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LAB 4: ANALYZING NETWORK DATA LOG

You are provided with the data file, in .csv format, in the working directory. Write the program to extract the following informations.

EXERCISE 4A: TOP TALKERS AND LISTENERS

One of the most commonly used function in analyzing data log is finding out the IP address of the hosts that send out large amount of packet and hosts that receive large number of packets, usually know as TOP TALKERS and LISTENERS. Based on the IP address we can obtained the organization who owns the IP address.

List the TOP 5 TALKERS

Rank	IP address	# of packets	Organisation
1	193.62.192.8	3041	RIPE Network Coordination Centre (RIPE)
2	155.69.160.32	2975	Asia Pacific Network Information Centre (APNIC)
3	130.14.250.11	2604	National Library of Medicine (NLM)
4	14.139.196.58	2452	Asia Pacific Network Information Centre (APNIC)
5	140.112.8.139	2056	Asia Pacific Network Information Centre (APNIC)

TOP 5 LISTENERS

Rank	IP address	# of packets	Organisation
1	103.37.198.100	3841	Asia Pacific Network Information Centre (APNIC)
2	137.132.228.15	3715	Asia Pacific Network Information Centre (APNIC)
3	202.21.159.244	2446	Asia Pacific Network Information Centre (APNIC)
4	192.101.107.153	2368	Battelle Memorial Institute, Pacific Northwest Division (PNNL-Z)
5	103.21.126.2	2056	Asia Pacific Network Information Centre (APNIC)

EXERCISE 4B: TRANSPORT PROTOCOL

Using the IP protocol type attribute, determine the percentage of TCP and UDP protocol

	Header value	Transport layer protocol	# of packets	Percentage
1	6	TCP	56064	82.37%
2	17	UDP	9462	13.90%
3	50	ESP	1698	2.49%
4	47	GREs	657	0.97%

EXERCISE 4C: APPLICATIONS PROTOCOL

Using the Destination IP port number determine the most frequently used application protocol. (For finding the service given the port number https://www.adminsub.net/tcp-udp-port-finder/)

Rank	Destination IP port number	# of packets	Service
1	443	13423	HTTPS
2	80	2647	HTTP
3	52866	2068	Dynamic / Private Ports
4	45512	1356	Unassigned Ports
5	56152	1341	Dynamic / Private Ports

EXERCISE 4D: TRAFFIC

The traffic intensity is an important parameter that a network engineer needs to monitor closely to determine if there is congestion. You would use the IP packet size to calculate the estimated total traffic over the monitored period of 15 seconds. (Assume the sampling rate is 1 in 2048)

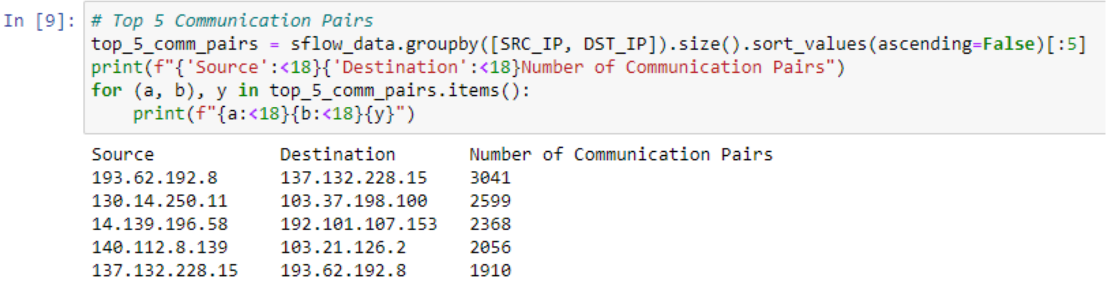
Total Traffic(MB)	61.7769

EXERCISE 4E: ADDITIONAL ANALYSIS

Please append ONE page to provide additional analysis of the data and the insight it provides.
Examples include:
Top 5 communication pairs;
Visualization of communications between different IP hosts;
etc.

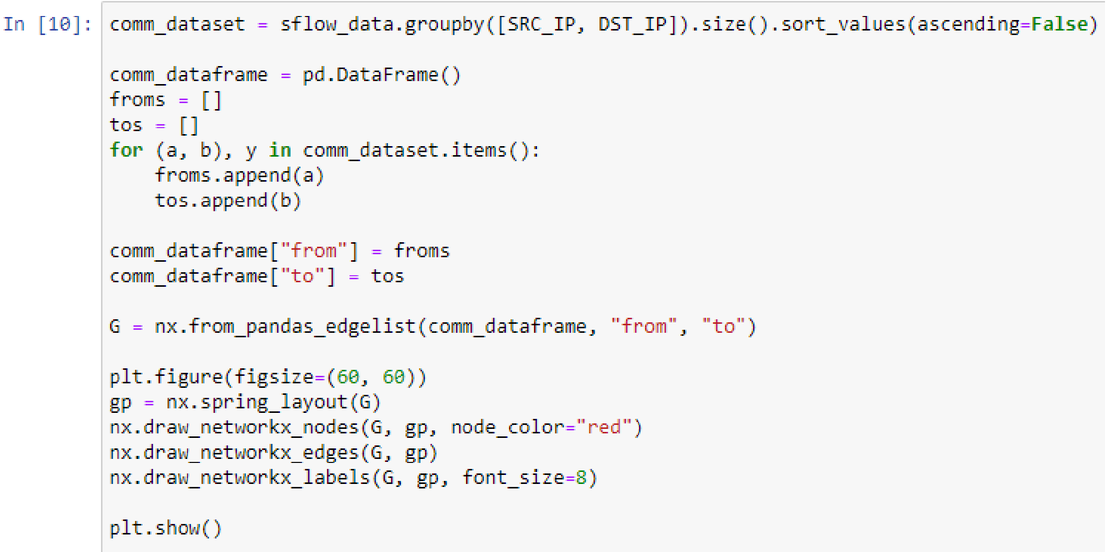
Please limit your results within one page (and any additional results that fall beyond one page limit will not be assessed).

Top 5 Communication Pair

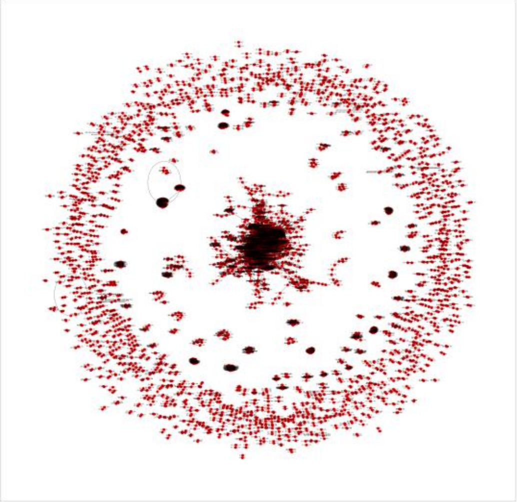


```
In [9]: # Top 5 Communication Pairs
        top_5_comm_pairs = sflow_data.groupby([SRC_IP, DST_IP]).size().sort_values(ascending=False)[:5]
        print(f"{'Source':<18}{'Destination':<18}Number of Communication Pairs")
        for (a, b), y in top_5_comm_pairs.items():
            print(f"{a:<18}{b:<18}{y}")

        Source            Destination       Number of Communication Pairs
        193.62.192.8      137.132.228.15    3041
        130.14.250.11     103.37.198.100    2599
        14.139.196.58     192.101.107.153   2368
        140.112.8.139     103.21.126.2      2056
        137.132.228.15    193.62.192.8      1910
```

Visualisation



```
In [10]: comm_dataset = sflow_data.groupby([SRC_IP, DST_IP]).size().sort_values(ascending=False)

         comm_dataframe = pd.DataFrame()
         froms = []
         tos = []
         for (a, b), y in comm_dataset.items():
             froms.append(a)
             tos.append(b)

         comm_dataframe["from"] = froms
         comm_dataframe["to"] = tos

         G = nx.from_pandas_edgelist(comm_dataframe, "from", "to")

         plt.figure(figsize=(60, 60))
         gp = nx.spring_layout(G)
         nx.draw_networkx_nodes(G, gp, node_color="red")
         nx.draw_networkx_edges(G, gp)
         nx.draw_networkx_labels(G, gp, font_size=8)

         plt.show()
```



EXERCISE 4F: SOFTWARE CODE

Please also submit your code to the NTULearn lab site.

SC2008 Lab 4: Analysing Network Data Log

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import networkx as nx
```

In [3]:

```
TYPE = 0
SFLOW_AGENT_ADDRESS = 1
INPUT_PORT = 2
OUTPUT_PORT = 3
SRC_MAC = 4
DST_MAC = 5
ETHERNET_TYPE = 6
IN_VLAN = 7
OUT_VLAN = 8
SRC_IP = 9
DST_IP = 10
IP_PROTOCOL = 11
IP_TOS = 12
IP_TTL = 13
SRC_PORT = 14
DST_PORT = 15
TCP_FLAGS = 16
PACKET_SIZE = 17
IP_PACKET_SIZE = 18
SAMPLING_RATE = 19
```

In [20]:

```
# Read csv file
sflow_data = pd.read_csv('./SFlow_Data_lab4.csv', header=None)
sflow_data = sflow_data[sflow_data[TYPE] == "FLOW"]
sflow_data.head()
```

Out[20]:

	0	1	2	3	4	5	6	7	8	9	...
0	FLOW	aa.aa.aa.aa	137	200	d404ff55fd4d	80711fc76001	0x0800	919.0	280	130.246.176.22	...
1	FLOW	aa.aa.aa.aa	129	193	609c9f851b00	0031466b23cf	0x0800	11.0	919	155.69.160.32	...
2	FLOW	aa.aa.aa.aa	137	200	d404ff55fd4d	80711fc76001	0x0800	919.0	280	130.246.176.53	...
3	FLOW	aa.aa.aa.aa	129	135	609c9f851b00	002688cd5fc7	0x0800	11.0	919	155.69.160.32	...
4	FLOW	aa.aa.aa.aa	130	199	00239cd087c1	544b8cf9a7df	0x0800	919.0	600	137.132.228.15	...

5 rows × 21 columns

Exercise 4A: Top Talkers and Listeners

In [21]:

```
# Top 5 Talkers
top_5_talkers = sflow_data[SRC_IP].value_counts()
top_5_talkers = list(zip(top_5_talkers.index, top_5_talkers.values))
print("Top 5 Talkers:")
print(f"{'IP':<20}No. of Packets")
```

```
for x, y in top_5_talkers[:5]:
    print(f"{x:<20}{y}")
```

```
Top 5 Talkers:
IP                  No. of Packets
193.62.192.8        3041
155.69.160.32       2975
130.14.250.11       2604
14.139.196.58       2452
140.112.8.139       2056
```

In [22]:

```
# Top 5 Listeners
top_5_listeners = sflow_data[DST_IP].value_counts()
top_5_listeners = list(zip(top_5_listeners.index, top_5_listeners.values))
print("Top 5 Listeners:")
print(f"{'IP':<20}No. of Packets")
for x, y in top_5_listeners[:5]:
    print(f"{x:<20}{y}")
```

```
Top 5 Listeners:
IP                  No. of Packets
103.37.198.100      3841
137.132.228.15      3715
202.21.159.244      2446
192.101.107.153     2368
103.21.126.2        2056
```

Exercise 4B: Transport Protocol

In [48]:

```
# TCP vs UDP vs the other protocols
protocols_and_packets = sflow_data[IP_PROTOCOL].value_counts()
packets = protocols_and_packets.sum()

print(f"Total packets: {packets}")
print("Protocol    Number of Packets")
for x, y in protocols_and_packets.items():
    print(f"{x:<12d}{y:<8d} {y / packets * 100:>6.2f}%")
```

```
Total packets: 68065
Protocol    Number of Packets
6           56064     82.37%
17          9462      13.90%
50          1698       2.49%
47          657        0.97%
41          104        0.15%
1           74         0.11%
58          4          0.01%
103         1          0.00%
0           1          0.00%
```

Exercise 4C: Applications Protocol

In [23]:

```
# Top 5 destination ip port number
top_5_dst_ip_port_no = sflow_data[DST_PORT].value_counts()[:5]
top_5_dst_ip_port_no = list(
    zip(top_5_dst_ip_port_no.index, top_5_dst_ip_port_no.values)
)
print("Top 5 Destination Port Number:")
print(f"{'Dest. Port Number':<20}No. of Packets")
```

```
for x, y in top_5_dst_ip_port_no:
    print(f"{x:<20}{y}")
```

```
Top 5 Destination Port Number:
Dest. Port Number   No. of Packets
443                 13423
80                  2647
52866               2068
45512               1356
56152               1341
```

Exercise 4D: Traffic

In [24]:

```
# Total packet size / total traffic
total_packet_size = sflow_data[IP_PACKET_SIZE].sum()
print(f"Total Packet Size (B)   : {total_packet_size}")
print(f"Total Packet Size (MB)  : {total_packet_size / 1024 / 1024}")
```

```
Total Packet Size (B)   : 64777822
Total Packet Size (MB)  : 61.77694511413574
```

Exercise 4E: Additional Analysis

In [26]:

```
# Top 5 Communication Pairs
top_5_comm_pairs = sflow_data.groupby([SRC_IP, DST_IP]).size().sort_values(ascending
print(f"{'Source':<18}{'Destination':<18}Number of Communication Pairs")
for (a, b), y in top_5_comm_pairs.items():
    print(f"{a:<18}{b:<18}{y}")
```

```
Source            Destination       Number of Communication Pairs
193.62.192.8      137.132.228.15    3041
130.14.250.11     103.37.198.100    2599
14.139.196.58     192.101.107.153   2368
140.112.8.139     103.21.126.2      2056
137.132.228.15    193.62.192.8      1910
```

In [29]:

```
comm_dataset = sflow_data.groupby([SRC_IP, DST_IP]).size().sort_values(ascending=Fal

comm_dataframe = pd.DataFrame()
froms = []
tos = []
for (a, b), y in comm_dataset.items():
    froms.append(a)
    tos.append(b)

comm_dataframe["from"] = froms
comm_dataframe["to"] = tos

G = nx.from_pandas_edgelist(comm_dataframe, "from", "to")

plt.figure(figsize=(60, 60))
gp = nx.spring_layout(G)
nx.draw_networkx_nodes(G, gp, node_color="red")
nx.draw_networkx_edges(G, gp)
nx.draw_networkx_labels(G, gp, font_size=8)

plt.show()
```