

HIGH SPEED NETWORKS

LAB ASSIGNMENT 2

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EXP 1:

Code: Customized_topo.py

```
from mininet.topo import Topo
from mininet.net import Mininet
from mininet.link import TCLink
```

```
class MyTopo(Topo):
```

```
    def __init__(self):
```

```
        Topo.__init__( self)
```

```
        host1 = self.addHost('h1',mac='00:00:00:00:ff:01')
```

```
        host2 = self.addHost('h2',mac='00:00:00:00:ff:02')
```

```
        host3 = self.addHost('h3',mac='00:00:00:00:ff:03')
```

```
        host4 = self.addHost('h4',mac='00:00:00:00:ff:04')
```

```
        switchA = self.addSwitch('s1')
```

```
        switchB = self.addSwitch('s2')
```

```
        self.addLink(host1, switchA,cls=TCLink,bw=10, delay='2ms')
```

```
        self.addLink(host2, switchA,cls=TCLink,bw=20, delay='10ms')
```

```
        self.addLink(host3, switchB,cls=TCLink,bw=10, delay='2ms')
```

```
        self.addLink(host4, switchB,cls=TCLink,bw=20, delay='10ms')
```

```
        self.addLink(switchA, switchB,cls=TCLink,bw=20, delay='2ms',loss=10)
```

```
topos = { 'mytopo': ( lambda: MyTopo() ) }
```

Screen Shots:

```
[ 4] 22.5-23.0 sec  1.41 KBytes  23.2 Kbits/sec
[ 4] 23.0-23.5 sec 35.4 KBytes  579 Kbits/sec
*** Stopping 4 hosts
h1 h2 h3 h4
*** Stopping 2 switches
s1 ....s2 ....
*** Stopping 1 controllers
c0
*** Done
2016-03-23 02:50:34.833124
prasad@prasad-Ideapad-Z570:~/Desktop$ sudo mn --custom customized_topo.py --topo mytopo --test pingall
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4
*** Adding switches:
s1 s2
*** Adding links:
(10.00Mbit 2ms delay) (10.00Mbit 2ms delay) (h1, s1) (20.00Mbit 10ms delay) (20.00Mbit 10ms delay) (h2, s1) (10.00Mbit 2ms delay) (10.00Mbit 2ms delay) (h3, s2) (20.00Mbit 10ms delay) (20.00Mbit 10ms delay) (h4, s2) (20.00Mbit 2ms delay 10% loss) (20.00Mbit 2ms delay 10% loss) (s1, s2)
*** Configuring hosts
h1 h2 h3 h4
*** Starting controller
*** Starting 2 switches
s1 (10.00Mbit 2ms delay) (20.00Mbit 10ms delay) (20.00Mbit 2ms delay 10% loss) s2 (10.00Mbit 2ms delay) (20.00Mbit 10ms delay) (20.00Mbit 2ms delay 10% loss)
*** Ping: testing ping reachability
h1 -> h2 h3 h4
h2 -> h1 h3 h4
h3 -> h1 h2 h4
h4 -> h1 h2 h3
*** Results: 0% dropped (0/12 lost)
*** Stopping 4 hosts
h1 h2 h3 h4
*** Stopping 2 switches
s1 ....s2 ....
*** Stopping 1 controllers
c0
*** Done
completed in 5.585 seconds
prasad@prasad-Ideapad-Z570:~/Desktop$
```

```
XTerm
usage: xterm [-/+i32] [-C] [-Scn] [-T string] [-/+ah] [-/+ai] [-/+aw]
[-b number] [-/+bc] [-bcf milliseconds] [-bcn milliseconds] [-bd color]
[-/+bdc]
Node: h4
[ 25.0-25.5 sec 0.00 Bytes 0.00 bits/sec
[ 25.5-26.0 sec 0.00 Bytes 0.00 bits/sec
[ 26.0-26.5 sec 0.00 Bytes 0.00 bits/sec
[ 26.5-27.0 sec 0.00 Bytes 0.00 bits/sec
[ 27.0-27.5 sec 0.00 Bytes 0.00 bits/sec
[ 27.5-28.0 sec 0.00 Bytes 0.00 bits/sec
[ 28.0-28.5 sec 0.00 Bytes 0.00 bits/sec
[ 28.5-29.0 sec 0.00 Bytes 0.00 bits/sec
[ 29.0-29.5 sec 0.00 Bytes 0.00 bits/sec
[ 29.5-30.0 sec 0.00 Bytes 0.00 bits/sec
[ 30.0-30.5 sec 0.00 Bytes 0.00 bits/sec
[ 30.5-31.0 sec 0.00 Bytes 0.00 bits/sec
[ 31.0-31.5 sec 0.00 Bytes 0.00 bits/sec
[ 31.5-32.0 sec 0.00 Bytes 0.00 bits/sec
[ 32.0-32.5 sec 11.3 KBytes 185 Kbits/sec
[ 32.5-33.0 sec 65.0 KBytes 1.07 Mbits/sec
[ 33.0-33.5 sec 36.8 KBytes 502 Kbits/sec
[ 33.5-34.0 sec 0.00 Bytes 0.00 bits/sec
[ 34.0-34.5 sec 0.00 Bytes 0.00 bits/sec
[ 34.5-35.0 sec 0.00 Bytes 0.00 bits/sec
[ 35.0-35.5 sec 0.00 Bytes 0.00 bits/sec
[ 35.5-36.0 sec 0.00 Bytes 0.00 bits/sec
[ 36.0-36.5 sec 0.00 Bytes 0.00 bits/sec
[ 36.5-37.0 sec 0.00 Bytes 0.00 bits/sec
[ 37.0-37.5 sec 0.00 Bytes 0.00 bits/sec
[ 37.5-38.0 sec 0.00 Bytes 0.00 bits/sec
[ 0.0-38.2 sec 696 KBytes 192 Kbits/sec
Type xterm -
prasad@prasad-Ideapad-Z570:~/Desktop$
*** Creating
*** Adding c
*** Adding h
h1 h2 h3 h4
*** Adding switches:
s1 s2
*** Adding links:
(10.00Mbit 2ms delay) (10.00Mbit 2ms delay) (h1, s1) (20.00Mbit 10ms delay) (20.00Mbit 10ms delay) (h2, s1) (10.00Mbit 2ms delay) (10.00Mbit 2ms d
elay) (h3, s2) (20.00Mbit 10ms delay) (20.00Mbit 10ms delay) (h4, s2) (20.00Mbit 2ms delay 10% loss) (20.00Mbit 2ms delay 10% loss) (s1, s2)
*** Configuring hosts
h1 h2 h3 h4
*** Starting controller
*** Starting 2 switches
s1 (10.00Mbit 2ms delay) (20.00Mbit 10ms delay) (20.00Mbit 2ms delay 10% loss) s2 (10.00Mbit 2ms delay) (20.00Mbit 10ms delay) (20.00Mbit 2ms dela
y 10% loss)
*** Starting CLI:
mininet> xterm h1 h3
mininet> xterm h2 h4
mininet>
```

```
XTerm
xterm: bad command line option "h1"
usage: x
Node: h3
[ 7.0- 7.5 sec 2.83 KBytes 46.3 Kbits/sec
[ 7.5- 8.0 sec 25.5 KBytes 417 Kbits/sec
[ 8.0- 8.5 sec 0.00 Bytes 0.00 bits/sec
[ 8.5- 9.0 sec 0.00 Bytes 0.00 bits/sec
[ 9.0- 9.5 sec 0.00 Bytes 0.00 bits/sec
[ 9.5-10.0 sec 11.3 KBytes 185 Kbits/sec
[ 10.0-10.5 sec 0.00 Bytes 0.00 bits/sec
[ 10.5-11.0 sec 0.00 Bytes 0.00 bits/sec
[ 11.0-11.5 sec 0.00 Bytes 0.00 bits/sec
[ 11.5-12.0 sec 0.00 Bytes 0.00 bits/sec
[ 12.0-12.5 sec 0.00 Bytes 0.00 bits/sec
[ 12.5-13.0 sec 0.00 Bytes 0.00 bits/sec
[ 13.0-13.5 sec 0.00 Bytes 0.00 bits/sec
[ 13.5-14.0 sec 0.00 Bytes 0.00 bits/sec
[ 14.0-14.5 sec 0.00 Bytes 0.00 bits/sec
[ 14.5-15.0 sec 0.00 Bytes 0.00 bits/sec
[ 15.0-15.5 sec 0.00 Bytes 0.00 bits/sec
[ 15.5-16.0 sec 0.00 Bytes 0.00 bits/sec
[ 16.0-16.5 sec 0.00 Bytes 0.00 bits/sec
[ 16.5-17.0 sec 0.00 Bytes 0.00 bits/sec
[ 17.0-17.5 sec 0.00 Bytes 0.00 bits/sec
[ 17.5-18.0 sec 0.00 Bytes 0.00 bits/sec
[ 0.0-18.4 sec 256 KBytes 114 Kbits/sec
Type xterm -help for a full description.
prasad@prasad-Ideapad-Z570:~/Desktop$ sudo mn --custom customized_topo.py --topo mytopo
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4
*** Adding switches:
s1 s2
*** Adding links:
(10.00Mbit 2ms delay) (10.00Mbit 2ms delay) (h1, s1) (20.00Mbit 10ms delay) (20.00Mbit 10ms delay) (h2, s1) (10.00Mbit 2ms delay) (10.00Mbit 2ms d
elay) (h3, s2) (20.00Mbit 10ms delay) (20.00Mbit 10ms delay) (h4, s2) (20.00Mbit 2ms delay 10% loss) (20.00Mbit 2ms delay 10% loss) (s1, s2)
*** Configuring hosts
h1 h2 h3 h4
*** Starting controller
*** Starting 2 switches
s1 (10.00Mbit 2ms delay) (20.00Mbit 10ms delay) (20.00Mbit 2ms delay 10% loss) s2 (10.00Mbit 2ms delay) (20.00Mbit 10ms delay) (20.00Mbit 2ms dela
y 10% loss)
*** Starting CLI:
mininet> xterm h1 h3
mininet>
```

EXP 2:

```
from mininet.topo import Topo
from mininet.net import Mininet
from mininet.link import TCLink
from mininet.util import dumpNodeConnections
from mininet.log import setLogLevel
import time
import threading
import datetime

class MyTopo(Topo):

    def build(self):

        Topo.__init__( self)

        host1 = self.addHost('h1',mac='00:00:00:00:ff:01')
        host2 = self.addHost('h2',mac='00:00:00:00:ff:02')
        host3 = self.addHost('h3',mac='00:00:00:00:ff:03')
        host4 = self.addHost('h4',mac='00:00:00:00:ff:04')
        switchA = self.addSwitch('s1')
        switchB = self.addSwitch('s2')

        self.addLink(host1, switchA,cls=TCLink,bw=10, delay='2ms')
        self.addLink(host2, switchA,cls=TCLink,bw=20, delay='10ms')
        self.addLink(host3, switchB,cls=TCLink,bw=10, delay='2ms')
        self.addLink(host4, switchB,cls=TCLink,bw=20, delay='10ms')
        self.addLink(switchA, switchB,cls=TCLink,bw=20, delay='2ms',loss=10)

def mytest():
    topo=MyTopo(Topo)
    topo.build()
    global net
    net=Mininet(topo=topo,link=TCLink)
    net.start()
    print "Dumping Host connections"
    dumpNodeConnections(net.hosts)
    print "Testing connectivity"
    net.pingAll()

def test1():
    h1,h3 = net.get('h1','h3')
    h3.cmd('iperf -s -i 0.5 > a.txt &') #taking iperf results from server side
    h1.cmd('iperf -c 10.0.0.3 -t 20')
```

```

print "Testing bandwidth between h1 and h3"
f=open('/home/prasad/Desktop/a.txt')
for line in f.readlines():
    print '%s' %(line.strip())
f.close()

def test2():
    h2,h4 = net.get('h2','h4')
    h4.cmd('iperf -s -i 0.5 > b.txt &') #taking iperf results from server side
    time.sleep(10)
    h2.cmd('iperf -c 10.0.0.4 -t 20')
    print "Testing bandwidth between h2 and h4"
    f=open('/home/prasad/Desktop/b.txt')
    for line in f.readlines():
        print '%s' %(line.strip())
    f.close()
    net.stop()

if __name__ == '__main__':
    setLogLevel('info')
    mytest()
    thread1 = threading.Thread(target=test1, args=())
    thread2 = threading.Thread(target=test2, args=())
    print datetime.datetime.now()
    thread1.start()
    thread2.start()
    thread1.join()
    thread2.join()
    print datetime.datetime.now()

```

Explanation:

I am using threads to run the two process parallelly . The two process are defined as test1() and test2().Threads can be started using thread.start(), and thread.join() is used to maintain the order of thread running. I have also printed time just to make sure the two process are running as desired. Total time taken will be 30 seconds- 1st process from 0-20 sec and 2nd process from 10-30 sec. Iperf is used to check bandwidth measurements between two hosts. I have taken iperf readings on the server side, for this I have printed server side reading to a file and later I have used python's inbuilt readlines() and line.strip() to read and write bandwidth measurements in the terminal.'& ' is used to run process in background. I have defined a function mytest() and there I have called the class Mytopo and function build().Also, TCLink is a class defined in mininet where all the link parameters such as delay,bandwidth etc are defined.

(Note: Kindly change the path of text file-a.txt and b.txt, if you are running it on your PC).

Screenshots:

```
python: can't open file 'host_iperf.py': [Errno 2] No such file or directory
prasad@prasad-Ideapad-Z570:~$ cd Desktop
prasad@prasad-Ideapad-Z570:~/Desktop$ sudo python host_iperf.py
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4
*** Adding switches:
s1 s2
*** Adding links:
(10.00Mbit 2ms delay) (10.00Mbit 2ms delay) (h1, s1) (20.00Mbit 10ms delay) (20.
00Mbit 10ms delay) (h2, s1) (10.00Mbit 2ms delay) (10.00Mbit 2ms delay) (h3, s2)
(20.00Mbit 10ms delay) (20.00Mbit 10ms delay) (h4, s2) (20.00Mbit 2ms delay 10%
loss) (20.00Mbit 2ms delay 10% loss) (s1, s2)
*** Configuring hosts
h1 h2 h3 h4
*** Starting controller
*** Starting 2 switches
s1 (10.00Mbit 2ms delay) (20.00Mbit 10ms delay) (20.00Mbit 2ms delay 10% loss) s
2 (10.00Mbit 2ms delay) (20.00Mbit 10ms delay) (20.00Mbit 2ms delay 10% loss)
Dumping Host connections
h1 h1-eth0:s1-eth1
h2 h2-eth0:s1-eth2
h3 h3-eth0:s2-eth1
h4 h4-eth0:s2-eth2
Testing connectivity
*** Ping: testing ping reachability
h1 -> h2 h3 h4
h2 -> h1 X X
h3 -> X X h4
h4 -> h1 h2 h3
*** Results: 33% dropped (4/12 lost)
2016-03-23 03:20:50.617094
Testing bandwidth between h1 and h3
-----
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)
-----
[ 4] local 10.0.0.3 port 5001 connected with 10.0.0.1 port 57410
[ ID] Interval      Transfer      Bandwidth
[ 4]  0.0- 0.5 sec   165 KBytes   2.71 Mbits/sec
```

```
[ 4]  2.5- 3.0 sec    0.00 Bytes    0.00 bits/sec
[ 4]  3.0- 3.5 sec   17.0 KBytes   278 Kbits/sec
[ 4]  3.5- 4.0 sec    0.00 Bytes    0.00 bits/sec
[ 4]  4.0- 4.5 sec    4.24 KBytes   69.5 Kbits/sec
[ 4]  4.5- 5.0 sec    0.00 Bytes    0.00 bits/sec
[ 4]  5.0- 5.5 sec    0.00 Bytes    0.00 bits/sec
[ 4]  5.5- 6.0 sec    0.00 Bytes    0.00 bits/sec
[ 4]  6.0- 6.5 sec    0.00 Bytes    0.00 bits/sec
[ 4]  6.5- 7.0 sec    0.00 Bytes    0.00 bits/sec
[ 4]  7.0- 7.5 sec    0.00 Bytes    0.00 bits/sec
[ 4]  7.5- 8.0 sec    0.00 Bytes    0.00 bits/sec
[ 4]  8.0- 8.5 sec    0.00 Bytes    0.00 bits/sec
[ 4]  8.5- 9.0 sec    0.00 Bytes    0.00 bits/sec
[ 4]  9.0- 9.5 sec    0.00 Bytes    0.00 bits/sec
[ 4]  9.5-10.0 sec    1.41 KBytes   23.2 Kbits/sec
[ 4] 10.0-10.5 sec    0.00 Bytes    0.00 bits/sec
[ 4] 10.5-11.0 sec    0.00 Bytes    0.00 bits/sec
[ 4] 11.0-11.5 sec   35.4 KBytes   579 Kbits/sec
[ 4] 11.5-12.0 sec    0.00 Bytes    0.00 bits/sec
[ 4] 12.0-12.5 sec    24.0 KBytes   394 Kbits/sec
[ 4] 12.5-13.0 sec    7.07 KBytes   116 Kbits/sec
[ 4] 13.0-13.5 sec    7.07 KBytes   116 Kbits/sec
[ 4] 13.5-14.0 sec    1.41 KBytes   23.2 Kbits/sec
[ 4] 14.0-14.5 sec   32.5 KBytes   533 Kbits/sec
[ 4] 14.5-15.0 sec   12.7 KBytes   209 Kbits/sec
[ 4] 15.0-15.5 sec   15.6 KBytes   255 Kbits/sec
[ 4] 15.5-16.0 sec    5.66 KBytes   92.7 Kbits/sec
[ 4] 16.0-16.5 sec   26.9 KBytes   440 Kbits/sec
[ 4] 16.5-17.0 sec   22.6 KBytes   371 Kbits/sec
[ 4] 17.0-17.5 sec   42.4 KBytes   695 Kbits/sec
[ 4] 17.5-18.0 sec    2.83 KBytes   46.3 Kbits/sec
[ 4] 18.0-18.5 sec    1.41 KBytes   23.2 Kbits/sec
[ 4] 18.5-19.0 sec   26.9 KBytes   440 Kbits/sec
[ 4] 19.0-19.5 sec   42.4 KBytes   695 Kbits/sec
[ 4] 19.5-20.0 sec   12.7 KBytes   209 Kbits/sec
[ 4] 20.0-20.5 sec   36.8 KBytes   602 Kbits/sec
[ 4] 20.5-21.0 sec   46.7 KBytes   765 Kbits/sec
[ 4] 21.0-21.5 sec   14.1 KBytes   232 Kbits/sec
[ 4] 21.5-22.0 sec   36.8 KBytes   602 Kbits/sec
Testing bandwidth between h2 and h4
-----
```

```

-----
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)
-----
[ 4] local 10.0.0.4 port 5001 connected with 10.0.0.2 port 52978
[ ID] Interval      Transfer      Bandwidth
[ 4] 0.0- 0.5 sec    107 KBytes    1.76 Mbits/sec
[ 4] 0.5- 1.0 sec    1.41 KBytes    23.2 Kbits/sec
[ 4] 1.0- 1.5 sec    25.5 KBytes    417 Kbits/sec
[ 4] 1.5- 2.0 sec    7.07 KBytes    116 Kbits/sec
[ 4] 2.0- 2.5 sec    7.07 KBytes    116 Kbits/sec
[ 4] 2.5- 3.0 sec    12.7 KBytes    209 Kbits/sec
[ 4] 3.0- 3.5 sec    0.00 Bytes     0.00 bits/sec
[ 4] 3.5- 4.0 sec    14.1 KBytes    232 Kbits/sec
[ 4] 4.0- 4.5 sec    28.3 KBytes    463 Kbits/sec
[ 4] 4.5- 5.0 sec    0.00 Bytes     0.00 bits/sec
[ 4] 5.0- 5.5 sec    12.7 KBytes    209 Kbits/sec
[ 4] 5.5- 6.0 sec    12.7 KBytes    209 Kbits/sec
[ 4] 6.0- 6.5 sec    58.0 KBytes    950 Kbits/sec
[ 4] 6.5- 7.0 sec    38.2 KBytes    626 Kbits/sec
[ 4] 7.0- 7.5 sec    4.24 KBytes    69.5 Kbits/sec
[ 4] 7.5- 8.0 sec    24.0 KBytes    394 Kbits/sec
[ 4] 8.0- 8.5 sec    48.1 KBytes    788 Kbits/sec
[ 4] 8.5- 9.0 sec    39.6 KBytes    649 Kbits/sec
[ 4] 9.0- 9.5 sec    63.6 KBytes    1.04 Mbits/sec
[ 4] 9.5-10.0 sec    33.9 KBytes    556 Kbits/sec
[ 4] 10.0-10.5 sec    1.41 KBytes    23.2 Kbits/sec
[ 4] 10.5-11.0 sec    4.24 KBytes    69.5 Kbits/sec
[ 4] 11.0-11.5 sec    52.3 KBytes    857 Kbits/sec
[ 4] 11.5-12.0 sec    2.83 KBytes    46.3 Kbits/sec
[ 4] 12.0-12.5 sec    18.4 KBytes    301 Kbits/sec
[ 4] 12.5-13.0 sec    0.00 Bytes     0.00 bits/sec
[ 4] 13.0-13.5 sec    11.3 KBytes    185 Kbits/sec
[ 4] 13.5-14.0 sec    17.0 KBytes    278 Kbits/sec
[ 4] 14.0-14.5 sec    55.1 KBytes    904 Kbits/sec
[ 4] 14.5-15.0 sec    9.90 KBytes    162 Kbits/sec
[ 4] 15.0-15.5 sec    26.9 KBytes    440 Kbits/sec
[ 4] 15.5-16.0 sec    35.4 KBytes    579 Kbits/sec
[ 4] 16.0-16.5 sec    22.6 KBytes    371 Kbits/sec
[ 4] 16.5-17.0 sec    12.7 KBytes    209 Kbits/sec
[ 4] 17.0-17.5 sec    1.41 KBytes    23.2 Kbits/sec

```

```

[ 4] 6.5- 7.0 sec    38.2 KBytes    626 Kbits/sec
[ 4] 7.0- 7.5 sec    4.24 KBytes    69.5 Kbits/sec
[ 4] 7.5- 8.0 sec    24.0 KBytes    394 Kbits/sec
[ 4] 8.0- 8.5 sec    48.1 KBytes    788 Kbits/sec
[ 4] 8.5- 9.0 sec    39.6 KBytes    649 Kbits/sec
[ 4] 9.0- 9.5 sec    63.6 KBytes    1.04 Mbits/sec
[ 4] 9.5-10.0 sec    33.9 KBytes    556 Kbits/sec
[ 4] 10.0-10.5 sec    1.41 KBytes    23.2 Kbits/sec
[ 4] 10.5-11.0 sec    4.24 KBytes    69.5 Kbits/sec
[ 4] 11.0-11.5 sec    52.3 KBytes    857 Kbits/sec
[ 4] 11.5-12.0 sec    2.83 KBytes    46.3 Kbits/sec
[ 4] 12.0-12.5 sec    18.4 KBytes    301 Kbits/sec
[ 4] 12.5-13.0 sec    0.00 Bytes     0.00 bits/sec
[ 4] 13.0-13.5 sec    11.3 KBytes    185 Kbits/sec
[ 4] 13.5-14.0 sec    17.0 KBytes    278 Kbits/sec
[ 4] 14.0-14.5 sec    55.1 KBytes    904 Kbits/sec
[ 4] 14.5-15.0 sec    9.90 KBytes    162 Kbits/sec
[ 4] 15.0-15.5 sec    26.9 KBytes    440 Kbits/sec
[ 4] 15.5-16.0 sec    35.4 KBytes    579 Kbits/sec
[ 4] 16.0-16.5 sec    22.6 KBytes    371 Kbits/sec
[ 4] 16.5-17.0 sec    12.7 KBytes    209 Kbits/sec
[ 4] 17.0-17.5 sec    1.41 KBytes    23.2 Kbits/sec
[ 4] 17.5-18.0 sec    39.6 KBytes    649 Kbits/sec
[ 4] 18.0-18.5 sec    73.5 KBytes    1.20 Mbits/sec
[ 4] 18.5-19.0 sec    106 KBytes    1.74 Mbits/sec
[ 4] 19.0-19.5 sec    77.8 KBytes    1.27 Mbits/sec
[ 4] 19.5-20.0 sec    12.7 KBytes    209 Kbits/sec
[ 4] 20.0-20.5 sec    32.5 KBytes    533 Kbits/sec
[ 4] 20.5-21.0 sec    18.4 KBytes    301 Kbits/sec
[ 4] 21.0-21.5 sec    53.7 KBytes    880 Kbits/sec
[ 4] 21.5-22.0 sec    18.4 KBytes    301 Kbits/sec
[ 4] 22.0-22.5 sec    79.2 KBytes    1.30 Mbits/sec
*** Stopping 4 hosts
h1 h2 h3 h4
*** Stopping 2 switches
s1 ....s2 ....
*** Stopping 1 controllers
c0
*** Done
2016-03-23 03:21:23.965616
prasad@prasad-Ideapad-Z570:~/Desktop$

```