

2020F_ESE_3014_1

SEMESTER: 3rd SEM

INSTRUCTOR: Prof. Linchen Wang

LAB 9

SUBMISSION DATE: 3 Dec, 2020

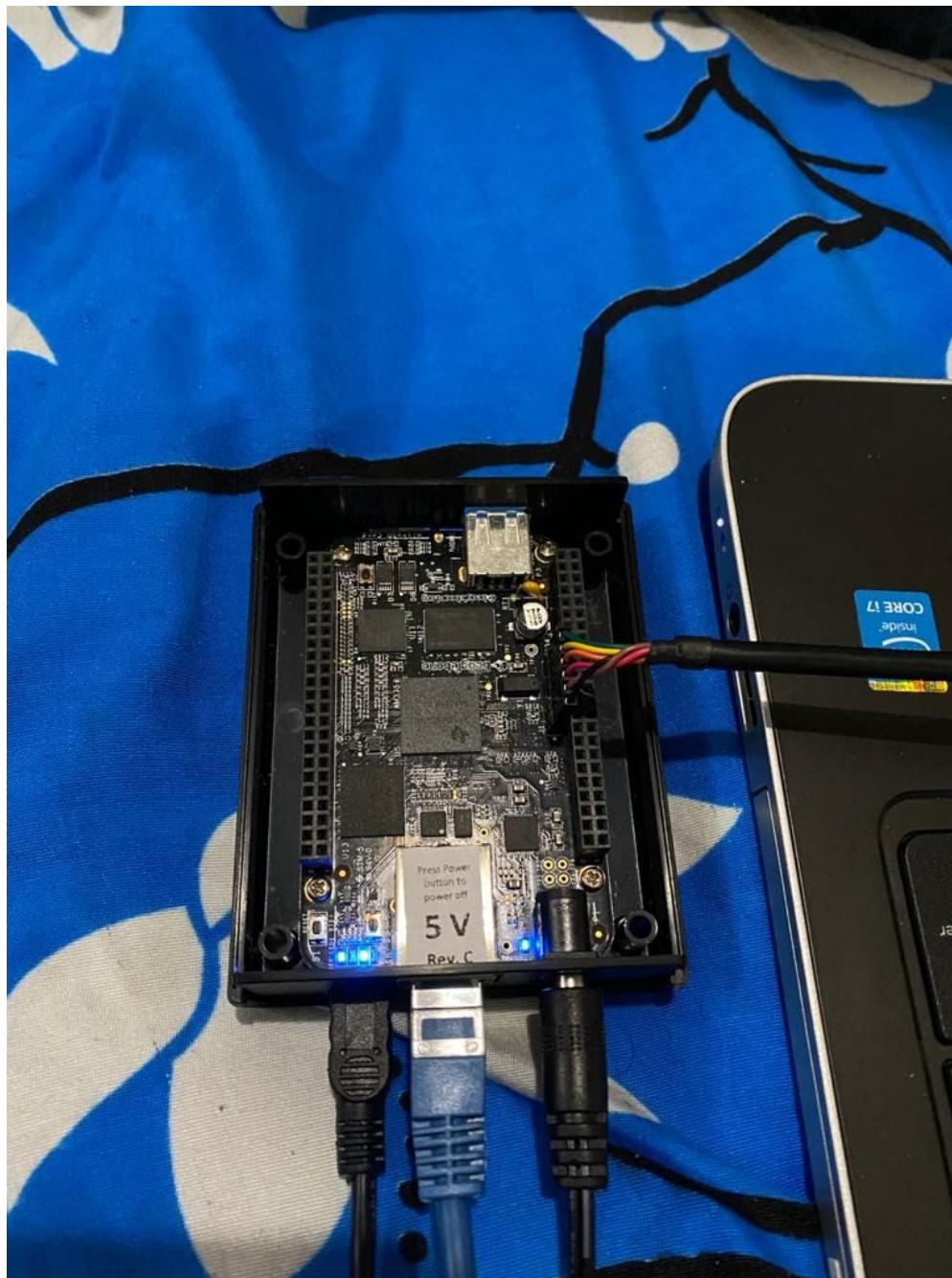
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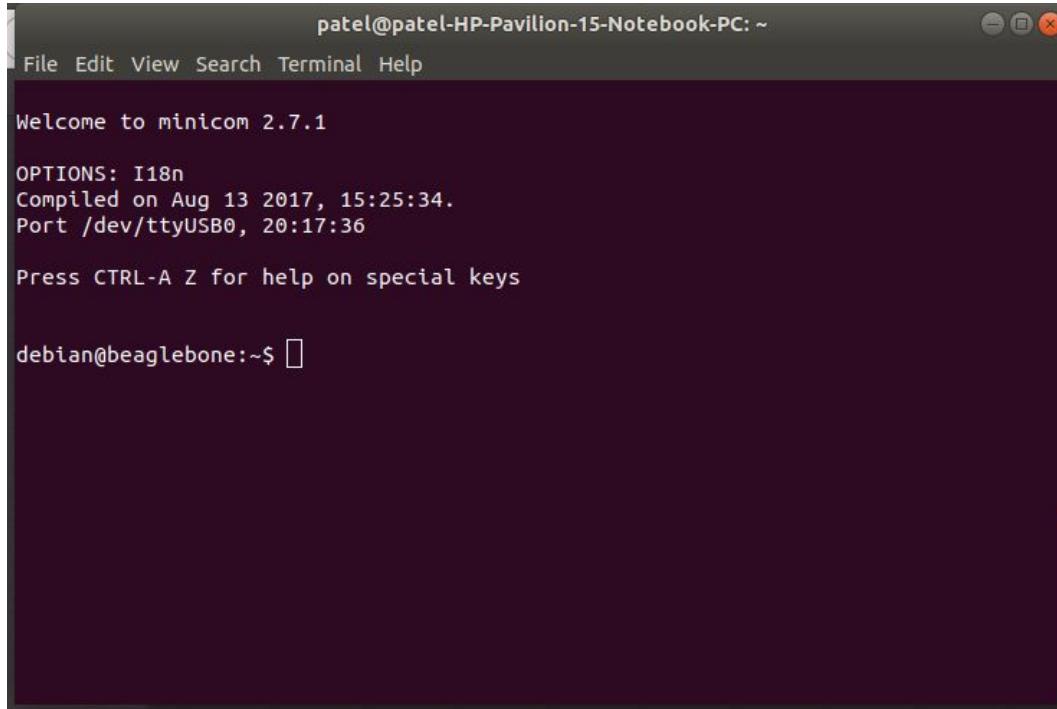
Part : 1 (CONNECTIONS)



We have connected serial debug 3.3 v FTDI cable to PC and beaglebone and then we have connected beagle bone to 5 V - 2 A power adapter.
After that we connected beaglebone's ethernet port to the router.

Then we launched minicom on beaglebone by below command

\$ sudo minicom



The screenshot shows a terminal window titled "patel@patel-HP-Pavilion-15-Notebook-PC: ~". The window contains the following text:

```
Welcome to minicom 2.7.1
OPTIONS: I18n
Compiled on Aug 13 2017, 15:25:34.
Port /dev/ttyUSB0, 20:17:36

Press CTRL-A Z for help on special keys

debian@beaglebone:~$
```

The next thing we tried to check connection status on the host machine as well as on beaglebone.

First we will check connection status on beaglebone. By following command

\$ ifconfig

Image is shown below :

|
|
|
|
|
|
|
|
|

```
patel@patel-HP-Pavilion-15-Notebook-PC: ~
File Edit View Search Terminal Help
debian@beaglebone:~$ ifconfig
eth0: flags=28605<UP,BROADCAST,RUNNING,MULTICAST,DYNAMIC> mtu 1500
    inet 192.168.2.79 netmask 255.255.255.0 broadcast 192.168.2.5
        inet6 fe80::679:b7ff:fea1:ecc3 prefixlen 64 scopeid 0x20<link>
            ether 04:79:b7:a1:ec:c3 txqueuelen 1000 (Ethernet)
            RX packets 3656 bytes 429313 (419.2 KiB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 1676 bytes 456960 (446.2 KiB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
            device interrupt 55

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 282 bytes 33940 (33.1 KiB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 282 bytes 33940 (33.1 KiB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

usb0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.7.2 netmask 255.255.255.252 broadcast 192.168.7.3
        inet6 fe80::679:b7ff:fea1:ecc5 prefixlen 64 scopeid 0x20<link>
            ether 04:79:b7:a1:ec:c5 txqueuelen 1000 (Ethernet)
```

In the second step we checked connection status on the host machine. We can see the connection status of various ports like LAN.

```
patel@patel-HP-Pavilion-15-Notebook-PC: ~
File Edit View Search Terminal Help
patel@patel-HP-Pavilion-15-Notebook-PC:~$ ifconfig
eno1: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    ether 8c:dc:d4:87:4d:45 txqueuelen 1000 (Ethernet)
    RX packets 1935 bytes 722766 (722.7 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1843 bytes 245631 (245.6 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

enx0479b7a1ecc4: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.7.1 netmask 255.255.255.252 broadcast 192.168.7.3
        inet6 fe80::8a7d:6330:6bcb:f1cb prefixlen 64 scopeid 0x20<link>
            ether 04:79:b7:a1:ec:c4 txqueuelen 1000 (Ethernet)
            RX packets 336 bytes 47355 (47.3 KB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 350 bytes 68487 (68.4 KB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

enx0479b7a1ecc7: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.6.1 netmask 255.255.255.252 broadcast 192.168.6.3
        inet6 fe80::13ed:7ea1:a668:4681 prefixlen 64 scopeid 0x20<link>
            ether 04:79:b7:a1:ec:c7 txqueuelen 1000 (Ethernet)
            RX packets 333 bytes 47315 (47.3 KB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 346 bytes 52919 (52.9 KB)
```

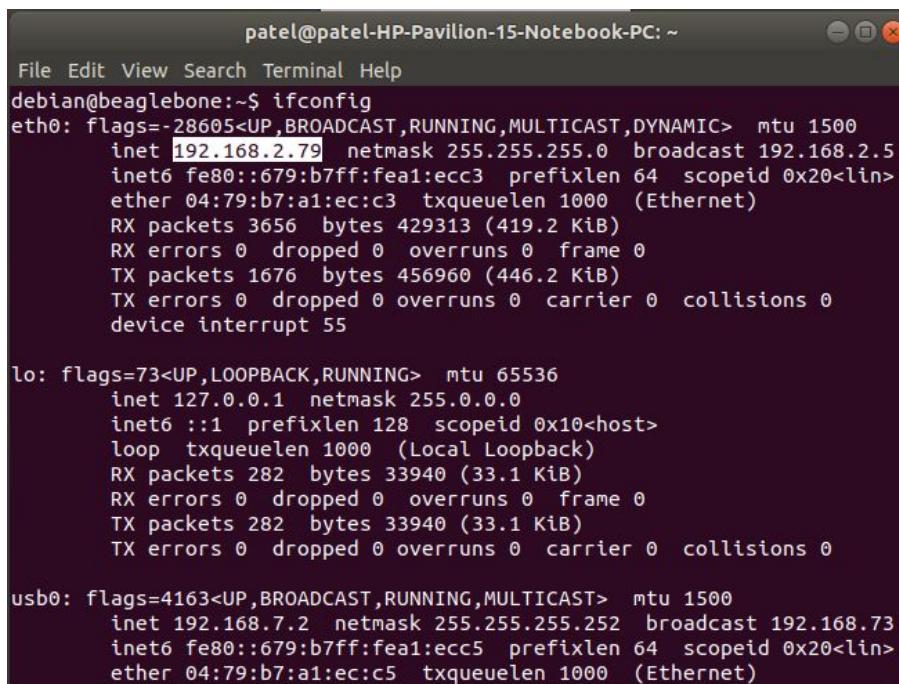
```
patrick@patrick-HP-Pavilion-15-Notebook-PC: ~
File Edit View Search Terminal Help
inet 192.168.6.1 netmask 255.255.255.252 broadcast 192.168.6.3
inet6 fe80::13ed:7ea1:a668:4681 prefixlen 64 scopeid 0x20<link>
ether 04:79:b7:a1:ec:c7 txqueuelen 1000 (Ethernet)
RX packets 333 bytes 47315 (47.3 KB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 346 bytes 52919 (52.9 KB)
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 12579 bytes 1304951 (1.3 MB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 12579 bytes 1304951 (1.3 MB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wlo1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
inet 192.168.2.29 netmask 255.255.255.0 broadcast 192.168.2.255
inet6 fe80::6238:d7fb:9311:e653 prefixlen 64 scopeid 0x20<link>
ether ec:0e:c4:33:8b:f9 txqueuelen 1000 (Ethernet)
RX packets 382490 bytes 498937886 (498.9 MB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 340348 bytes 38515619 (38.5 MB)
```

Part : 2

- 1) We identified the ethernet connection name **eth0** and IP address **192.168.2.79** on beaglebone.



```
patel@patel-HP-Pavilion-15-Notebook-PC: ~
File Edit View Search Terminal Help
debian@beaglebone:~$ ifconfig
eth0: flags=28605<UP,BROADCAST,RUNNING,MULTICAST,DYNAMIC> mtu 1500
    inet 192.168.2.79 netmask 255.255.255.0 broadcast 192.168.2.5
        inet6 fe80::679:b7ff:fea1:ecc3 prefixlen 64 scopeid 0x20<lin>
            ether 04:79:b7:a1:ec:c3 txqueuelen 1000 (Ethernet)
            RX packets 3656 bytes 429313 (419.2 KiB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 1676 bytes 456960 (446.2 KiB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
            device interrupt 55

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 282 bytes 33940 (33.1 KiB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 282 bytes 33940 (33.1 KiB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

usb0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.7.2 netmask 255.255.255.252 broadcast 192.168.7.3
        inet6 fe80::679:b7ff:fea1:ecc5 prefixlen 64 scopeid 0x20<lin>
            ether 04:79:b7:a1:ec:c5 txqueuelen 1000 (Ethernet)
```

2)

Then for host machine connection name **wlo1** and IP is **192.168.2.29**

The IP address is Local. If the router is attached to a computer with default settings, then the router will automatically assign a local IP address.

```
patel@patel-HP-Pavilion-15-Notebook-PC: ~
File Edit View Search Terminal Help
    RX packets 333 bytes 47315 (47.3 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 346 bytes 52919 (52.9 KB)
    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 12579 bytes 1304951 (1.3 MB)
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 12579 bytes 1304951 (1.3 MB)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wlo1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.2.29 netmask 255.255.255.0 broadcast 192.168.2.255
    inet6 fe80::6238:d7fb:9311:e653 prefixlen 64 scopeid 0x20<link>
        ether ec:0e:c4:33:8b:f9 txqueuelen 1000 (Ethernet)
        RX packets 382490 bytes 498937886 (498.9 MB)
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 340348 bytes 38515619 (38.5 MB)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

patel@patel-HP-Pavilion-15-Notebook-PC:~$
```

3)

Now we ping the connection of each machine from another by using the following command for beaglebone.

```
patel@patel-HP-Pavilion-15-Notebook-PC: ~
File Edit View Search Terminal Help
PING(8)          System Manager's Manual: iputils          PING(8)

NAME
ping - send ICMP ECHO_REQUEST to network hosts

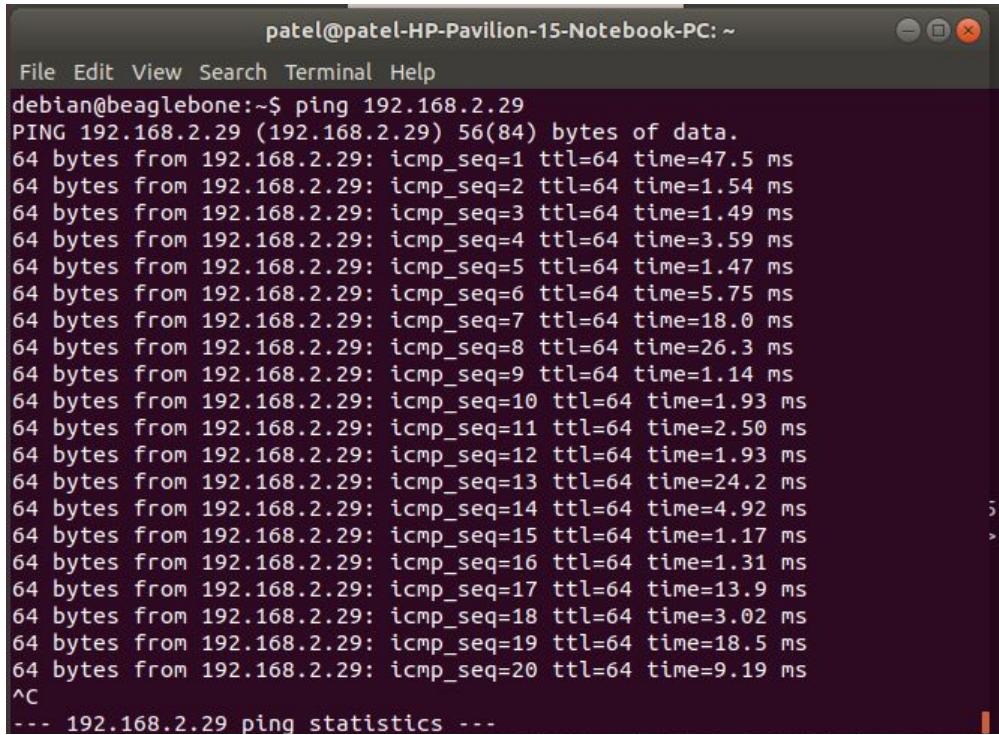
SYNOPSIS
ping [-aAbBdDfhLnOqrRUvV46] [-c count] [-F flowlabel] [-i interval] [-I
interface] [-l preload] [-m mark] [-M pmtudisc_option] [-N node-
info_option] [-w deadline] [-W timeout] [-p pattern] [-Q tos] [-s pack-
etsize] [-S sndbuf] [-t ttl] [-T timestamp option] [hop ...] destina-
tion

DESCRIPTION
ping uses the ICMP protocol's mandatory ECHO_REQUEST datagram to elicit
an ICMP ECHO_RESPONSE from a host or gateway. ECHO_REQUEST datagrams
(``pings'') have an IP and ICMP header, followed by a struct timeval
and then an arbitrary number of ``pad'' bytes used to fill out the
packet.

ping works with both IPv4 and IPv6. Using only one of them explicitly
can be enforced by specifying -4 or -6.

ping can also send IPv6 Node Information Queries (RFC4620). Intermedi-
Manual page ping(8) line 1 (press h for help or q to quit)
```

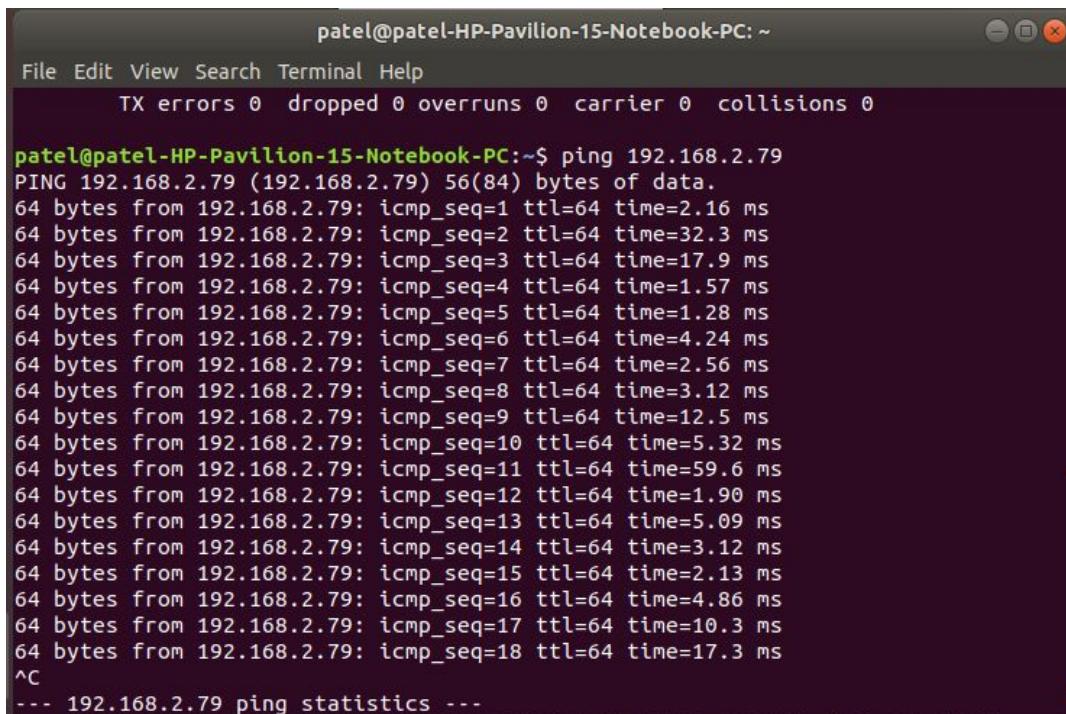
```
$ ping 192.168.2.29
```



```
patel@beaglebone:~$ ping 192.168.2.29
PING 192.168.2.29 (192.168.2.29) 56(84) bytes of data.
64 bytes from 192.168.2.29: icmp_seq=1 ttl=64 time=47.5 ms
64 bytes from 192.168.2.29: icmp_seq=2 ttl=64 time=1.54 ms
64 bytes from 192.168.2.29: icmp_seq=3 ttl=64 time=1.49 ms
64 bytes from 192.168.2.29: icmp_seq=4 ttl=64 time=3.59 ms
64 bytes from 192.168.2.29: icmp_seq=5 ttl=64 time=1.47 ms
64 bytes from 192.168.2.29: icmp_seq=6 ttl=64 time=5.75 ms
64 bytes from 192.168.2.29: icmp_seq=7 ttl=64 time=18.0 ms
64 bytes from 192.168.2.29: icmp_seq=8 ttl=64 time=26.3 ms
64 bytes from 192.168.2.29: icmp_seq=9 ttl=64 time=1.14 ms
64 bytes from 192.168.2.29: icmp_seq=10 ttl=64 time=1.93 ms
64 bytes from 192.168.2.29: icmp_seq=11 ttl=64 time=2.50 ms
64 bytes from 192.168.2.29: icmp_seq=12 ttl=64 time=1.93 ms
64 bytes from 192.168.2.29: icmp_seq=13 ttl=64 time=24.2 ms
64 bytes from 192.168.2.29: icmp_seq=14 ttl=64 time=4.92 ms
64 bytes from 192.168.2.29: icmp_seq=15 ttl=64 time=1.17 ms
64 bytes from 192.168.2.29: icmp_seq=16 ttl=64 time=1.31 ms
64 bytes from 192.168.2.29: icmp_seq=17 ttl=64 time=13.9 ms
64 bytes from 192.168.2.29: icmp_seq=18 ttl=64 time=3.02 ms
64 bytes from 192.168.2.29: icmp_seq=19 ttl=64 time=18.5 ms
64 bytes from 192.168.2.29: icmp_seq=20 ttl=64 time=9.19 ms
^C
--- 192.168.2.29 ping statistics ---
```

For our host machine to ping the connection

```
$ ping 192.168.2.79
```

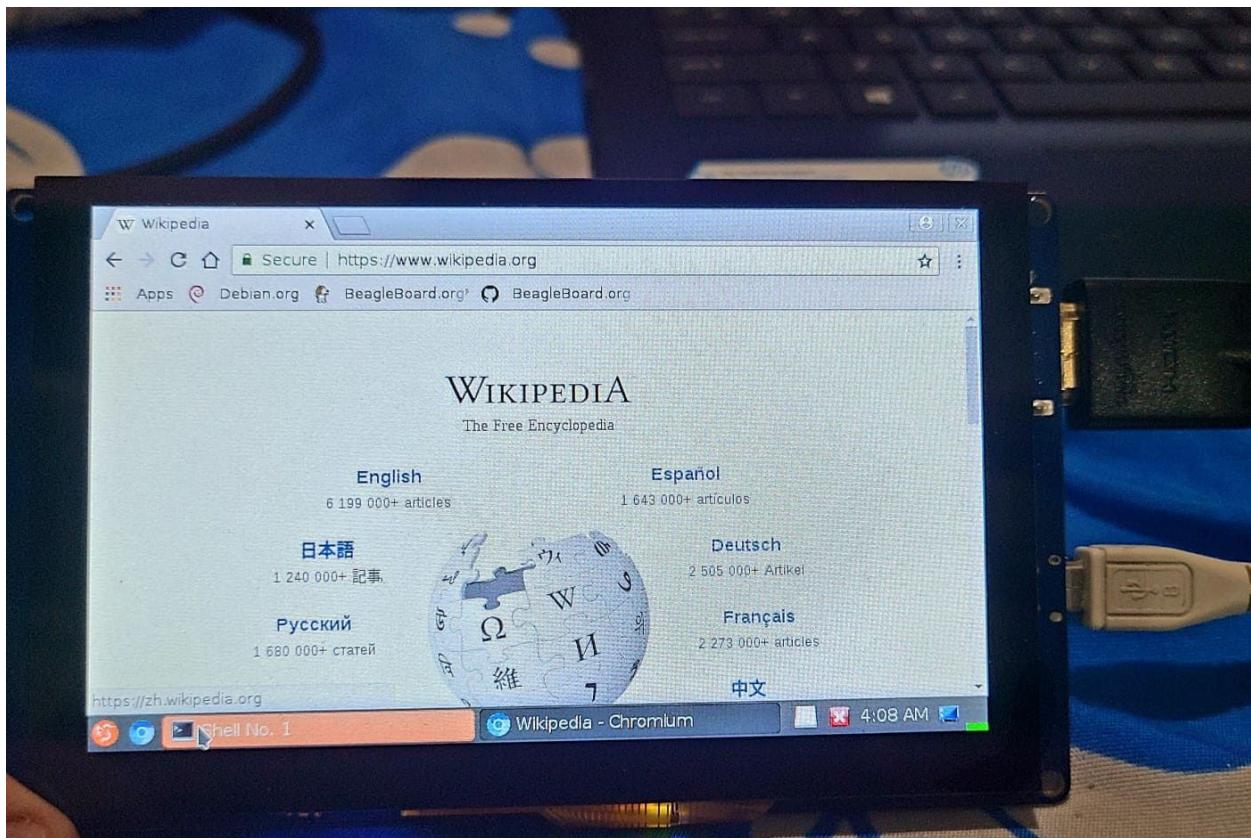


```
patel@patel-HP-Pavilion-15-Notebook-PC:~$ ping 192.168.2.79
TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

patel@patel-HP-Pavilion-15-Notebook-PC:~$ ping 192.168.2.79
PING 192.168.2.79 (192.168.2.79) 56(84) bytes of data.
64 bytes from 192.168.2.79: icmp_seq=1 ttl=64 time=2.16 ms
64 bytes from 192.168.2.79: icmp_seq=2 ttl=64 time=32.3 ms
64 bytes from 192.168.2.79: icmp_seq=3 ttl=64 time=17.9 ms
64 bytes from 192.168.2.79: icmp_seq=4 ttl=64 time=1.57 ms
64 bytes from 192.168.2.79: icmp_seq=5 ttl=64 time=1.28 ms
64 bytes from 192.168.2.79: icmp_seq=6 ttl=64 time=4.24 ms
64 bytes from 192.168.2.79: icmp_seq=7 ttl=64 time=2.56 ms
64 bytes from 192.168.2.79: icmp_seq=8 ttl=64 time=3.12 ms
64 bytes from 192.168.2.79: icmp_seq=9 ttl=64 time=12.5 ms
64 bytes from 192.168.2.79: icmp_seq=10 ttl=64 time=5.32 ms
64 bytes from 192.168.2.79: icmp_seq=11 ttl=64 time=59.6 ms
64 bytes from 192.168.2.79: icmp_seq=12 ttl=64 time=1.90 ms
64 bytes from 192.168.2.79: icmp_seq=13 ttl=64 time=5.09 ms
64 bytes from 192.168.2.79: icmp_seq=14 ttl=64 time=3.12 ms
64 bytes from 192.168.2.79: icmp_seq=15 ttl=64 time=2.13 ms
64 bytes from 192.168.2.79: icmp_seq=16 ttl=64 time=4.86 ms
64 bytes from 192.168.2.79: icmp_seq=17 ttl=64 time=10.3 ms
64 bytes from 192.168.2.79: icmp_seq=18 ttl=64 time=17.3 ms
^C
--- 192.168.2.79 ping statistics ---
```

4)

Here you can see that, we have connected our internet to an embedded platform (i.e BBB). We have also shown that we can access the web page on our GUI Linux interface .



Youtube link:

<https://www.youtube.com/watch?v=Ly3IgUJFun8&t=5s>

5) Lastly we logged into beaglebone from the host machine using the embedded platform (beaglebone)'s IP address.

```
patel@patel-HP-Pavilion-15-Notebook-PC: ~
File Edit View Search Terminal Help
patel@patel-HP-Pavilion-15-Notebook-PC:~$ ssh debian@192.168.2.79
Debian GNU/Linux 9

BeagleBoard.org Debian Image 2019-10-01

Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian

default username:password is [debian:temppwd]

debian@192.168.2.79's password:

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Dec  2 00:41:40 2020 from 192.168.2.29
debian@beaglebone:~$
```

Part Three: “crossover connection”

BONUS POINTS

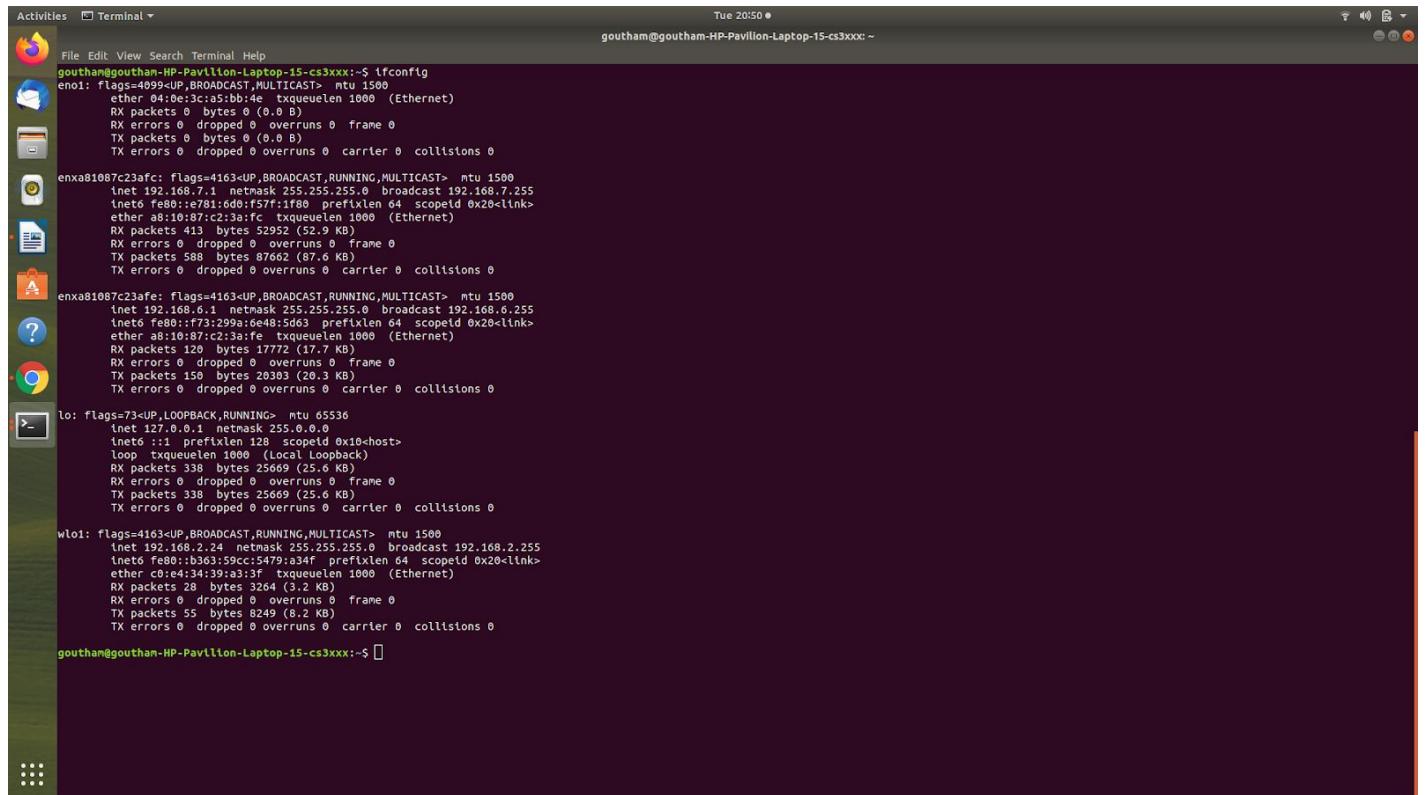
It should be possible to establish a direct connection from your Linux host machine to your Beaglebone using an ethernet patch cable; in older systems, the ethernet cable had to be a “crossover” type to allow a direct link, however, modern systems can work with a conventional patch cable. Investigate this type of connection, and see if you are able to do it! Name your sources in your discussion. This part is strictly for bonus points.

STEP-1:

Here, the settings for a Linux desktop to enable network are below:

Along with internet-over-USB device attached, just type **ifconfig** in terminal, then we will get the display of attached network interfaces.

The next step is to find the main adapter (eg.,eth0) and internet-over-USB adapter(e.g.,eth1).



A screenshot of a Ubuntu desktop environment. A terminal window is open, showing the output of the 'ifconfig' command. The terminal title is 'Terminal'. The output lists several network interfaces: eno1, enxa81087c23afe, and lo. The eno1 interface is connected to an Ethernet port with an IP of 192.168.7.255. The enxa81087c23afe interface is connected to a Beaglebone's eth0 port with an IP of 192.168.6.255. The lo interface is the loopback interface. The terminal prompt is 'goutham@goutham-HP-Pavilion-Laptop-15-cs3xxx:~\$'.

```
File Edit View Search Terminal Help
goutham@goutham-HP-Pavilion-Laptop-15-cs3xxx:~$ ifconfig
eno1: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
      ether 04:0e:3ca:5:bb:4e txqueuelen 1000  (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
enxa81087c23afe: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
      inet 192.168.6.1 netmask 255.255.255.0 broadcast 192.168.7.255
        brd 192.168.7.255
        ether a8:10:87:c2:3a:fe txqueuelen 1000  (Ethernet)
          RX packets 413 bytes 52952 (52.9 KB)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 588 bytes 87662 (87.6 KB)
          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
        brd 127.0.0.1
        ether 00:00:00:00:00:00 txqueuelen 128  (Local Loopback)
          RX packets 338 bytes 25669 (25.6 KB)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 338 bytes 25669 (25.6 KB)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
wlo1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
      inet 192.168.2.24 netmask 255.255.255.0 broadcast 192.168.2.255
        brd 192.168.2.255
        ether c0:ee:4:34:39:a3 txqueuelen 1000  (Ethernet)
          RX packets 28 bytes 3264 (3.2 KB)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 55 bytes 8249 (8.2 KB)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
goutham@goutham-HP-Pavilion-Laptop-15-cs3xxx:~$
```

Here, the eth0 is “wlo1” and eth1 is “enxa81087c23afe” from the above screenshot.

STEP-2:

Login in to your beaglebone by typing <ssh debian@192.168.7.2>

Here we have to use the iptables program for configuring the Linux kernel firewall rules.

```
debian@beaglebone:~$ sudo iptables --table nat --append POSTROUTING
--out-interface eth0 -j MASQUERADE
```

In place of **eth0**, type **wl01** and the command changes as below.

Run it on your beaglebone machine, and give the password as **temppwd**.

```
debian@beaglebone:~$ sudo iptables --table nat --append POSTROUTING
--out-interface wl01 -j MASQUERADE
```

STEP-3:

Similarly, in the following command

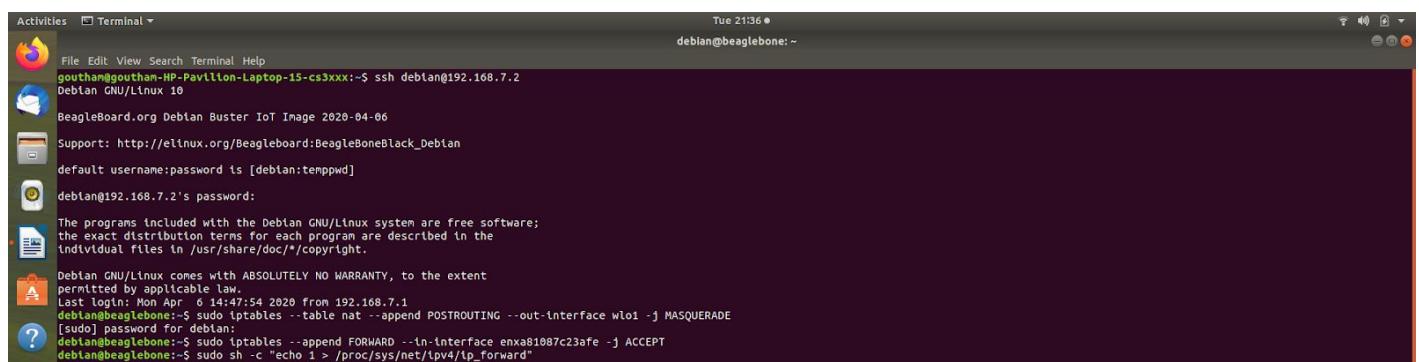
```
debian@beaglebone:~$ sudo iptables --append FORWARD --in-interface eth1 -j ACCEPT
```

Replace eth1 with enxa81087c23afe. Run the below command on your beaglebone.

```
debian@beaglebone:~$ sudo iptables --append FORWARD --in-interface enxa81087c23afe -j ACCEPT
```

Followed by below command,

```
debian@beaglebone:~$ sudo sh -c "echo 1 > /proc/sys/net/ipv4/ip_forward"
```



The screenshot shows a Linux desktop environment with a terminal window open. The terminal window title is 'Terminal'. The terminal content shows the following session:

```
Tue 21:36 ●  
debian@beaglebone:~  
goutham@goutham-HP-Pavilion-Laptop-15-cs3xxx:~$ ssh debian@192.168.7.2  
Debian GNU/Linux 10  
BeagleBoard.org Debian Buster IoT Image 2020-04-06  
Support: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian  
default username:password is [debian:temppwd]  
debian@192.168.7.2's password:  
The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/*copyright.  
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.  
Last login: Mon Apr  6 14:47:54 2020 from 192.168.7.1  
debian@beaglebone:~$ sudo iptables --table nat --append POSTROUTING --out-interface wlo1 -j MASQUERADE  
[sudo] password for debian:  
debian@beaglebone:~$ sudo iptables --append FORWARD --in-interface enxa81087c23afe -j ACCEPT  
debian@beaglebone:~$ sudo sh -c "echo 1 > /proc/sys/net/ipv4/ip_forward"
```

INTERNET-OVER-USB NETWORK SETTINGS

Now type the command `debian@beaglebone:~$ ping 8.8.8.8`

If the process gets started it will be fine otherwise we need to type the following command before we proceed to root.

```
root@beaglebone:~# route add default gw 192.168.7.2
```

After this change it to root user by entering the following command.

```
debian@beaglebone:~$ sudo -i
```

The user changes to root@beaglebone

Then type `ping www.google.com` to ping the website and the process begins as follows.

```
Activities Terminal Tue 21:49 ● debian@beaglebone: ~
File Edit View Search Terminal Help
default username:password is [debian:tempPWD]
debilan@192.168.7.2's password:
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/*copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Mon Apr  6 14:47:54 2020 from 192.168.7.1
debilan@beaglebone:~$ sudo iptables --table nat --append POSTROUTING --out-interface wlo1 -j MASQUERADE
[sudo] password for debilan:
debilan@beaglebone:~$ sudo sh -c "echo 1 > /proc/sys/net/ipv4/ip_forward"
debilan@beaglebone:~$ ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=114 time=5.16 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=114 time=5.78 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=114 time=5.44 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=114 time=5.14 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=114 time=6.27 ms
64 bytes from 8.8.8.8: icmp_seq=6 ttl=114 time=5.66 ms
64 bytes from 8.8.8.8: icmp_seq=7 ttl=114 time=5.23 ms
64 bytes from 8.8.8.8: icmp_seq=8 ttl=114 time=5.33 ms
64 bytes from 8.8.8.8: icmp_seq=9 ttl=114 time=21.5 ms
^Z
[1]+  Stopped                  ping 8.8.8.8
root@beaglebone:~$ sudo -l
root@beaglebone:~# route add default gw 192.168.7.2
SIOCADDRT: File exists
root@beaglebone:~# ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=114 time=4.95 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=114 time=6.62 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=114 time=6.55 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=114 time=18.6 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=114 time=5.49 ms
^Z
[1]+  Stopped                  ping 8.8.8.8
root@beaglebone:~# ping
ping  ping4  ping6
root@beaglebone:~# ping www.google.com
PING www.google.com (172.217.165.4) 56(84) bytes of data.
64 bytes from yzz1z506-in-f4.1e100.net (172.217.165.4): icmp_seq=1 ttl=113 time=8.77 ms
64 bytes from yzz1z506-in-f4.1e100.net (172.217.165.4): icmp_seq=2 ttl=113 time=12.3 ms
64 bytes from yzz1z506-in-f4.1e100.net (172.217.165.4): icmp_seq=3 ttl=113 time=4.93 ms
64 bytes from yzz1z506-in-f4.1e100.net (172.217.165.4): icmp_seq=4 ttl=113 time=12.1 ms
64 bytes from yzz1z506-in-f4.1e100.net (172.217.165.4): icmp_seq=5 ttl=113 time=5.21 ms
^Z
[2]+  Stopped                  ping www.google.com
root@beaglebone:~# debilan@beaglebone:~$ ping 8.8.8.8
-bash: debilan@beaglebone:~$: command not found
root@beaglebone:~#
```

Youtube link:

<https://youtu.be/k4UuGSNNg0Q>