

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 PIIIX3 ISA [Natoma/Triton II]
00:01.1 IDE interface: Intel Corporation 82371AB/EB/MB PIIIX4 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 PIIIX4 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 latency=64 link=yes mii-negot=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

[illegible]

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]
nettuple-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-ixip4-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.

```
abhishek@MiWiFi-R4CM-srv: ~  
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  
    TX packets 1515 bytes 154828 (154.8 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions  
    0  
  
abhishek@MiWiFi-R4CM-srv:~$
```


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:

```
abhishek@MiWiFi-R4CM-srv: ~  
My traceroute [v0.93] 2021-01-25T23:04:43+0530  
MiWiFi-R4CM-srv (192.168.31.41)  
Keys: Help Display mode Restart statistics Order of fields quit  
Host  
1. XiaoQiang  
2. 116.74.6.1  
3. 202.88.149.229  
4. 202.88.149.70  
5. (waiting for reply)  
6. (waiting for reply)  
7. (waiting for reply)  
8. (waiting for reply)  
9. (waiting for reply)  
10. (waiting for reply)  
11. (waiting for reply)  
12. (waiting for reply)  
13. (waiting for reply)  
14. 104.27.201.87  
Packets  
Loss% Snt Last Avg Best Wrst StDev  
0.0% 16 37.3 9.5 1.3 37.3 8.8  
0.0% 16 6.8 56.0 3.3 217.6 59.0  
0.0% 16 64.7 41.6 3.5 143.9 39.0  
0.0% 16 32.5 60.7 3.2 171.5 49.2  
0.0% 15 230.9 232.9 184.9 370.5 52.6
```

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:~$ 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      0 127.0.0.0:53:53        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 :::33060                :::*                     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-Mode     PID/Program name     Path
```

Proto	RefCnt	Flags	Type	State	I-Node	PID/Program name	Path
unix	2	[ACC]	SEQPACKET	LISTENING	15653	-	/run/udev/control
unix	2	[]	DGRAM	LISTENING	28525	1271/systemd	/run/user/1000/systemd/notify
unix	2	[ACC]	STREAM	LISTENING	32195	-	/var/snap/docker/471/run/docker/containerd/containe
unix	2	[ACC]	STREAM	LISTENING	28528	1271/systemd	/run/user/1000/systemd/private
unix	2	[ACC]	STREAM	LISTENING	16672	-	/run/systemd/journal/io.systemd.journal
unix	2	[ACC]	STREAM	LISTENING	28534	1271/systemd	/run/user/1000/bus
unix	2	[ACC]	STREAM	LISTENING	28535	1271/systemd	/run/user/1000/gnupg/S.dirmngr
unix	2	[ACC]	STREAM	LISTENING	28536	1271/systemd	/run/user/1000/gnupg/S.gpg-agent.browser
unix	2	[ACC]	STREAM	LISTENING	26374	-	@/tmp/dbus-59xYQ5uP
unix	2	[ACC]	STREAM	LISTENING	28537	1271/systemd	/run/user/1000/gnupg/S.gpg-agent.extra
unix	2	[ACC]	STREAM	LISTENING	28538	1271/systemd	/run/user/1000/gnupg/S.gpg-agent.ssh
unix	2	[ACC]	STREAM	LISTENING	28539	1271/systemd	/run/user/1000/gnupg/S.gpg-agent
unix	2	[ACC]	STREAM	LISTENING	28540	1271/systemd	/run/user/1000/pk-debconf-socket
unix	2	[ACC]	STREAM	LISTENING	28541	1271/systemd	/run/user/1000/pulse/native
unix	2	[ACC]	STREAM	LISTENING	28603	-	@/tmp/dbus-CCA8lRqa
unix	2	[ACC]	STREAM	LISTENING	28542	1271/systemd	/run/user/1000/snapd-session-agent.socket
unix	2	[ACC]	STREAM	LISTENING	32196	-	/var/snap/docker/471/run/docker/containerd/containe
unix	2	[ACC]	STREAM	LISTENING	29447	1603/gnome-session-	@/tmp/.ICE-unix/1603
unix	2	[ACC]	STREAM	LISTENING	28597	-	/run/user/1000/keyring/control
unix	2	[ACC]	STREAM	LISTENING	25595	1297/Xorg	@/tmp/.X11-unix/X0
unix	2	[ACC]	STREAM	LISTENING	30203	-	/run/user/1000/keyring/pkcs11
unix	2	[ACC]	STREAM	LISTENING	30243	-	/run/user/1000/keyring/ssh
unix	2	[ACC]	STREAM	LISTENING	29585	-	/var/snap/docker/471/run/docker/metrics.sock
unix	2	[ACC]	STREAM	LISTENING	28602	-	@/tmp/dbus-sCL1pAVM
unix	2	[ACC]	STREAM	LISTENING	34848	-	/var/snap/docker/471/run/docker/libnetwork/94c10f74
unix	2	[ACC]	STREAM	LISTENING	25390	-	/var/run/mysqld/mysqld.sock
unix	2	[ACC]	STREAM	LISTENING	26404	-	/run/pulse/native
unix	2	[ACC]	STREAM	LISTENING	25506	-	/var/run/mysqld/mysqld.sock
unix	2	[ACC]	STREAM	LISTENING	25506	1297/Xorg	@/tmp/.X11-unix/X0

```
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:

```
abhishek@MiWiFi-R4CM-srv:~$ sudo lsof -i
COMMAND  PID    USER   FD   TYPE DEVICE SIZE/OFF NODE NAME
systemd-r 580  systemd-resolve 12u  IPv4 19835 0t0  UDP localhost:domain
systemd-r 580  systemd-resolve 13u  IPv4 19836 0t0  TCP localhost:domain (LISTEN)
avahi-dae 652    avahi   12u  IPv4 23970 0t0  UDP *:mdns
avahi-dae 652    avahi   13u  IPv6 23971 0t0  UDP *:mdns
avahi-dae 652    avahi   14u  IPv4 23972 0t0  UDP *:45953
avahi-dae 652    avahi   15u  IPv6 23973 0t0  UDP *:38174
NetworkMa 660    root    23u  IPv4 29938 0t0  UDP MiWiFi-R4CM-srv:bootpc->XiaoQiang:bootps
sshd      791    root     3u  IPv4 24179 0t0  TCP *:ssh (LISTEN)
sshd      791    root     4u  IPv6 24181 0t0  TCP *:ssh (LISTEN)
apache2   931    root     4u  IPv6 24443 0t0  TCP *:http (LISTEN)
mysqld    940    mysql   32u  IPv6 27639 0t0  TCP *:33060 (LISTEN)
mysqld    940    mysql   34u  IPv6 29891 0t0  TCP *:mysql (LISTEN)
teamviewe 1409   root    11u  IPv4 29100 0t0  TCP localhost:5939 (LISTEN)
firefox   3761   abhishek 127u IPv4 422736 0t0  TCP MiWiFi-R4CM-srv:34778->202.88.147.49:https (ESTABLISHED)
firefox   3761   abhishek 196u IPv4 314006 0t0  TCP MiWiFi-R4CM-srv:33152->del03s18-in-f14.1e100.net:https (ESTABLISHED)
firefox   3761   abhishek 216u IPv4 315904 0t0  TCP MiWiFi-R4CM-srv:58328->del03s10-in-f14.1e100.net:https (ESTABLISHED)
firefox   3761   abhishek 219u IPv4 422739 0t0  TCP MiWiFi-R4CM-srv:42610->server-13-224-22-91.del54.r.cloudfront.net:https (ESTABLISHED)
firefox   3761   abhishek 235u IPv4 86315 0t0  TCP MiWiFi-R4CM-srv:48174->ec2-35-161-248-141.us-west-2.compute.amazonaws.com:https (ESTABLISHED)
firefox   3761   abhishek 239u IPv4 90436 0t0  TCP MiWiFi-R4CM-srv:37800->stackoverflow.com:https (ESTABLISHED)
apache2   8846   www-data 4u  IPv6 24443 0t0  TCP *:http (LISTEN)
apache2   8847   www-data 4u  IPv6 24443 0t0  TCP *:http (LISTEN)
apache2   8848   www-data 4u  IPv6 24443 0t0  TCP *:http (LISTEN)
apache2   8849   www-data 4u  IPv6 24443 0t0  TCP *:http (LISTEN)
apache2   8850   www-data 4u  IPv6 24443 0t0  TCP *:http (LISTEN)
cupsd     8851   root     6u  IPv6 313528 0t0  TCP ip6-localhost:ipp (LISTEN)
cupsd     8851   root     7u  IPv4 313529 0t0  TCP localhost:ipp (LISTEN)
cups-brow 8852   root     7u  IPv4 313538 0t0  UDP *:631
abhishek@MiWiFi-R4CM-srv:~$
```