TP 1

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M2 D&K Big Data Processing

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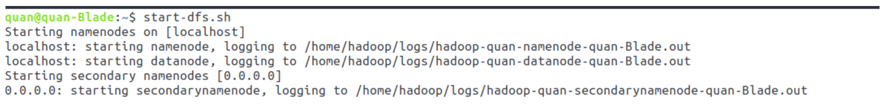
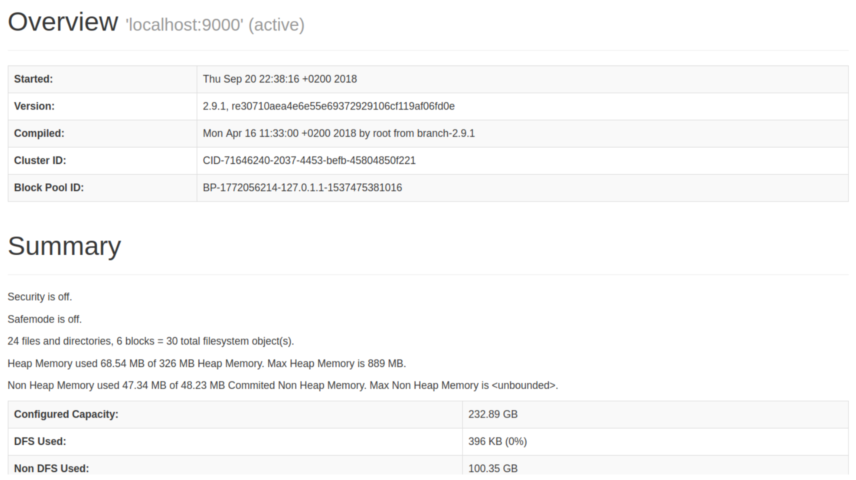
1 Intall Hadoop with Pseudo-Distributed Mode

In this tp, I successfully install Hadoop in Pseudo-Distributed Operation mode and YARN. Following is the images of HDFS and YARN.



```
quan@quan-Blade:~$ start-dfs.sh
Starting namenodes on [localhost]
localhost: starting namenode, logging to /home/hadoop/logs/hadoop-quan-namenode-quan-Blade.out
localhost: starting datanode, logging to /home/hadoop/logs/hadoop-quan-datanode-quan-Blade.out
Starting secondary namenodes [0.0.0.0]
0.0.0.0: starting secondarynamenode, logging to /home/hadoop/logs/hadoop-quan-secondarynamenode-quan-Blade.out
```

Figure 1: Run the start-dfs.sh script to run the HDFS



Overview 'localhost:9000' (active)

Started:	Thu Sep 20 22:38:16 +0200 2018
Version:	2.9.1, re30710aea4e6e55e69372929106cf119af06fd0e
Compiled:	Mon Apr 16 11:33:00 +0200 2018 by root from branch-2.9.1
Cluster ID:	CID-71646240-2037-4453-befb-45804850f221
Block Pool ID:	BP-1772056214-127.0.1.1-1537475381016

Summary

Security is off.

Safemode is off.

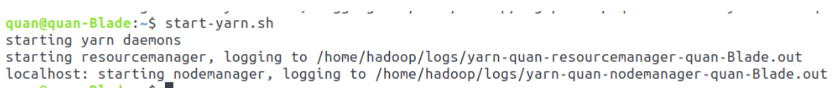
24 files and directories, 6 blocks = 30 total filesystem object(s).

Heap Memory used 68.54 MB of 326 MB Heap Memory. Max Heap Memory is 889 MB.

Non Heap Memory used 47.34 MB of 48.23 MB Commited Non Heap Memory. Max Non Heap Memory is <unbounded>.

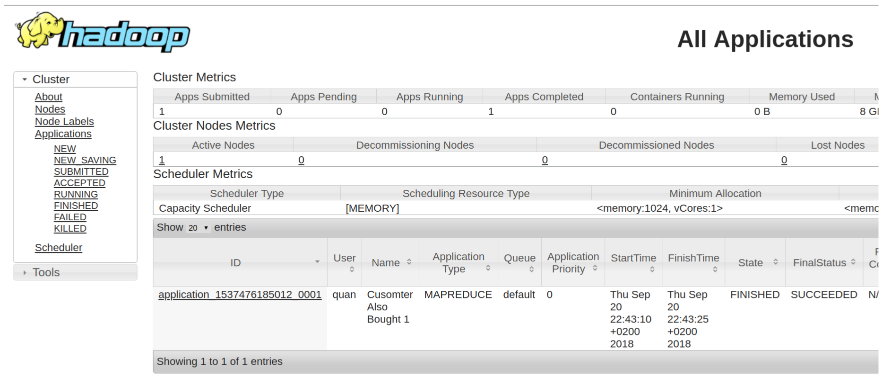
Configured Capacity:	232.89 GB
DFS Used:	396 KB (0%)
Non DFS Used:	100.35 GB

Figure 2: HDFS's web interface



```
quan@quan-Blade:~$ start-yarn.sh
starting yarn daemons
starting resourcemanager, logging to /home/hadoop/logs/yarn-quan-resourcemanager-quan-Blade.out
localhost: starting nodemanager, logging to /home/hadoop/logs/yarn-quan-nodemanager-quan-Blade.out
```

Figure 3: Run the start-yarn.sh script to run the YARN



Cluster Metrics

Apps Submitted	Apps Pending	Apps Running	Apps Completed	Containers Running	Memory Used	M
1	0	0	1	0	0 B	8 G

Cluster Nodes Metrics

Active Nodes	Decommissioning Nodes	Decommissioned Nodes	Lost Nodes
1	0	0	0

Scheduler Metrics

Scheduler Type	Scheduling Resource Type	Minimum Allocation	
Capacity Scheduler	[MEMORY]	<memory:1024, vCores:1>	<memo

Show 20 entries

ID	User	Name	Application Type	Queue	Application Priority	StartTime	FinishTime	State	FinalStatus	F C
application_1537476185012_0001	quan	Cusomter Also Bought 1	MAPREDUCE	default	0	Thu Sep 20 22:43:10 +0200 2018	Thu Sep 20 22:43:25 +0200 2018	FINISHED	SUCCEEDED	N/

Showing 1 to 1 of 1 entries

Figure 4: YARN's web interface

2 Solving "Customers who bought this item also bought" exercise using Hadoop

2.1 Code files structure

- folder **src**: contains the Java codes
  - *CustomerAlsoBoughtWithCombiner.java*: Hadoop application with *Mapper*, *Reducer* and *Combiner*
  - *CustomerAlsoBoughtWithoutCombiner.java*: Hadoop application with only *Mapper* and *Reducer*
  - *RandomData.java*: Generate *input* data for the hadoop program
- folder **test result**: Contains some example results of the Hadoop application including the input from slide and one random generated input.
- file **cab.jar**: jar file for submitting to the hadoop cluster.

2.2 How to run the program

1. Run the DFS (Distributed File System) and YARN:

```
start-dfs.sh
start-yarn.sh
```

2. Put the input file into the HDFS:

```
hdfs dfs -put input input
```

3. Run the Hadoop application without Combiner

```
hadoop jar cab.jar CustomerAlsoBoughtWithoutCombiner input output
```

4. Run the Hadoop application with Combiner

   ```
   hadoop jar cab.jar CustomerAlsoBoughtWithCombiner input output
   ```

5. Download the output from HDFS:

   ```
   hdfs dfs -get output
   ```

2.3 MapReduce Solution

I implement the exercise with *2 solutions*:

1. Hadoop application with *Mapper*, *Reducer*:

   - **Map function**:

     ```
     function MAP(docid a, doc d)
         items ← split d into list of item
         for all item1 ∈ items do
             for all item2 ∈ emphitems do
                 if item1 ! = item2 then
                     Emit(item1, item2)
                     Emit(item2, item1)
                 end if
             end for
         end for
     ```

   - **Reducer function**:

     ```
     function REDUCE(item item, list of item items)
         map ← put items into a map of key-value pairs: <item, number of occurences>
         SortedMap ← Sort the map by value (number of occurents) in descending
     order
         Emit(item, SortedMap)
     ```

2. Hadoop application with *Mapper*, *Combiner* and *Reducer*:

   - Mapper and Reducer are similar.
   - Combiner is the Reducer function without sorting the *map*

2.4 Result

Some test results:

1. Input from slides:

   - input:

     ```
     book12 book34 cd12 cd42 dvd32
     book32 book34 dvd32
     ```

- output:

```
book12  (cd42, 1) (book34, 1) (dvd32, 1) (cd12, 1)
book32  (book34, 1) (dvd32, 1)
book34  (dvd32, 2) (cd42, 1) (book12, 1) (book32, 1) (cd12, 1)
cd12    (book34, 1) (cd42, 1) (book12, 1) (dvd32, 1)
cd42    (book34, 1) (book12, 1) (dvd32, 1) (cd12, 1)
dvd32   (book34, 2) (cd42, 1) (book12, 1) (book32, 1) (cd12, 1)
```

2. A random generated input:

   - input:

```
book0 dvd3 hat4 car1 cd2 cake5 hat4
car1 book0 cd2 cake5 car1 car1 hat4
hat4 hat4 cake5 dvd3 car1 car1
hat4 cd2 cd2 cd2 cake5 hat4 book0
dvd3 dvd3 hat4 car1 dvd3
hat4 cake5 cd2 hat4 cake5 cd2 hat4
cd2 car1 cake5 car1 car1
hat4 cd2 hat4 cake5 car1 cake5 cd2
dvd3 cake5 cake5 cd2 dvd3
cd2 car1 car1 cake5 car1
hat4 car1 car1 book0 car1 cd2 dvd3 cake5
hat4 cd2 hat4 cd2 cake5
hat4 dvd3 car1 cake5 cd2 car1 cake5
cd2 cake5 hat4 cake5 cd2
cd2 car1 dvd3 hat4 hat4 hat4 hat4
```

   - output:

```
book0   (car1, 7) (cd2, 6) (hat4, 6) (cake5, 4) (dvd3, 2)
cake5   (cd2, 26) (hat4, 24) (car1, 21) (dvd3, 9) (book0, 4)
car1    (hat4, 21) (cake5, 21) (cd2, 18) (dvd3, 12) (book0, 7)
cd2     (hat4, 31) (cake5, 26) (car1, 18) (dvd3, 6) (book0, 6)
dvd3    (hat4, 13) (car1, 12) (cake5, 9) (cd2, 6) (book0, 2)
hat4    (cd2, 31) (cake5, 24) (car1, 21) (dvd3, 13) (book0, 6)
```