Computer Networks

Assignment 1

2020-21
Even Semester

Submitted By:
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Lab Batch: C4

Task1: Physical and Data Link Layer

1) Find out the network cards in your machine. What is the speed?

00:03.0 Ethernet controller: Intel Corporation 82540EM Gigabit Ethernet Controller (rev 02)

```
abhishek@linux:~$ lspci
00:00.0 Host bridge: Intel Corporation 440FX - 82441FX PMC [Natoma] (rev 02)
00:01.0 ISA bridge: Intel Corporation 82371SB PIIX3 ISA [Natoma/Triton II]
00:01.1 IDE interface: Intel Corporation 82371AB/EB/MB PIIX4 IDE (rev 01)
00:02.0 VGA compatible controller: VMware SVGA II Adapter
00:03.0 Ethernet controller: Intel Corporation 82540EM Gigabit Ethernet Controller (rev 02)
00:04.0 System peripheral: InnoTek Systemberatung GmbH VirtualBox Guest Service
00:05.0 Multimedia audio controller: Intel Corporation 82801AA AC'97 Audio Controller (rev 01)
00:06.0 USB controller: Apple Inc. KeyLargo/Intrepid USB
00:07.0 Bridge: Intel Corporation 82371AB/EB/MB PIIX4 ACPI (rev 08)
00:0d.0 SATA controller: Intel Corporation 82801HM/HEM (ICH8M/ICH8M-E) SATA Controller [AHCI mode] (rev 02)
```

Speed: 1Gbit/s

```
       *-network
            description: Ethernet interface
            product: 82540EM Gigabit Ethernet Controller
            vendor: Intel Corporation
            physical id: 3
            bus info: pci@0000:00:03.0
            logical name: enp0s3
            version: 02
            serial: 08:00:27:62:c3:94
            size: 1Gbit/s
            capacity: 1Gbit/s
            width: 32 bits
            clock: 66MHz
            capabilities: bus_master cap_list ethernet physical tp 10bt 10bt-fd 100bt 100bt-fd 1000bt-fd autonegotiation
            configuration: autonegotiation=on broadcast=yes driver=e1000 driverversion=7.3.21-k8-NAPI duplex=full ip=10.0.2.15 lat
ency=64 link=yes mingnt=255 multicast=yes port=twisted pair speed=1Gbit/s
            resources: irq:19 memory:f0200000-f021ffff ioport:d020(size=8)
```

2) What is the current speed of the network interface? What offload features are enabled?

Current Speed: 1000Mb/s

```
abhishek@MiWiFi-R4CM-srv:~$ ethtool enp0s3
Settings for enp0s3:
        Supported ports: [ TP ]
        Supported link modes:   10baseT/Half 10baseT/Full
                                100baseT/Half 100baseT/Full
                                1000baseT/Full
        Supported pause frame use: No
        Supports auto-negotiation: Yes
        Supported FEC modes: Not reported
        Advertised link modes:  10baseT/Half 10baseT/Full
                                100baseT/Half 100baseT/Full
                                1000baseT/Full
        Advertised pause frame use: No
        Advertised auto-negotiation: Yes
        Advertised FEC modes: Not reported
        Speed: 1000Mb/s
        Duplex: Full
        Port: Twisted Pair
        PHYAD: 0
        Transceiver: internal
        Auto-negotiation: on
        MDI-X: off (auto)
Cannot get wake-on-lan settings: Operation not permitted
        Current message level: 0x00000007 (7)
                               drv probe link
        Link detected: yes
```

Enabled offload features:

```
abhishek@MiWiFi-R4CM-srv:~$ ethtool --show-offload enp0s3
Features for enp0s3:
rx-checksumming: off
tx-checksumming: on
        tx-checksum-ipv4: off [fixed]
        tx-checksum-ip-generic: on
        tx-checksum-ipv6: off [fixed]
        tx-checksum-fcoe-crc: off [fixed]
        tx-checksum-sctp: off [fixed]
scatter-gather: on
        tx-scatter-gather: on
        tx-scatter-gather-fraglist: off [fixed]
tcp-segmentation-offload: on
        tx-tcp-segmentation: on
        tx-tcp-ecn-segmentation: off [fixed]
        tx-tcp-mangleid-segmentation: off
        tx-tcp6-segmentation: off [fixed]
generic-segmentation-offload: on
generic-receive-offload: on
large-receive-offload: off [fixed]
rx-vlan-offload: on
tx-vlan-offload: on [fixed]
ntuple-filters: off [fixed]
receive-hashing: off [fixed]
highdma: off [fixed]
rx-vlan-filter: on [fixed]
vlan-challenged: off [fixed]
tx-lockless: off [fixed]
netns-local: off [fixed]
tx-gso-robust: off [fixed]
tx-fcoe-segmentation: off [fixed]
tx-gre-segmentation: off [fixed]
tx-gre-csum-segmentation: off [fixed]
tx-ipxip4-segmentation: off [fixed]
```

```
tx-ipxip4-segmentation: off [fixed]
tx-ipxip6-segmentation: off [fixed]
tx-udp_tnl-segmentation: off [fixed]
tx-udp_tnl-csum-segmentation: off [fixed]
tx-gso-partial: off [fixed]
tx-sctp-segmentation: off [fixed]
tx-esp-segmentation: off [fixed]
tx-udp-segmentation: off [fixed]
fcoe-mtu: off [fixed]
tx-nocache-copy: off
loopback: off [fixed]
rx-fcs: off
rx-all: off
tx-vlan-stag-hw-insert: off [fixed]
rx-vlan-stag-hw-parse: off [fixed]
rx-vlan-stag-filter: off [fixed]
l2-fwd-offload: off [fixed]
hw-tc-offload: off [fixed]
esp-hw-offload: off [fixed]
esp-tx-csum-hw-offload: off [fixed]
rx-udp_tunnel-port-offload: off [fixed]
tls-hw-tx-offload: off [fixed]
tls-hw-rx-offload: off [fixed]
rx-gro-hw: off [fixed]
tls-hw-record: off [fixed]
```

3) What is the MAC address of your machine?

MAC Address of enp0s3: 08:00:27:62:c3:94

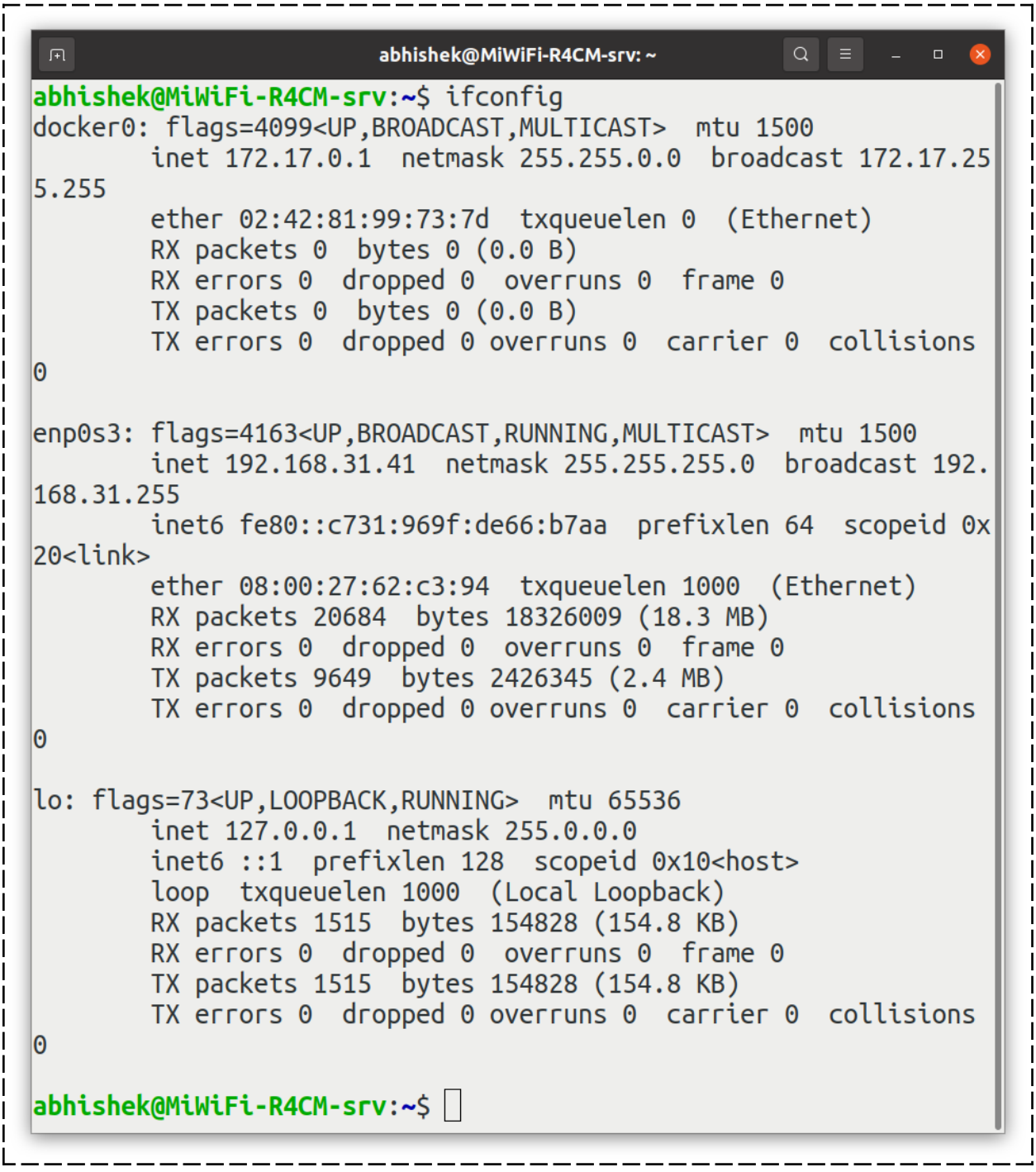
```
abhishek@MiWiFi-R4CM-srv:~$ ifconfig
docker0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        inet 172.17.0.1  netmask 255.255.0.0  broadcast 172.17.255.255
        ether 02:42:81:99:73:7d  txqueuelen 0  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.31.41  netmask 255.255.255.0  broadcast 192.168.31.255
        inet6 fe80::c731:969f:de66:b7aa  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:62:c3:94  txqueuelen 1000  (Ethernet)
        RX packets 20684  bytes 18326009 (18.3 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 9649  bytes 2426345 (2.4 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 1515  bytes 154828 (154.8 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
```

4) How many bytes did your eth0/eth1 interface receive since booted?

enp0s3 recieved 18326009 bytes i.e. 18.3 MB.



5) What is the MTU setting for eth0/eth1?

MTU: 1500 bytes

```
abhishek@MiWiFi-R4CM-srv:~$ ip link show enp0s3
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_co
del state UP mode DEFAULT group default qlen 1000
    link/ether 08:00:27:62:c3:94 brd ff:ff:ff:ff:ff:ff
```

Task 2: Network Layer

1) What is the network address of your machine? What is the default gateway (IP address and MAC address)of your network?

Network Address of machine: 192.168.31.41

Default Gateway :
IP Address: 192.168.31.1
MAC address: 8c:53:c3:5b:e0:8c

```
abhishek@MiWiFi-R4CM-srv:~$ ip route
default via 192.168.31.1 dev enp0s3 proto dhcp metric 100
169.254.0.0/16 dev enp0s3 scope link metric 1000
172.17.0.0/16 dev docker0 proto kernel scope link src 172.17.0.1 linkdown
192.168.31.0/24 dev enp0s3 proto kernel scope link src 192.168.31.41 metric 100
abhishek@MiWiFi-R4CM-srv:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         XiaoQiang       0.0.0.0         UG    100    0        0 enp0s3
link-local      0.0.0.0         255.255.0.0     U     1000   0        0 enp0s3
172.17.0.0      0.0.0.0         255.255.0.0     U     0      0        0 docker0
192.168.31.0    0.0.0.0         255.255.255.0   U     100    0        0 enp0s3
abhishek@MiWiFi-R4CM-srv:~$ ip neighbour
192.168.31.1 dev enp0s3 lladdr 8c:53:c3:5b:e0:8c REACHABLE
```

2) Show the ARP entries in your machine.

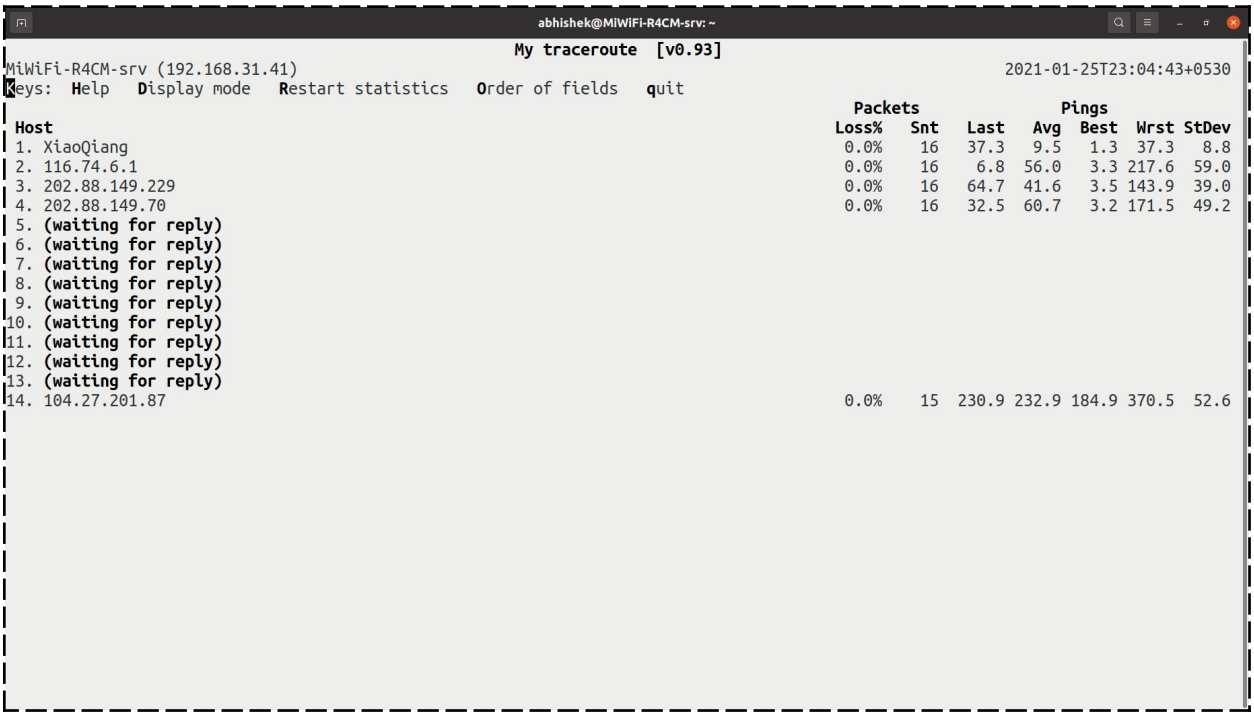
Shown below:

```
abhishek@MiWiFi-R4CM-srv:~$ ip neighbour
192.168.31.1 dev enp0s3 lladdr 8c:53:c3:5b:e0:8c REACHABLE
abhishek@MiWiFi-R4CM-srv:~$ arp
Address                  HWtype  HWaddress           Flags Mask            Iface
XiaoQiang                ether   8c:53:c3:5b:e0:8c   C                     enp0s3
```

3) Perform a traceroute/mtr to any web address. Provide the full traceroute/mtr output.

Command: `mtr www.whatismyip.com`

Output:



Command: `sudo traceroute google.com -I`

Output:

```
abhishek@MiWiFi-R4CM-srv:~$ sudo traceroute google.com -I
traceroute to google.com (172.217.31.14), 64 hops max
  1   192.168.31.1  1.433ms  1.169ms  3.571ms
  2   116.74.6.1  14.098ms  14.621ms  12.595ms
  3   202.88.149.229  10.889ms  9.416ms  7.328ms
  4   202.88.149.70  5.272ms  8.276ms  5.381ms
  5   *  *  *
  6   *  *  *
  7   *  *  *
  8   *  *  *
  9   *  *  *
 10   172.217.31.14  27.858ms  27.845ms  29.631ms
```

4) How many IP packets are received by your machine after current boot process?

Number of packets recieved by enp0s3 : 46092

```
abhishek@MiWiFi-R4CM-srv:~$ netstat -i
Kernel Interface table
Iface      MTU    RX-OK RX-ERR RX-DRP RX-OVR    TX-OK TX-ERR TX-DRP TX-OVR Flg
docker0   1500        0      0      0 0             0      0      0      0 BMU
enp0s3    1500    46092      0      0 0         23739      0      0      0 BMRU
lo       65536     2471      0      0 0          2471      0      0      0 LRU
```

Task 3: Transport Layer

1) Find the active TCP connection on your machine?

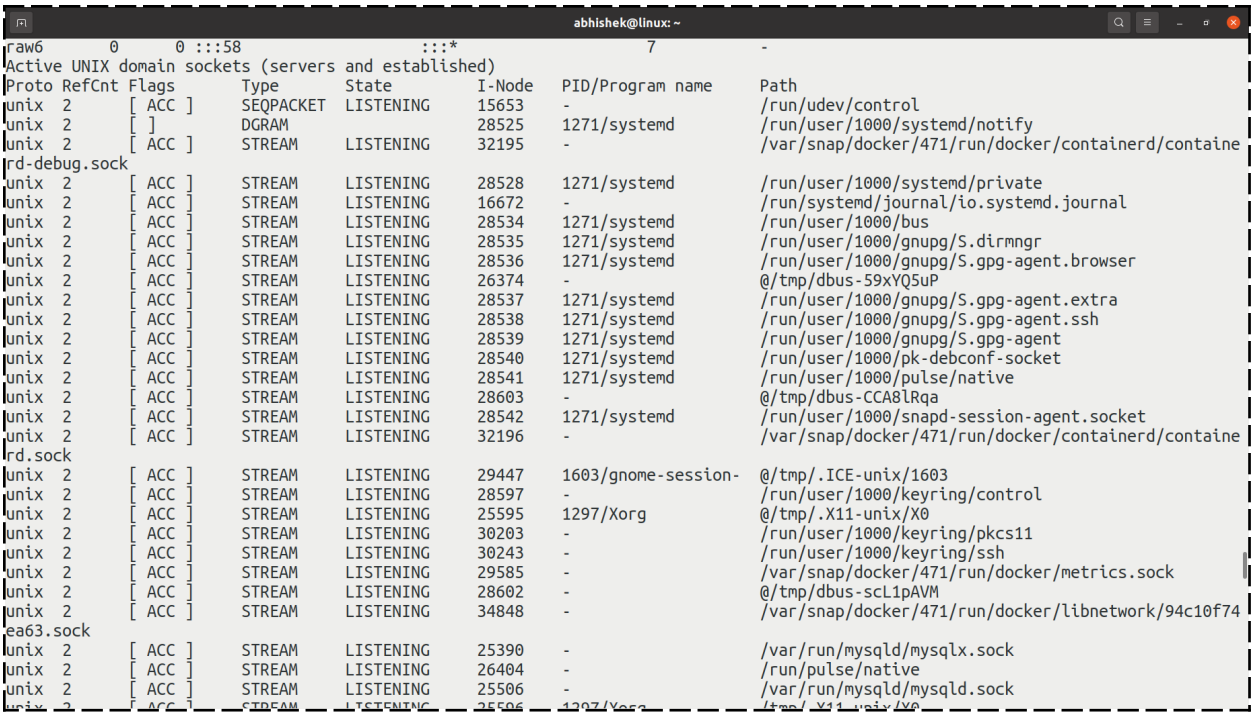
Shown below:

```
abhishek@MiWiFi-R4CM-srv:~$ netstat --tcp --listening
Active Internet connections (only servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 localhost:5939          0.0.0.0:*               LISTEN
tcp        0      0 localhost:domain        0.0.0.0:*               LISTEN
tcp        0      0 0.0.0.0:ssh             0.0.0.0:*               LISTEN
tcp        0      0 localhost:ipp           0.0.0.0:*               LISTEN
tcp6       0      0 [::]:ssh                [::]:*                  LISTEN
tcp6       0      0 ip6-localhost:ipp       [::]:*                  LISTEN
tcp6       0      0 [::]:33060              [::]:*                  LISTEN
tcp6       0      0 [::]:mysql              [::]:*                  LISTEN
tcp6       0      0 [::]:http               [::]:*                  LISTEN
```

2) How many sockets are currently opened on your machine?

Shown below:

```
abhishek@linux: ~
abhishek@linux:~$ netstat -nap
(Not all processes could be identified, non-owned process info
 will not be shown, you would have to be root to see it all.)
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State       PID/Program name
tcp        0      0 127.0.0.1:5939          0.0.0.0:*               LISTEN      -
tcp        0      0 127.0.0.53:53           0.0.0.0:*               LISTEN      -
tcp        0      0 0.0.0.0:22              0.0.0.0:*               LISTEN      -
tcp        0      0 127.0.0.1:631           0.0.0.0:*               LISTEN      -
tcp        0      0 10.0.2.15:36840         34.213.247.147:443      TIME_WAIT   -
tcp        0      0 10.0.2.15:53548         52.13.167.201:443       ESTABLISHED 3407/firefox
tcp        0      0 10.0.2.15:54370         68.183.248.166:443      TIME_WAIT   -
tcp        0      0 10.0.2.15:59014         13.35.238.152:443       ESTABLISHED 3407/firefox
tcp        0      0 10.0.2.15:38820         172.217.167.206:443     TIME_WAIT   -
tcp        0      0 10.0.2.15:40240         198.252.206.25:443      ESTABLISHED 3407/firefox
tcp        0      0 10.0.2.15:54374         68.183.248.166:443      TIME_WAIT   -
tcp        0      0 10.0.2.15:39870         172.217.166.206:443     ESTABLISHED 3407/firefox
tcp        0      0 10.0.2.15:54372         68.183.248.166:443      TIME_WAIT   -
tcp        0      0 10.0.2.15:54376         68.183.248.166:443      TIME_WAIT   -
tcp        0      0 10.0.2.15:53162         35.186.227.140:443      ESTABLISHED 3407/firefox
tcp6       0      0 :::3306                 :::*                    LISTEN      -
tcp6       0      0 :::80                   :::*                    LISTEN      -
tcp6       0      0 :::22                   :::*                    LISTEN      -
tcp6       0      0 ::1:631                 :::*                    LISTEN      -
tcp6       0      0 :::33060                :::*                    LISTEN      -
udp        0      0 0.0.0.0:44115           0.0.0.0:*                           -
udp        0      0 127.0.0.53:53           0.0.0.0:*                           -
udp        0      0 10.0.2.15:68            10.0.2.2:67             ESTABLISHED -
udp        0      0 0.0.0.0:631             0.0.0.0:*                           -
udp        0      0 0.0.0.0:5353            0.0.0.0:*                           -
udp6       0      0 :::46034                :::*                                -
udp6       0      0 :::5353                 :::*                                -
raw6       0      0 :::58                   :::*                    7           -
Active UNIX domain sockets (servers and established)
Proto RefCnt Flags       Type       State         I-Node   PID/Program name     Path
```




```
abhishek@linux:~$ netstat -nap | wc -l
(Not all processes could be identified, non-owned process info
 will not be shown, you would have to be root to see it all.)
828
```

3) How many applications are accessing network services on your machine? Also, identify their access protocol.

There are 27 entries, i.e. 27 applications are accessing network services and access protocol is either TCP or UDP as shown: