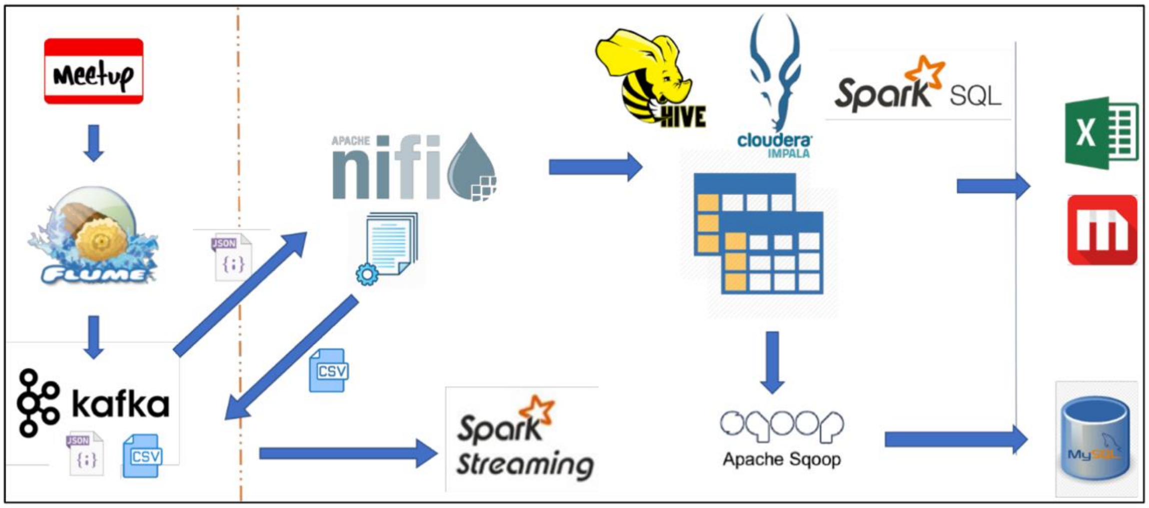
Assignment 3

Meetup stream data ingestion and analysis case study



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In our team, all of us were working and participating. We all worked on code on our own and shared our progress with each other to solve issues and obtain a final working code. In parallel we produced and review the documentation to supplement the exercise.

PLATFORM PLANNING

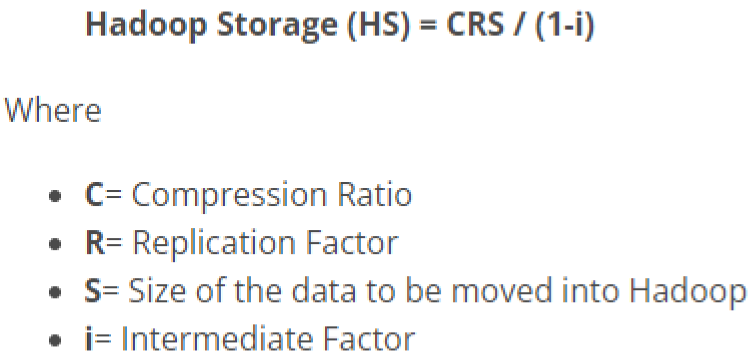
To determine the memory size of the NameNode server, we need to add the memory needed by NameNode to manage the HDFS cluster metadata (in memory) and the memory needed for the Operating System.
The IT department defined the hardware configuration for each node in the cluster:

- **1CPU8VCores,16GBmemory,20TB Hard Disk Drivespace. (to be shared between the OS and applications)**
- **The datanode storage capacity was calculated as 13TB**

- **<u>Assuming a replication factor of 3 how many nodes in the cluster we need to store all the data?</u>**

We used the formula from the following article to plan the HDFS cluster size:

https://www.edureka.co/blog/hadoop-cluster-capacity-planning/#factor



Hadoop Storage (HS) = CRS / (1-i)

Where

- **C**= Compression Ratio
- **R**= Replication Factor
- **S**= Size of the data to be moved into Hadoop
- **i**= Intermediate Factor

1. **Determine the size of the data from project requirements.**

   Big Company Group collect data in real time from social networks platforms. For a particular experience, there are 50 Flume agents (one per machine) in a data center that collect data in real time. There are multiple sources each with their own data elements, but they follow a common data format.

   - *The data is in JSON format*
   - *Each Flume agent transmits on average 50 attribute records every second.*
   - *Each record's data attribute row is on average 1600 bytes wide.*
   - *Corporate data standards require all input data to be persisted for 12 months.*

- *All QA test results data (estimated to 10% of the ingested data per year) to be stored for a period of 5 years.*

Based on this information, the amount of data we need to store for one year is equal to:

50 Flume agents * 50 attribute records/sec * 1600 bytes/attribute * 60 sec * 60 min * 24h * 365d = 126 144 000 000 000 bytes = **114.727 TB**

In addition, we need to store 10% of this data from the past 5 years. So the total size of the data stored is :

114.727*1 TB * (1 + 5*0.1) = **172.1 TB**

2. Determine the number of nodes required to store all the data.

Assuming a replication factor of 3, intermediate factor of 25% and compression ratio of 1 (no compression) we need a storage capacity of:

HS = CRS/(1-i) = 1*3*172.1 TB / (1-0.25) = **688.4 TB**

Based on the 13TB storage capacity of the nodes, we will require:

688.4 TB / 13 TB/node = **53 nodes**

- **Assuming a HDFS bloc size is 128 MB and each block need 680 Bytes for its metadata. What would be the recommended NameNode memory size if the memory allocated to the OS is 8 GB? (should be round up multiple of 2)**

1. Determine the number of blocks required for storing 172.1 TB (before replication factor):

172.1 TB = 180 459 929.6 MB

180 459 929.6 MB / 128 MB/block = 1 409 843.2 blocks

2. Determine metadata memory size based on the number of blocks:

1 409 843.2 blocks * 680 bytes/block = 958 693 376 bytes = 0.89 GB

3. Determine NameNode memory size required including OS:

8 GB + 0.89 GB = 8.89Gb ≈ **10 GB**

PLATFORM PREPARATION

TASK 01
Prepare Kafka topics

The topics characteristics should meet your hardware limitation

a. **Create a Kafka topic meetup-data that will be used to store events collected by the Flume agent. (Sink 1)**
b. **Create a Kafka topic meetup-agg that will be used to store events collected by the Flume agent. (Sink 2)**

Open a Terminal and navigate to the kafka directory:

```
$ cd /usr/lib/kafka
```

Run the kafka server using the following command:

```
$ sudo bin/kafka-server-start.sh config/server.properties
```

Open a new terminal window and navigate to the kafka directory

```
$ cd /usr/lib/kafka
```

Create a new topic called meetup-data, having a single partition and a replication factor set to of 1

```
> bin/kafka-topics.sh --create --zookeeper localhost:2181 --replication-factor 1 --partitions 1 --topic meetup-data
```

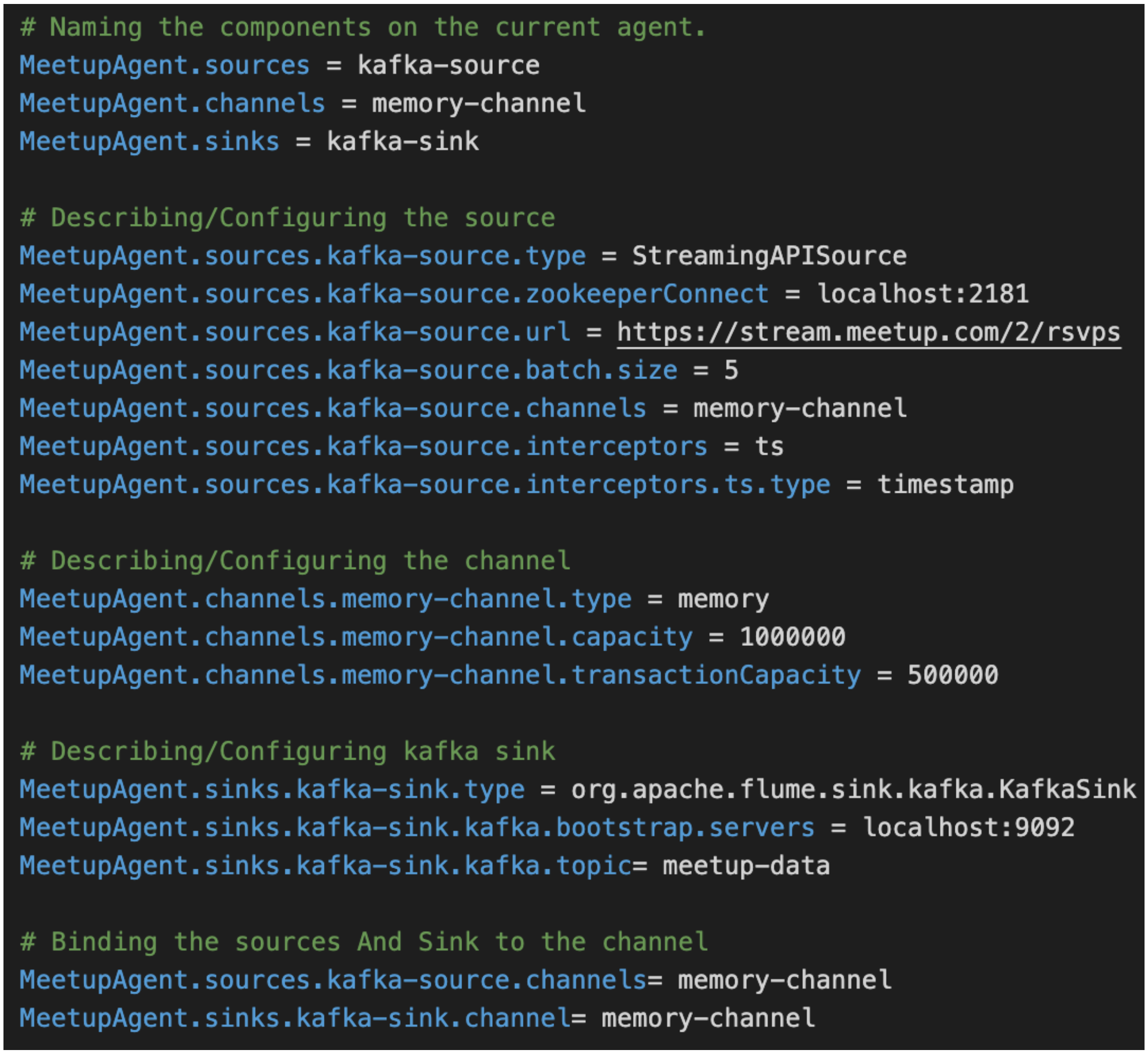
Create a new topic called meetup-agg, having a single partition and a replication factor set to of 1

```
> bin/kafka-topics.sh --create --zookeeper localhost:2181 --replication-factor 1 --partitions 1 --topic meetup-agg
```

MEETUP REAL-TIME DATA INGESTION

TASK 02
Create Flume agent

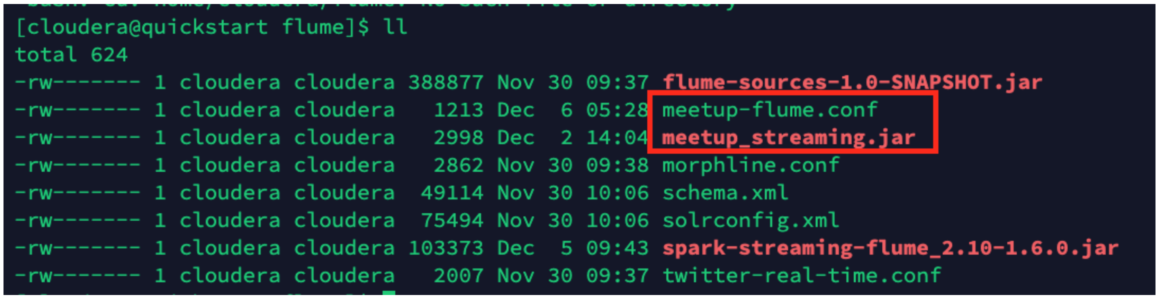
Part A:
Create a flume agent configuration file.



```
# Naming the components on the current agent.
MeetupAgent.sources = kafka-source
MeetupAgent.channels = memory-channel
MeetupAgent.sinks = kafka-sink

# Describing/Configuring the source
MeetupAgent.sources.kafka-source.type = StreamingAPISource
MeetupAgent.sources.kafka-source.zookeeperConnect = localhost:2181
MeetupAgent.sources.kafka-source.url = https://stream.meetup.com/2/rsvps
MeetupAgent.sources.kafka-source.batch.size = 5
MeetupAgent.sources.kafka-source.channels = memory-channel
MeetupAgent.sources.kafka-source.interceptors = ts
MeetupAgent.sources.kafka-source.interceptors.ts.type = timestamp

# Describing/Configuring the channel
MeetupAgent.channels.memory-channel.type = memory
MeetupAgent.channels.memory-channel.capacity = 1000000
MeetupAgent.channels.memory-channel.transactionCapacity = 500000

# Describing/Configuring kafka sink
MeetupAgent.sinks.kafka-sink.type = org.apache.flume.sink.kafka.KafkaSink
MeetupAgent.sinks.kafka-sink.kafka.bootstrap.servers = localhost:9092
MeetupAgent.sinks.kafka-sink.kafka.topic= meetup-data

# Binding the sources And Sink to the channel
MeetupAgent.sources.kafka-source.channels= memory-channel
MeetupAgent.sinks.kafka-sink.channel= memory-channel
```

Part B:
Write the command line to run the Flume agent.

We put the Flume agent meetup-flume.conf and the meetup_streaming.jar in the directory /home/cloudera/flume.



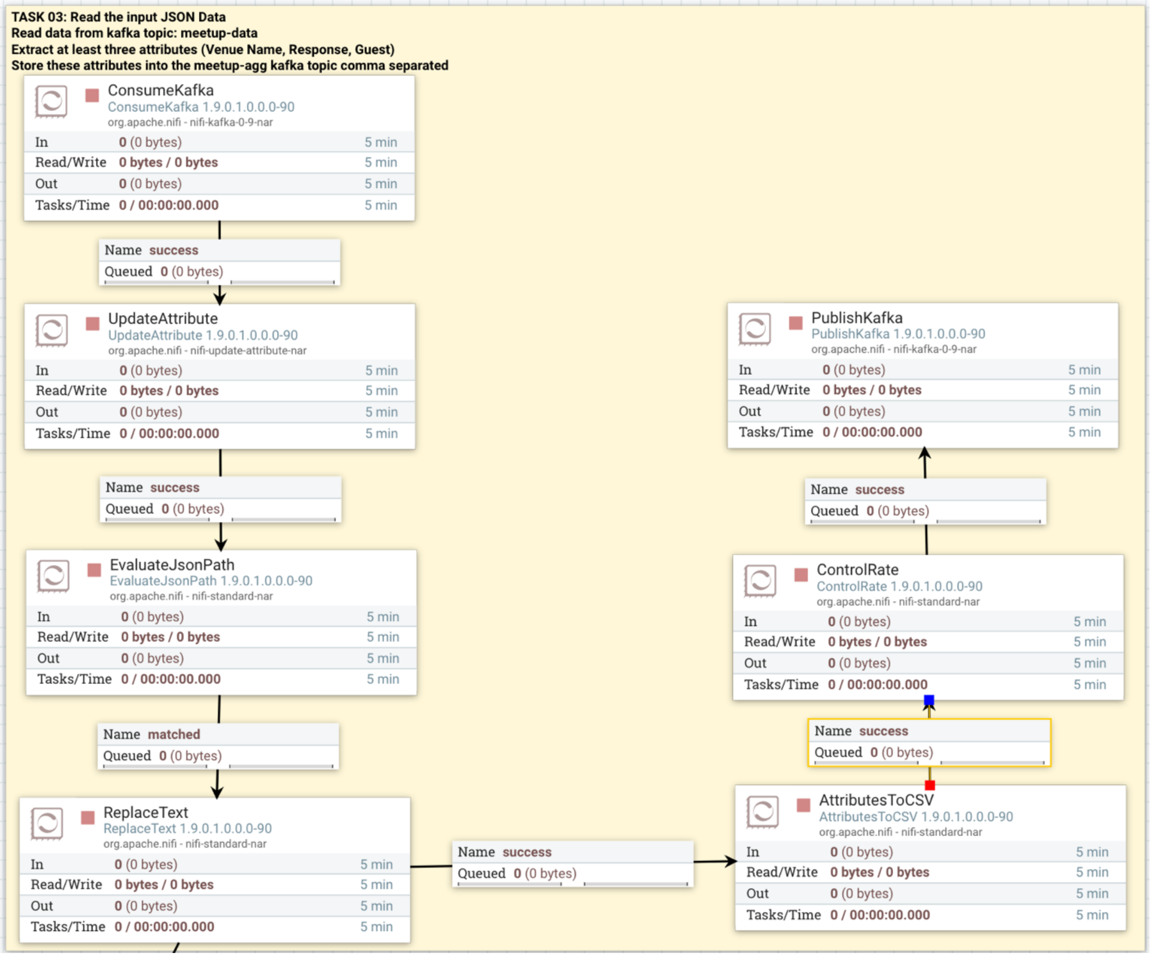
```
-bash: cd: home/cloudera/flume: No such file or directory
[cloudera@quickstart flume]$ ll
total 624
-rw------- 1 cloudera cloudera 388877 Nov 30 09:37 flume-sources-1.0-SNAPSHOT.jar
-rw------- 1 cloudera cloudera   1213 Dec  6 05:28 meetup-flume.conf
-rw------- 1 cloudera cloudera   2998 Dec  2 14:04 meetup_streaming.jar
-rw------- 1 cloudera cloudera   2862 Nov 30 09:38 morphline.conf
-rw------- 1 cloudera cloudera  49114 Nov 30 10:06 schema.xml
-rw------- 1 cloudera cloudera  75494 Nov 30 10:06 solrconfig.xml
-rw------- 1 cloudera cloudera 103373 Dec  5 09:43 spark-streaming-flume_2.10-1.6.0.jar
-rw------- 1 cloudera cloudera   2007 Nov 30 09:37 twitter-real-time.conf
```

We run after the flume Agent in the flume directory:

flume-ng agent –n MeetupAgent –c conf –f meetup-flume.conf –C meetup_streaming.jar

PREAPARING MEETUP DATA

Task 03
Read the input JSON Data (Nifi)



TASK 03: Read the input JSON Data
Read data from kafka topic: meetup-data
Extract at least three attributes (Venue Name, Response, Guest)
Store these attributes into the meetup-agg kafka topic comma separated

ConsumeKafka
ConsumeKafka 1.9.0.1.0.0.0-90
org.apache.nifi - nifi-kafka-0-9-nar
UpdateAttribute
UpdateAttribute 1.9.0.1.0.0.0-90
org.apache.nifi - nifi-update-attribute-nar
EvaluateJsonPath
EvaluateJsonPath 1.9.0.1.0.0.0-90
org.apache.nifi - nifi-standard-nar
ReplaceText
ReplaceText 1.9.0.1.0.0.0-90
org.apache.nifi - nifi-standard-nar
AttributesToCSV
AttributesToCSV 1.9.0.1.0.0.0-90
org.apache.nifi - nifi-standard-nar
ControlRate
ControlRate 1.9.0.1.0.0.0-90
org.apache.nifi - nifi-standard-nar
PublishKafka
PublishKafka 1.9.0.1.0.0.0-90
org.apache.nifi - nifi-kafka-0-9-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min
Name success
Name matched
Queued 0 (0 bytes)

- **Read Data from Kafka topic: meetup-data**

Processor	Properties	
ConsumeKafka	Kafka Brokers	localhost:9092
	Security Protocol	PLAINTEXT
	Topic Name(s)	Meetup-data
	Group ID	flume
	Offset Reset	latest
	Key Attribute Encoding	UTF-8 Encoded

Link on success to:

Processor	Properties	
UpdateAttribute	Store State	Do not store state
	Cache Value Lookup Cache Size	100
	Add these custom attributes	
	filename	${UUID()}
	mime.type	application/json
	schema.name	meetup

- **Extract at least three attributes (Venue Name, Response, Guest)**

Link on success to:

Processor	Properties	
EvaluateJsonPath	Destination	flowfile-attribute
	Return Type	auto-detect
Relationships: failure unmatched	Path Not Found Behavior	ignore
	Null Value Representation	Empty string
	Add these custom attributes	
	venue_name	$.venue.venue_name
	guest	$.guests
	response	$.response

Link on matched to:

Processor	Properties	
ReplaceText	Search Value	, →(,)
	Replacement Value	;
Relationships: failure	Character Set	UTF-8
	Maximum Buffer Size	1 MB
	Replacement Strategy	Literal Replace
	Evaluation Mode	Entire text

We use the processor Replace text for delete the comma (,) in the attribute venue_name. The rule is not perfect and with more time will be ameliorated. The comma generated in the text could be give some problems when we create after table with delimited ‘,’.

- **Store these attributes into the meetup-agg Kafka topic comma separated**

Link on success to:

Processor	Properties	
AttributesToCSV Relationships: failure	Attribute List	venue_name,guest,response
	Destination	flowfile-content
	Include Core Attributes	false
	Null Value	true
	Include Schema	false

Link on success to:

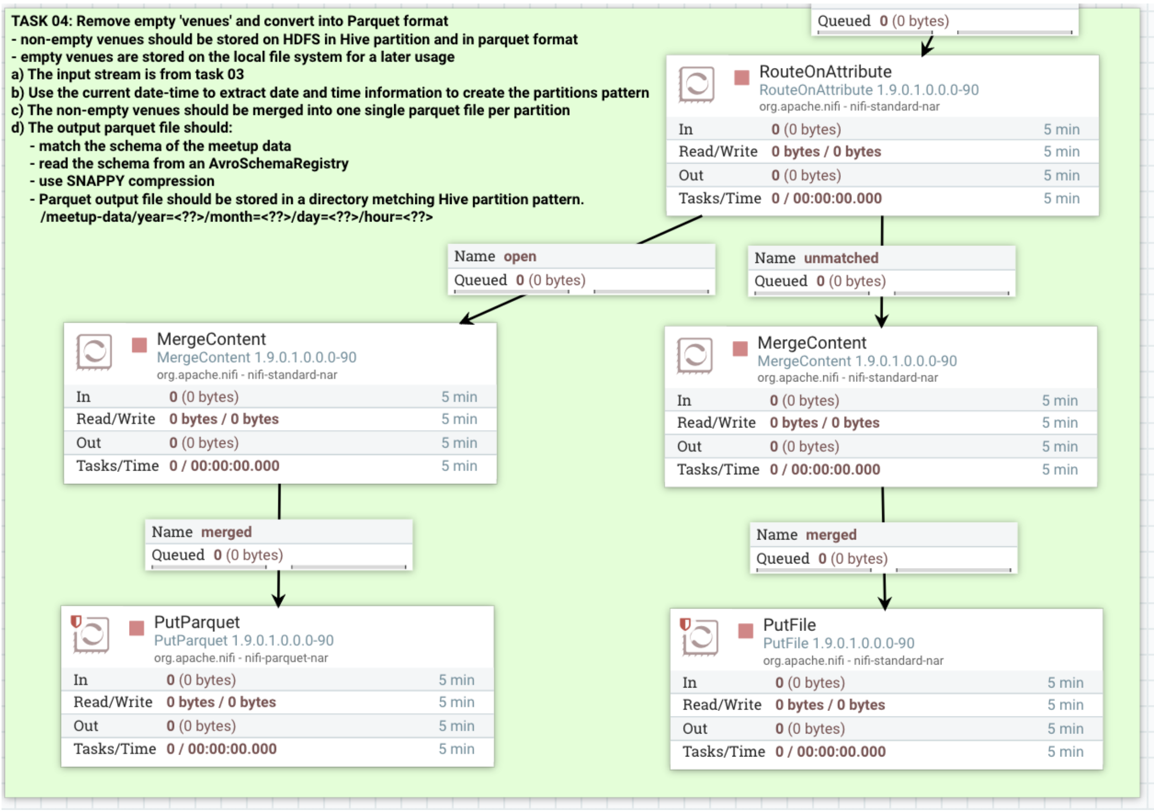
Processor	Properties	
ControlRate	Rate Control Criteria	flowfile count
	Maximum Rate	20
	Time Duration	1 min

Link on success to:

Processor	Properties	
PublishKafka	Kafka Brokers	localhost:9092
	Security Protocol	PLAINTEXT
	Topic Name	meetup-agg
	Delivery Encoding	Best Effort
	Key Attribute Encoding	UTF-8 Encoded
	Max Request Size	1 MB
	Acknowledgment Wait Time	5 secs
	Max Metadata Wait Time	5 sec
	Compression Type	none

STORING MEETUP DATA

Task 04
Remove empty ‘venues’ and convert into Parquet format



TASK 04: Remove empty 'venues' and convert into Parquet format
- non-empty venues should be stored on HDFS in Hive partition and in parquet format
- empty venues are stored on the local file system for a later usage
a) The input stream is from task 03
b) Use the current date-time to extract date and time information to create the partitions pattern
c) The non-empty venues should be merged into one single parquet file per partition
d) The output parquet file should:
- match the schema of the meetup data
- read the schema from an AvroSchemaRegistry
- use SNAPPY compression
- Parquet output file should be stored in a directory metching Hive partition pattern.
/meetup-data/year=<??>/month=<??>/day=<??>/hour=<??>

Queued 0 (0 bytes)
RouteOnAttribute
RouteOnAttribute 1.9.0.1.0.0.0-90
org.apache.nifi - nifi-standard-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min
Name open
Queued 0 (0 bytes)
Name unmatched
Queued 0 (0 bytes)
MergeContent
MergeContent 1.9.0.1.0.0.0-90
org.apache.nifi - nifi-standard-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min
MergeContent
MergeContent 1.9.0.1.0.0.0-90
org.apache.nifi - nifi-standard-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min
Name merged
Queued 0 (0 bytes)
Name merged
Queued 0 (0 bytes)
PutParquet
PutParquet 1.9.0.1.0.0.0-90
org.apache.nifi - nifi-parquet-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min
PutFile
PutFile 1.9.0.1.0.0.0-90
org.apache.nifi - nifi-standard-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min

Link ReplaceText (task 03) on success to:

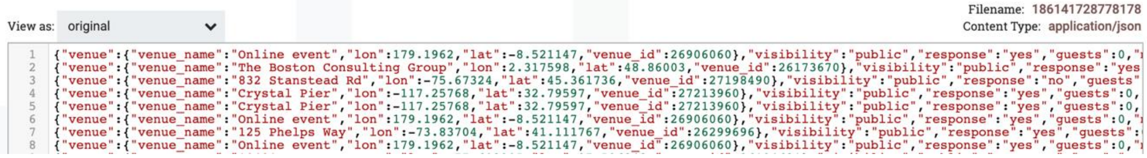
Processor	Properties	
RouteOnAttribute	Routing Strategy	Route to Property name
	Add this custom attribute	
	open	${venue_name:isEmpty():not()}

- **Non-empty venues should be stored on HDFS in Hive partition and in parquet format.**

Link on open to:

Processor	**Properties**	
MergeContent Relationships: failure original merged	Merge Strategy	Bin-Packing Algorithm
	Merge Format	Binary Concatenation
	Attribute Strategy	Keep Only Common Attributes
	Metadata Strategy	Do Not Merge Uncommon Metadata
	Minimum Number of Entries	1
	Maximum Number of Entries	1000000
	Minimum Group Size	0 B
	Maximum number of Bins	100
	Delimiter Strategy	Text
	Demarcator	Shift + enter
	Compression Level	1
	Keep Path	false
	Properties	
	Run Schedule	3600 sec

The data is merged in one file. We see the venue is not empty:



View as: original

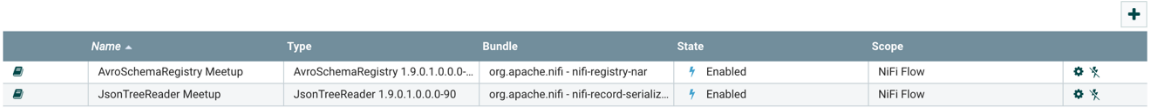
Filename: 186141728778178
Content Type: application/json

```
{"venue":{"venue_name":"Online event","lon":179.1962,"lat":-8.521147,"venue_id":26906060},"visibility":"public","response":"yes","guests":0,
{"venue":{"venue_name":"The Boston Consulting Group","lon":2.317598,"lat":48.86003,"venue_id":26173670},"visibility":"public","response":"yes
{"venue":{"venue_name":"832 Stanstead Rd","lon":-75.67324,"lat":45.361736,"venue_id":27198490},"visibility":"public","response":"no","guests"
{"venue":{"venue_name":"Crystal Pier","lon":-117.25768,"lat":32.79597,"venue_id":27213960},"visibility":"public","response":"yes","guests":0,
{"venue":{"venue_name":"Crystal Pier","lon":-117.25768,"lat":32.79597,"venue_id":27213960},"visibility":"public","response":"yes","guests":0,
{"venue":{"venue_name":"Online event","lon":179.1962,"lat":-8.521147,"venue_id":26906060},"visibility":"public","response":"yes","guests":0,
{"venue":{"venue_name":"125 Phelps Way","lon":-73.83704,"lat":41.111767,"venue_id":26299696},"visibility":"public","response":"yes","guests":
{"venue":{"venue_name":"Online event","lon":179.1962,"lat":-8.521147,"venue_id":26906060},"visibility":"public","response":"yes","guests":0,
```

Link on merged to:

Processor	**Properties**	
PutParquet Relationships: failure retry success	Hadoop Configuration Resources	/etc/hadoop/conf/core-site.xml,/etc/hadoop/conf/hdfs-site.xml
	Record Reader	JsonTreeReader Meetup
	Directory	/meetup-data/year=${now():format("yyyy", "GMT")}/month=${now():format("MM", "GMT")}/day=${now():format("dd", "GMT")}/hour=${now():format("HH", "GMT")}
	Compression Type	SNAPPY
	Overwrite Files	false
	Permission umask	0

For the JSONTreeReader:

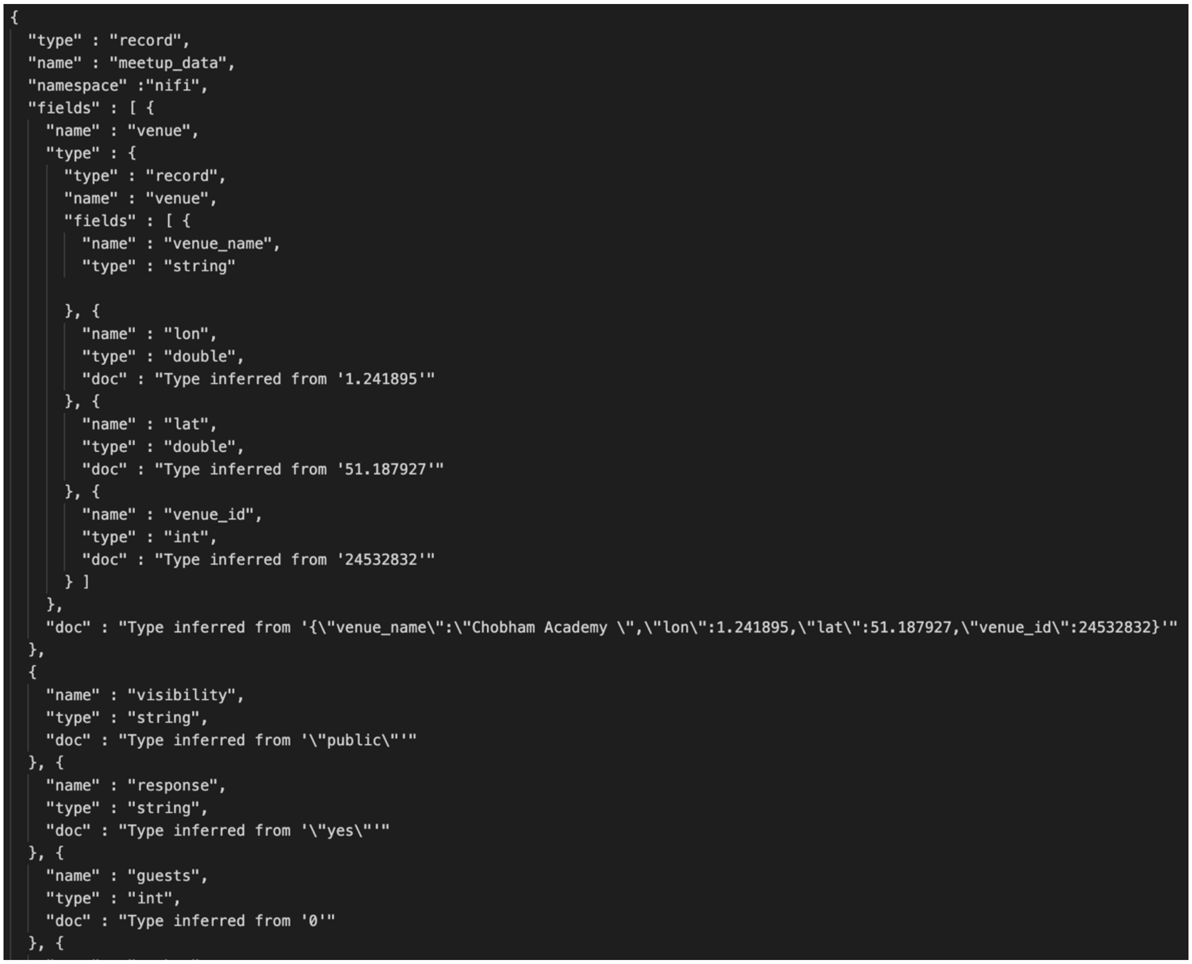


	Name ▲	Type	Bundle	State	Scope	
	AvroSchemaRegistry Meetup	AvroSchemaRegistry 1.9.0.1.0.0.0-...	org.apache.nifi - nifi-registry-nar	Enabled	NiFi Flow	
	JsonTreeReader Meetup	JsonTreeReader 1.9.0.1.0.0.0-90	org.apache.nifi - nifi-record-serializ...	Enabled	NiFi Flow	

We created a AvroSchemaRegistry and need the state Enabled

AvroSchemaRegistry Meetup	
Settings	
Controller Services	JsonTreeReader Meetup
Properties	
Validate Field Name	true
meetup	We put our schema (see below)

Sample of our Schema (Meetup.avsc)



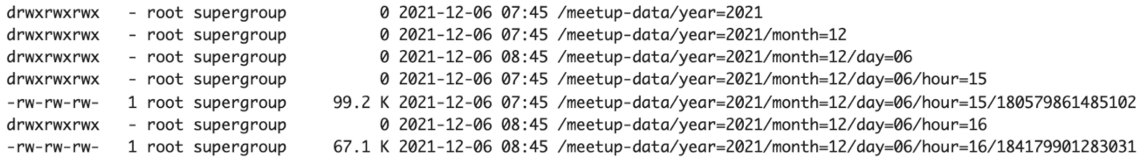
```
{
  "type" : "record",
  "name" : "meetup_data",
  "namespace" :"nifi",
  "fields" : [ {
    "name" : "venue",
    "type" : {
      "type" : "record",
      "name" : "venue",
      "fields" : [ {
        "name" : "venue_name",
        "type" : "string"

      }, {
        "name" : "lon",
        "type" : "double",
        "doc" : "Type inferred from '1.241895'"
      }, {
        "name" : "lat",
        "type" : "double",
        "doc" : "Type inferred from '51.187927'"
      }, {
        "name" : "venue_id",
        "type" : "int",
        "doc" : "Type inferred from '24532832'"
      } ]
    },
    "doc" : "Type inferred from '{\"venue_name\":\"Chobham Academy \",\"lon\":1.241895,\"lat\":51.187927,\"venue_id\":24532832}'"
  },
  {
    "name" : "visibility",
    "type" : "string",
    "doc" : "Type inferred from '\"public\"'"
  }, {
    "name" : "response",
    "type" : "string",
    "doc" : "Type inferred from '\"yes\"'"
  }, {
    "name" : "guests",
    "type" : "int",
    "doc" : "Type inferred from '0'"
  }, {
```

We created a JsonTreeReader and need the state Enabled

AvroSchemaRegistry Meetup	
Settings	
Controller Services	PutParquet
Properties	
Schema Access Strategy	Use 'Schema Name' Property
Schema Registry	AvroSchemaRegisty Meetup
Schema Name	${schema.name}
Schema Text	${avro.schema}

The parquet files are created in the HDFS directory:

```
%sh
hdfs dfs -ls -R -h /meetup-data
```



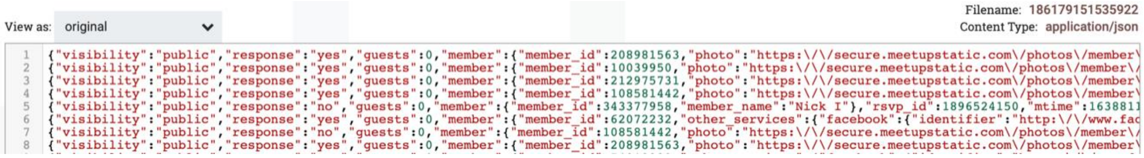
```
drwxrwxrwx   - root supergroup          0 2021-12-06 07:45 /meetup-data/year=2021
drwxrwxrwx   - root supergroup          0 2021-12-06 07:45 /meetup-data/year=2021/month=12
drwxrwxrwx   - root supergroup          0 2021-12-06 08:45 /meetup-data/year=2021/month=12/day=06
drwxrwxrwx   - root supergroup          0 2021-12-06 07:45 /meetup-data/year=2021/month=12/day=06/hour=15
-rw-rw-rw-   1 root supergroup     99.2 K 2021-12-06 07:45 /meetup-data/year=2021/month=12/day=06/hour=15/180579861485102
drwxrwxrwx   - root supergroup          0 2021-12-06 08:45 /meetup-data/year=2021/month=12/day=06/hour=16
-rw-rw-rw-   1 root supergroup     67.1 K 2021-12-06 08:45 /meetup-data/year=2021/month=12/day=06/hour=16/184179901283031
```

- **Empty venues are stored on the local file system for a later usage.**

Link RouteOnAttribute on unmatched to:

Processor	**Properties**	
MergeContent Relationships: failure original merged	Merge Strategy	Bin-Packing Algorithm
	Merge Format	Binary Concatenation
	Attribute Strategy	Keep Only Common Attributes
	Metadata Strategy	Do Not Merge Uncommon Metadata
	Minimum Number of Entries	1
	Maximum Number of Entries	1000000
	Minimum Group Size	0 B
	Maximum number of Bins	100
	Delimiter Strategy	Text
	Demarcator	Shift + enter
	Compression Level	1
	Keep Path	false
	Properties	
	Run Schedule	3600 sec

The data is merged in one file. We see the venue is empty:


View as: original

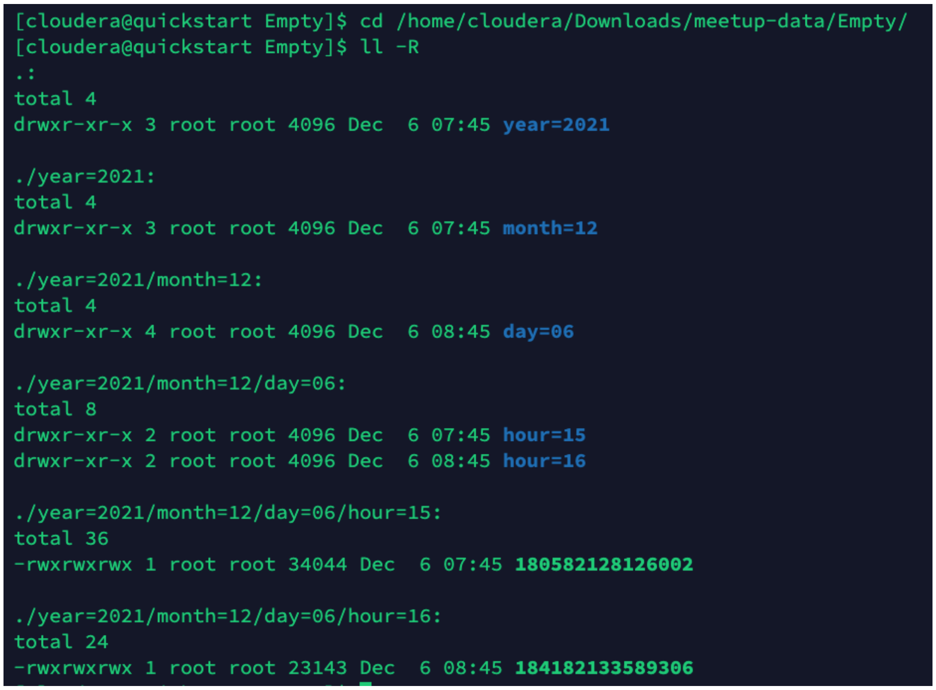
Filename: 186179151535922
Content Type: application/json

```
{"visibility":"public","response":"yes","guests":0,"member":{"member_id":208981563,"photo":"https:\/\/secure.meetupstatic.com\/photos\/member\
{"visibility":"public","response":"yes","guests":0,"member":{"member_id":10039950,"photo":"https:\/\/secure.meetupstatic.com\/photos\/member\/
{"visibility":"public","response":"yes","guests":0,"member":{"member_id":212975731,"photo":"https:\/\/secure.meetupstatic.com\/photos\/member\
{"visibility":"public","response":"yes","guests":0,"member":{"member_id":108581442,"photo":"https:\/\/secure.meetupstatic.com\/photos\/member\
{"visibility":"public","response":"no","guests":0,"member":{"member_id":343377958,"member_name":"Nick I"},"rsvp_id":1896524150,"mtime":1638811
{"visibility":"public","response":"yes","guests":0,"member":{"member_id":62072232,"other_services":{"facebook":{"identifier":"http:\/\/www.fac
{"visibility":"public","response":"no","guests":0,"member":{"member_id":108581442,"photo":"https:\/\/secure.meetupstatic.com\/photos\/member\/
{"visibility":"public","response":"yes","guests":0,"member":{"member_id":208981563,"photo":"https:\/\/secure.meetupstatic.com\/photos\/member\
```

Link on merged to:

Processor	Properties	
PutFile Relationships: failure success	Directory	/home/cloudera/Downloads/meetup-data/Empty/year=${now():format("yyyy", "GMT")}/month=${now():format("MM", "GMT")}/day=${now():format("dd", "GMT")}/hour=${now():format("HH", "GMT")}
	Conflict Resolution Strategy	replace
	Create Missing Directories	True
	Permissions	777

The files are created in the local system:



```
[cloudera@quickstart Empty]$ cd /home/cloudera/Downloads/meetup-data/Empty/
[cloudera@quickstart Empty]$ ll -R
.:
total 4
drwxr-xr-x 3 root root 4096 Dec  6 07:45 year=2021

./year=2021:
total 4
drwxr-xr-x 3 root root 4096 Dec  6 07:45 month=12

./year=2021/month=12:
total 4
drwxr-xr-x 4 root root 4096 Dec  6 08:45 day=06

./year=2021/month=12/day=06:
total 8
drwxr-xr-x 2 root root 4096 Dec  6 07:45 hour=15
drwxr-xr-x 2 root root 4096 Dec  6 08:45 hour=16

./year=2021/month=12/day=06/hour=15:
total 36
-rwxrwxrwx 1 root root 34044 Dec  6 07:45 180582128126002

./year=2021/month=12/day=06/hour=16:
total 24
-rwxrwxrwx 1 root root 23143 Dec  6 08:45 184182133589306
```

DATA MODELING

Task 05
Impala Partitioned Tables

Create a new Impala user-managed partitioned table named meetup.

Create directory for the schema

```
%sh
hdfs dfs -mkdir /schema
```

Put the meetup schema in the directory

```
%sh
hdfs dfs -put /home/cloudera/Downloads/Meetup.avsc /schema
```

Create a database

```
%hive
create database meetup
```

Use the database meetup

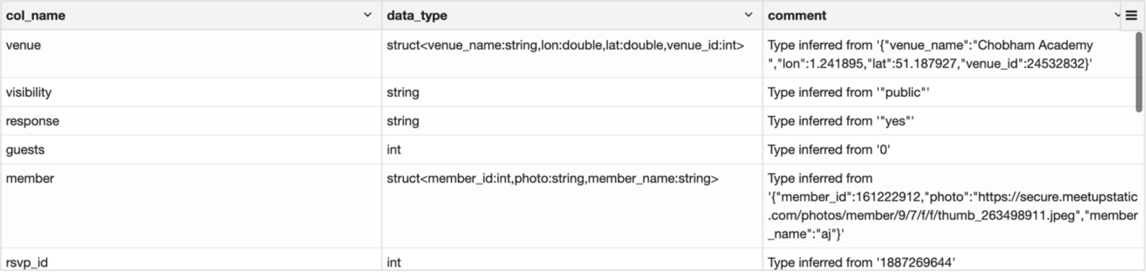
```
%hive
use meetup
```

Create a table with the schema Meetup.avsc

```
%hive
CREATE EXTERNAL TABLE avro_meetup
 ROW FORMAT SERDE
 'org.apache.hadoop.hive.serde2.avro.AvroSerDe'
 STORED AS INPUTFORMAT
 'org.apache.hadoop.hive.ql.io.avro.AvroContainerInputFormat'
 OUTPUTFORMAT
 'org.apache.hadoop.hive.ql.io.avro.AvroContainerOutputFormat'
 TBLPROPERTIES ( 'avro.schema.url'='hdfs:///schema/Meetup.avsc')
```

Describe the table created

```
%hive
DESCRIBE avro_meetup
```



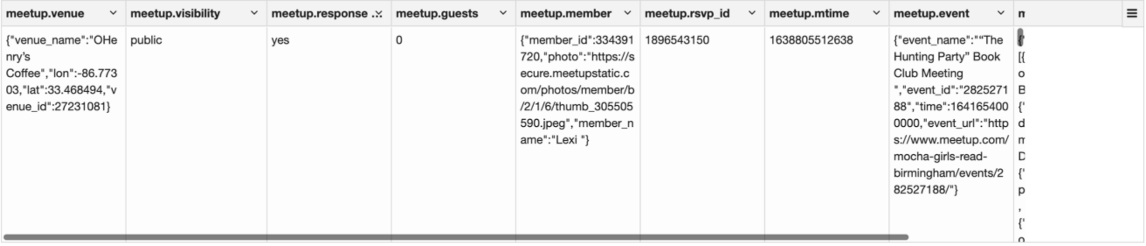
col_name	data_type	comment
venue	struct<venue_name:string,lon:double,lat:double,venue_id:int>	Type inferred from '{"venue_name":"Chobham Academy ","lon":1.241895,"lat":51.187927,"venue_id":24532832}'
visibility	string	Type inferred from '"public"'
response	string	Type inferred from '"yes"'
guests	int	Type inferred from '0'
member	struct<member_id:int,photo:string,member_name:string>	Type inferred from '{"member_id":161222912,"photo":"https://secure.meetupstatic.com/photos/member/9/7/f/f/thumb_263498911.jpeg","member_name":"aj"}'
rsvp_id	int	Type inferred from '1887269644'

Create the table meetup with the parquet file

```
%hive
-- Create the table meetup with the parquet file
CREATE EXTERNAL TABLE if not exists meetup
LIKE avro_meetup
STORED AS PARQUET
LOCATION '/meetup-data/year=2021/month=12/day=06/hour=16/'
TBLPROPERTIES ("parquet.compression"="SNAPPY")
```

Show 5 lines of the table

```
%hive
select * from meetup limit 5
```



meetup.venue	meetup.visibility	meetup.response	meetup.guests	meetup.member	meetup.rsvp_id	meetup.mtime	meetup.event	n
{"venue_name":"OHenry's Coffee","lon":-86.77303,"lat":33.468494,"venue_id":27231081}	public	yes	0	{"member_id":334391720,"photo":"https://secure.meetupstatic.com/photos/member/b/2/1/6/thumb_305505590.jpeg","member_name":"Lexi "}	1896543150	1638805512638	{"event_name":"“The Hunting Party” Book Club Meeting ","event_id":"282527188","time":1641654000000,"event_url":"https://www.meetup.com/mocha-girls-read-birmingham/events/282527188/"}	{' [{ o B {' d n D {' p , {'

Refresh the metadata in impala

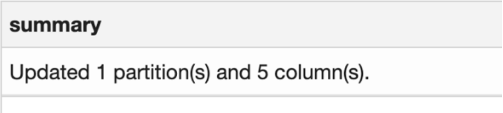
```
%impala
invalidate metadata
```

Use database meetup in impala

```
%impala
use meetup
```

Compute stats of the table

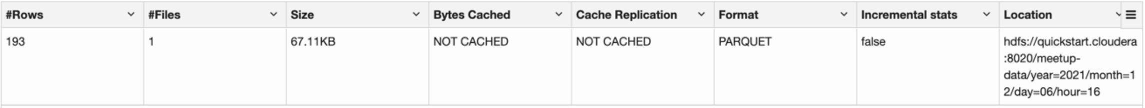
```
%impala
compute stats meetup
```



summary
Updated 1 partition(s) and 5 column(s).

Show the stats of the table to see the number of rows and the size

```
%impala
show table stats meetup
```



#Rows	#Files	Size	Bytes Cached	Cache Replication	Format	Incremental stats	Location
193	1	67.11KB	NOT CACHED	NOT CACHED	PARQUET	false	hdfs://quickstart.cloudera:8020/meetup-data/year=2021/month=12/day=06/hour=16

Rows: 193

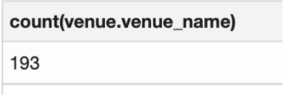
Size: 67.11KB

DATA ANALYSIS

Task 06
Basic meetup rsvps analysis

venues rows count

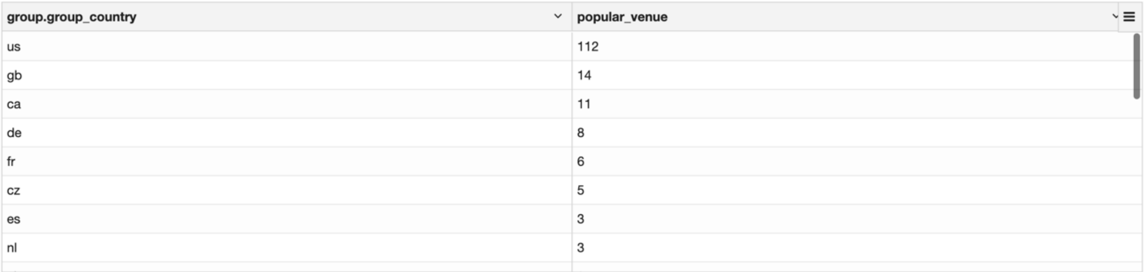
```
%impala
select count(venue.venue_name) from meetup
```



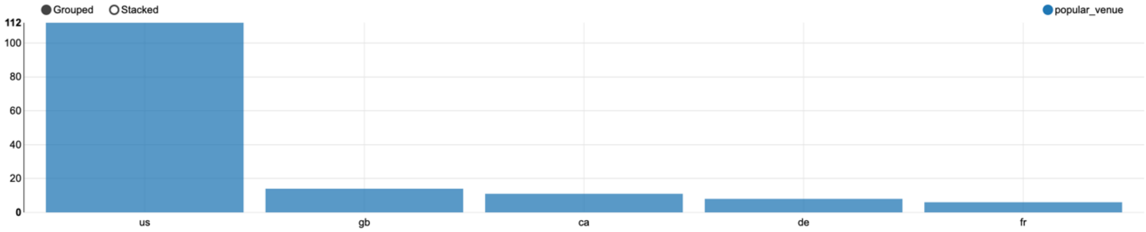
count(venue.venue_name)
193

Most popular venue by country location

```
%impala
select  `group`.group_country, count(*) as popular_venue
from meetup
group by `group`.group_country
order by popular_venue desc
```

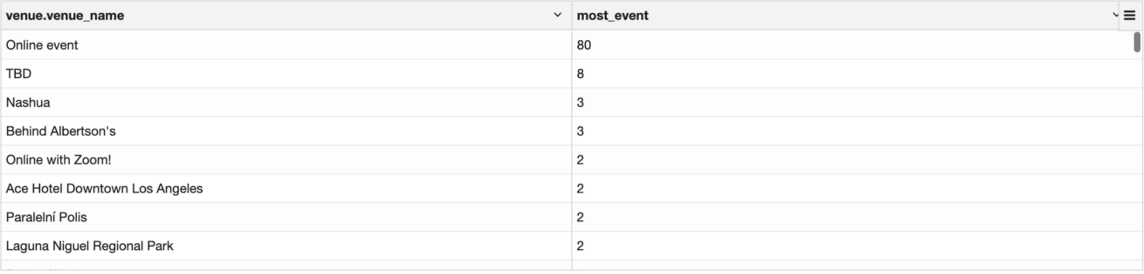


group.group_country	popular_venue
us	112
gb	14
ca	11
de	8
fr	6
cz	5
es	3
nl	3

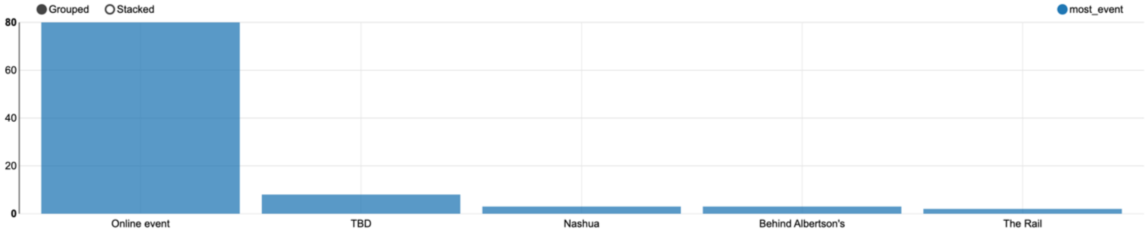


venue has the most event

```
%impala
select  venue.venue_name, count(event.event_id) as most_event
from meetup
group by venue.venue_name
order by most_event desc
```

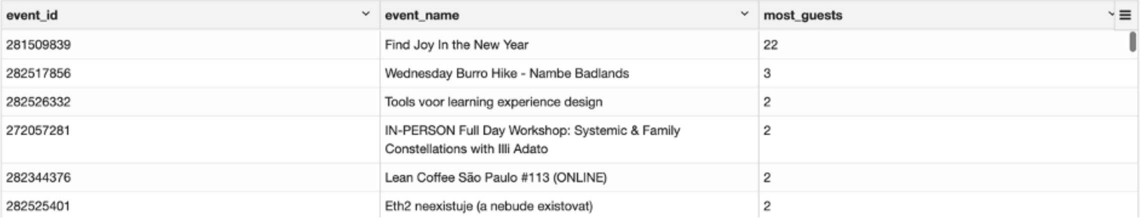


venue.venue_name	most_event
Online event	80
TBD	8
Nashua	3
Behind Albertson's	3
Online with Zoom!	2
Ace Hotel Downtown Los Angeles	2
Paralelní Polis	2
Laguna Niguel Regional Park	2

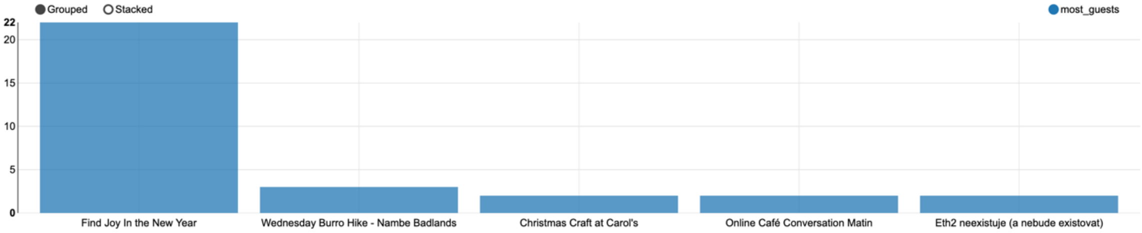


Event has the most guest

```
%impala
select  event.event_id as event_id,event.event_name as event_name,
            count(guests) as most_guests
from meetup
group by event.event_id,event.event_name
order by most_guests desc
```

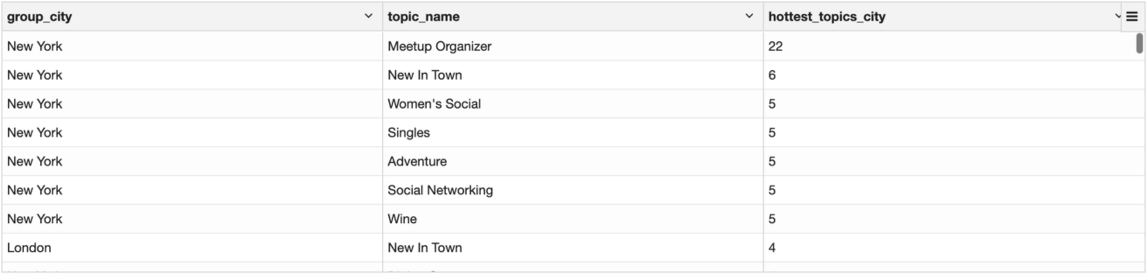


event_id	event_name	most_guests
281509839	Find Joy In the New Year	22
282517856	Wednesday Burro Hike - Nambe Badlands	3
282526332	Tools voor learning experience design	2
272057281	IN-PERSON Full Day Workshop: Systemic & Family Constellations with Illi Adato	2
282344376	Lean Coffee São Paulo #113 (ONLINE)	2
282525401	Eth2 neexistuje (a nebude existovat)	2

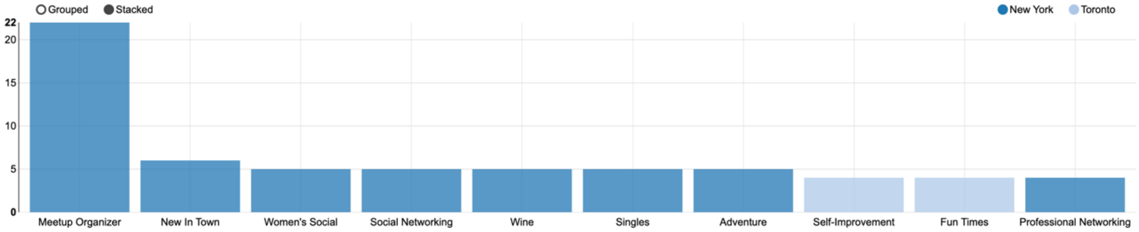


hotest topics in the given city

```
%impala
select `group`.group_city as group_city,
        grouptopics.topic_name as topic_name,
        count(grouptopics.topic_name) hottest_topics_city
from meetup,
    meetup.`group`.group_topics  as grouptopics
group by `group`.group_city, grouptopics.topic_name
order by hottest_topics_city desc
```



group_city	topic_name	hottest_topics_city
New York	Meetup Organizer	22
New York	New In Town	6
New York	Women's Social	5
New York	Singles	5
New York	Adventure	5
New York	Social Networking	5
New York	Wine	5
London	New In Town	4



Task 07

a) Basic SparkSQL meetup rsvps analysis

- **Load the meetup parquet file**

Generate SQLContext using the following command

```
%spark
val sqlContext = new org.apache.spark.sql.SQLContext(sc)
```

Create an RDD DataFrame by reading a data from the parquet file

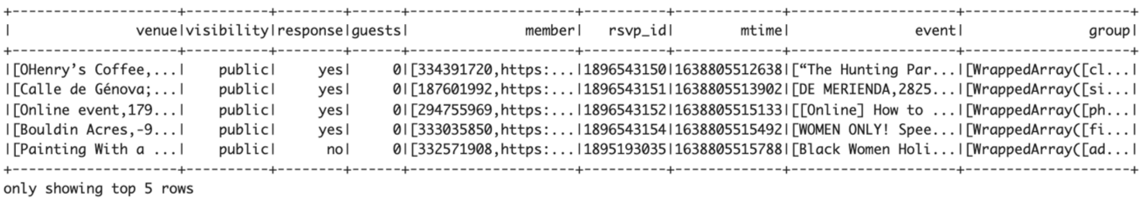
```
%spark
val parqfile =
sqlContext.read.parquet("/meetupdata/year=2021/month=12/day=06/hour=16/")
```

Use the following command for storing the DataFrame data into a table named meetup

```
%spark
parqfile.registerTempTable("meetup")
```

View 5 lines of the table

```
%spark
parqfile.show(5)
```



```
+--------------------+----------+--------+------+--------------------+----------+-------------+--------------------+--------------------+
|               venue|visibility|response|guests|              member|   rsvp_id|        mtime|               event|               group|
+--------------------+----------+--------+------+--------------------+----------+-------------+--------------------+--------------------+
|[OHenry’s Coffee,...|    public|     yes|     0|[334391720,https:...|1896543150|1638805512638|[“The Hunting Par...|[WrappedArray([cl...|
|[Calle de Génova;...|    public|     yes|     0|[187601992,https:...|1896543151|1638805513902|[DE MERIENDA,2825...|[WrappedArray([si...|
|[Online event,179...|    public|     yes|     0|[294755969,https:...|1896543152|1638805515133|[[Online] How to ...|[WrappedArray([ph...|
|[Bouldin Acres,-9...|    public|     yes|     0|[333035850,https:...|1896543154|1638805515492|[WOMEN ONLY! Spee...|[WrappedArray([fi...|
|[Painting With a ...|    public|      no|     0|[332571908,https:...|1895193035|1638805515788|[Black Women Holi...|[WrappedArray([ad...|
+--------------------+----------+--------+------+--------------------+----------+-------------+--------------------+--------------------+
only showing top 5 rows
```

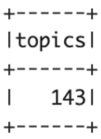
- **Report the number of unique topics**

Use the following command for storing the distinct count of group_topics

```
%spark
val allrecords = sqlContext.sql("SELECT count(distinct group.group_topics) as topics
FROM meetup")
```

Show the result of count

```
%spark
allrecords.show()
```



```
+------+
|topics|
+------+
|   143|
+------+
```

b) Basic Spark Structured Streaming analysis

- **Read data from meetup-agg Kafka topic**

install Spark Streaming dependencies
1 - upload the jars files to the VM (e.g Downloads)
2 - run the following commands on this directory

```
sudo cp spark-streaming-kafka-0-10_2.11-2.2.1.jar /usr/lib/zeppelin/interpreter/spark/dep/
sudo chmod 777 /usr/lib/zeppelin/interpreter/spark/dep/spark-streaming-kafka-0-10_2.11-2.2.1.jar

sudo cp spark-sql-kafka-0-10_2.11-2.1.1.jar /usr/lib/zeppelin/interpreter/spark/dep/
sudo chmod 777 /usr/lib/zeppelin/interpreter/spark/dep/spark-sql-kafka-0-10_2.11-2.1.1.jar

sudo cp kafka-clients-0.11.0.1.jar /usr/lib/zeppelin/interpreter/spark/dep/
sudo chmod 777 /usr/lib/zeppelin/interpreter/spark/dep/kafka-clients-0.11.0.1.jar
```

Load all the dependencies in zeppelin (need run this code at the beginning)
This will let us connect Spark Streaming to kafka topic

```
%dep
z.load("spark-streaming-kafka-0-10_2.11-2.2.1.jar")
z.load("spark-sql-kafka-0-10_2.11-2.1.1.jar")
z.load("kafka-clients-0.11.0.1.jar")
```

Import Kafka and Spark Streaming libraries

```
%spark
import org.apache.spark.streaming._
import org.apache.spark.sql.types._
```

Define a case class to hold meetup-agg

```
%spark
case class meetup
   (
   venue_name: String,
   guest: Int,
   response: String
   )
```

Create the kafka Consumer

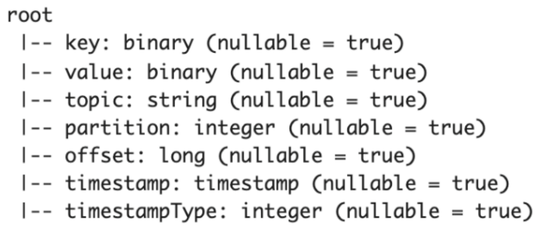
The consumer will read from kafka movie topic

```
%spark
val kafkaStream = spark
   .readStream
   .format("kafka")
   .option("kafka.bootstrap.servers","localhost:9092")
   .option("subscribe","meetup-agg")
   .load()
```

Print the Schema

The 'value' column contains the meetup data in binary format

```
%spark
kafkaStream.printSchema
```



```
root
 |-- key: binary (nullable = true)
 |-- value: binary (nullable = true)
 |-- topic: string (nullable = true)
 |-- partition: integer (nullable = true)
 |-- offset: long (nullable = true)
 |-- timestamp: timestamp (nullable = true)
 |-- timestampType: integer (nullable = true)
```

We are interested by the 'value' column

Let's cast this as String

```
%spark
val dataStream = kafkaStream.selectExpr("CAST(value AS STRING)").as[String]
```

```
%spark
val meetupDataStream = dataStream.map(row => row.split(","))
                              .map(
                                        row => meetup(
                                                  row(0),                   //venue_name
                                                  row(1).trim.toInt,        //guest
                                                  row(2)                    //response
                                        )
                              )
```

Create a Tempory View to run your SparkSQL queries on the data

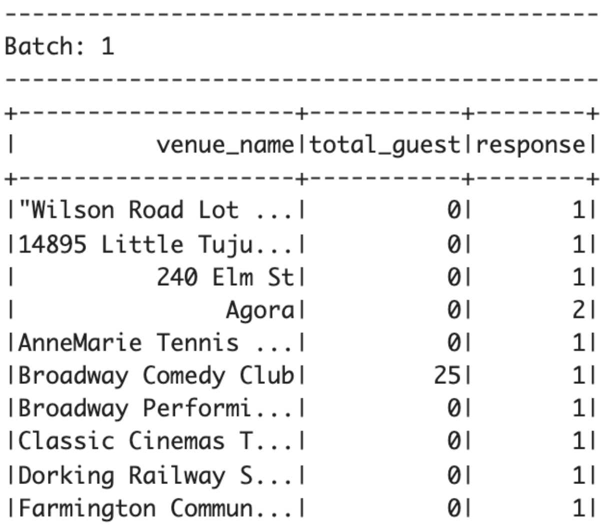
```
%spark
meetupDataStream.createOrReplaceTempView("meetup")
```

```
AGGREGATION
%spark
val meetupCount = meetupDataStream
.groupBy($"venue_name")
.agg(sum("guest").alias("total_guest"), count("response").alias("response"))
.sort("venue_name")
```

- **Report (on the console) the guest count and response per venue**

Console

```
**************** AGGREGATION ****************
%spark
meetupCount
   .writeStream
      .format("console")
      .outputMode("complete")
      .start()
      .awaitTermination()
```



```
-------------------------------------------
Batch: 1
-------------------------------------------
+--------------------+-----------+--------+
|          venue_name|total_guest|response|
+--------------------+-----------+--------+
|"Wilson Road Lot ...|          0|       1|
|14895 Little Tuju...|          0|       1|
|          240 Elm St|          0|       1|
|               Agora|          0|       2|
|AnneMarie Tennis ...|          0|       1|
|Broadway Comedy Club|         25|       1|
|Broadway Performi...|          0|       1|
|Classic Cinemas T...|          0|       1|
|Dorking Railway S...|          0|       1|
|Farmington Commun...|          0|       1|
```

PLATFORME INTEGRATION

Task 08
Show meetup data in MS Excel

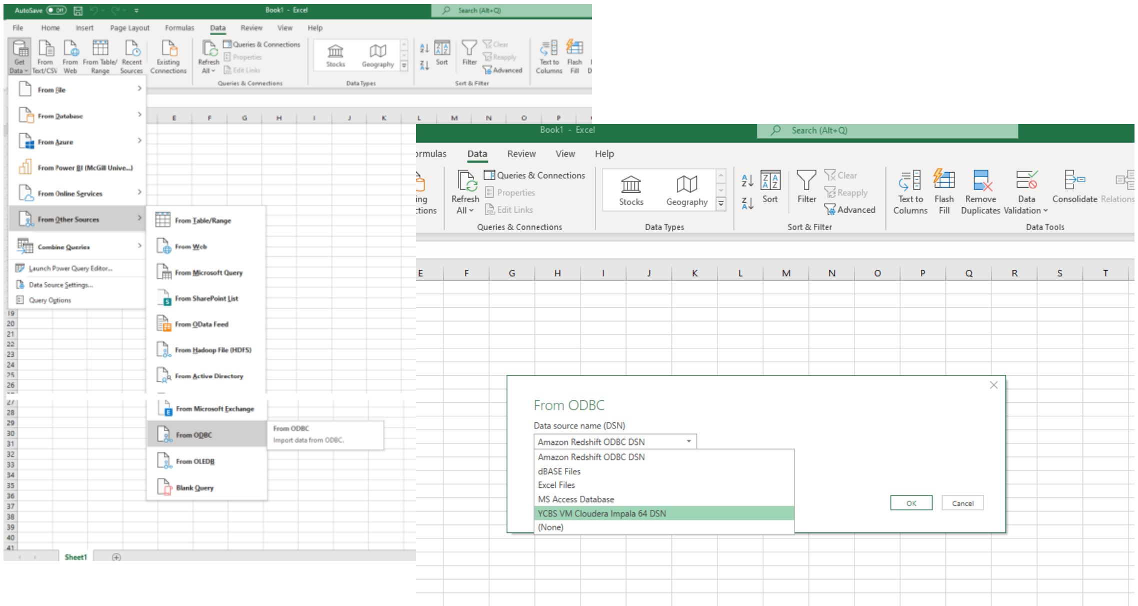
Create view (meetup_view) based on meetup table

```
%impala
create view meetup_view as
select meetup.`group`.group_country as country,
        meetup.venue.venue_name as venue_name, grouptopics.topic_name as topic_name,
        meetup.`group`.group_name as group_name
from meetup,
    meetup.`group`.group_topics  as grouptopics
    limit 50
```

Create view (meetup_view_count) based on meetup table

```
%impala
create view meetup_view_count as
select meetup.`group`.group_country as country,
        count(meetup.venue.venue_name) as
        cnt_venue_name,count(grouptopics.topic_name) as
        cnt_topic_name,count(meetup.`group`.group_name) as cnt_group_name
from meetup,
    meetup.`group`.group_topics  as grouptopics
    group by meetup.`group`.group_country
    limit 50
```

ODBC connection

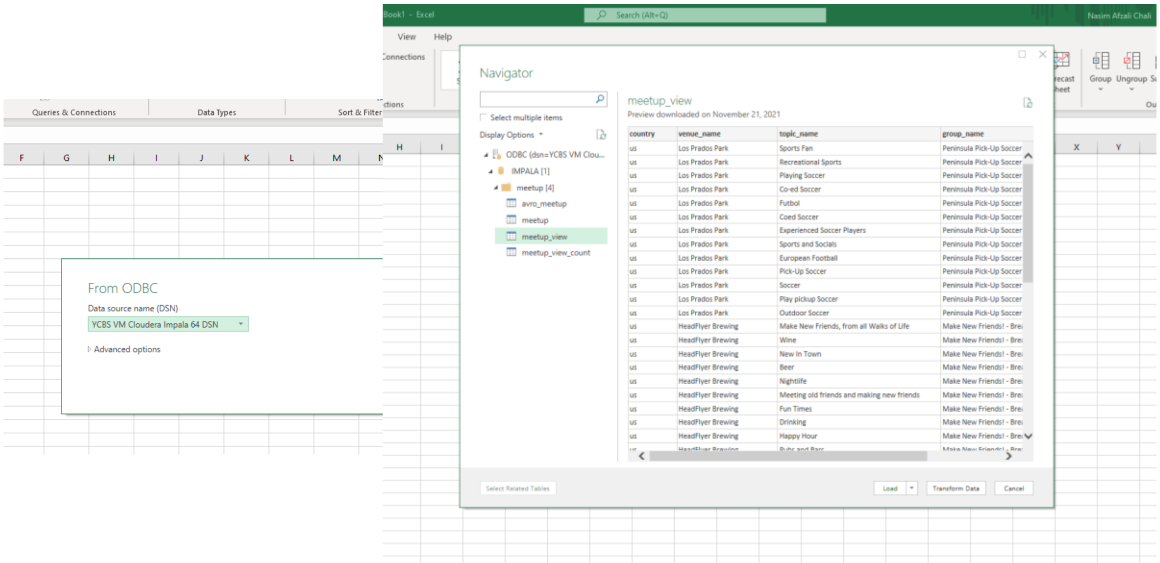


From ODBC

Data source name (DSN)

Amazon Redshift ODBC DSN

Amazon Redshift ODBC DSN
dBASE Files
Excel Files
MS Access Database
YCBS VM Cloudera Impala 64 DSN
(None)



From ODBC

Data source name (DSN): YCBS VM Cloudera Impala 64 DSN

▷ Advanced options

Navigator

□ Select multiple items

- ODBC (dsn=YCBS VM Clou...
  - IMPALA [1]
    - meetup [4]
      - avro_meetup
      - meetup
      - meetup_view
      - meetup_view_count

meetup_view

Preview downloaded on November 21, 2021

country	venue_name	topic_name	group_name
us	Los Prados Park	Sports Fan	Peninsula Pick-Up Soccer
us	Los Prados Park	Recreational Sports	Peninsula Pick-Up Soccer
us	Los Prados Park	Playing Soccer	Peninsula Pick-Up Soccer
us	Los Prados Park	Co-ed Soccer	Peninsula Pick-Up Soccer
us	Los Prados Park	Futbol	Peninsula Pick-Up Soccer
us	Los Prados Park	Coed Soccer	Peninsula Pick-Up Soccer
us	Los Prados Park	Experienced Soccer Players	Peninsula Pick-Up Soccer
us	Los Prados Park	Sports and Socials	Peninsula Pick-Up Soccer
us	Los Prados Park	European Football	Peninsula Pick-Up Soccer
us	Los Prados Park	Pick-Up Soccer	Peninsula Pick-Up Soccer
us	Los Prados Park	Soccer	Peninsula Pick-Up Soccer
us	Los Prados Park	Play pickup Soccer	Peninsula Pick-Up Soccer
us	Los Prados Park	Outdoor Soccer	Peninsula Pick-Up Soccer
us	HeadFlyer Brewing	Make New Friends, from all Walks of Life	Make New Friends! - Brea
us	HeadFlyer Brewing	Wine	Make New Friends! - Brea
us	HeadFlyer Brewing	New In Town	Make New Friends! - Brea
us	HeadFlyer Brewing	Beer	Make New Friends! - Brea
us	HeadFlyer Brewing	Nightlife	Make New Friends! - Brea
us	HeadFlyer Brewing	Meeting old friends and making new friends	Make New Friends! - Brea
us	HeadFlyer Brewing	Fun Times	Make New Friends! - Brea
us	HeadFlyer Brewing	Drinking	Make New Friends! - Brea
us	HeadFlyer Brewing	Happy Hour	Make New Friends! - Brea

Table meetup_view:

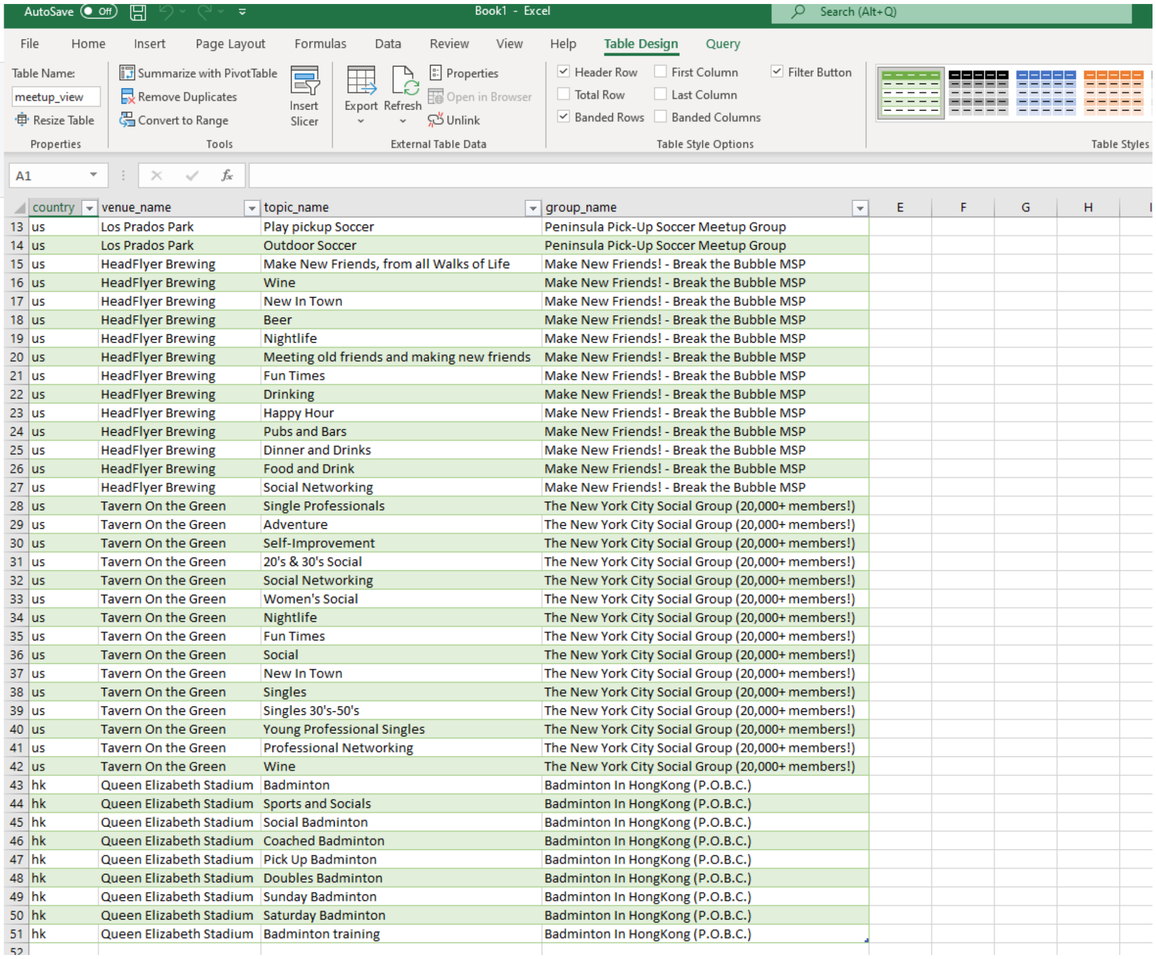


Table Name: meetup_view

☑ Header Row □ First Column ☑ Filter Button
□ Total Row □ Last Column
☑ Banded Rows □ Banded Columns

	country	venue_name	topic_name	group_name
13	us	Los Prados Park	Play pickup Soccer	Peninsula Pick-Up Soccer Meetup Group
14	us	Los Prados Park	Outdoor Soccer	Peninsula Pick-Up Soccer Meetup Group
15	us	HeadFlyer Brewing	Make New Friends, from all Walks of Life	Make New Friends! - Break the Bubble MSP
16	us	HeadFlyer Brewing	Wine	Make New Friends! - Break the Bubble MSP
17	us	HeadFlyer Brewing	New In Town	Make New Friends! - Break the Bubble MSP
18	us	HeadFlyer Brewing	Beer	Make New Friends! - Break the Bubble MSP
19	us	HeadFlyer Brewing	Nightlife	Make New Friends! - Break the Bubble MSP
20	us	HeadFlyer Brewing	Meeting old friends and making new friends	Make New Friends! - Break the Bubble MSP
21	us	HeadFlyer Brewing	Fun Times	Make New Friends! - Break the Bubble MSP
22	us	HeadFlyer Brewing	Drinking	Make New Friends! - Break the Bubble MSP
23	us	HeadFlyer Brewing	Happy Hour	Make New Friends! - Break the Bubble MSP
24	us	HeadFlyer Brewing	Pubs and Bars	Make New Friends! - Break the Bubble MSP
25	us	HeadFlyer Brewing	Dinner and Drinks	Make New Friends! - Break the Bubble MSP
26	us	HeadFlyer Brewing	Food and Drink	Make New Friends! - Break the Bubble MSP
27	us	HeadFlyer Brewing	Social Networking	Make New Friends! - Break the Bubble MSP
28	us	Tavern On the Green	Single Professionals	The New York City Social Group (20,000+ members!)
29	us	Tavern On the Green	Adventure	The New York City Social Group (20,000+ members!)
30	us	Tavern On the Green	Self-Improvement	The New York City Social Group (20,000+ members!)
31	us	Tavern On the Green	20's & 30's Social	The New York City Social Group (20,000+ members!)
32	us	Tavern On the Green	Social Networking	The New York City Social Group (20,000+ members!)
33	us	Tavern On the Green	Women's Social	The New York City Social Group (20,000+ members!)
34	us	Tavern On the Green	Nightlife	The New York City Social Group (20,000+ members!)
35	us	Tavern On the Green	Fun Times	The New York City Social Group (20,000+ members!)
36	us	Tavern On the Green	Social	The New York City Social Group (20,000+ members!)
37	us	Tavern On the Green	New In Town	The New York City Social Group (20,000+ members!)
38	us	Tavern On the Green	Singles	The New York City Social Group (20,000+ members!)
39	us	Tavern On the Green	Singles 30's-50's	The New York City Social Group (20,000+ members!)
40	us	Tavern On the Green	Young Professional Singles	The New York City Social Group (20,000+ members!)
41	us	Tavern On the Green	Professional Networking	The New York City Social Group (20,000+ members!)
42	us	Tavern On the Green	Wine	The New York City Social Group (20,000+ members!)
43	hk	Queen Elizabeth Stadium	Badminton	Badminton In HongKong (P.O.B.C.)
44	hk	Queen Elizabeth Stadium	Sports and Socials	Badminton In HongKong (P.O.B.C.)
45	hk	Queen Elizabeth Stadium	Social Badminton	Badminton In HongKong (P.O.B.C.)
46	hk	Queen Elizabeth Stadium	Coached Badminton	Badminton In HongKong (P.O.B.C.)
47	hk	Queen Elizabeth Stadium	Pick Up Badminton	Badminton In HongKong (P.O.B.C.)
48	hk	Queen Elizabeth Stadium	Doubles Badminton	Badminton In HongKong (P.O.B.C.)
49	hk	Queen Elizabeth Stadium	Sunday Badminton	Badminton In HongKong (P.O.B.C.)
50	hk	Queen Elizabeth Stadium	Saturday Badminton	Badminton In HongKong (P.O.B.C.)
51	hk	Queen Elizabeth Stadium	Badminton training	Badminton In HongKong (P.O.B.C.)

meetup-view_count (Per country / venues, group, topic)

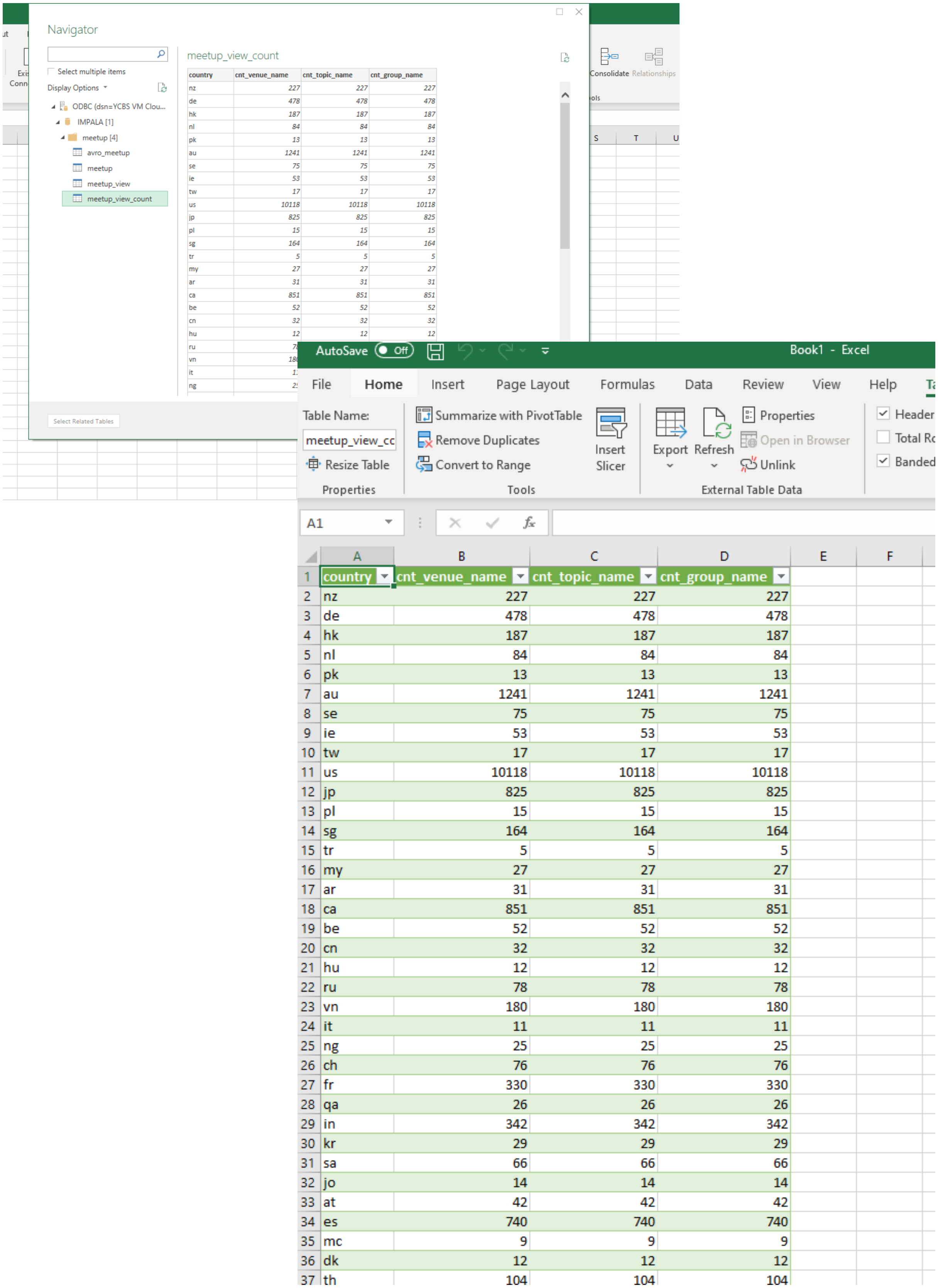


Table Name: meetup_view_cc

meetup_view_count

country	cnt_venue_name	cnt_topic_name	cnt_group_name
nz	227	227	227
de	478	478	478
hk	187	187	187
nl	84	84	84
pk	13	13	13
au	1241	1241	1241
se	75	75	75
ie	53	53	53
tw	17	17	17
us	10118	10118	10118
jp	825	825	825
pl	15	15	15
sg	164	164	164
tr	5	5	5
my	27	27	27
ar	31	31	31
ca	851	851	851
be	52	52	52
cn	32	32	32
hu	12	12	12
ru	7		
vn	18		
it	1:		
ng	2:		

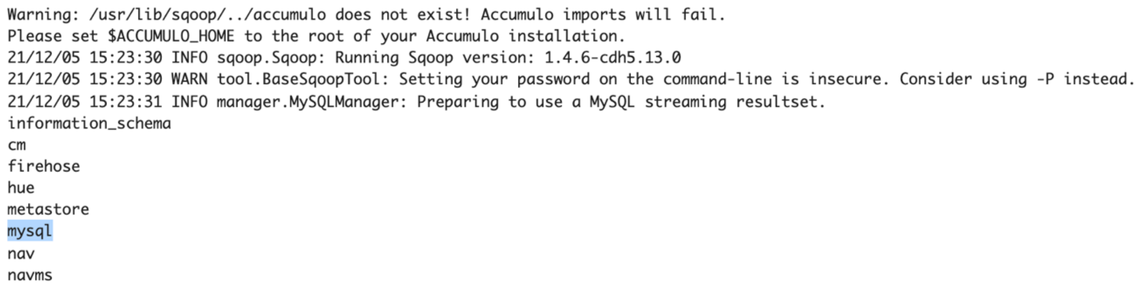
	A	B	C	D	E	F
1	country	cnt_venue_name	cnt_topic_name	cnt_group_name		
2	nz	227	227	227		
3	de	478	478	478		
4	hk	187	187	187		
5	nl	84	84	84		
6	pk	13	13	13		
7	au	1241	1241	1241		
8	se	75	75	75		
9	ie	53	53	53		
10	tw	17	17	17		
11	us	10118	10118	10118		
12	jp	825	825	825		
13	pl	15	15	15		
14	sg	164	164	164		
15	tr	5	5	5		
16	my	27	27	27		
17	ar	31	31	31		
18	ca	851	851	851		
19	be	52	52	52		
20	cn	32	32	32		
21	hu	12	12	12		
22	ru	78	78	78		
23	vn	180	180	180		
24	it	11	11	11		
25	ng	25	25	25		
26	ch	76	76	76		
27	fr	330	330	330		
28	qa	26	26	26		
29	in	342	342	342		
30	kr	29	29	29		
31	sa	66	66	66		
32	jo	14	14	14		
33	at	42	42	42		
34	es	740	740	740		
35	mc	9	9	9		
36	dk	12	12	12		
37	th	104	104	104		

Task 09
Sqoop Export

Export data into a MySQL.
We use an existing database (mysql)

Use sqoop to list all databases on the running MySQL local instance

```
%sh
sqoop list-databases --connect jdbc:mysql://localhost/ --username root --password
cloudera
```



```
Warning: /usr/lib/sqoop/../accumulo does not exist! Accumulo imports will fail.
Please set $ACCUMULO_HOME to the root of your Accumulo installation.
21/12/05 15:23:30 INFO sqoop.Sqoop: Running Sqoop version: 1.4.6-cdh5.13.0
21/12/05 15:23:30 WARN tool.BaseSqoopTool: Setting your password on the command-line is insecure. Consider using -P instead.
21/12/05 15:23:31 INFO manager.MySQLManager: Preparing to use a MySQL streaming resultset.
information_schema
cm
firehose
hue
metastore
mysql
nav
navms
```

Use mysql database for create the table

```
%mysql
use mysql
```

Write a Sqoop command to export all venues in the US from the meetup table

Create database sqoop

```
%hive
create database sqoop
```

Use the database sqoop

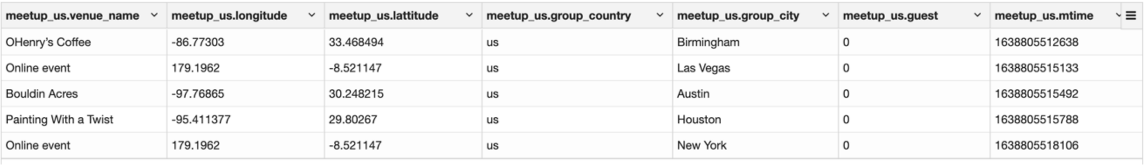
```
%hive
use sqoop
```

Create table meetup_us in sqoop database

```
%hive
create table sqoop.meetup_us
row format delimited fields terminated by ','
as
select cast(venue.venue_name as varchar(100)) as venue_name,
       cast(venue.lon as double) as longitude,
       cast(venue.lat as double) as lattitude,
       cast(`group`.group_country as varchar(5)) as group_country,
       cast(`group`.group_city as varchar(35)) as group_city,
    cast(guests as int) as guest,
    cast(mtime as bigint) as mtime
from meetup
where group.group_country ='us'
```

View 5 lines on the table meetup_us

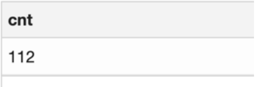
```
%hive
select * from sqoop.meetup_us limit 5
```



meetup_us.venue_name	meetup_us.longitude	meetup_us.lattitude	meetup_us.group_country	meetup_us.group_city	meetup_us.guest	meetup_us.mtime
OHenry's Coffee	-86.77303	33.468494	us	Birmingham	0	1638805512638
Online event	179.1962	-8.521147	us	Las Vegas	0	1638805515133
Bouldin Acres	-97.76865	30.248215	us	Austin	0	1638805515492
Painting With a Twist	-95.411377	29.80267	us	Houston	0	1638805515788
Online event	179.1962	-8.521147	us	New York	0	1638805518106

Count the number in line from meetup_us created in hive

```
%hive
select count(*) from sqoop.meetup_us
```



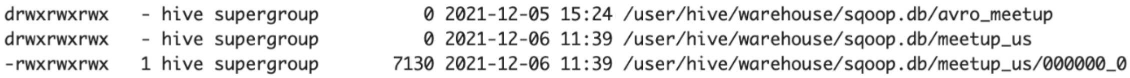
cnt
112

The target MySQL table must be existed in the target database prior to run the Sqoop export command

```
%mysql
CREATE TABLE mysql.meetup (
        venue_name varchar(100),
        longitude double,
        latitude double,
        country varchar(5),
        city varchar(35),
        guests int,
        mtime bigint)
```

Check recursively the directory of the warehouse table meetup_us

```
%sh
hdfs dfs -ls -R /user/hive/warehouse/sqoop.db/
```



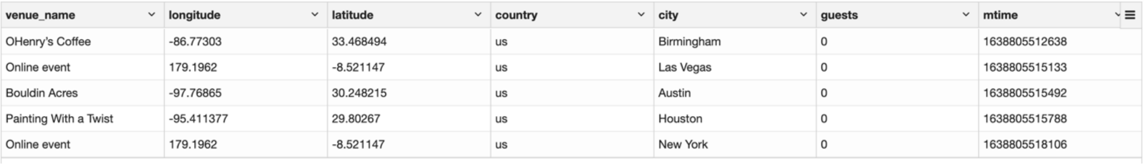
```
drwxrwxrwx   - hive supergroup          0 2021-12-05 15:24 /user/hive/warehouse/sqoop.db/avro_meetup
drwxrwxrwx   - hive supergroup          0 2021-12-06 11:39 /user/hive/warehouse/sqoop.db/meetup_us
-rwxrwxrwx   1 hive supergroup       7130 2021-12-06 11:39 /user/hive/warehouse/sqoop.db/meetup_us/000000_0
```

Export the table with sqoop

```
%sh
sqoop export --connect jdbc:mysql://localhost/mysql --username root --password cloudera --table meetup --export-dir /user/hive/warehouse/sqoop.db/meetup_us --input-fields-terminated-by ","
```

Show 5 lines of the table meetup in mysql

```
%mysql
select * from mysql.meetup limit 5
```

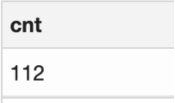


venue_name	longitude	latitude	country	city	guests	mtime
OHenry's Coffee	-86.77303	33.468494	us	Birmingham	0	1638805512638
Online event	179.1962	-8.521147	us	Las Vegas	0	1638805515133
Bouldin Acres	-97.76865	30.248215	us	Austin	0	1638805515492
Painting With a Twist	-95.411377	29.80267	us	Houston	0	1638805515788
Online event	179.1962	-8.521147	us	New York	0	1638805518106

Report rows count from the target table

Count the number of lines (same number of lines of the table created in hive)

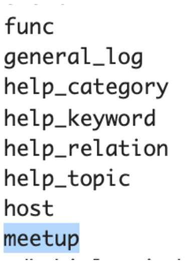
```
%mysql
select count(*) as cnt from mysql.meetup
```



cnt
112

View the list of all tables in mysql database

```
%mysql
sqoop list-tables --connect jdbc:mysql://localhost/mysql --username root --password cloudera
```



```
func
general_log
help_category
help_keyword
help_relation
help_topic
host
meetup
```