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Partitioning the Table

Apache Hive is an open source data warehouse system used for querying and analyzing large datasets. Data in Apache Hive can be categorized into Table, Partition, and Bucket.The table in Hive is logically made up of the data being stored.

Hive provides way to categories data into smaller directories and files using partitioning or/and bucketing/clustering in order to improve performance of data retrieval queries and make them faster.

Main difference between Partitioning and Bucketing is that partitioning is applied directly on the column value and data is stored within directory named with column value whereas bucketing is applied using hash function on the column value MOD function with the number of buckets to store data in specific bucket file.

Hive table partition is a way to split a large table into smaller logical tables based on one or more partition keys. These smaller logical tables are not visible to users and users still access the data from just one table.

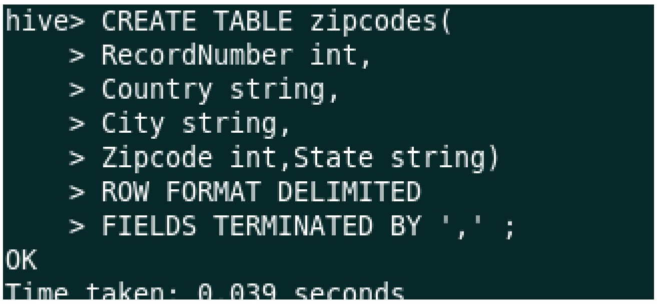
Partition eliminates creating smaller tables, accessing, and managing them separately.

To create a Hive table with partitions, you need to use PARTITIONED BY clause along with the column you wanted to partition and its type. Let’s create a table and Load the CSV file.

The data file that I am using to explain partitions can be downloaded from GitHub, It’s a simplified zipcodes codes where I have RecordNumber, Country, City, Zipcode, and State columns. I will be using State as a partition column.

Load Data into Partition Table

Download the zipcodes.CSV from GitHub, upload it to HDFS, and finally load the CSV file into a partition table.



```
hive> CREATE TABLE zipcodes(
    > RecordNumber int,
    > Country string,
    > City string,
    > Zipcode int,State string)
    > ROW FORMAT DELIMITED
    > FIELDS TERMINATED BY ',' ;
OK
Time taken: 0.039 seconds
```

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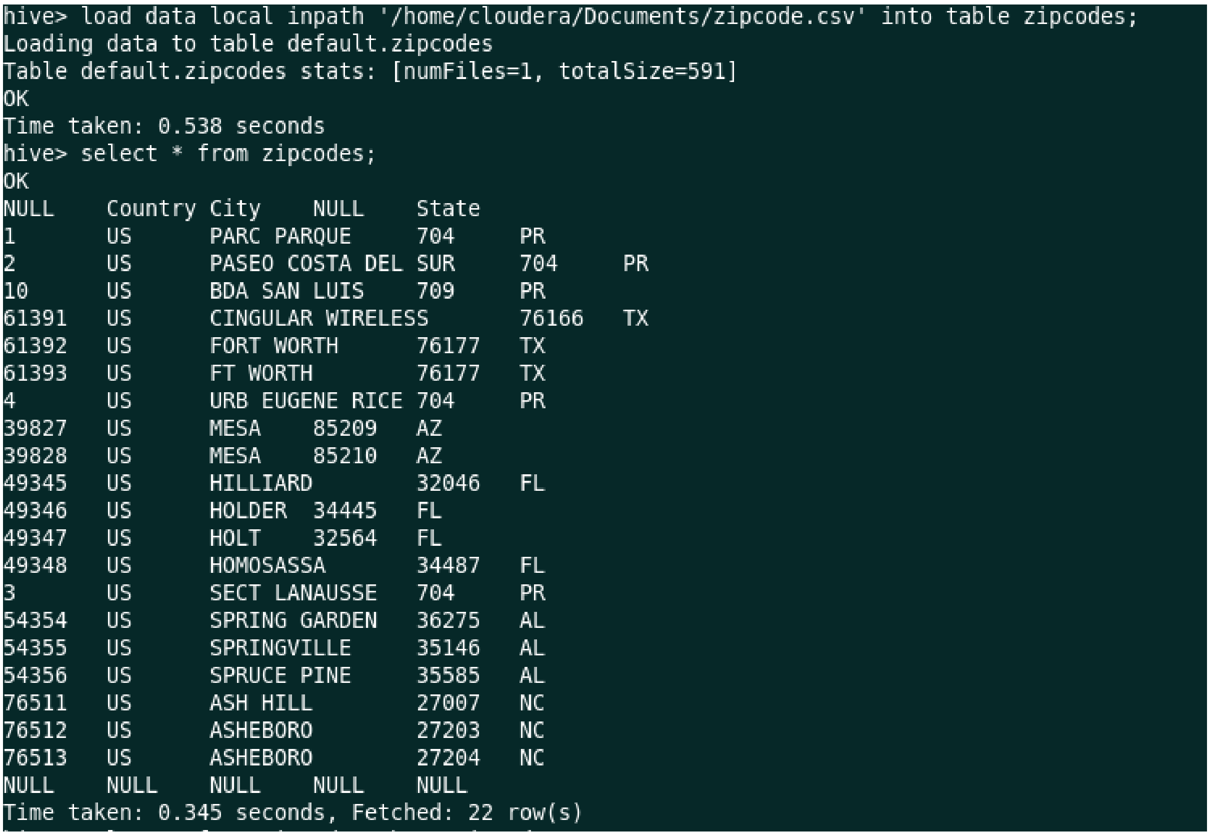
Load Data into Partition Table

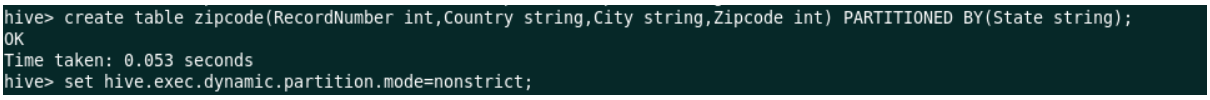
Download the zipcodes.CSV from GitHub, upload it to HDFS, and finally load the CSV file into a partition table.

Show All Partitions on Hive Table

After loading the data into the Hive partition table, you can use SHOW PARTITIONS command to see all partitions that are present.



```
hive> load data local inpath '/home/cloudera/Documents/zipcode.csv' into table zipcodes;
Loading data to table default.zipcodes
Table default.zipcodes stats: [numFiles=1, totalSize=591]
OK
Time taken: 0.538 seconds
hive> select * from zipcodes;
OK
NULL    Country City    NULL    State
1       US      PARC PARQUE     704     PR
2       US      PASEO COSTA DEL SUR     704     PR
10      US      BDA SAN LUIS    709     PR
61391   US      CINGULAR WIRELESS       76166   TX
61392   US      FORT WORTH      76177   TX
61393   US      FT WORTH        76177   TX
4       US      URB EUGENE RICE 704     PR
39827   US      MESA    85209   AZ
39828   US      MESA    85210   AZ
49345   US      HILLIARD        32046   FL
49346   US      HOLDER  34445   FL
49347   US      HOLT    32564   FL
49348   US      HOMOSASSA       34487   FL
3       US      SECT LANAUSSE   704     PR
54354   US      SPRING GARDEN   36275   AL
54355   US      SPRINGVILLE     35146   AL
54356   US      SPRUCE PINE     35585   AL
76511   US      ASH HILL        27007   NC
76512   US      ASHEBORO        27203   NC
76513   US      ASHEBORO        27204   NC
NULL    NULL    NULL    NULL    NULL
Time taken: 0.345 seconds, Fetched: 22 row(s)
```



```
hive> create table zipcode(RecordNumber int,Country string,City string,Zipcode int) PARTITIONED BY(State string);
OK
Time taken: 0.053 seconds
hive> set hive.exec.dynamic.partition.mode=nonstrict;
```

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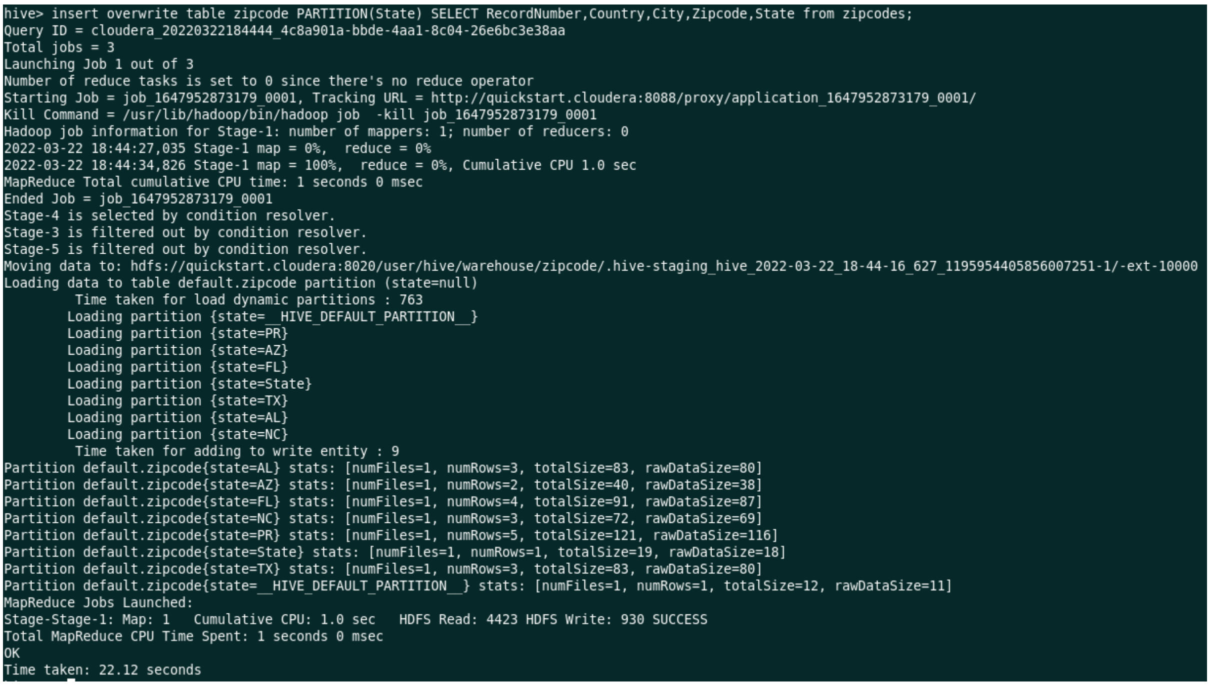
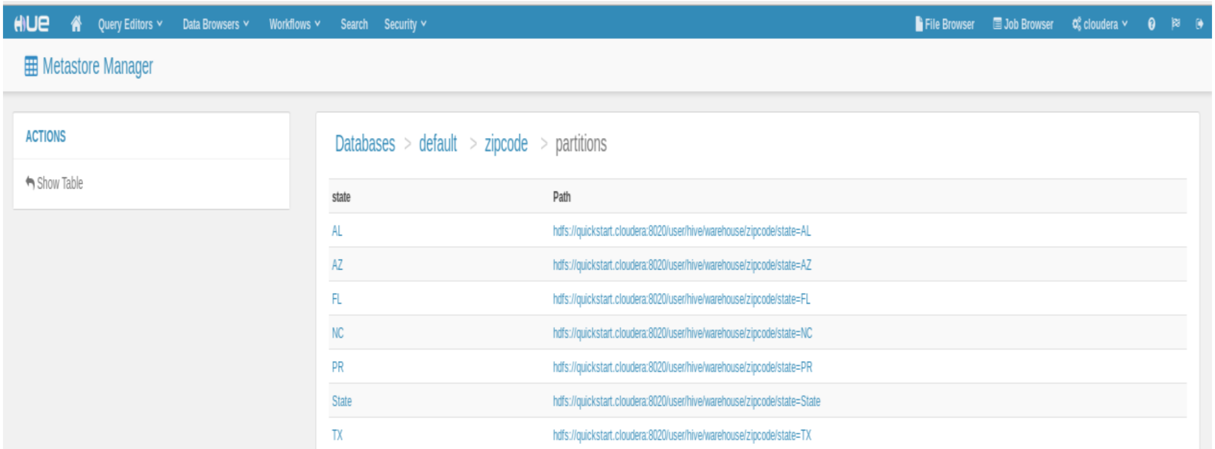
Add New Partition to the Hive Table

A new partition can be added to the table using the ALERT TABLE statement, you can also specify the location where you wanted to store partition data on HDFS.



```
hive> insert overwrite table zipcode PARTITION(State) SELECT RecordNumber,Country,City,Zipcode,State from zipcodes;
Query ID = cloudera_20220322184444_4c8a901a-bbde-4aa1-8c04-26e6bc3e38aa
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_1647952873179_0001, Tracking URL = http://quickstart.cloudera:8088/proxy/application_1647952873179_0001/
Kill Command = /usr/lib/hadoop/bin/hadoop job  -kill job_1647952873179_0001
Hadoop job information for Stage-1: number of mappers: 1; number of reducers: 0
2022-03-22 18:44:27,035 Stage-1 map = 0%,  reduce = 0%
2022-03-22 18:44:34,826 Stage-1 map = 100%,  reduce = 0%, Cumulative CPU 1.0 sec
MapReduce Total cumulative CPU time: 1 seconds 0 msec
Ended Job = job_1647952873179_0001
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/zipcode/.hive-staging_hive_2022-03-22_18-44-16_627_1195954405856007251-1/-ext-10000
Loading data to table default.zipcode partition (state=null)
         Time taken for load dynamic partitions : 763
        Loading partition {state=__HIVE_DEFAULT_PARTITION__}
        Loading partition {state=PR}
        Loading partition {state=AZ}
        Loading partition {state=FL}
        Loading partition {state=State}
        Loading partition {state=TX}
        Loading partition {state=AL}
        Loading partition {state=NC}
         Time taken for adding to write entity : 9
Partition default.zipcode{state=AL} stats: [numFiles=1, numRows=3, totalSize=83, rawDataSize=80]
Partition default.zipcode{state=AZ} stats: [numFiles=1, numRows=2, totalSize=40, rawDataSize=38]
Partition default.zipcode{state=FL} stats: [numFiles=1, numRows=4, totalSize=91, rawDataSize=87]
Partition default.zipcode{state=NC} stats: [numFiles=1, numRows=3, totalSize=72, rawDataSize=69]
Partition default.zipcode{state=PR} stats: [numFiles=1, numRows=5, totalSize=121, rawDataSize=116]
Partition default.zipcode{state=State} stats: [numFiles=1, numRows=1, totalSize=19, rawDataSize=18]
Partition default.zipcode{state=TX} stats: [numFiles=1, numRows=3, totalSize=83, rawDataSize=80]
Partition default.zipcode{state=__HIVE_DEFAULT_PARTITION__} stats: [numFiles=1, numRows=1, totalSize=12, rawDataSize=11]
MapReduce Jobs Launched:
Stage-Stage-1: Map: 1   Cumulative CPU: 1.0 sec   HDFS Read: 4423 HDFS Write: 930 SUCCESS
Total MapReduce CPU Time Spent: 1 seconds 0 msec
OK
Time taken: 22.12 seconds
```

From the below image we can see that 6 partition have been created based on the name of the States.



Databases > default > zipcode > partitions

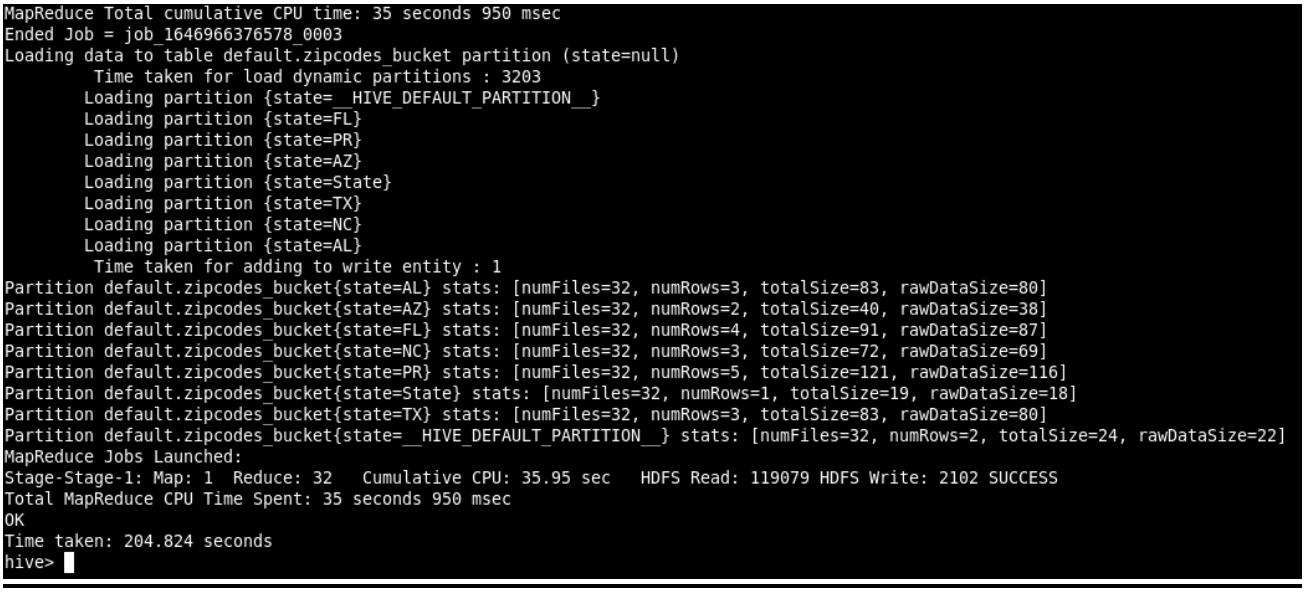
state	Path
AL	hdfs://quickstart.cloudera:8020/user/hive/warehouse/zipcode/state=AL
AZ	hdfs://quickstart.cloudera:8020/user/hive/warehouse/zipcode/state=AZ
FL	hdfs://quickstart.cloudera:8020/user/hive/warehouse/zipcode/state=FL
NC	hdfs://quickstart.cloudera:8020/user/hive/warehouse/zipcode/state=NC
PR	hdfs://quickstart.cloudera:8020/user/hive/warehouse/zipcode/state=PR
State	hdfs://quickstart.cloudera:8020/user/hive/warehouse/zipcode/state=State
TX	hdfs://quickstart.cloudera:8020/user/hive/warehouse/zipcode/state=TX

Bucketing the Table

Hive Bucketing is a way to split the table into a managed number of clusters with or without partitions. With partitions, Hive divides(creates a directory) the table into smaller parts for every distinct value of a column whereas with bucketing you can specify the number of buckets to create at the time of creating a Hive table.

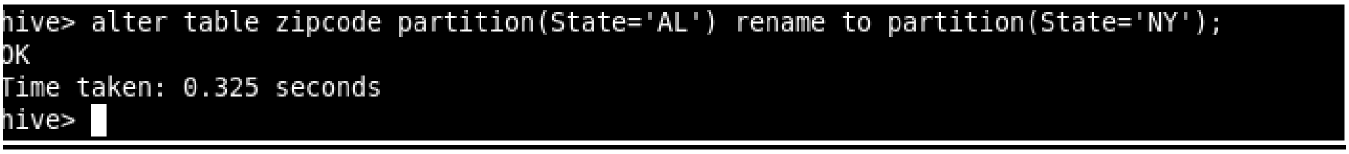
Load Data into Bucket

Loading/inserting data into the Bucketing table would be the same as inserting data into the table.



```
MapReduce Total cumulative CPU time: 35 seconds 950 msec
Ended Job = job_1646966376578_0003
Loading data to table default.zipcodes_bucket partition (state=null)
         Time taken for load dynamic partitions : 3203
        Loading partition {state=__HIVE_DEFAULT_PARTITION__}
        Loading partition {state=FL}
        Loading partition {state=PR}
        Loading partition {state=AZ}
        Loading partition {state=State}
        Loading partition {state=TX}
        Loading partition {state=NC}
        Loading partition {state=AL}
         Time taken for adding to write entity : 1
Partition default.zipcodes_bucket{state=AL} stats: [numFiles=32, numRows=3, totalSize=83, rawDataSize=80]
Partition default.zipcodes_bucket{state=AZ} stats: [numFiles=32, numRows=2, totalSize=40, rawDataSize=38]
Partition default.zipcodes_bucket{state=FL} stats: [numFiles=32, numRows=4, totalSize=91, rawDataSize=87]
Partition default.zipcodes_bucket{state=NC} stats: [numFiles=32, numRows=3, totalSize=72, rawDataSize=69]
Partition default.zipcodes_bucket{state=PR} stats: [numFiles=32, numRows=5, totalSize=121, rawDataSize=116]
Partition default.zipcodes_bucket{state=State} stats: [numFiles=32, numRows=1, totalSize=19, rawDataSize=18]
Partition default.zipcodes_bucket{state=TX} stats: [numFiles=32, numRows=3, totalSize=83, rawDataSize=80]
Partition default.zipcodes_bucket{state=__HIVE_DEFAULT_PARTITION__} stats: [numFiles=32, numRows=2, totalSize=24, rawDataSize=22]
MapReduce Jobs Launched:
Stage-Stage-1: Map: 1  Reduce: 32   Cumulative CPU: 35.95 sec   HDFS Read: 119079 HDFS Write: 2102 SUCCESS
Total MapReduce CPU Time Spent: 35 seconds 950 msec
OK
Time taken: 204.824 seconds
hive> 
```

Altering the table : Renaming the State name AL to ‘NY’



```
hive> alter table zipcode partition(State='AL') rename to partition(State='NY');
OK
Time taken: 0.325 seconds
hive> 
```

Now we can see from the below image ,the state name ‘AL’ is renamed to ‘NY’.

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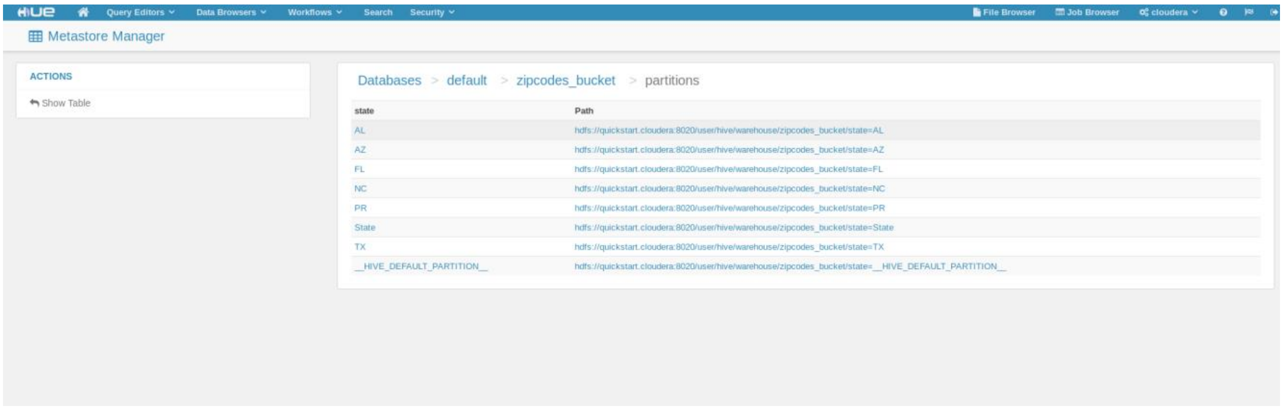

Databases > default > zipcodes_bucket > partitions

state	Path
AL	hdfs://quickstart.cloudera:8020/user/hive/warehouse/zipcodes_bucket/state=AL
AZ	hdfs://quickstart.cloudera:8020/user/hive/warehouse/zipcodes_bucket/state=AZ
FL	hdfs://quickstart.cloudera:8020/user/hive/warehouse/zipcodes_bucket/state=FL
NC	hdfs://quickstart.cloudera:8020/user/hive/warehouse/zipcodes_bucket/state=NC
PR	hdfs://quickstart.cloudera:8020/user/hive/warehouse/zipcodes_bucket/state=PR
State	hdfs://quickstart.cloudera:8020/user/hive/warehouse/zipcodes_bucket/state=State
TX	hdfs://quickstart.cloudera:8020/user/hive/warehouse/zipcodes_bucket/state=TX
__HIVE_DEFAULT_PARTITION__	hdfs://quickstart.cloudera:8020/user/hive/warehouse/zipcodes_bucket/state=__HIVE_DEFAULT_PARTITION__