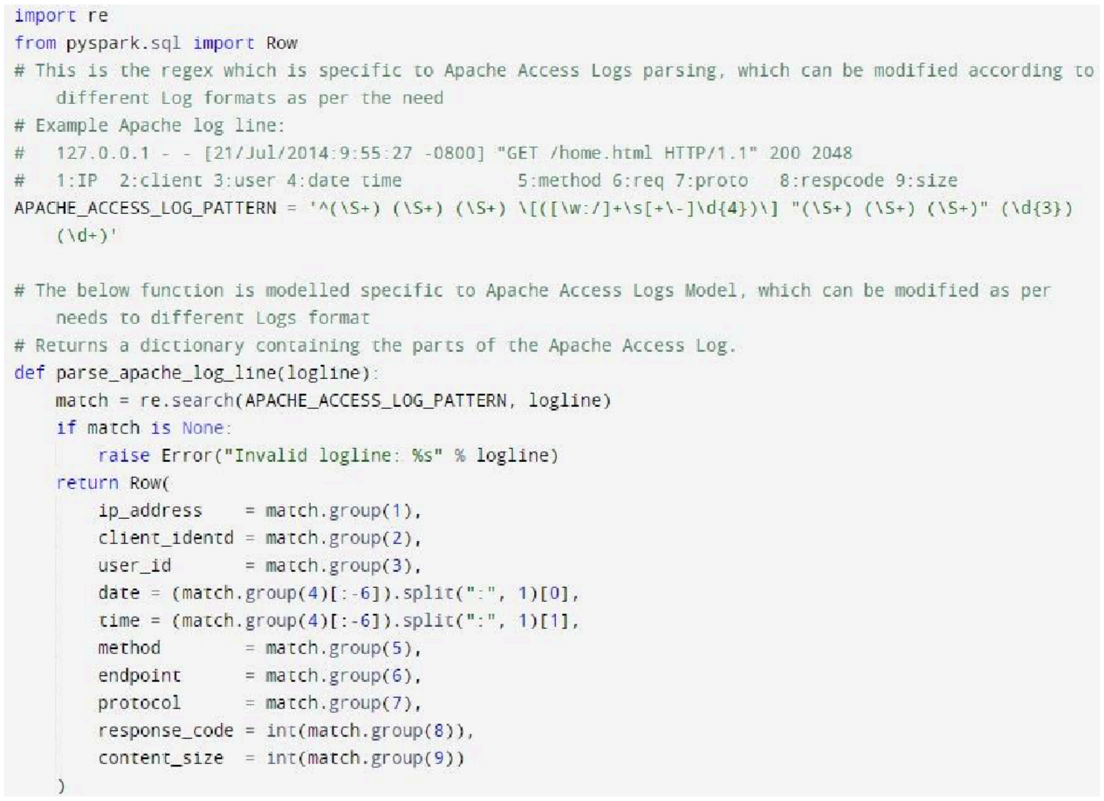
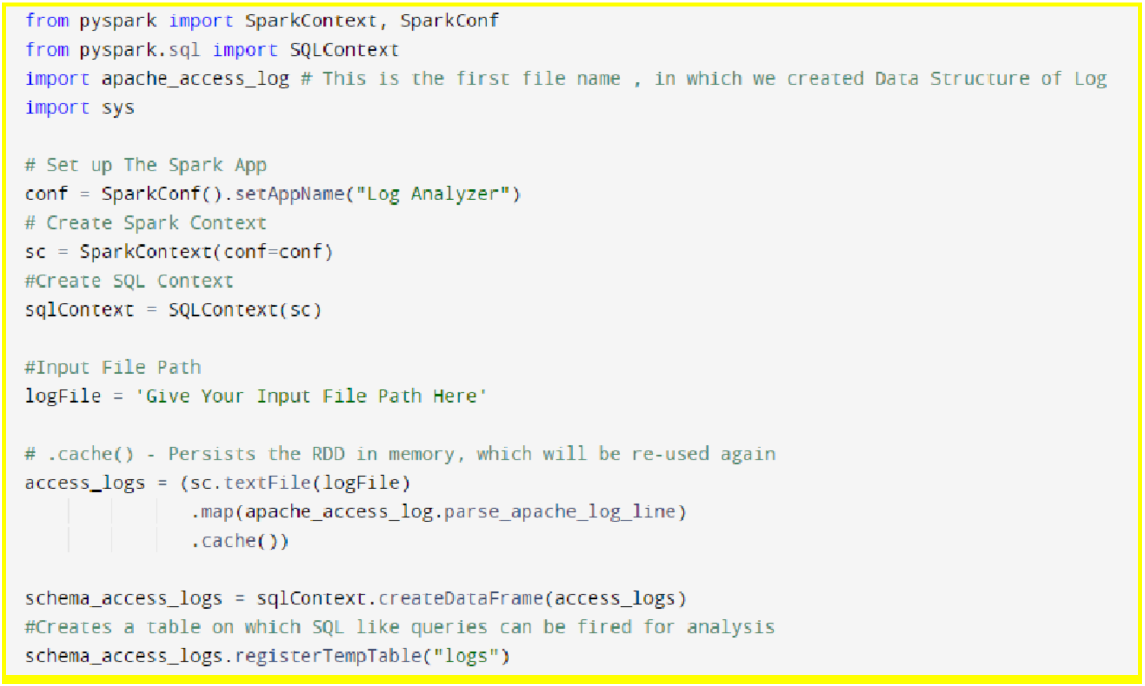


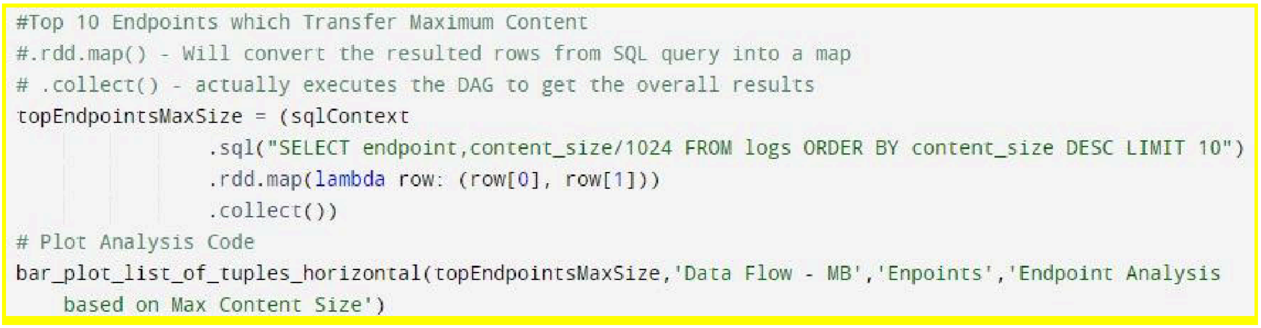
```
import re
from pyspark.sql import Row
# This is the regex which is specific to Apache Access Logs parsing, which can be modified according to
    different Log formats as per the need
# Example Apache log line:
#   127.0.0.1 - - [21/Jul/2014:9:55:27 -0800] "GET /home.html HTTP/1.1" 200 2048
#   1:IP  2:client 3:user 4:date time           5:method 6:req 7:proto   8:respcode 9:size
APACHE_ACCESS_LOG_PATTERN = '^(\S+) (\S+) (\S+) \[([\w:/]+\s[+\-]\d{4})\] "(\S+) (\S+) (\S+)" (\d{3})
    (\d+)'

# The below function is modelled specific to Apache Access Logs Model, which can be modified as per
    needs to different Logs format
# Returns a dictionary containing the parts of the Apache Access Log.
def parse_apache_log_line(logline):
    match = re.search(APACHE_ACCESS_LOG_PATTERN, logline)
    if match is None:
        raise Error("Invalid logline: %s" % logline)
    return Row(
        ip_address    = match.group(1),
        client_identd = match.group(2),
        user_id       = match.group(3),
        date = (match.group(4)[:-6]).split(":", 1)[0],
        time = (match.group(4)[:-6]).split(":", 1)[1],
        method        = match.group(5),
        endpoint      = match.group(6),
        protocol      = match.group(7),
        response_code = int(match.group(8)),
        content_size  = int(match.group(9))
    )
```

Step 2: Create Spark Context, SQL Context, DataFrame (is a distributed collection of data organized into named columns. It is conceptually equivalent to a table in a relational database)

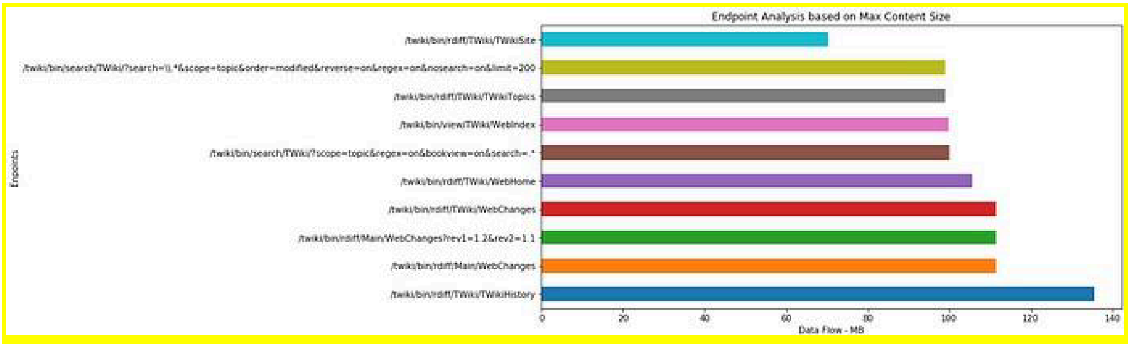


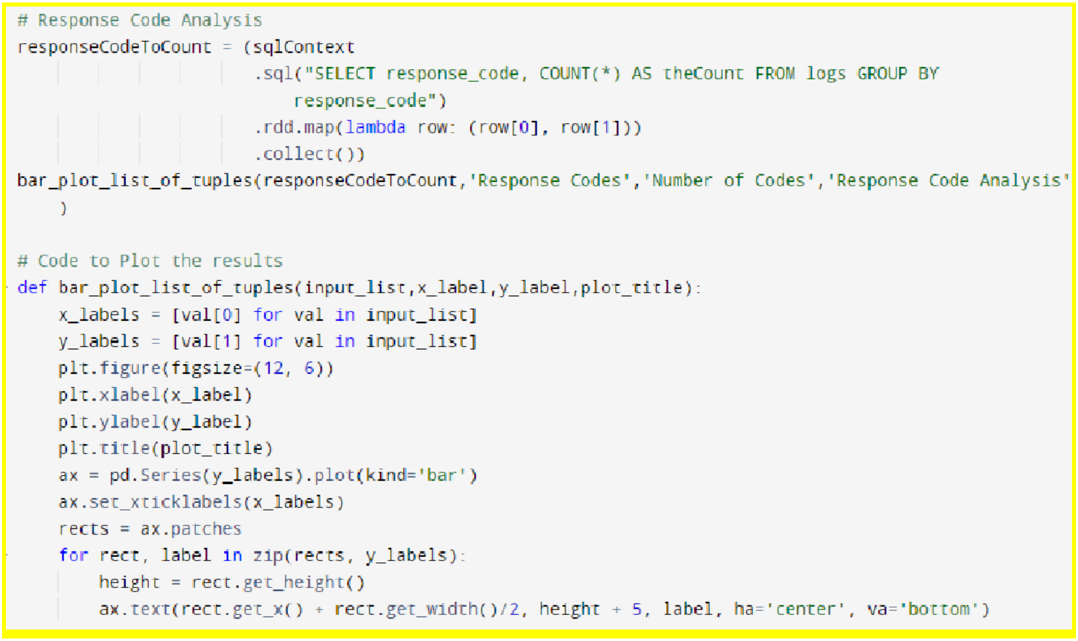
```
from pyspark import SparkContext, SparkConf
from pyspark.sql import SQLContext
import apache_access_log # This is the first file name , in which we created Data Structure of Log
import sys

# Set up The Spark App
conf = SparkConf().setAppName("Log Analyzer")
# Create Spark Context
sc = SparkContext(conf=conf)
#Create SQL Context
sqlContext = SQLContext(sc)

#Input File Path
logFile = 'Give Your Input File Path Here'

# .cache() - Persists the RDD in memory, which will be re-used again
access_logs = (sc.textFile(logFile)
               .map(apache_access_log.parse_apache_log_line)
               .cache())

schema_access_logs = sqlContext.createDataFrame(access_logs)
#Creates a table on which SQL like queries can be fired for analysis
schema_access_logs.registerTempTable("logs")
```

Step 3: Analyze Top 10 Endpoints which Transfer Maximum Content in MB

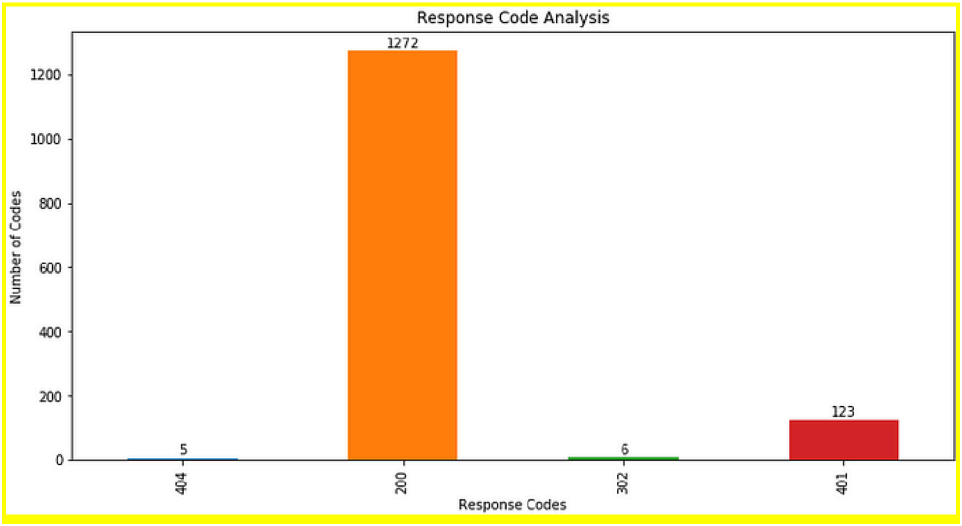


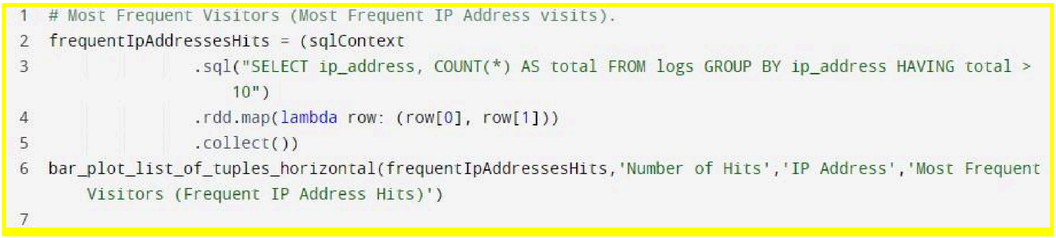
```
#Top 10 Endpoints which Transfer Maximum Content
#.rdd.map() - Will convert the resulted rows from SQL query into a map
# .collect() - actually executes the DAG to get the overall results
topEndpointsMaxSize = (sqlContext
                .sql("SELECT endpoint,content_size/1024 FROM logs ORDER BY content_size DESC LIMIT 10")
                .rdd.map(lambda row: (row[0], row[1]))
                .collect())
# Plot Analysis Code
bar_plot_list_of_tuples_horizontal(topEndpointsMaxSize,'Data Flow - MB','Enpoints','Endpoint Analysis
    based on Max Content Size')
```



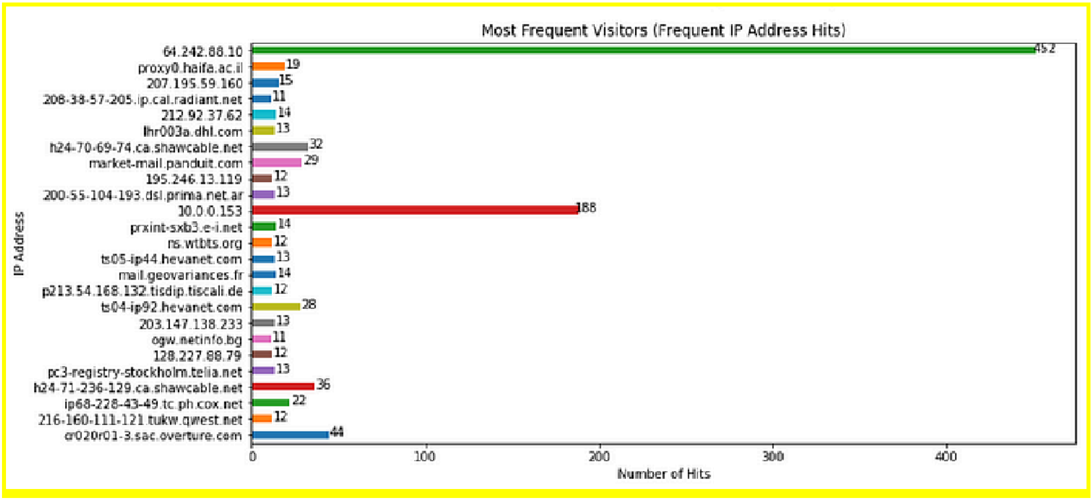


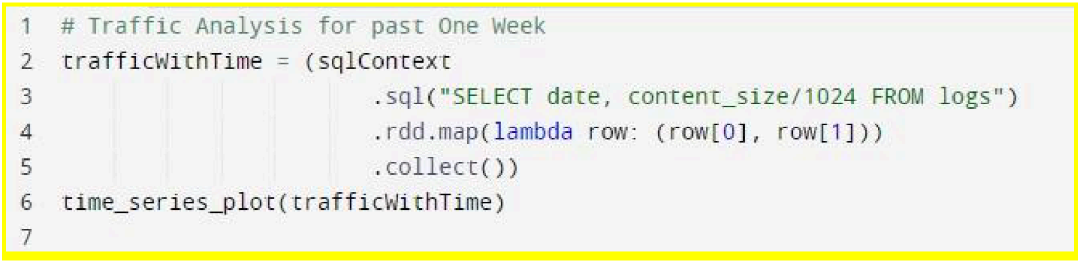
```
# Response Code Analysis
responseCodeToCount = (sqlContext
                    .sql("SELECT response_code, COUNT(*) AS theCount FROM logs GROUP BY
                        response_code")
                    .rdd.map(lambda row: (row[0], row[1]))
                    .collect())
bar_plot_list_of_tuples(responseCodeToCount,'Response Codes','Number of Codes','Response Code Analysis'
    )

# Code to Plot the results
def bar_plot_list_of_tuples(input_list,x_label,y_label,plot_title):
    x_labels = [val[0] for val in input_list]
    y_labels = [val[1] for val in input_list]
    plt.figure(figsize=(12, 6))
    plt.xlabel(x_label)
    plt.ylabel(y_label)
    plt.title(plot_title)
    ax = pd.Series(y_labels).plot(kind='bar')
    ax.set_xticklabels(x_labels)
    rects = ax.patches
    for rect, label in zip(rects, y_labels):
        height = rect.get_height()
        ax.text(rect.get_x() + rect.get_width()/2, height + 5, label, ha='center', va='bottom')
```



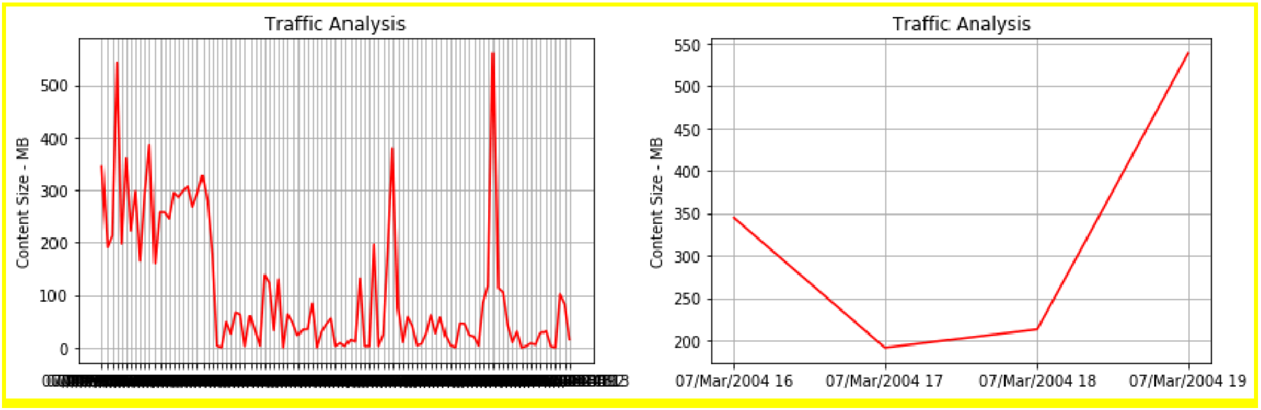


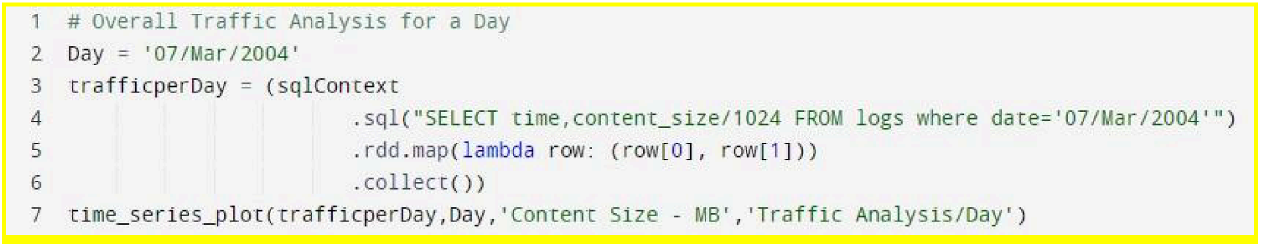
```
# Most Frequent Visitors (Most Frequent IP Address visits).
frequentIpAddressesHits = (sqlContext
                  .sql("SELECT ip_address, COUNT(*) AS total FROM logs GROUP BY ip_address HAVING total > 10")
                  .rdd.map(lambda row: (row[0], row[1]))
                  .collect())
bar_plot_list_of_tuples_horizontal(frequentIpAddressesHits,'Number of Hits','IP Address','Most Frequent Visitors (Frequent IP Address Hits)')

```



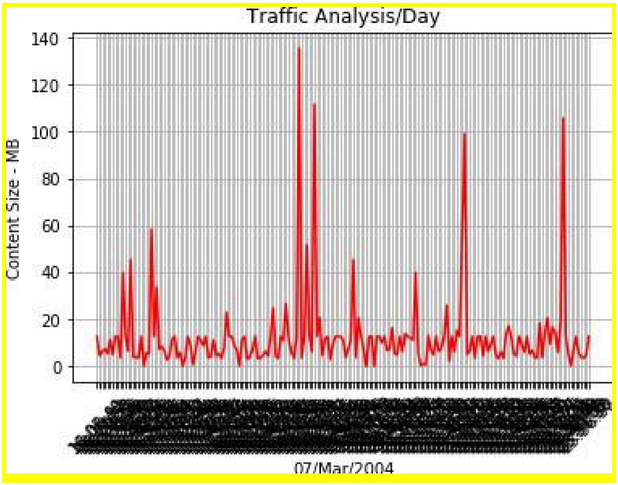


```
# Traffic Analysis for past One Week
trafficWithTime = (sqlContext
                   .sql("SELECT date, content_size/1024 FROM logs")
                   .rdd.map(lambda row: (row[0], row[1]))
                   .collect())
time_series_plot(trafficWithTime)

```

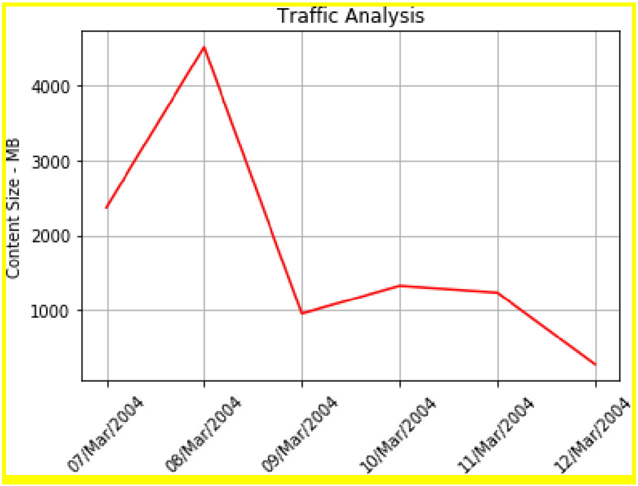




```
# Overall Traffic Analysis for a Day
Day = '07/Mar/2004'
trafficperDay = (sqlContext
                        .sql("SELECT time,content_size/1024 FROM logs where date='07/Mar/2004'")
                        .rdd.map(lambda row: (row[0], row[1]))
                        .collect())
time_series_plot(trafficperDay,Day,'Content Size - MB','Traffic Analysis/Day')
```

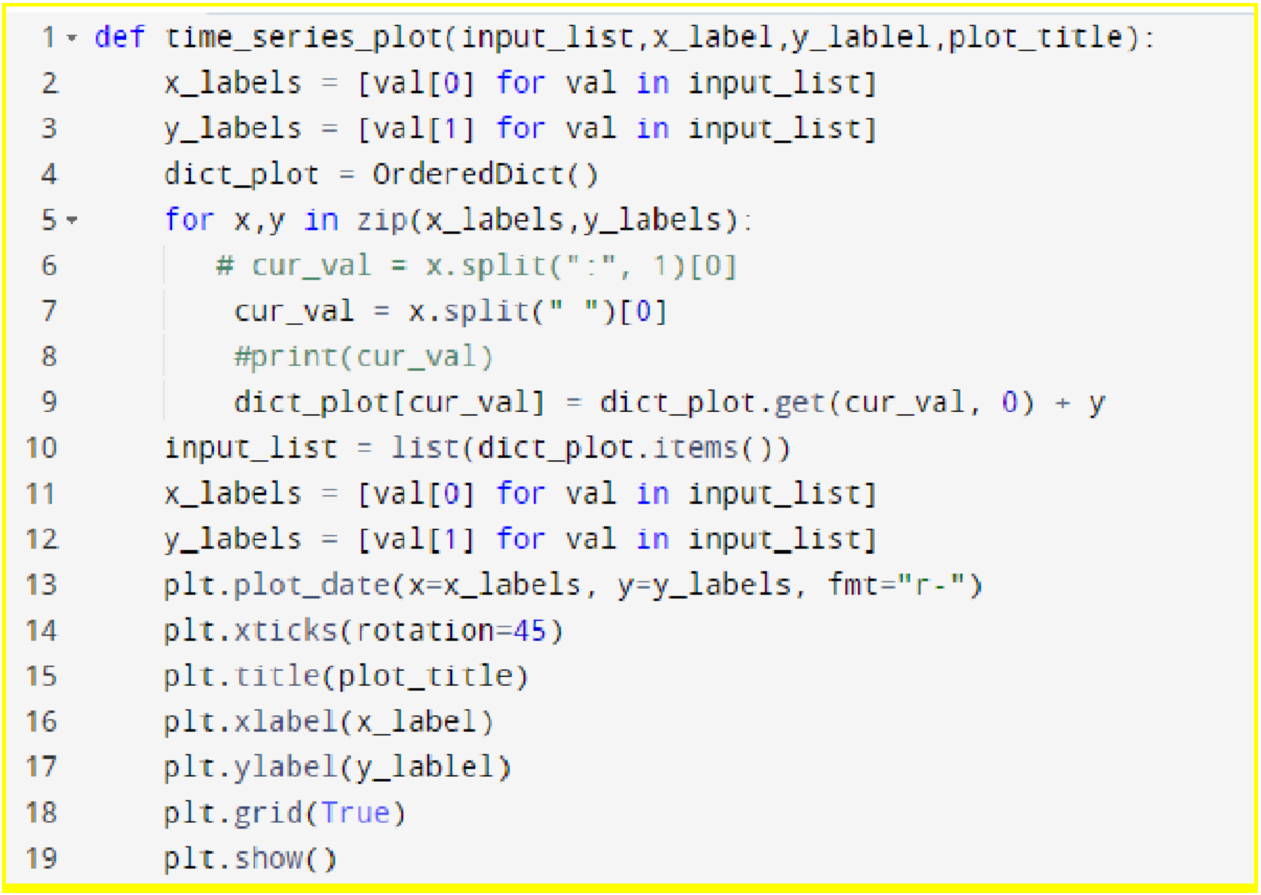


Outliers can be clearly detected by analysis the spikes and which end points were been hit at time by what IP Addresses.

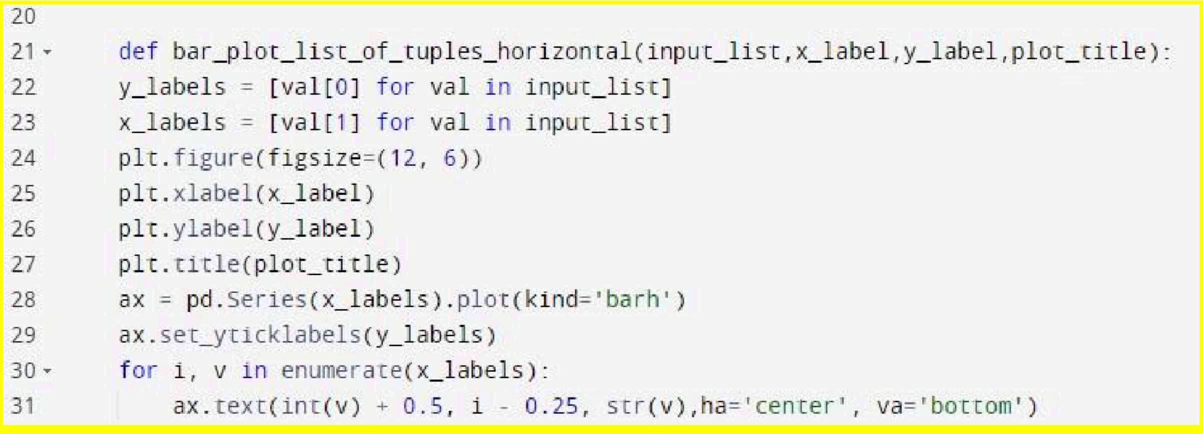


Here, we can see an unusual spike on 8th March, which can be analyzed further for identifying discrepancy.

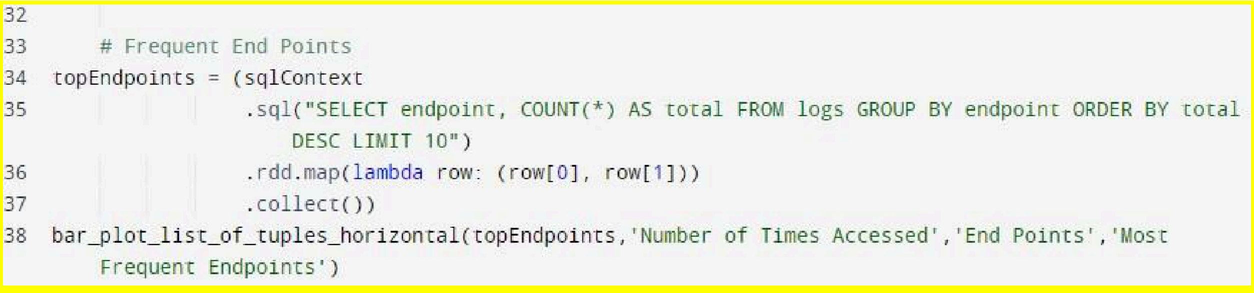
Code for Plot Analysis:



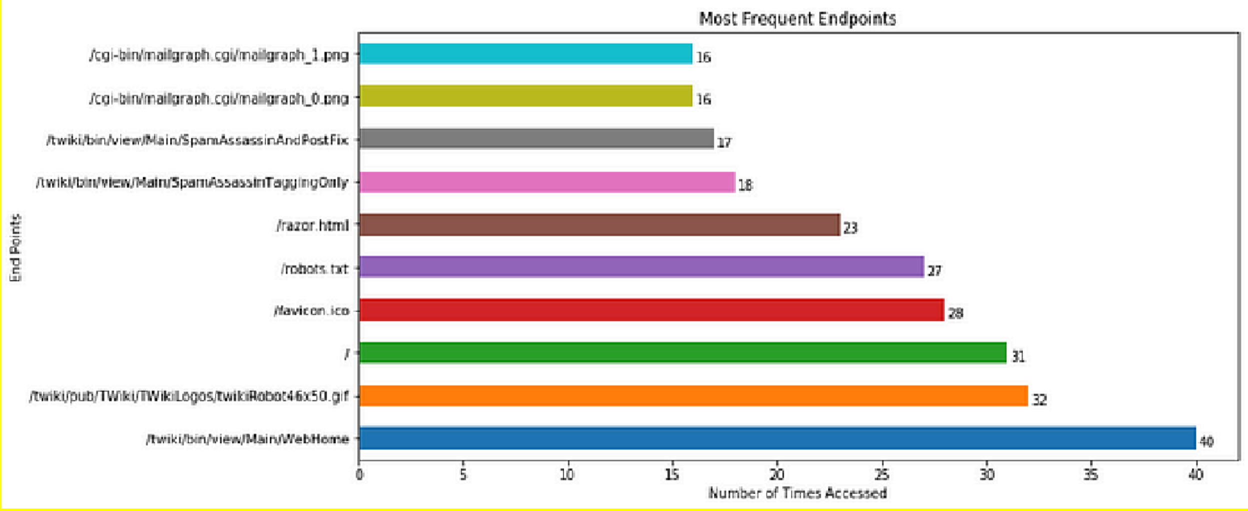
```python
def time_series_plot(input_list,x_label,y_lablel,plot_title):
    x_labels = [val[0] for val in input_list]
    y_labels = [val[1] for val in input_list]
    dict_plot = OrderedDict()
    for x,y in zip(x_labels,y_labels):
        # cur_val = x.split(":", 1)[0]
        cur_val = x.split(" ")[0]
        #print(cur_val)
        dict_plot[cur_val] = dict_plot.get(cur_val, 0) + y
    input_list = list(dict_plot.items())
    x_labels = [val[0] for val in input_list]
    y_labels = [val[1] for val in input_list]
    plt.plot_date(x=x_labels, y=y_labels, fmt="r-")
    plt.xticks(rotation=45)
    plt.title(plot_title)
    plt.xlabel(x_label)
    plt.ylabel(y_lablel)
    plt.grid(True)
    plt.show()
```



```
def bar_plot_list_of_tuples_horizontal(input_list,x_label,y_label,plot_title):
y_labels = [val[0] for val in input_list]
x_labels = [val[1] for val in input_list]
plt.figure(figsize=(12, 6))
plt.xlabel(x_label)
plt.ylabel(y_label)
plt.title(plot_title)
ax = pd.Series(x_labels).plot(kind='barh')
ax.set_yticklabels(y_labels)
for i, v in enumerate(x_labels):
    ax.text(int(v) + 0.5, i - 0.25, str(v),ha='center', va='bottom')
```



```

    # Frequent End Points
topEndpoints = (sqlContext
                .sql("SELECT endpoint, COUNT(*) AS total FROM logs GROUP BY endpoint ORDER BY total DESC LIMIT 10")
                .rdd.map(lambda row: (row[0], row[1]))
                .collect())
bar_plot_list_of_tuples_horizontal(topEndpoints,'Number of Times Accessed','End Points','Most Frequent Endpoints')
```


Most Frequent Endpoints
End Points
/cgi-bin/mailgraph.cgi/mailgraph_1.png
/cgi-bin/mailgraph.cgi/mailgraph_0.png
/twiki/bin/view/Main/SpamAssassinAndPostFix
/twiki/bin/view/Main/SpamAssassinTaggingOnly
/razor.html
/robots.txt
/favicon.ico
/
/twiki/pub/TWiki/TWikiLogos/twikiRobot46x50.gif
/twiki/bin/view/Main/WebHome
Number of Times Accessed