Exercises Preparation

Install and Setup Hive

Create VM Instance

1. Delete previously created VM instance:

```
gcloud compute instances delete big-data
```

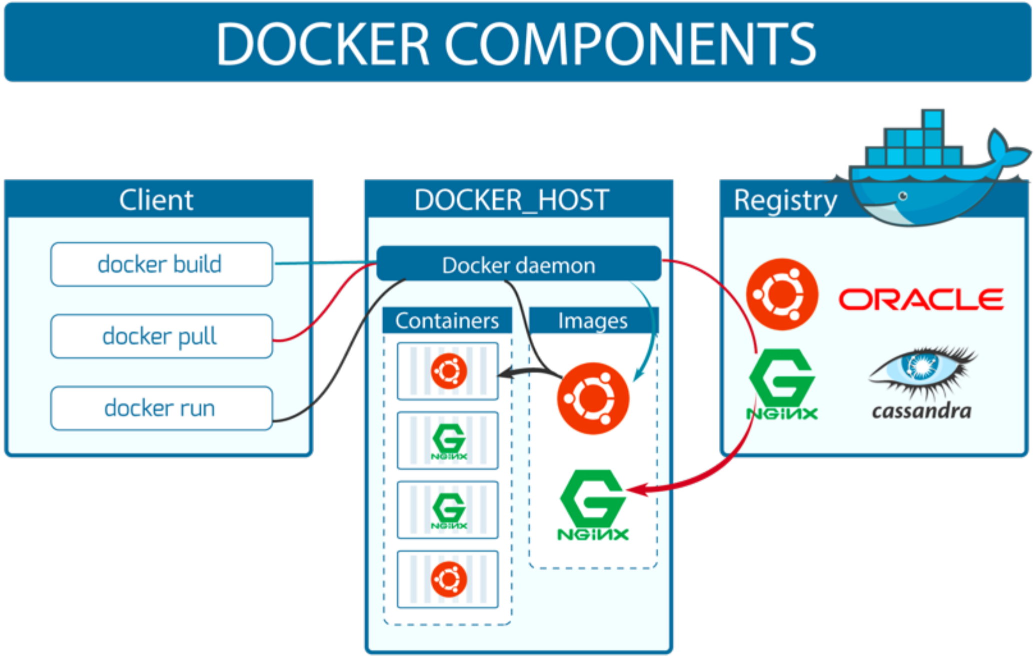
2. Create new instance:

```
gcloud compute --project=[your-project-id] instances create big-data \
           --zone=europe-west3-a \
           --machine-type=n2-highmem-4 \
           --subnet=default --network-tier=PREMIUM \
           --maintenance-policy=MIGRATE \
           --image=ubuntu-2004-focal-v20210129 \
           --image-project=ubuntu-os-cloud \
           --boot-disk-size=100GB \
           --boot-disk-type=pd-standard \
           --boot-disk-device-name=big-data
```

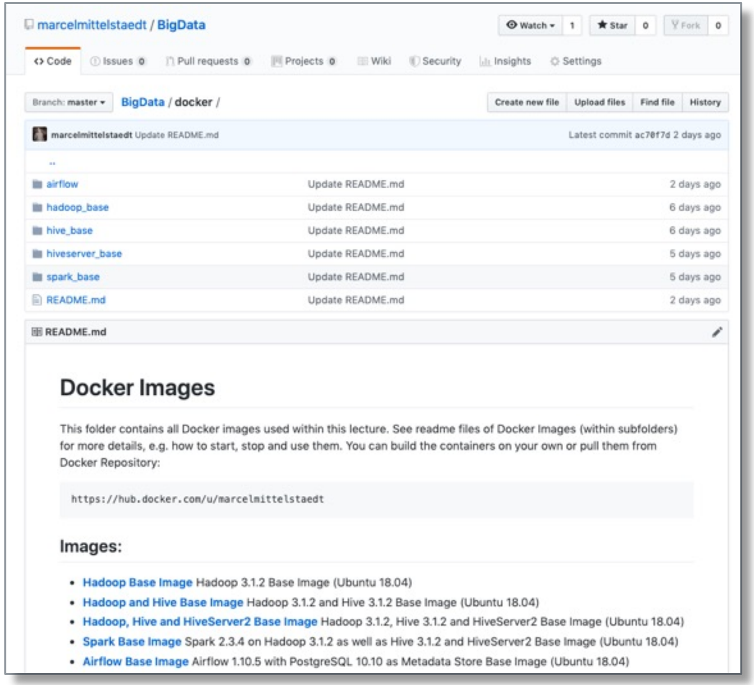
```
ssh hans.wurst@XXX.XXX.XXX.XXX
```

Docker

To speed things up and not waste time on installation and configuration of Hive and other tools, we will make use of docker container I‘ve already prepared.



Docker Images/Dockerfiles



marcelmittelstaedt Update README.md — Latest commit ac70f7d 2 days ago

..		
airflow	Update README.md	2 days ago
hadoop_base	Update README.md	6 days ago
hive_base	Update README.md	6 days ago
hiveserver_base	Update README.md	5 days ago
spark_base	Update README.md	5 days ago
README.md	Update README.md	2 days ago

README.md

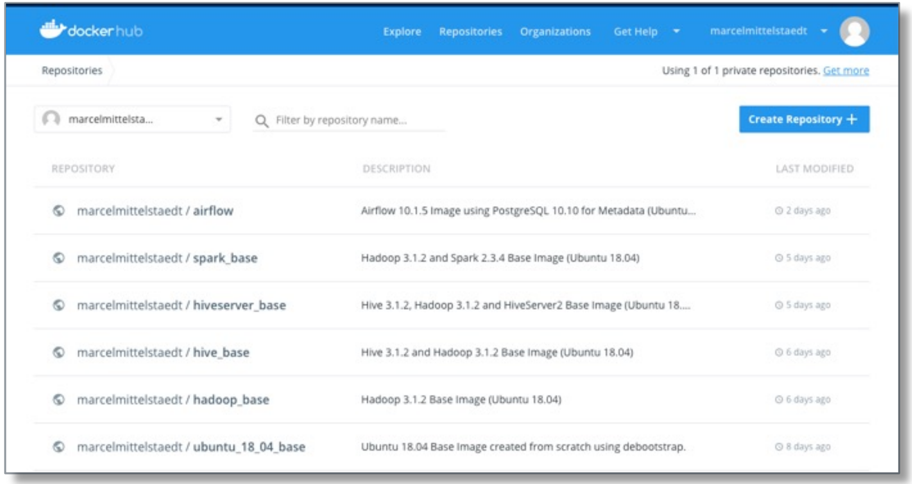
Docker Images

This folder contains all Docker images used within this lecture. See readme files of Docker Images (within subfolders) for more details, e.g. how to start, stop and use them. You can build the containers on your own or pull them from Docker Repository:

```
https://hub.docker.com/u/marcelmittelstaedt
```

Images:

- **Hadoop Base Image** Hadoop 3.1.2 Base Image (Ubuntu 18.04)
- **Hadoop and Hive Base Image** Hadoop 3.1.2 and Hive 3.1.2 Base Image (Ubuntu 18.04)
- **Hadoop, Hive and HiveServer2 Base Image** Hadoop 3.1.2, Hive 3.1.2 and HiveServer2 Base Image (Ubuntu 18.04)
- **Spark Base Image** Spark 2.3.4 on Hadoop 3.1.2 as well as Hive 3.1.2 and HiveServer2 Base Image (Ubuntu 18.04)
- **Airflow Base Image** Airflow 1.10.5 with PostgreSQL 10.10 as Metadata Store Base Image (Ubuntu 18.04)



REPOSITORY	DESCRIPTION	LAST MODIFIED
marcelmittelstaedt / airflow	Airflow 10.1.5 Image using PostgreSQL 10.10 for Metadata (Ubuntu...	2 days ago
marcelmittelstaedt / spark_base	Hadoop 3.1.2 and Spark 2.3.4 Base Image (Ubuntu 18.04)	5 days ago
marcelmittelstaedt / hiveserver_base	Hive 3.1.2, Hadoop 3.1.2 and HiveServer2 Base Image (Ubuntu 18....	5 days ago
marcelmittelstaedt / hive_base	Hive 3.1.2 and Hadoop 3.1.2 Base Image (Ubuntu 18.04)	6 days ago
marcelmittelstaedt / hadoop_base	Hadoop 3.1.2 Base Image (Ubuntu 18.04)	6 days ago
marcelmittelstaedt / ubuntu_18_04_base	Ubuntu 18.04 Base Image created from scratch using debootstrap.	8 days ago

https://hub.docker.com/u/marcelmittelstaedt

https://github.com/marcelmittelstaedt/BigData/tree/master/docker

Setup Docker Container

3. Install and setup docker

```
sudo apt-get update
sudo apt-get install docker.io
sudo usermod -aG docker $USER
# exit and login again
```

4. Pull Hadoop with Hive Image

```
docker pull marcelmittelstaedt/hive_base:latest
```

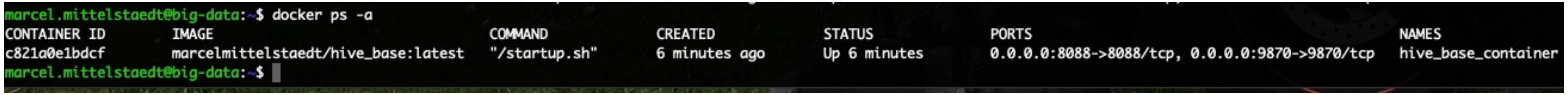
5. Start Container from pulled image:

```
docker run -dit --name hive_base_container -p 8088:8088 -p 9870:9870 -p 9864:
9864 marcelmittelstaedt/hive_base:latest
```

Setup Docker Container

6. Show Running Container:

```
docker ps -a
```



```
marcel.mittelstaedt@big-data:~$ docker ps -a
CONTAINER ID   IMAGE                                   COMMAND          CREATED         STATUS         PORTS                                             NAMES
c821a0e1bdcf   marcelmittelstaedt/hive_base:latest     "/startup.sh"    6 minutes ago   Up 6 minutes   0.0.0.0:8088->8088/tcp, 0.0.0.0:9870->9870/tcp    hive_base_container
marcel.mittelstaedt@big-data:~$
```

7. Show Logs of container (wait till finished):

```
docker logs hive_base_container

[…]
Stopping namenodes on [localhost]
Stopping datanodes
Stopping secondary namenodes [c821a0e1bdcf]
Stopping nodemanagers
Stopping resourcemanager
Container Startup finished.
```

Setup Docker Container

8. Get a shell inside the container:

```
hans.wurst@big-data:~$ docker exec -it hive_base_container bash
root@c821a0e1bdcf:/#
```

9. Switch to hadoop user:

```
root@c821a0e1bdcf:/# sudo su hadoop
hadoop@c821a0e1bdcf:/$ cd
hadoop@c821a0e1bdcf:~$
```

10. Start DFS and YARN:

```
start-all.sh
```

Test Hive

11. Test if Hive Installation and Configuration is successful. Start Hive:

```
hive
```

```
SLF4J: Class path contains multiple SLF4J bindings.
SLF4J: Found binding in [jar:file:/home/hadoop/hive/lib/log4j-slf4j-impl-2.10.0.jar!/org/slf4j/
impl/StaticLoggerBinder.class]
SLF4J: Found binding in [jar:file:/home/hadoop/hadoop/share/hadoop/common/lib/slf4j-log4j12-1.7
.25.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: See http://www.slf4j.org/codes.html#multiple_bindings for an explanation.
SLF4J: Actual binding is of type [org.apache.logging.slf4j.Log4jLoggerFactory]
Hive Session ID = c120d0b1-9025-43db-96e4-48ccfb875f1a

Logging initialized using configuration in jar:file:/home/hadoop/hive/lib/hive-common-3.1.0.jar
!/hive-log4j2.properties Async: true
Hive-on-MR is deprecated in Hive 2 and may not be available in the future versions. Consider us
ing a different execution engine (i.e. spark, tez) or using Hive 1.X releases.
Hive Session ID = fdd6f06a-d4e4-48e6-8971-997e8a0a8e2c
hive>
```

Install and Setup Hive

12. Execute First SQL Query:

```
hive> show databases;
OK
default
Time taken: 0.083 seconds, Fetched: 1 row(s)
hive>
```

Break

TIME FOR

A

BREAK

Hive: Create and Work with External Tables

Using public dataset of IMDb.com

Get IMDb Data And Move It To HDFS

1. Get **IMDb Data** (*https://www.imdb.com/interfaces/*):

```
wget https://datasets.imdbws.com/title.basics.tsv.gz
wget https://datasets.imdbws.com/title.ratings.tsv.gz
```

2. Uncompress IMDb Data:

```
gunzip title.basics.tsv.gz
gunzip title.ratings.tsv.gz
```

3. Create HDFS Directories for IMDb Data:

```
hadoop fs -mkdir /user/hadoop/imdb
hadoop fs -mkdir /user/hadoop/imdb/title_basics
hadoop fs -mkdir /user/hadoop/imdb/title_ratings
```

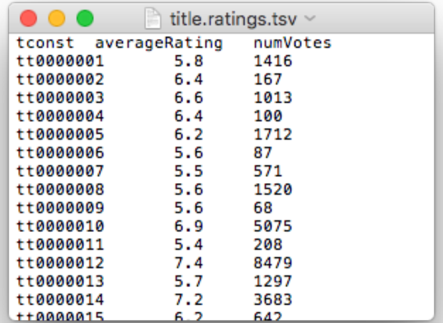
Create External Tables In Hive

4. Transfer IMDb data files to HDFS:

```
hadoop fs -put title.basics.tsv /user/hadoop/imdb/title_basics/title.basics.tsv
hadoop fs -put title.ratings.tsv /user/hadoop/imdb/title_ratings/title.ratings.tsv
```

5. Create External Table `title_ratings` (file *title.ratings.tsv*) in Hive:

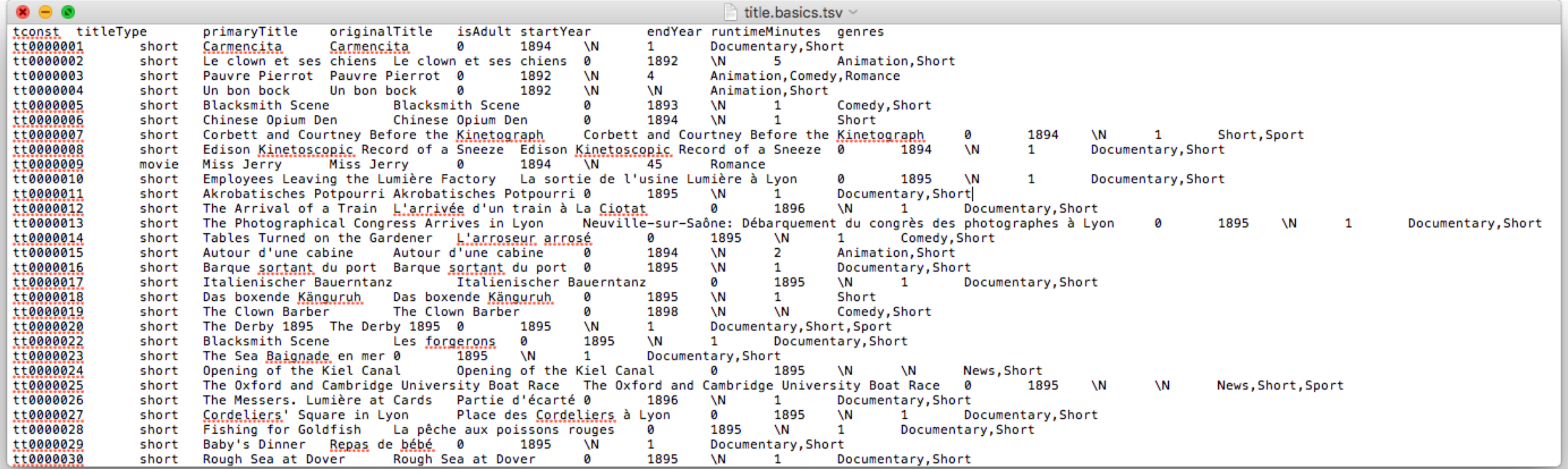
```
hive > CREATE EXTERNAL TABLE IF NOT EXISTS title_ratings(
          tconst STRING,
          average_rating DECIMAL(2,1),
          num_votes BIGINT
) COMMENT 'IMDb Ratings'
ROW FORMAT DELIMITED FIELDS TERMINATED BY '\t' STORED AS
TEXTFILE LOCATION '/user/hadoop/imdb/title_ratings'
TBLPROPERTIES ('skip.header.line.count'='1');
```



```
tconst     averageRating    numVotes
tt0000001         5.8       1416
tt0000002         6.4       167
tt0000003         6.6       1013
tt0000004         6.4       100
tt0000005         6.2       1712
tt0000006         5.6       87
tt0000007         5.5       571
tt0000008         5.6       1520
tt0000009         5.6       68
tt0000010         6.9       5075
tt0000011         5.4       208
tt0000012         7.4       8479
tt0000013         5.7       1297
tt0000014         7.2       3683
tt0000015         6.2       642
```

Create External Tables In Hive

6. Create External Table `title_basics` for file *title.basics.tsv* in Hive:



```
tconst  titleType       primaryTitle    originalTitle   isAdult startYear       endYear runtimeMinutes  genres
tt0000001       short   Carmencita      Carmencita      0       1894    \N      1       Documentary,Short
tt0000002       short   Le clown et ses chiens  Le clown et ses chiens  0       1892    \N      5       Animation,Short
tt0000003       short   Pauvre Pierrot  Pauvre Pierrot  0       1892    \N      4       Animation,Comedy,Romance
tt0000004       short   Un bon bock     Un bon bock     0       1892    \N      \N      Animation,Short
tt0000005       short   Blacksmith Scene        Blacksmith Scene        0       1893    \N      1       Comedy,Short
tt0000006       short   Chinese Opium Den       Chinese Opium Den       0       1894    \N      1       Short
tt0000007       short   Corbett and Courtney Before the Kinetograph     Corbett and Courtney Before the Kinetograph     0       1894    \N      1       Short,Sport
tt0000008       short   Edison Kinetoscopic Record of a Sneeze  Edison Kinetoscopic Record of a Sneeze  0       1894    \N      1       Documentary,Short
tt0000009       movie   Miss Jerry      Miss Jerry      0       1894    \N      45      Romance
tt0000010       short   Employees Leaving the Lumière Factory   La sortie de l'usine Lumière à Lyon     0       1895    \N      1       Documentary,Short
tt0000011       short   Akrobatisches Potpourri Akrobatisches Potpourri 0       1895    \N      1       Documentary,Short
tt0000012       short   The Arrival of a Train  L'arrivée d'un train à La Ciotat        0       1896    \N      1       Documentary,Short
tt0000013       short   The Photographical Congress Arrives in Lyon     Neuville-sur-Saône: Débarquement du congrès des photographes à Lyon    0       1895    \N      1       Documentary,Short
tt0000014       short   Tables Turned on the Gardener   L'arroseur arrosé       0       1895    \N      1       Comedy,Short
tt0000015       short   Autour d'une cabine     Autour d'une cabine     0       1894    \N      2       Animation,Short
tt0000016       short   Barque sortant du port  Barque sortant du port  0       1895    \N      1       Documentary,Short
tt0000017       short   Italienischer Bauerntanz        Italienischer Bauerntanz        0       1895    \N      1       Documentary,Short
tt0000018       short   Das boxende Känguruh    Das boxende Känguruh    0       1895    \N      1       Short
tt0000019       short   The Clown Barber        The Clown Barber        0       1898    \N      \N      Comedy,Short
tt0000020       short   The Derby 1895  The Derby 1895  0       1895    \N      1       Documentary,Short,Sport
tt0000022       short   Blacksmith Scene        Les forgerons   0       1895    \N      1       Documentary,Short
tt0000023       short   The Sea Baignade en mer 0       1895    \N      1       Documentary,Short
tt0000024       short   Opening of the Kiel Canal       Opening of the Kiel Canal       0       1895    \N      \N      News,Short
tt0000025       short   The Oxford and Cambridge University Boat Race   The Oxford and Cambridge University Boat Race   0       1895    \N      \N      News,Short,Sport
tt0000026       short   The Messers. Lumière at Cards   Partie d'écarté 0       1896    \N      1       Documentary,Short
tt0000027       short   Cordeliers' Square in Lyon      Place des Cordeliers à Lyon     0       1895    \N      1       Documentary,Short
tt0000028       short   Fishing for Goldfish    La pêche aux poissons rouges    0       1895    \N      1       Documentary,Short
tt0000029       short   Baby's Dinner   Repas de bébé   0       1895    \N      1       Documentary,Short
tt0000030       short   Rough Sea at Dover      Rough Sea at Dover      0       1895    \N      1       Documentary,Short
```

Create External Tables In Hive

6. Create External Table **`title_basics`** for file *title.basics.tsv* in Hive:

```
hive > CREATE EXTERNAL TABLE IF NOT EXISTS title_basics (
        tconst STRING,
        title_type STRING,
        primary_title STRING,
        original_title STRING,
        is_adult DECIMAL(1,0),
        start_year DECIMAL(4,0),
        end_year STRING,
        runtime_minutes INT,
        genres STRING
) COMMENT 'IMDb Movies' ROW FORMAT DELIMITED FIELDS TERMINATED BY
'\t' STORED AS TEXTFILE LOCATION '/user/hadoop/imdb/title_basics'
TBLPROPERTIES ('skip.header.line.count'='1');
```

Create External Tables In Hive

7. Query Table `title_basics` in Hive using SQL (HiveQL):

```
hive> select * from title_basics limit 3;
OK
tt0000001 short Carmencita Carmencita 0 1894 NULL 1 Documentary,Short
tt0000002 short Le clown et ses chiens Le clown et ses chiens 0 1892 NULL 5 Animation,Short
tt0000003 short Pauvre Pierrot Pauvre Pierrot 0 1892 NULL 4 Animation,Comedy,Romance
Time taken: 0.139 seconds, Fetched: 5 row(s)
hive>
```

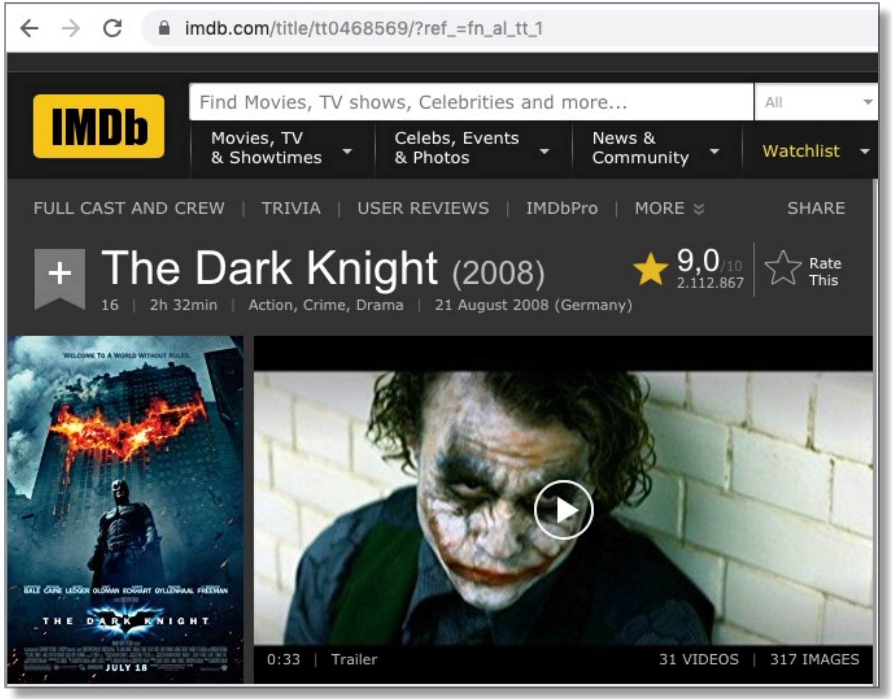
8. Query Table `title_ratings` in Hive using SQL (HiveQL):

```
hive> select * from title_ratings limit 3;
OK
tt0000001 5.6 1540
tt0000002 6.1 186
tt0000003 6.5 1199
Time taken: 0.119 seconds, Fetched: 3 row(s)
hive>
```

Create External Tables In Hive

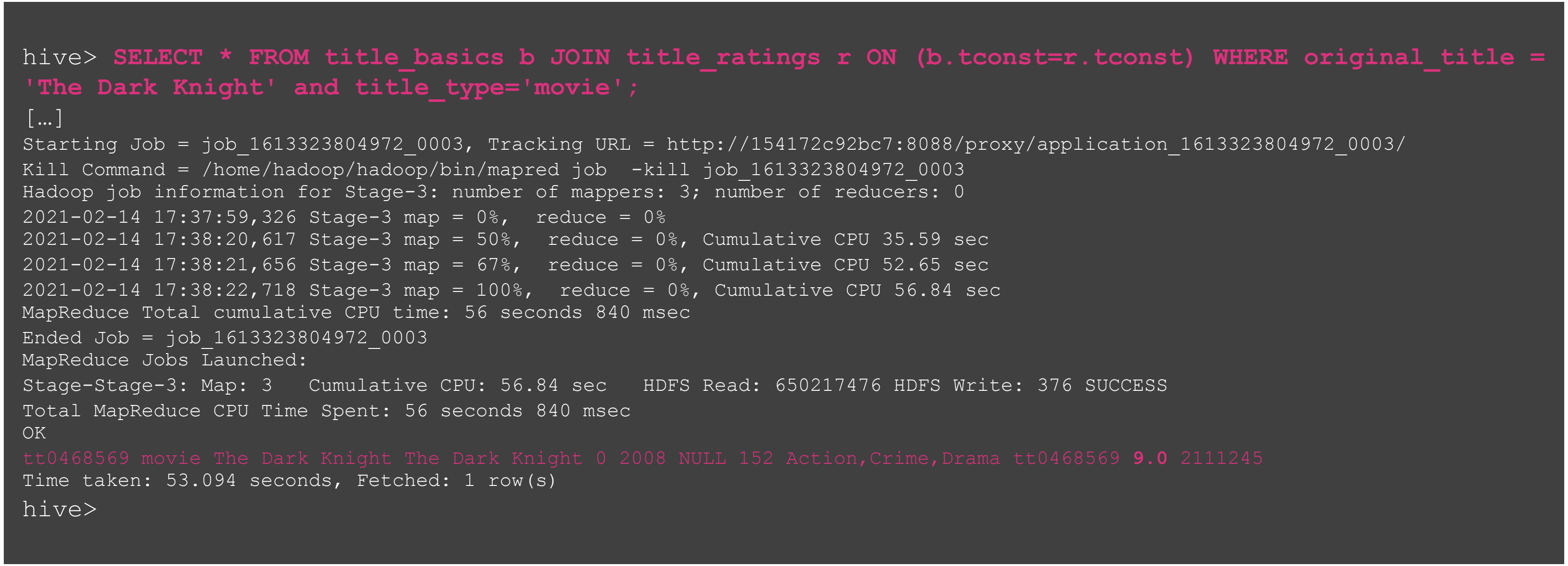
9. Run a complex query which starts a MapReduce Job on Yarn, e.g. get Rating of movie „*The Dark Knight*“:

```
SELECT
   *
FROM
   title_basics b
   JOIN title_ratings r ON (b.tconst=r.tconst)
WHERE
   original_title = 'The Dark Knight'
   AND title_type='movie';
```


imdb.com/title/tt0468569/?ref_=fn_al_tt_1
IMDb
Find Movies, TV shows, Celebrities and more...
All
Movies, TV & Showtimes
Celebs, Events & Photos
News & Community
Watchlist
FULL CAST AND CREW | TRIVIA | USER REVIEWS | IMDbPro | MORE
SHARE
The Dark Knight (2008)
16 | 2h 32min | Action, Crime, Drama | 21 August 2008 (Germany)
9,0/10
2.112.867
Rate This
WELCOME TO A WORLD WITHOUT RULES.
BALE CAINE LEDGER OLDMAN ECKHART GYLLENHAAL FREEMAN
THE DARK KNIGHT
JULY 18
0:33 | Trailer
31 VIDEOS | 317 IMAGES

Create External Tables In Hive

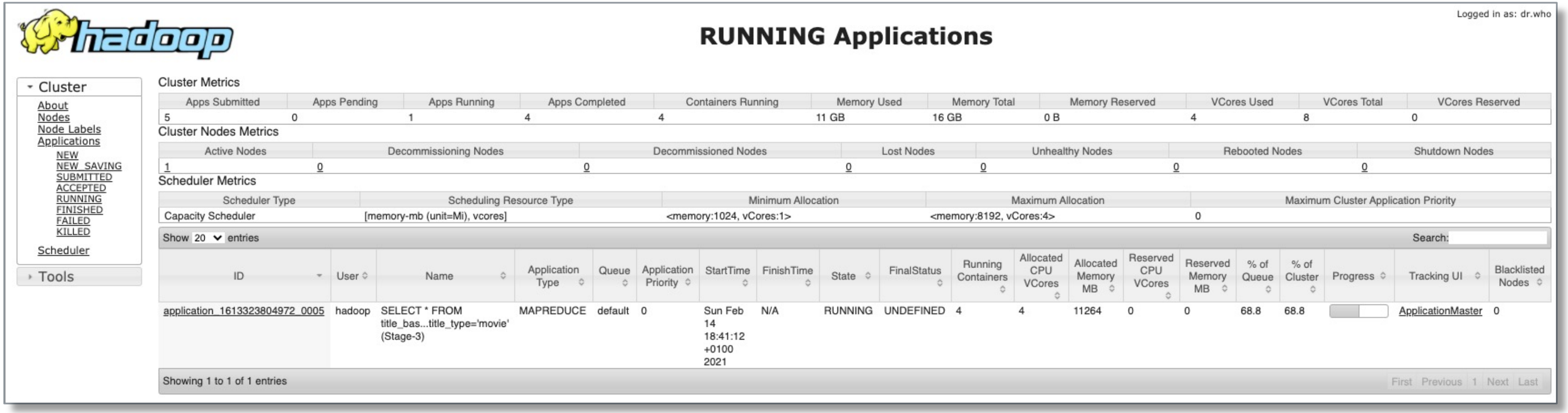
9. Execute Query



```
hive> SELECT * FROM title_basics b JOIN title_ratings r ON (b.tconst=r.tconst) WHERE original_title =
'The Dark Knight' and title_type='movie';
[…]
Starting Job = job_1613323804972_0003, Tracking URL = http://154172c92bc7:8088/proxy/application_1613323804972_0003/
Kill Command = /home/hadoop/hadoop/bin/mapred job  -kill job_1613323804972_0003
Hadoop job information for Stage-3: number of mappers: 3; number of reducers: 0
2021-02-14 17:37:59,326 Stage-3 map = 0%,  reduce = 0%
2021-02-14 17:38:20,617 Stage-3 map = 50%,  reduce = 0%, Cumulative CPU 35.59 sec
2021-02-14 17:38:21,656 Stage-3 map = 67%,  reduce = 0%, Cumulative CPU 52.65 sec
2021-02-14 17:38:22,718 Stage-3 map = 100%,  reduce = 0%, Cumulative CPU 56.84 sec
MapReduce Total cumulative CPU time: 56 seconds 840 msec
Ended Job = job_1613323804972_0003
MapReduce Jobs Launched:
Stage-Stage-3: Map: 3   Cumulative CPU: 56.84 sec   HDFS Read: 650217476 HDFS Write: 376 SUCCESS
Total MapReduce CPU Time Spent: 56 seconds 840 msec
OK
tt0468569 movie The Dark Knight The Dark Knight 0 2008 NULL 152 Action,Crime,Drama tt0468569 9.0 2111245
Time taken: 53.094 seconds, Fetched: 1 row(s)
hive>
```

Create External Tables In Hive

9. Take a look at YARN (http://XXX.XXX.XXX.XXX:8088/cluster/):



RUNNING Applications

Cluster Metrics

Apps Submitted	Apps Pending	Apps Running	Apps Completed	Containers Running	Memory Used	Memory Total	Memory Reserved	VCores Used	VCores Total	VCores Reserved
5	0	1	4	4	11 GB	16 GB	0 B	4	8	0

Cluster Nodes Metrics

Active Nodes	Decommissioning Nodes	Decommissioned Nodes	Lost Nodes	Unhealthy Nodes	Rebooted Nodes	Shutdown Nodes
1	0	0	0	0	0	0

Scheduler Metrics

Scheduler Type	Scheduling Resource Type	Minimum Allocation	Maximum Allocation	Maximum Cluster Application Priority
Capacity Scheduler	[memory-mb (unit=Mi), vcores]	<memory:1024, vCores:1>	<memory:8192, vCores:4>	0

Show 20 entries

Search:

ID	User	Name	Application Type	Queue	Application Priority	StartTime	FinishTime	State	FinalStatus	Running Containers	Allocated CPU VCores	Allocated Memory MB	Reserved CPU VCores	Reserved Memory MB	% of Queue	% of Cluster	Progress	Tracking UI	Blacklisted Nodes
application_1613323804972_0005	hadoop	SELECT * FROM title_bas...title_type='movie' (Stage-3)	MAPREDUCE	default	0	Sun Feb 14 18:41:12 +0100 2021	N/A	RUNNING	UNDEFINED	4	4	11264	0	0	68.8	68.8		ApplicationMaster	0

Showing 1 to 1 of 1 entries

First Previous 1 Next Last

Break

TIME FOR

A

BREAK

Exercises

Hive: Create and Work with External Tables

HDFS and HiveQL Exercises - **IMDB**

1. Execute Tasks of previous HandsOn Slides

2. Download https://datasets.imdbws.com/name.basics.tsv.gz

3. Create HDFS Directory **/user/hadoop/imdb/name_basics**/ for file name.basics.tsv

4. Create External Hive Table **`name_basics`** for name.basics.tsv

5. Use HiveQL to answer following questions:
   a) How many **movies** and how many **TV series** are within the IMDB dataset?
   b) Who is the **youngest** actor/writer/… within the dataset?
   c) Create a list (`tconst, original_title, start_year, average_rating, num_votes`) of movies which are:
   - equal or newer than year 2010
   - have an average rating equal or better than 8,1
   - have been voted more than 100.000 times
   d) How many movies are in list of c)?

HDFS and HiveQL Exercises - **IMDB**

5. Use HiveQL to answer following questions:

e) We want to know which years have been great for cinema.
Create a list with one row per year and a related count of movies which:
- have an average rating better than 8
- have been voted more than 100.000 times
ordered descending by count of movies.

Stop Your VM Instances

DON'T FORGET TO STOP YOUR VM INSTANCE!

```
gcloud compute instances stop big-data
```