column=events:eventTime, timestamp=1727472149999, value=59:44.5
 10|23|9223370572126391280             column=events:eventType, timestamp=1727472149999, value=Normal
 10|23|9223370572126391280             column=events:latitude, timestamp=1727472149999, value=38.64
 10|23|9223370572126391280             column=events:longitude, timestamp=1727472149999, value=-90.18
 10|23|9223370572126391280             column=events:routeId, timestamp=1727472149999, value=1390372503
 10|23|9223370572126391280             column=events:routeName, timestamp=1727472149999, value=Saint Louis to Tulsa
 10|23|9223370572126391280             column=events:truckId, timestamp=1727472149999, value=23
 10|23|9223370572126392279             column=events:correlationId, timestamp=1727472149999, value=1000
 10|23|9223370572126392279             column=events:driverId, timestamp=1727472149999, value=10
 10|23|9223370572126392279             column=events:driverName, timestamp=1727472149999, value=George Vetticaden
 10|23|9223370572126392279             column=events:eventDate, timestamp=1727472149999, value=2016-06-02-20
 10|23|9223370572126392279             column=events:eventTime, timestamp=1727472149999, value=59:43.5
 10|23|9223370572126392279             column=events:eventType, timestamp=1727472149999, value=Normal
 10|23|9223370572126392279             column=events:latitude, timestamp=1727472149999, value=38.64
 10|23|9223370572126392279             column=events:longitude, timestamp=1727472149999, value=-90.18
 10|23|9223370572126392279             column=events:routeId, timestamp=1727472149999, value=1390372503
 10|23|9223370572126392279             column=events:routeName, timestamp=1727472149999, value=Saint Louis to Tulsa
 10|23|9223370572126392279             column=events:truckId, timestamp=1727472149999, value=23
2 row(s)
Took 0.5325 seconds
hbase(main):002:0>
```

2 rows are obtained as limited to get only 2 rows from the table and also found 11 columns in each row.

Please write and run HBase commands against the table created above.
1. Write and run 11 HBase commands to insert a new row into the table.
a. Table name: <your-namespace>:truck_event
b. Rowkey: 2000
c. Column family name: events
d. Columns: values
i. driverId: <your-login or UIS NetID>
ii. truckId: 999
iii. eventTime: 01:01.1
iv. eventType: <Pick one from Normal, Overspeed, and Lane Departure>
v. longitude: -84.58
vi. latitude: 27.03
vii. eventKey (This is a RowKey)
viii. CorrelationId: 1000
ix. driverName: <Your name>
x. routeId: 888
xi. routeName: UIS to St. Louis
xii. eventDate: <current date> e.g. 2030-01-01-01, year-month-day-hour (24)

Inserted each column of a row using put command.Likewise, inserted 11 columns to a row.

```
put 'tdend2:truck_event', '2000', 'events:driverId', 'tdend2'
put 'tdend2:truck_event', '2000', 'events:truckId', '999'
put 'tdend2:truck_event', '2000', 'events:eventTime', '01:01.1'
put 'tdend2:truck_event', '2000', 'events:eventType', 'Overspeed'
put 'tdend2:truck_event', '2000', 'events:longitude', '-84.58'
put 'tdend2:truck_event', '2000', 'events:latitude', '27.03'
put 'tdend2:truck_event', '2000', 'events:correlationId', '1000'
put 'tdend2:truck_event', '2000', 'events:driverName', 'Tejashri Dendi'
put 'tdend2:truck_event', '2000', 'events:routeId', '888'
put 'tdend2:truck_event', '2000', 'events:routeName', 'UIS to St. Louis'
put 'tdend2:truck_event', '2000', 'events:eventDate', '2024-09-27-01'
```

```
tdend2@node00:~
hbase(main):004:0> put 'tdend2:truck_event', '2000', 'events:driverId', 'tdend2'
Took 0.0084 seconds
hbase(main):005:0> put 'tdend2:truck_event', '2000', 'events:truckId', '999'
Took 0.0067 seconds
hbase(main):006:0> put 'tdend2:truck_event', '2000', 'events:eventTime', '01:01.1'
Took 0.0040 seconds
hbase(main):007:0> put 'tdend2:truck_event', '2000', 'events:eventType', 'Overspeed'
Took 0.0092 seconds
hbase(main):008:0> put 'tdend2:truck_event', '2000', 'events:longitude', '-84.58'
Took 0.0044 seconds
hbase(main):009:0> put 'tdend2:truck_event', '2000', 'events:latitude', '27.03'
Took 0.0037 seconds
hbase(main):010:0> put 'tdend2:truck_event', '2000', 'events:correlationId', '1000'
Took 0.0057 seconds
hbase(main):011:0> put 'tdend2:truck_event', '2000', 'events:driverName', 'Tejashri Dendi'
Took 0.0064 seconds
hbase(main):012:0> put 'tdend2:truck_event', '2000', 'events:routeId', '888'
Took 0.0063 seconds
hbase(main):013:0> put 'tdend2:truck_event', '2000', 'events:routeName', 'UIS to St. Louis'
Took 0.0041 seconds
hbase(main):014:0> put 'tdend2:truck_event', '2000', 'events:eventDate', '2024-09-27-01'
Took 0.0057 seconds
hbase(main):015:0>
```

---

2. Write and run an HBase command to retrieve the row only you just inserted.
14
a. Table name: <your-namespace>:truck_event
b. Rowkey: 2000
c. Column family name: events
d. Note: the row only. No other rows.
e. You may want to check the help page 'help <command>'
get 'tdend2:truck_event', '2000', 'events'

```
tdend2@node00:~
hbase(main):015:0> get 'tdend2:truck_event', '2000', 'events'
COLUMN                                CELL
 events:correlationId                 timestamp=1727474286479, value=1000
 events:driverId                      timestamp=1727474207096, value=tdend2
 events:driverName                    timestamp=1727474303286, value=Tejashri Dendi
 events:eventDate                     timestamp=1727474335546, value=2024-09-27-01
 events:eventTime                     timestamp=1727474239055, value=01:01.1
 events:eventType                     timestamp=1727474251258, value=Overspeed
 events:latitude                      timestamp=1727474274854, value=27.03
 events:longitude                     timestamp=1727474262124, value=-84.58
 events:routeId                       timestamp=1727474314644, value=888
 events:routeName                     timestamp=1727474324876, value=UIS to St. Louis
 events:truckId                       timestamp=1727474225074, value=999
1 row(s)
Took 0.0237 seconds
hbase(main):016:0>
```

Used **get command** as it allows specific row retrieval as scan command gives the information of the entire table.

---

3. Write and run two HBase commands to update the value of the row you inserted/retrieved and show the changes.
a. Table name: <your-namespace>:truck_event
b. Rowkey: 2000
c. Column family name: events
d. Column name(qualifier): routeName
e. NEW value: St. Louis to UIS
f. Write and run your second command to show the changes
i. Expected changes: 'UIS to St. Louis' ➔ 'St. Louis to UIS'

```
tdend2@node00:~
hbase(main):016:0> put 'tdend2:truck_event', '2000', 'events:routeName', 'St. Louis to UIS'
Took 0.0120 seconds
hbase(main):017:0> get 'tdend2:truck_event', '2000', 'events'
COLUMN                                        CELL
 events:correlationId                         timestamp=1727474286479, value=1000
 events:driverId                              timestamp=1727474207096, value=tdend2
 events:driverName                            timestamp=1727474303286, value=Tejashri Dendi
 events:eventDate                             timestamp=1727474335546, value=2024-09-27-01
 events:eventTime                             timestamp=1727474239055, value=01:01.1
 events:eventType                             timestamp=1727474251258, value=Overspeed
 events:latitude                              timestamp=1727474274054, value=27.03
 events:longitude                             timestamp=1727474262124, value=-84.58
 events:routeId                               timestamp=1727474314644, value=888
 events:routeName                             timestamp=1727474637928, value=St. Louis to UIS
 events:truckId                               timestamp=1727474225074, value=999
1 row(s)
Took 0.0233 seconds
hbase(main):018:0>
```

Updated the value of a column using
put command- *put 'tdend2:truck_event', '2000', 'events:routeName', 'St. Louis to UIS'* and used **get command** to confirm the changes done as it allows parameters to query the data.
get 'tdend2:truck_event', '2000', 'events

---

4. Write and run an HBase command to retrieve two columns of the row you inserted/retrieved
a. Table name: <your-namespace>:truck_event
b. Rowkey: 2000
c. Column family name: events
d. Two columns we want to see: driverName and routeName ONLY
e. Note: Two columns (qualifiers) only. No other columns.
f. You may want to check the help page 'help <command>'

get 'tdend2:truck_event', '2000', 'events:driverName', 'events:routeName'

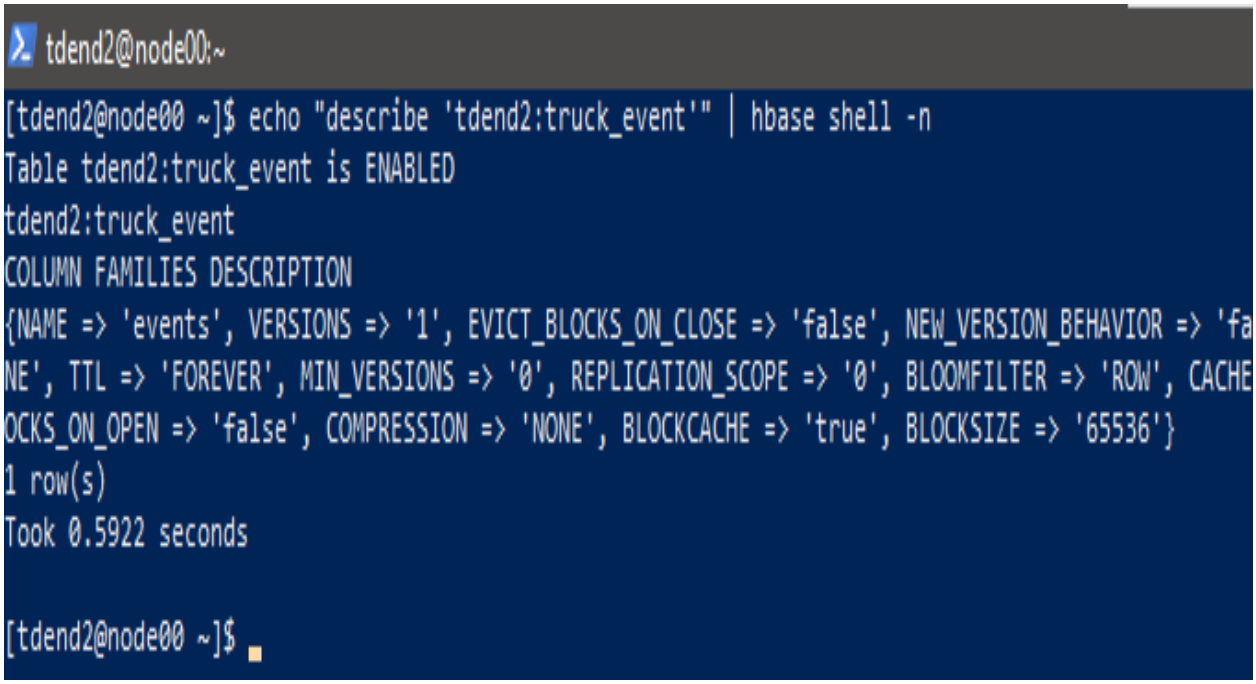
```
tdend2@node00:~
hbase(main):019:0> get 'tdend2:truck_event', '2000', 'events:driverName', 'events:routeName'
COLUMN                                        CELL
 events:driverName                            timestamp=1727474303286, value=Tejashri Dendi
 events:routeName                             timestamp=1727474637928, value=St. Louis to UIS
1 row(s)
Took 0.0187 seconds
hbase(main):020:0>
```

Used get command for the retrieval.

---

5. Write and run an HBase command in non-interactive mode
a. Retrieve the meta-data of your table in the Linux shell.
b. Table name: <your-namespace>:truck_event
c. Use Both Linux commands and HBase shell commands
i. Linux command: echo
ii. HBase shell command: describe (retrieve meta-data of a table)
d. This code should run outside of the HBase shell.
i. Don't log in to the HBase shell.
ii. Should be run in a Linux shell
iii. e.g. [sslee777@node00 ~]$ <your command here....>
e. This scripting is quite useful in some cases, e.g., when you want to run HBase commands outside the HBase shell.
i. Batch processing
ii. Administration
iii. Automation – Cron jobs
iv. Etc

```
echo "describe 'tdend2:truck_event'" | hbase shell -n
```



Echo command is used to display the results to the console whereas describe command gave the information of the meta data of table.

==========THE END==========