Introduction To Hive

How to use Hive in Amazon EC2

CS 341: Project in Mining Massive Data Sets
Hyung Jin(Evion) Kim
Stanford University

References:
Cloudera Tutorials,
CS345a session slides,
"Hadoop - The Definitive Guide"
Roshan Sumbaly, LinkedIn

Todays Session

- Framework: Hadoop/Hive
- Computing Power: Amazon Web Service
- Demo
- LinkedIn's frameworks & project ideas

Hadoop

- Collection of related sub projects for distributed computing
- Open source
- Core, Avro, **MapReduce**, HDFS, Pig, HBase, ZooKeeper, **Hive**, Chukwa ...

Hive

- Data warehousing tool on top of Hadoop
- Built at Facebook
- 3 Parts
  - Metastore over Hadoop
  - Libraries for (De)Serialization
  - Query Engine(HQL)

AWS - Amazon Web Service

- S3 - Data Storage
- EC2 - Computing Power
- Elastic Map Reduce

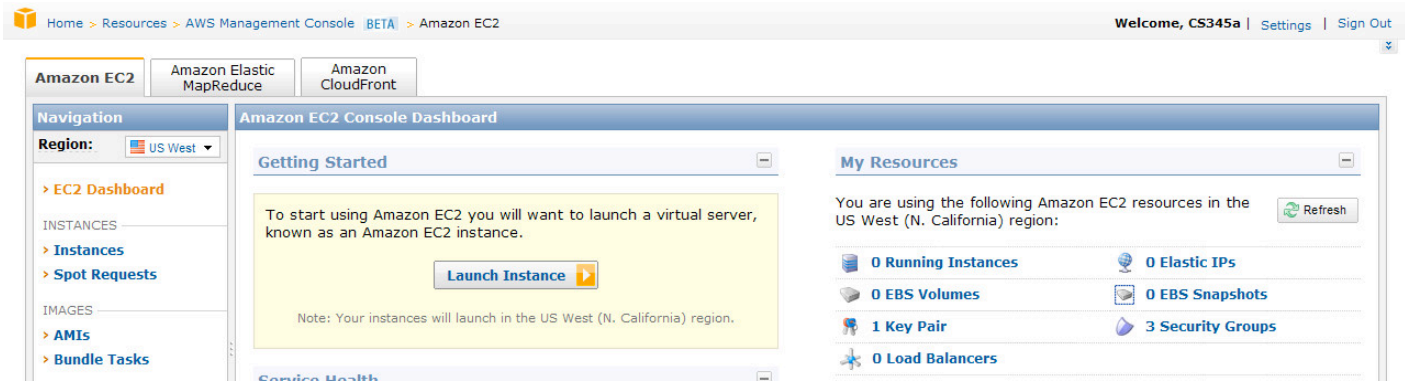
Step by step

- Prepare Security Keys
- Upload your input files to S3
- Turn on elastic Map-Reduce job flow
- Log in to job flow
- HiveQL with custom mapper/reducer

0. Prepare Security Key

- AWS: Access Key / Private Key

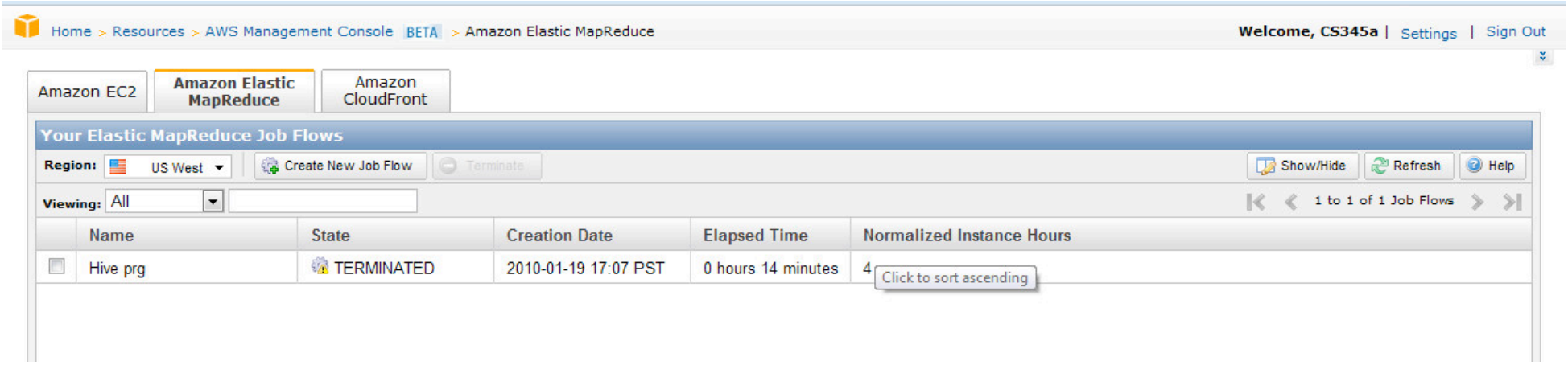
- EC2: Key Pair - Key name and Key file(.pem)



1. Upload files to S3

- Data stored in buckets(folders)
- This is your only permanent storage in AWS - save input, output here
- Use Firefox Add-on S3Fox Organizer (http://www.s3fox.net)

2. Turn Elastic MapReduce On



3. Connect to Job Flow (1)

- Using Amazon Elastic MapReduce Client
- http://developer.amazonwebservices.com/connect/entry.jspa?externalID=2264
- Need Ruby installed on your computer

3.Connect to Job flow (2) - security

- Place credentials.json and .pem file in Amazon Elastic MapReduce Client folder, to avoid type things again and again
- {

```
"access-id":      "<access-id>",
"private-key":    "<private-key>",
"key-pair":       "new-key",
"key-pair-file":  "./new-key.pem",
"region":         "us-west-1",
```

}

3. Connect to Job Flow (3)

- **list jobflows:**
  elastic-mapreduce --list
- **terminate job flow:**
  elastic-mapreduce --terminate --jobflow <id>
- **SSH to master:**
  elastic-mapreduce --ssh <id>

4.HiveQL(1)

- SQL like language
- Hive WIKI
  http://wiki.apache.org/hadoop/Hive/GettingStarted
- Cloudera Hive Tutorial
  http://www.cloudera.com/hadoop-training-hiveintroduction

4.HiveQL(2)

- SQL like Queries
  - SHOW TABLES, DESCRIBE, DROP TABLE
  - CREATE TABLE, ALTER TABLE
  - SELECT, INSERT

4.HiveQL(3)- usage

- Create a schema around data: CREATE EXTERNAL TABLE
- Use like regular SQL: Hive automatically change SQL query to map/reduce
- Use with custom mapper/reducer: Any executable program with stdin/stdout.

Example - problem

- Basic map reduce example - count frequencies of each word!

  ‘I’ - 3
  ‘data’ - 2
  ‘mining’ - 2
  ‘awesome’ - 1
  ...

Example - Input

- Input: 270 twitter tweets
- sample_tweets.txt

  T 2009-06-08 21:49:37
  U http://twitter.com/evion
  W I think data mining is awesome!

  T 2009-06-08 21:49:37
  U http://twitter.com/hyungjin
  W I don't think so. I don't like data mining

Example - How?

- **Create table from raw data file**
  table raw_tweets
- **Parse data file to match our format, and save to new table**
  parser.py
  table tweets_test_parsed
- **Run map/reduce**
  mappr.py, reducer.py
- **Save result to new table**
  table word_count
- **Find top 10 most frequent words from word_count table.**

Example-Create Input Table

Create Schema around raw data file

```
CREATE EXTERNAL TABLE
raw_tweets(line string)
ROW FORMAT DELIMITED
LOCATION 's3://cs341/test-tweets';
```

With this command, '\t' will be separator among columns, and '\n' will be separator among rows.

Example -Create Output Table

```
CREATE EXTERNAL TABLE tweets_parsed
(time string, id string, tweet string)
ROW FORMAT DELIMITED
LOCATION 's3://cs341/tweets_parsed';

CREATE EXTERNAL TABLE word_count
(word string, count int)
ROW FORMAT DELIMITED
LOCATION 's3://cs341/word_count';
```

Example - TRANSFORM

TRANSFORM - given python script will transform the input columns
Let's parse original file to <time>, <id>, <tweet>

```
ADD FILE parser.py;

INSERT OVERWRITE TABLE tweets_parsed
SELECT TRANSFORM(line)
USING 'python parser.py' AS (time, id, tweet)
FROM raw_tweets;
```

Add whatever the script file you want to use to hive first.

Write out result of this select to tweets_parsed table

Example - Map/Reduce

Use command MAP and REDUCE: Basically, same as TRANSFOM
tweets_parsed -> map_output -> word_count

```
ADD FILE mapper.py;
ADD FILE reducer.py;


FROM (
    FROM tweets_parsed
    MAP tweets_parsed.time, tweets_parsed.id, tweets_parsed.tweet
    USING 'python mapper.py'
    AS word, count
    CLUSTER BY word) map_output
INSERT OVERWRITE TABLE word_count
    REDUCE map_output.word, map_output.count
    USING 'python reducer.py'
    AS word, count;
```

Use word as key

Example - Finding Top 10 Words

Using similar syntax as SQL

```
SELECT word, count FROM word_count
ORDER BY count DESC limit 10;
```

Example -JOIN

Finding pairs of words that have same count, and count bigger than 5

```
SELECT wc1.word, wc2.word, wc2.count
FROM word_count wc1 JOIN word_count wc2
ON(wc1.count = wc2.count)
WHERE wc1.count > 5  AND wc1.word < wc2.word;
```

Frameworks from LinkedIn

- Complete "data stack" from LinkedIn open source @ http://sna-projects.com
- Any questions - rsumbaly@linkedin.com
- Introduce "Kafka" and "Azkaban" today.

Kafka(1)

- Distributed publish/ subscribe system
- Used at LinkedIn for tracking activity events
- http://sna-projects.com/kafka/

Kafka(2)

- Parsing data in files every time you want to run an algorithm is tedius
- What would be ideal? An iterator over your data(hiding all the underneath semantics)
- Kafka helps you publish data once(or continuously) to this system and then consume it as a “stream”.

Kafka(3)

- Example: Easy for implementing stream algorithms on top of Twitter stream

Azkaban(1)

- A simple Hadoop workflow system
- Used at LinkedIn to generate wokflows for recommendation features
- Last year many students wanted to iterate on their algorithms multiple times. This required them to build a chain of Hadoop jobs which they ran manually every day.

Azkaban(2)

- Example workflow
  - Generate n-grams as a Java program
    -> Feed n-grams to MR Algorithms X run on Hadoop
    -> Fork n parallel MR jobs to feed this to Algorithm X_1 to X_n
    -> Compare the results at the end
- http://sna-projects.com/azkaban