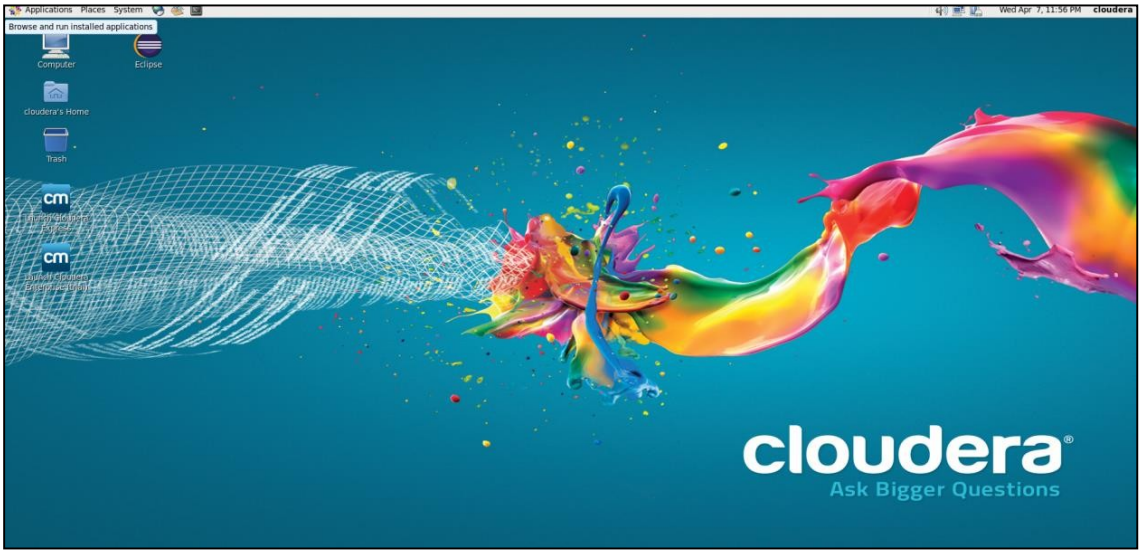
MapReduce for Frequent Itemset Mining:

Let's solve a frequent itemset mining problem using MapReduce.

Step 1: Open Cloudera Quickstart VM



Step 2: Clone the following repository on your local machine.

www.github.com/NSTiwari/Hadoop-MapReduce-Programs

You'll find the **`Frequent-Itemset-Mining`** folder along with some other folders. The **`Frequent-Itemset-Mining`** directory contains three files –

- **`frequent_itemset_data.txt`** – The text data file that contains transactions.
- **`frequent_itemset_mapper.py`** – The mapper file for Frequent Itemset Mining.
- **`frequent_itemset_reducer.py`** – The reducer file for Frequent Itemset Mining.

frequent_itemset_data.txt

```
apple   orange  grapes
apple   mango
orange  apple   chickoo
apple   grapes  orange
milk    butter
butter  cheese
bread   milk    butter
cheese  bread   butter  milk
cheese  apple   orange
```

frequent_itemset_mapper.py:

```
#!/usr/bin/env python

import sys
import re

# input comes from STDIN (standard input)

for line in sys.stdin:
     # remove leading and trailing whitespace
     line = line.strip()

     # split the line into digits
     words = re.findall(r'\w+', line)

     lst = []
     for i in words:
          lst.append(i)    #lst contains items in each transaction

    for item1 in words:
         for item2 in lst:
             if item1!=item2 and lst:
                  print('%s\t%s\t%s' % (item1, item2, 1))
#outputs frequent 2itemsets with value 1 and key=item1, item2

        lst.pop(0)
```

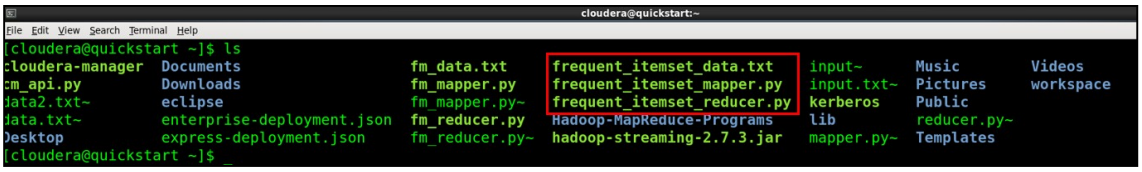
frequent_itemset_reducer.py:

```
#!/usr/bin/env python

import sys
item1 = None
item2 = None
current_count = 0

# input comes from STDIN

for line in sys.stdin:
     # remove leading and trailing whitespace
     line = line.strip()

     # parse the input we got from mapper.py
     key1, key2, count = line.split('\t', 2)
     # print(key1, key2, count)

    # convert count (currently a string) to int

   try:
        count = int(count)
   except ValueError:
        # count was not a number, ignore
        continue


   if item1 == key1 and item2 == key2:
        current_count += count
   else:
        if item1!=None and item2!=None and current_count>=2:
```

```
        # output as a frequent 2 itemset if support>2
             print('%s\t%s' % (item1, item2))

        current_count = count
        item1 = key1
        item2 = key2


# last itemset

if item1 == key1 and item2 == key2 and current_count>=2:
     print('%s\t%s' % (item1, item2))
```

Copy these three files inside **/home/cloudera** directory. Once done, confirm their presence.

ls



All three files are present.

Step 3: Test MapReduce program locally.

Now that we have the input data file of transactions and the mapper, reducer files, let's test them locally to see if the program is correct.

Just run the mapper file on the input data.

cat frequent_itemset_data.txt | python frequent_itemset_mapper.py | sort

```
[cloudera@quickstart ~]$ cat frequent_itemset_data.txt | python frequent_itemset_mapper.py | sort
apple   chickoo 1
apple   grapes  1
apple   grapes  1
apple   mango   1
apple   orange  1
apple   orange  1
apple   orange  1
bread   butter  1
bread   butter  1
bread   milk    1
bread   milk    1
butter  cheese  1
butter  milk    1
cheese  apple   1
cheese  bread   1
cheese  butter  1
cheese  milk    1
cheese  orange  1
grapes  orange  1
milk    butter  1
milk    butter  1
orange  apple   1
orange  chickoo 1
orange  grapes  1
```

As you can see, for each transaction, all possible pairs of items have been created, mapped with count 1 each and then sorted in lexicographical order.

So far, so good. Now let's run the complete MapReduce program.

cat frequent_itemset_data.txt | python frequent_itemset_mapper.py | sort | python frequent_itemset_reducer.py

```
[cloudera@quickstart ~]$ cat frequent_itemset_data.txt | python frequent_itemset_mapper.py | sort | python frequent_itemset_reducer.py
apple   grapes
apple   orange
bread   butter
bread   milk
milk    butter
```

And here we go. These are the pair of items that are frequently bought for minimum support of 2.

Results obtained are as expected. Now we can run this on Hadoop.

Step 4: Create a directory on HDFS.

sudo -u hdfs hadoop fs -mkdir /frequent_itemset
hdfs dfs -ls /

```
cloudera@quickstart:~
File  Edit  View  Search  Terminal  Help
[cloudera@quickstart ~]$ sudo -u hdfs hadoop fs -mkdir /frequent_itemset
[cloudera@quickstart ~]$ hdfs dfs -ls /
Found 7 items
drwxr-xr-x   - cloudera supergroup          0 2021-04-06 01:49 /flajolet_martin
drwxr-xr-x   - hdfs     supergroup          0 2021-04-08 00:53 /frequent_itemset
drwxr-xr-x   - hbase    supergroup          0 2021-04-05 06:21 /hbase
drwxr-xr-x   - solr     solr                0 2015-06-09 03:38 /solr
drwxrwxrwx   - hdfs     supergroup          0 2021-04-05 06:45 /tmp
drwxr-xr-x   - hdfs     supergroup          0 2021-04-05 07:36 /user
drwxr-xr-x   - hdfs     supergroup          0 2015-06-09 03:36 /var
```

Step 5: Copy input file to HDFS.

sudo -u hdfs hadoop fs -put /home/cloudera/frequent_itemset_data.txt /frequent_itemset
hdfs dfs -ls /frequent_itemset

```
[cloudera@quickstart ~]$ sudo -u hdfs hadoop fs -put /home/cloudera/frequent_itemset_data.txt /frequent_itemset
[cloudera@quickstart ~]$ hdfs dfs -ls /frequent_itemset
Found 1 items
-rw-r--r--   1 hdfs supergroup        169 2021-04-08 00:56 /frequent_itemset/frequent_itemset_data.txt
[cloudera@quickstart ~]$
```

The input file is copied successfully inside **`frequent_itemset`** directory on HDFS.

Step 6: Configure permissions to run MapReduce for Frequent Itemset Mining on Hadoop.

Now, we have to provide permission to read, write and execute the MapReduce program before the MapReduce job is executed on Hadoop. We also need to provide permission for the default user (cloudera) to write the output file on HDFS.

chmod 777 frequent_itemset_mapper.py frequent_itemset_reducer.py
sudo -u hdfs hadoop fs -chown cloudera /frequent_itemset

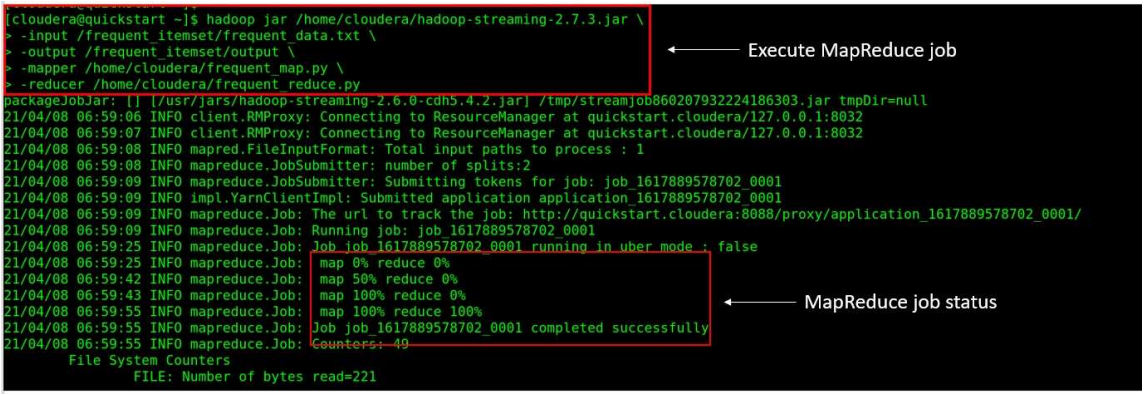
```
[cloudera@quickstart ~]$ chmod 777 frequent_itemset_mapper.py frequent_itemset_reducer.py
[cloudera@quickstart ~]$ sudo -u hdfs hadoop fs -chown cloudera /frequent_itemset
[cloudera@quickstart ~]$
```

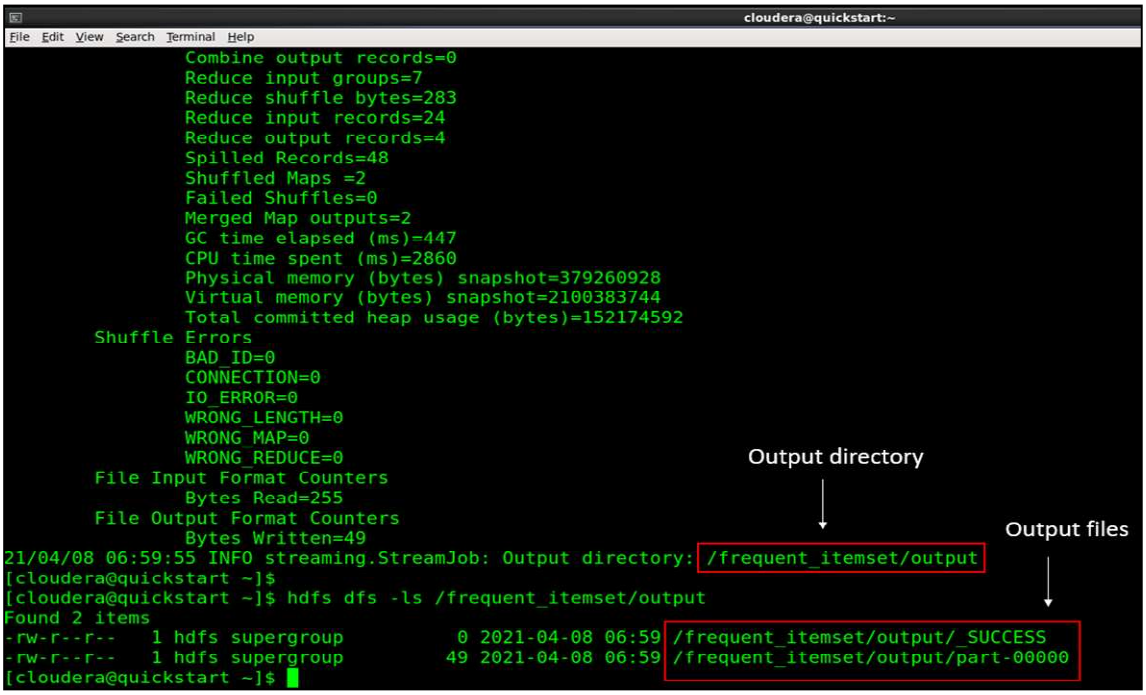
All the required permissions have now been configured. Let's now execute Hadoop streaming.

Step 7: Run MapReduce on Hadoop.

Run the following command on terminal.

```
hadoop jar /home/cloudera/hadoop-streaming-2.7.3.jar \
> -input /frequent_itemset/frequent_data.txt
> -output /frequent_itemset/output \
> -mapper /home/cloudera/frequent_map.py \
> -reducer /home/cloudera/frequent_reduce.py
```





Step 8: Read MapReduce output.

```
hdfs dfs -cat /frequent_itemset/output/part-00000
```

Here we go, the output is right here.