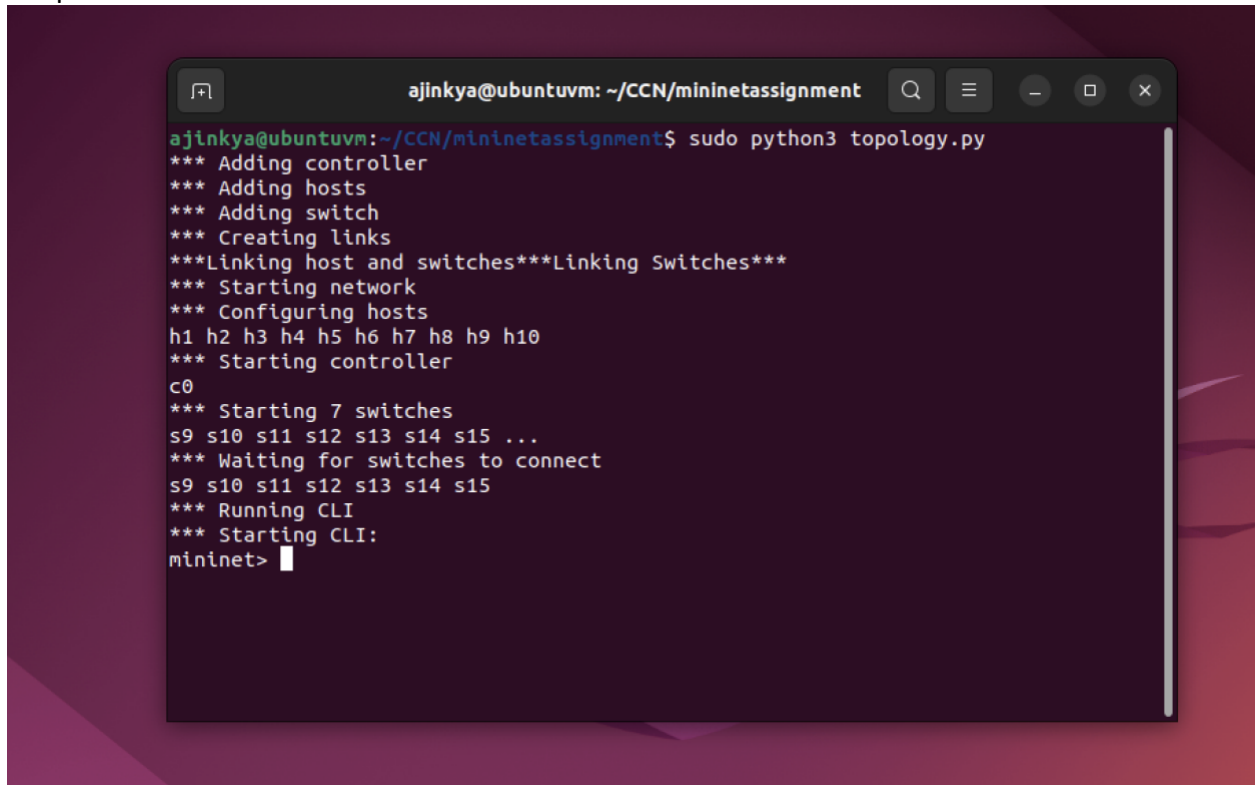


## Assignment 2 – Mininet Topology Analysis

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1. Script file **topology.py** the file can be found in the submitted zip file
2. Output

A terminal window titled 'ajinkya@ubuntuvm: ~/CCN/mininetassignment' displays the output of running 'sudo python3 topology.py'. The output shows the sequential steps of setting up a Mininet network: adding a controller, hosts, and switches; creating links; starting the network; configuring hosts (h1-h10); starting the controller (c0); starting 7 switches (s9-s15); waiting for switches to connect; running the CLI; and starting the CLI. The prompt 'mininet>' is visible at the bottom.

```
ajinkya@ubuntuvm:~/CCN/mininetassignment$ sudo python3 topology.py
*** Adding controller
*** Adding hosts
*** Adding switch
*** Creating links
***Linking host and switches***Linking Switches***
*** Starting network
*** Configuring hosts
h1 h2 h3 h4 h5 h6 h7 h8 h9 h10
*** Starting controller
c0
*** Starting 7 switches
s9 s10 s11 s12 s13 s14 s15 ...
*** Waiting for switches to connect
s9 s10 s11 s12 s13 s14 s15
*** Running CLI
*** Starting CLI:
mininet>
```

Python Code:

Open ▾



topology.py

~/CCN/mininetassignment

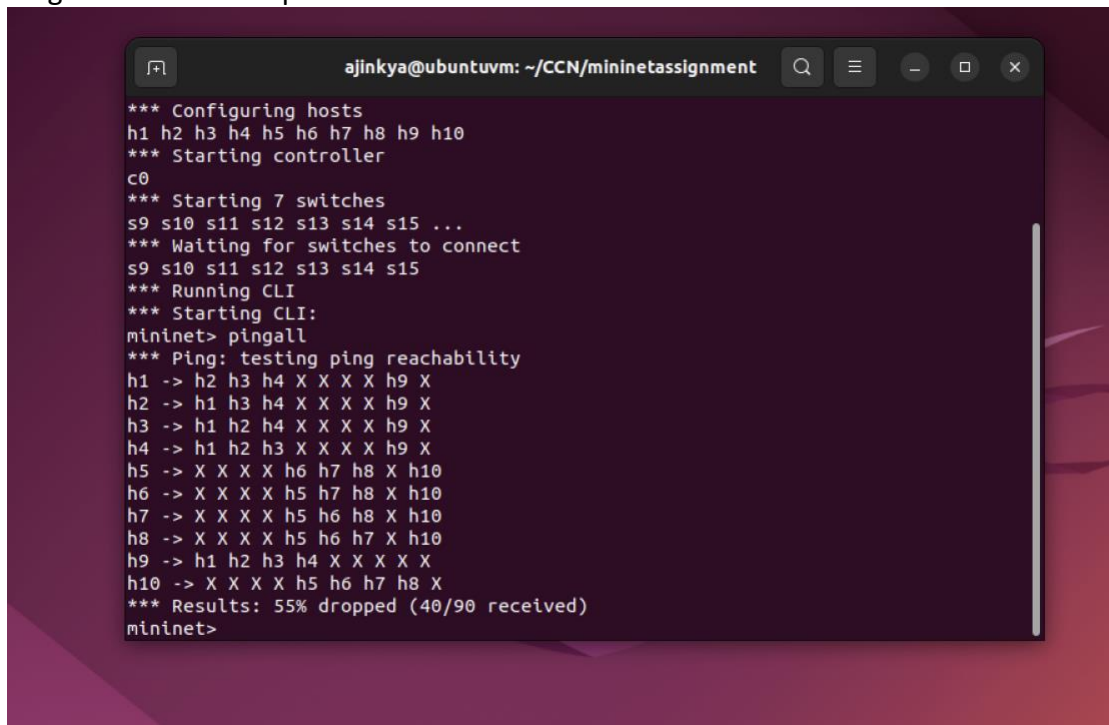
```
1 from mininet.net import Mininet
2 from mininet.node import Controller
3 from mininet.cli import CLI
4 from mininet.log import setLogLevel,info
5
6 def network():
7     net = Mininet(topo=None,controller = Controller, waitConnected = True)
8
9     info( '*** Adding controller\n' )
10    net.addController('c0')
11
12    info( '*** Adding hosts\n' )
13    h1 = net.addHost('h1', ip='10.0.1.10/24')
14    h2 = net.addHost('h2', ip='10.0.1.11/24')
15    h3 = net.addHost('h3', ip='10.0.1.12/24')
16    h4 = net.addHost('h4', ip='10.0.1.13/24')
17    h5 = net.addHost('h5', ip='10.0.2.10/24')
18    h6 = net.addHost('h6', ip='10.0.2.11/24')
19    h7 = net.addHost('h7', ip='10.0.2.12/24')
20    h8 = net.addHost('h8', ip='10.0.2.13/24')
21    h9 = net.addHost('h9', ip='10.0.1.1/24')
22    h10 = net.addHost('h10', ip='10.0.2.1/24')
23
24    info( '*** Adding switch\n' )
25    s9 = net.addSwitch('s9')
26    s10 = net.addSwitch('s10')
27    s11 = net.addSwitch('s11')
28    s12 = net.addSwitch('s12')
29    s13 = net.addSwitch('s13')
30    s14 = net.addSwitch('s14')
31    s15 = net.addSwitch('s15')
32
33    info( '*** Creating links\n' )
34    info('***Linking host and switches')
35    net.addLink( h1, s11 )
36    net.addLink( h2, s11 )
37
38    net.addLink( h3, s12 )
39    net.addLink( h4, s12 )
40
```

```

41 net.addLink( h5, s14 )
42 net.addLink( h6, s14 )
43
44 net.addLink( h7, s15 )
45 net.addLink( h8, s15 )
46
47 net.addLink( h9, s9 )
48 net.addLink( h10, s9 )
49
50 info('***Linking Switches***\n')
51 net.addLink(s10,s11)
52 net.addLink(s10,s12)
53
54 net.addLink(s13,s14)
55 net.addLink(s13,s15)
56
57 net.addLink(s9,s10)
58 net.addLink(s9,s13)
59
60 info( '*** Starting network\n')
61 net.start()
62
63 info( '*** Running CLI\n' )
64 CLI( net )
65
66 info( '*** Stopping network' )
67 net.stop()
68
69 if __name__ == '__main__':
70     setLogLevel( 'info' )
71     network()

```

### 3. Pingall command output



```

ajinkya@ubuntuvm: ~/CCN/mininetassignment
*** Configuring hosts
h1 h2 h3 h4 h5 h6 h7 h8 h9 h10
*** Starting controller
c0
*** Starting 7 switches
s9 s10 s11 s12 s13 s14 s15 ...
*** Waiting for switches to connect
s9 s10 s11 s12 s13 s14 s15
*** Running CLI
*** Starting CLI:
mininet> pingall
*** Ping: testing ping reachability
h1 -> h2 h3 h4 X X X h9 X
h2 -> h1 h3 h4 X X X h9 X
h3 -> h1 h2 h4 X X X h9 X
h4 -> h1 h2 h3 X X X h9 X
h5 -> X X X h6 h7 h8 X h10
h6 -> X X X h5 h7 h8 X h10
h7 -> X X X h5 h6 h8 X h10
h8 -> X X X h5 h6 h7 X h10
h9 -> h1 h2 h3 h4 X X X X
h10 -> X X X h5 h6 h7 h8 X
*** Results: 55% dropped (40/90 received)
mininet>

```

#### 4. Table for scenario 1 and 2

### Scenario 1:

H9 -> H1:

```
ajinkya@ubuntuvm: ~/CCN/mininetassignment
***Linking host and switches***Linking Switches***
*** Starting network
*** Configuring hosts
h1 h2 h3 h4 h5 h6 h7 h8 h9 h10
*** Starting controller
c0
*** Starting 7 switches
s9 s10 s11 s12 s13 s14 s15 ...
*** Waiting for switches to connect
s9 s10 s11 s12 s13 s14 s15
*** Running CLI
*** Starting CLI:
mininet> xterm h1
mininet> xterm h9
mininet> h9 ping h1
PING 10.0.1.10 (10.0.1.10) 56(84) bytes of data.
64 bytes from 10.0.1.10: icmp_seq=1 ttl=64 time=3.56 ms
64 bytes from 10.0.1.10: icmp_seq=2 ttl=64 time=0.463 ms
64 bytes from 10.0.1.10: icmp_seq=3 ttl=64 time=0.077 ms
^C
--- 10.0.1.10 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 1012ms
rtt min/avg/max/mdev = 0.077/1.366/3.558/1.557 ms
mininet>

"Node: h9"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 65.3 KByte (default)
[ 1] local 10.0.1.1 port 5001 connected with 10.0.1.10 port 56290
[ ID] Interval Transfer Bandwidth
[ 1] 0.000-3.996 sec 84.7 GBytes 72.7 Gbits/sec
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#

"Node: h1"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.1.1
Client connecting to 10.0.1.1, TCP port 5001
TCP window size: 65.3 KByte (default)
[ 1] local 10.0.1.10 port 56290 connected with 10.0.1.1 port 5001
[ ID] Interval Transfer Bandwidth
[ 1] 0.000-10.004 sec 84.7 GBytes 72.7 Gbits/sec
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#
```

H9 -> H2

```
ajinkya@ubuntuvm: ~/CCN/mininetassignment
mininet> xterm h9
mininet> xterm h2
mininet> h9 ping h2
PING 10.0.1.11 (10.0.1.11) 56(84) bytes of data.
64 bytes from 10.0.1.11: icmp_seq=1 ttl=64 time=5.82 ms
64 bytes from 10.0.1.11: icmp_seq=2 ttl=64 time=0.502 ms
64 bytes from 10.0.1.11: icmp_seq=3 ttl=64 time=0.106 ms
64 bytes from 10.0.1.11: icmp_seq=4 ttl=64 time=0.058 ms
64 bytes from 10.0.1.11: icmp_seq=5 ttl=64 time=0.050 ms
64 bytes from 10.0.1.11: icmp_seq=6 ttl=64 time=0.045 ms
64 bytes from 10.0.1.11: icmp_seq=7 ttl=64 time=0.061 ms
64 bytes from 10.0.1.11: icmp_seq=8 ttl=64 time=0.164 ms
64 bytes from 10.0.1.11: icmp_seq=9 ttl=64 time=0.053 ms
64 bytes from 10.0.1.11: icmp_seq=10 ttl=64 time=0.050 ms
64 bytes from 10.0.1.11: icmp_seq=11 ttl=64 time=0.044 ms
64 bytes from 10.0.1.11: icmp_seq=12 ttl=64 time=0.054 ms
64 bytes from 10.0.1.11: icmp_seq=13 ttl=64 time=0.063 ms
64 bytes from 10.0.1.11: icmp_seq=14 ttl=64 time=0.050 ms
64 bytes from 10.0.1.11: icmp_seq=15 ttl=64 time=0.067 ms
64 bytes from 10.0.1.11: icmp_seq=16 ttl=64 time=0.042 ms
^C
--- 10.0.1.11 ping statistics ---
16 packets transmitted, 16 received, 0% packet loss, time 1532ms
rtt min/avg/max/mdev = 0.042/0.452/5.823/1.391 ms

"Node: h9"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 65.3 KByte (default)
[ 1] local 10.0.1.1 port 5001 connected with 10.0.1.11 port 56734
[ ID] Interval Transfer Bandwidth
[ 1] 0.000-9.994 sec 89.5 GBytes 76.9 Gbits/sec
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#

"Node: h2"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.1.1
Client connecting to 10.0.1.1, TCP port 5001
TCP window size: 65.3 KByte (default)
[ 1] local 10.0.1.11 port 56734 connected with 10.0.1.1 port 5001
[ ID] Interval Transfer Bandwidth
[ 1] 0.000-10.004 sec 89.5 GBytes 76.9 Gbits/sec
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#
```

## H9 -> H3

```

ajinkya@ubuntuvm: ~/CCN/mininetassignment
64 bytes from 10.0.1.11: icmp_seq=14 ttl=64 time=0.050 ms
64 bytes from 10.0.1.11: icmp_seq=15 ttl=64 time=0.067 ms
64 bytes from 10.0.1.11: icmp_seq=16 ttl=64 time=0.042 ms
^C
--- 10.0.1.11 ping statistics ---
16 packets transmitted, 16 received, 0% packet loss, time 15321ms
rtt min/avg/max/mdev = 0.042/0.452/5.823/1.391 ms
mininet> xterm h9
mininet> xterm h3
mininet> h9 ping h3
PING 10.0.1.12 (10.0.1.12) 56(84) bytes of data:
64 bytes from 10.0.1.12: icmp_seq=1 ttl=64 time=3.95 ms
64 bytes from 10.0.1.12: icmp_seq=2 ttl=64 time=0.672 ms
64 bytes from 10.0.1.12: icmp_seq=3 ttl=64 time=0.094 ms
64 bytes from 10.0.1.12: icmp_seq=4 ttl=64 time=0.051 ms
64 bytes from 10.0.1.12: icmp_seq=5 ttl=64 time=0.043 ms
64 bytes from 10.0.1.12: icmp_seq=6 ttl=64 time=0.044 ms
64 bytes from 10.0.1.12: icmp_seq=7 ttl=64 time=0.060 ms
64 bytes from 10.0.1.12: icmp_seq=8 ttl=64 time=0.147 ms
^C
--- 10.0.1.12 ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7135ms
rtt min/avg/max/mdev = 0.043/0.633/3.953/1.270 ms
mininet>

```

"Node: h9"

```

root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)
[ 1] local 10.0.1.1 port 5001 connected with 10.0.1.12 port 51946
[ ID] Interval      Transfer    Bandwidth
[ 1] 0.0000-9.9999 sec  86.4 GBytes  74.2 Gbits/sec

```

"Node: h3"

```

root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.1.1
Client connecting to 10.0.1.1, TCP port 5001
TCP window size: 85.3 KByte (default)
[ 1] local 10.0.1.12 port 51946 connected with 10.0.1.1 port 5001
[ ID] Interval      Transfer    Bandwidth
[ 1] 0.0000-10.0031 sec  86.4 GBytes  74.2 Gbits/sec
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#

```

## H9 -> H4

```

ajinkya@ubuntuvm: ~/CCN/mininetassignment
64 bytes from 10.0.1.12: icmp_seq=2 ttl=64 time=0.672 ms
64 bytes from 10.0.1.12: icmp_seq=3 ttl=64 time=0.094 ms
64 bytes from 10.0.1.12: icmp_seq=4 ttl=64 time=0.051 ms
64 bytes from 10.0.1.12: icmp_seq=5 ttl=64 time=0.043 ms
64 bytes from 10.0.1.12: icmp_seq=6 ttl=64 time=0.044 ms
64 bytes from 10.0.1.12: icmp_seq=7 ttl=64 time=0.060 ms
64 bytes from 10.0.1.12: icmp_seq=8 ttl=64 time=0.147 ms
^C
--- 10.0.1.12 ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7135ms
rtt min/avg/max/mdev = 0.043/0.633/3.953/1.270 ms
mininet> xterm h9
mininet> xterm h4
mininet> h9 ping h4
PING 10.0.1.13 (10.0.1.13) 56(84) bytes of data:
64 bytes from 10.0.1.13: icmp_seq=1 ttl=64 time=3.25 ms
64 bytes from 10.0.1.13: icmp_seq=2 ttl=64 time=0.524 ms
64 bytes from 10.0.1.13: icmp_seq=3 ttl=64 time=0.052 ms
64 bytes from 10.0.1.13: icmp_seq=4 ttl=64 time=0.052 ms
^C
--- 10.0.1.13 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3057ms
rtt min/avg/max/mdev = 0.052/0.969/3.249/1.330 ms
mininet>

```

"Node: h9"

```

root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)
[ 1] local 10.0.1.1 port 5001 connected with 10.0.1.13 port 59776
[ ID] Interval      Transfer    Bandwidth
[ 1] 0.0000-9.9999 sec  85.3 GBytes  73.2 Gbits/sec

```

"Node: h4"

```

root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.1.1
Client connecting to 10.0.1.1, TCP port 5001
TCP window size: 85.3 KByte (default)
[ 1] local 10.0.1.13 port 59776 connected with 10.0.1.1 port 5001
[ ID] Interval      Transfer    Bandwidth
[ 1] 0.0000-10.0195 sec  85.3 GBytes  73.1 Gbits/sec
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#

```



## H9 -> H5

The screenshot shows two terminal windows. The left window, titled 'ajinkya@ubuntuvm: ~/CCN/mininetassignment', displays the output of a ping command from H9 to H5 (10.0.1.13). The ping statistics show 4 packets transmitted, 4 received, 0% packet loss, and a time of 3057ms. The right window, titled '"Node: h9"', shows the output of an 'iperf -s' command, indicating that the server is listening on TCP port 5001 and the TCP window size is 65,536 bytes (default).

```

ajinkya@ubuntuvm: ~/CCN/mininetassignment
64 bytes from 10.0.1.12: icmp_seq=6 ttl=64 time=0.044 ms
64 bytes from 10.0.1.12: icmp_seq=7 ttl=64 time=0.060 ms
64 bytes from 10.0.1.12: icmp_seq=8 ttl=64 time=0.147 ms
^C
--- 10.0.1.12 ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7135ms
rtt min/avg/max/mdev = 0.043/0.633/3.953/1.270 ms
mininet> xterm h9
mininet> xterm h4
mininet> h9 ping h4
PING 10.0.1.13 (10.0.1.13) 56(84) bytes of data:
64 bytes from 10.0.1.13: icmp_seq=1 ttl=64 time=3.25 ms
64 bytes from 10.0.1.13: icmp_seq=2 ttl=64 time=0.524 ms
64 bytes from 10.0.1.13: icmp_seq=3 ttl=64 time=0.052 ms
64 bytes from 10.0.1.13: icmp_seq=4 ttl=64 time=0.052 ms
^C
--- 10.0.1.13 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3057ms
rtt min/avg/max/mdev = 0.052/0.969/3.249/1.330 ms
mininet> xterm h9
mininet> xterm h5
mininet> h9 ping h5
ping: connect: Network is unreachable
mininet>

```

```

"Node: h9"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 65,536 Byte (default)

```

```

"Node: h5"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.1.1
tcp connect failed: Network is unreachable
Client connecting to 10.0.1.1, TCP port 5001
TCP window size: -1,00 Byte (default)
[ 1] local 0.0.0.0 port 0 connected with 10.0.1.1 port 5001
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.1.1
tcp connect failed: Network is unreachable
Client connecting to 10.0.1.1, TCP port 5001
TCP window size: -1,00 Byte (default)
[ 1] local 0.0.0.0 port 0 connected with 10.0.1.1 port 5001
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#

```

## H9 -> H6

The screenshot shows two terminal windows. The left window, titled 'ajinkya@ubuntuvm: ~/CCN/mininetassignment', displays the output of a ping command from H9 to H6 (10.0.1.14). The ping statistics show 4 packets transmitted, 4 received, 0% packet loss, and a time of 3057ms. The right window, titled '"Node: h9"', shows the output of an 'iperf -s' command, indicating that the server is listening on TCP port 5001 and the TCP window size is 65,536 bytes (default).

```

ajinkya@ubuntuvm: ~/CCN/mininetassignment
8 packets transmitted, 8 received, 0% packet loss, time 7135ms
rtt min/avg/max/mdev = 0.043/0.633/3.953/1.270 ms
mininet> xterm h9
mininet> xterm h4
mininet> h9 ping h4
PING 10.0.1.13 (10.0.1.13) 56(84) bytes of data:
64 bytes from 10.0.1.13: icmp_seq=1 ttl=64 time=3.25 ms
64 bytes from 10.0.1.13: icmp_seq=2 ttl=64 time=0.524 ms
64 bytes from 10.0.1.13: icmp_seq=3 ttl=64 time=0.052 ms
64 bytes from 10.0.1.13: icmp_seq=4 ttl=64 time=0.052 ms
^C
--- 10.0.1.13 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3057ms
rtt min/avg/max/mdev = 0.052/0.969/3.249/1.330 ms
mininet> xterm h9
mininet> xterm h5
mininet> h9 ping h5
ping: connect: Network is unreachable
mininet> h9 ping h6
ping: connect: Network is unreachable
mininet> xterm h6
mininet> h9 ping h6
ping: connect: Network is unreachable
mininet>

```

```

"Node: h9"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 65,536 Byte (default)

```

```

"Node: h6"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.1.1
tcp connect failed: Network is unreachable
Client connecting to 10.0.1.1, TCP port 5001
TCP window size: -1,00 Byte (default)
[ 1] local 0.0.0.0 port 0 connected with 10.0.1.1 port 5001
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.1.1
tcp connect failed: Network is unreachable
Client connecting to 10.0.1.1, TCP port 5001
TCP window size: -1,00 Byte (default)
[ 1] local 0.0.0.0 port 0 connected with 10.0.1.1 port 5001
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#

```

## H9 -> H7

The screenshot shows a Mininet terminal window and two iperf windows. The terminal window displays the following commands and output:

```
mininet> h9 ping h4
PING 10.0.1.13 (10.0.1.13) 56(84) bytes of data:
64 bytes from 10.0.1.13: icmp_seq=1 ttl=64 time=3.25 ms
64 bytes from 10.0.1.13: icmp_seq=2 ttl=64 time=0.524 ms
64 bytes from 10.0.1.13: icmp_seq=3 ttl=64 time=0.052 ms
64 bytes from 10.0.1.13: icmp_seq=4 ttl=64 time=0.052 ms
^C
--- 10.0.1.13 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3057ms
rtt min/avg/max/mdev = 0.052/0.969/3.249/1.330 ms
mininet> xterm h9
mininet> xterm h5
mininet> h9 ping h5
ping: connect: Network is unreachable
mininet> h9 ping h6
ping: connect: Network is unreachable
mininet> xterm h6
mininet> h9 ping h6
ping: connect: Network is unreachable
mininet> xterm h7
mininet> xterm h9
mininet> h9 ping h7
ping: connect: Network is unreachable
mininet>
```

The "Node: h9" window shows the iperf server output:

```
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 65.3 KByte (default)
[]
```

The "Node: h7" window shows the iperf client output:

```
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.1.1
tcp connect failed: Network is unreachable
Client connecting to 10.0.1.1, TCP port 5001
TCP window size: -1.00 Byte (default)
[ 1] local 0.0.0.0 port 0 connected with 10.0.1.1 port 5001
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# []
```

## H9 -> H8

The screenshot shows a Mininet terminal window and two iperf windows. The terminal window displays the following commands and output:

```
64 bytes from 10.0.1.13: icmp_seq=2 ttl=64 time=0.524 ms
64 bytes from 10.0.1.13: icmp_seq=3 ttl=64 time=0.052 ms
64 bytes from 10.0.1.13: icmp_seq=4 ttl=64 time=0.052 ms
^C
--- 10.0.1.13 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3057ms
rtt min/avg/max/mdev = 0.052/0.969/3.249/1.330 ms
mininet> xterm h9
mininet> xterm h5
mininet> h9 ping h5
ping: connect: Network is unreachable
mininet> h9 ping h6
ping: connect: Network is unreachable
mininet> xterm h6
mininet> h9 ping h6
ping: connect: Network is unreachable
mininet> xterm h7
mininet> xterm h9
mininet> h9 ping h7
ping: connect: Network is unreachable
mininet> xterm h8
mininet> h9 ping h8
ping: connect: Network is unreachable
mininet> []
```

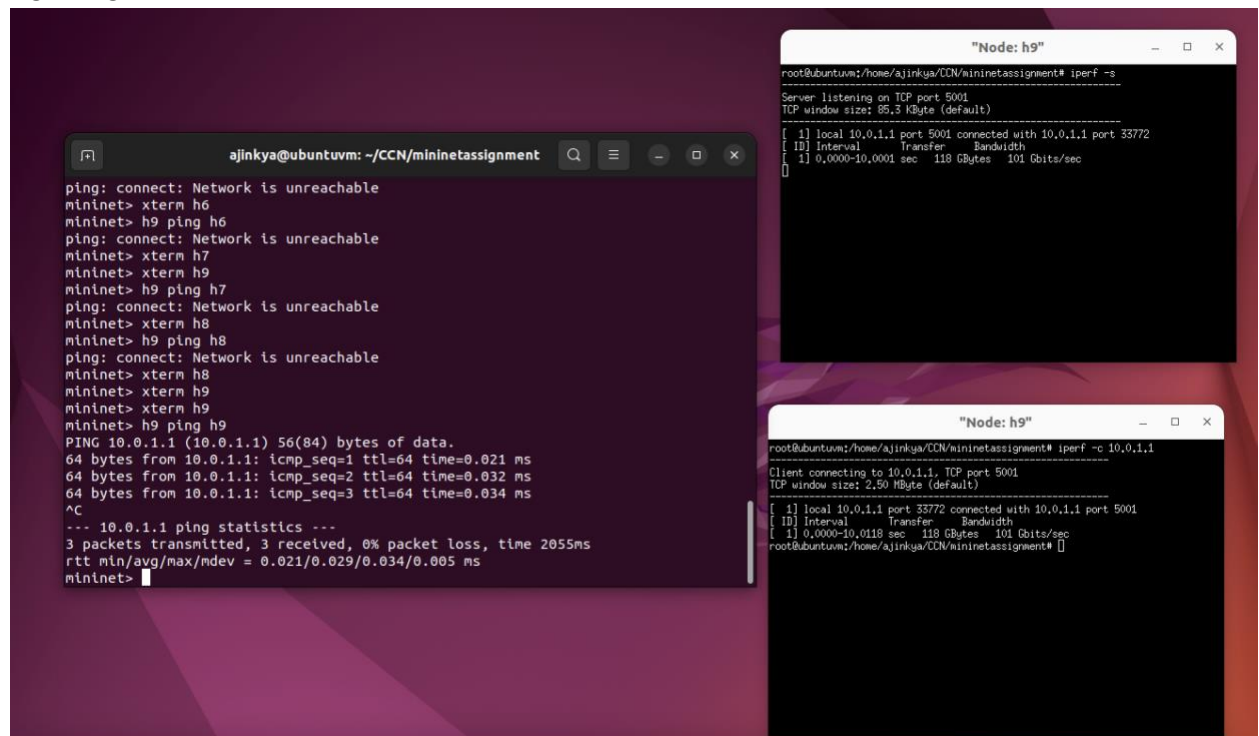
The "Node: h9" window shows the iperf server output:

```
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 65.3 KByte (default)
[]
```

The "Node: h8" window shows the iperf client output:

```
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.1.1
tcp connect failed: Network is unreachable
Client connecting to 10.0.1.1, TCP port 5001
TCP window size: -1.00 Byte (default)
[ 1] local 0.0.0.0 port 0 connected with 10.0.1.1 port 5001
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# []
```

H9 -> H9:



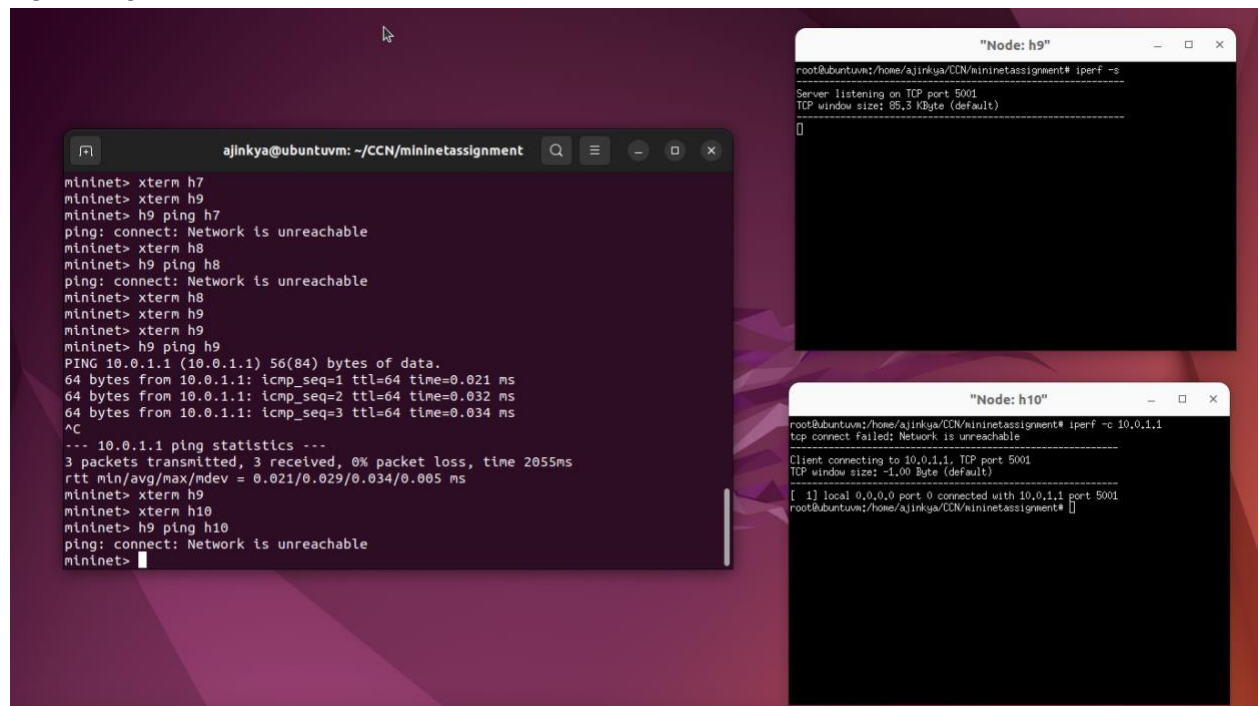
The screenshot shows a terminal window titled 'ajinkya@ubuntuvm: ~/CCN/mininetassignment' and two iperf windows titled '"Node: h9"'. The terminal shows the user creating terminals for h6, h7, h8, and h9, then pinging h9 from h9. The ping results show 3 packets transmitted, 3 received, 0% packet loss, and a time of 2055ms. The iperf windows show the server listening on TCP port 5001 and the client connecting to 10.0.1.1, TCP port 5001. The iperf results show a transfer of 118 GBytes and a bandwidth of 101 Gbits/sec.

```
ajinkya@ubuntuvm: ~/CCN/mininetassignment
mininet> ping: connect: Network is unreachable
mininet> xterm h6
mininet> h9 ping h6
ping: connect: Network is unreachable
mininet> xterm h7
mininet> xterm h9
mininet> h9 ping h7
ping: connect: Network is unreachable
mininet> xterm h8
mininet> h9 ping h8
ping: connect: Network is unreachable
mininet> xterm h8
mininet> xterm h9
mininet> h9 ping h9
PING 10.0.1.1 (10.0.1.1) 56(84) bytes of data.
64 bytes from 10.0.1.1: icmp_seq=1 ttl=64 time=0.021 ms
64 bytes from 10.0.1.1: icmp_seq=2 ttl=64 time=0.032 ms
64 bytes from 10.0.1.1: icmp_seq=3 ttl=64 time=0.034 ms
^C
--- 10.0.1.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2055ms
rtt min/avg/max/mdev = 0.021/0.029/0.034/0.005 ms
mininet>
```

```
"Node: h9"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)
[ 1] local 10.0.1.1 port 5001 connected with 10.0.1.1 port 3372
[ ID] Interval      Transfer    Bandwidth
[ 1] 0.0000-10.0001 sec  118 GBytes  101 Gbits/sec
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#
```

```
"Node: h9"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.1.1
Client connecting to 10.0.1.1, TCP port 5001
TCP window size: 2.50 MByte (default)
[ 1] local 10.0.1.1 port 3372 connected with 10.0.1.1 port 5001
[ ID] Interval      Transfer    Bandwidth
[ 1] 0.0000-10.0118 sec  118 GBytes  101 Gbits/sec
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#
```

H9 -> H10:



The screenshot shows a terminal window titled 'ajinkya@ubuntuvm: ~/CCN/mininetassignment' and two iperf windows titled '"Node: h9"' and '"Node: h10"'. The terminal shows the user creating terminals for h7, h9, h8, and h10, then pinging h10 from h9. The ping results show 3 packets transmitted, 3 received, 0% packet loss, and a time of 2055ms. The iperf windows show the server listening on TCP port 5001 and the client connecting to 10.0.1.1, TCP port 5001. The iperf results show a transfer of 118 GBytes and a bandwidth of 101 Gbits/sec.

```
ajinkya@ubuntuvm: ~/CCN/mininetassignment
mininet> xterm h7
mininet> xterm h9
mininet> h9 ping h7
ping: connect: Network is unreachable
mininet> xterm h8
mininet> h9 ping h8
ping: connect: Network is unreachable
mininet> xterm h8
mininet> xterm h9
mininet> xterm h9
mininet> h9 ping h9
PING 10.0.1.1 (10.0.1.1) 56(84) bytes of data.
64 bytes from 10.0.1.1: icmp_seq=1 ttl=64 time=0.021 ms
64 bytes from 10.0.1.1: icmp_seq=2 ttl=64 time=0.032 ms
64 bytes from 10.0.1.1: icmp_seq=3 ttl=64 time=0.034 ms
^C
--- 10.0.1.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2055ms
rtt min/avg/max/mdev = 0.021/0.029/0.034/0.005 ms
mininet> xterm h9
mininet> xterm h10
mininet> h9 ping h10
ping: connect: Network is unreachable
mininet>
```

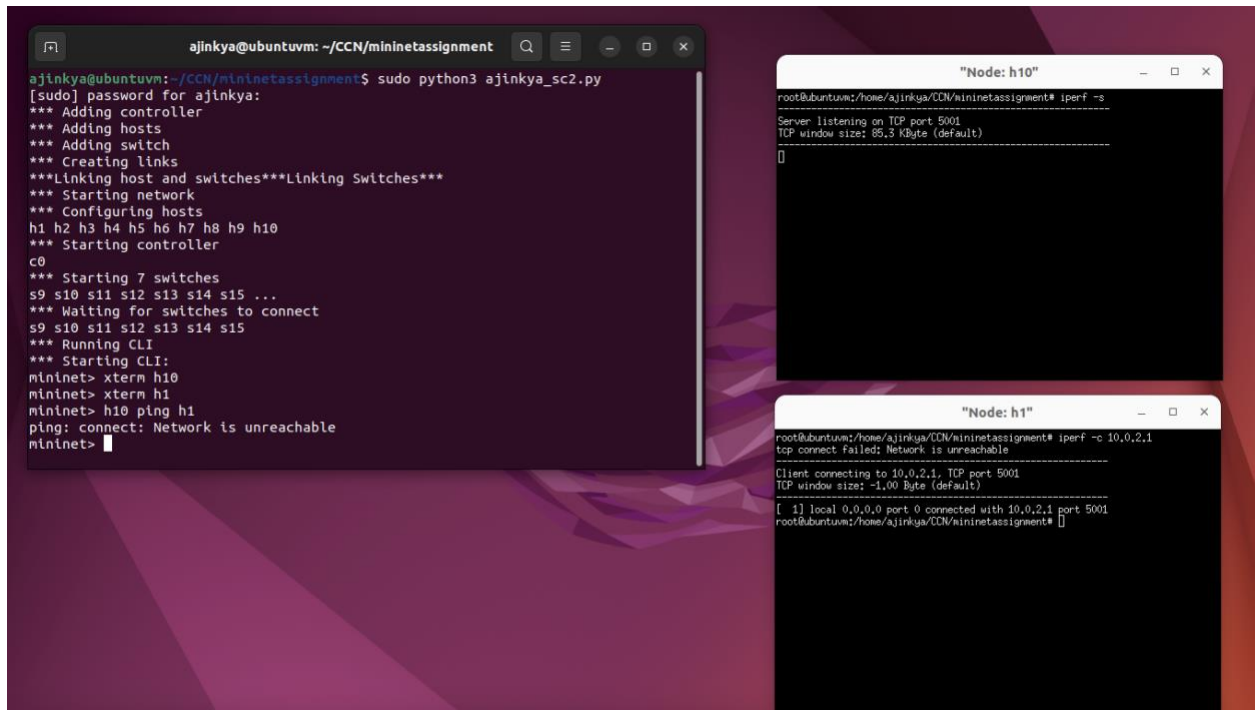
```
"Node: h9"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#
```

```
"Node: h10"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.1.1
Client connecting to 10.0.1.1, TCP port 5001
TCP window size: 1.00 Byte (default)
[ 1] local 0.0.0.0 port 0 connected with 10.0.1.1 port 5001
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#
```



## Scenario 2:

H10 -> H1



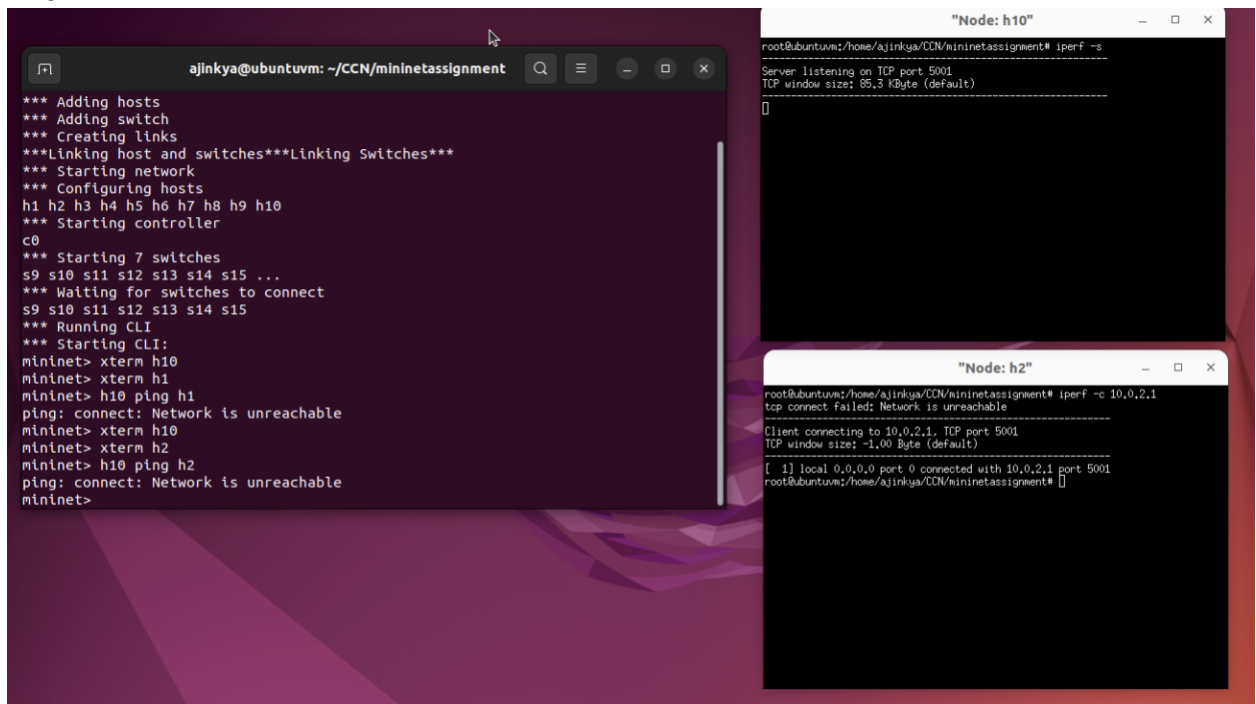
The screenshot shows three terminal windows. The main window on the left is titled 'ajinkya@ubuntuvm: ~/CCN/mininetassignment' and displays the output of a Python script 'ajinkya\_sc2.py'. The script sets up a Mininet network with hosts h1 through h10, switches s9 through s15, and a controller c0. It then starts the CLI and runs 'xterm h10', 'xterm h1', and 'h10 ping h1', which returns 'ping: connect: Network is unreachable'. The top-right window is titled '"Node: h10"' and shows 'root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s' with 'Server listening on TCP port 5001' and 'TCP window size: 65.3 KByte (default)'. The bottom-right window is titled '"Node: h1"' and shows 'root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.2.1' with 'top connect failed: Network is unreachable', 'Client connecting to 10.0.2.1, TCP port 5001', and 'TCP window size: -1.00 Byte (default)'. It then shows '[ 1] local 0.0.0.0 port 0 connected with 10.0.2.1 port 5001'.

```
ajinkya@ubuntuvm: ~/CCN/mininetassignment
ajinkya@ubuntuvm:~/CCN/mininetassignment$ sudo python3 ajinkya_sc2.py
[sudo] password for ajinkya:
*** Adding controller
*** Adding hosts
*** Adding switch
*** Creating links
***Linking host and switches***Linking Switches***
*** Starting network
*** Configuring hosts
h1 h2 h3 h4 h5 h6 h7 h8 h9 h10
*** Starting controller
c0
*** Starting 7 switches
s9 s10 s11 s12 s13 s14 s15 ...
*** Waiting for switches to connect
s9 s10 s11 s12 s13 s14 s15
*** Running CLI
*** Starting CLI:
mininet> xterm h10
mininet> xterm h1
mininet> h10 ping h1
ping: connect: Network is unreachable
mininet>

"Node: h10"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 65.3 KByte (default)

"Node: h1"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.2.1
top connect failed: Network is unreachable
Client connecting to 10.0.2.1, TCP port 5001
TCP window size: -1.00 Byte (default)
[ 1] local 0.0.0.0 port 0 connected with 10.0.2.1 port 5001
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#
```

H10 -> H2:



The screenshot shows three terminal windows. The main window on the left is titled 'ajinkya@ubuntuvm: ~/CCN/mininetassignment' and displays the output of a Python script 'ajinkya\_sc2.py'. The script sets up a Mininet network with hosts h1 through h10, switches s9 through s15, and a controller c0. It then starts the CLI and runs 'xterm h10', 'xterm h1', 'xterm h2', and 'h10 ping h2', which returns 'ping: connect: Network is unreachable'. The top-right window is titled '"Node: h10"' and shows 'root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s' with 'Server listening on TCP port 5001' and 'TCP window size: 65.3 KByte (default)'. The bottom-right window is titled '"Node: h2"' and shows 'root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.2.1' with 'top connect failed: Network is unreachable', 'Client connecting to 10.0.2.1, TCP port 5001', and 'TCP window size: -1.00 Byte (default)'. It then shows '[ 1] local 0.0.0.0 port 0 connected with 10.0.2.1 port 5001'.

```
ajinkya@ubuntuvm: ~/CCN/mininetassignment
ajinkya@ubuntuvm:~/CCN/mininetassignment$ sudo python3 ajinkya_sc2.py
[sudo] password for ajinkya:
*** Adding hosts
*** Adding switch
*** Creating links
***Linking host and switches***Linking Switches***
*** Starting network
*** Configuring hosts
h1 h2 h3 h4 h5 h6 h7 h8 h9 h10
*** Starting controller
c0
*** Starting 7 switches
s9 s10 s11 s12 s13 s14 s15 ...
*** Waiting for switches to connect
s9 s10 s11 s12 s13 s14 s15
*** Running CLI
*** Starting CLI:
mininet> xterm h10
mininet> xterm h1
mininet> h10 ping h1
ping: connect: Network is unreachable
mininet> xterm h10
mininet> xterm h2
mininet> h10 ping h2
ping: connect: Network is unreachable
mininet>

"Node: h10"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 65.3 KByte (default)

"Node: h2"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.2.1
top connect failed: Network is unreachable
Client connecting to 10.0.2.1, TCP port 5001
TCP window size: -1.00 Byte (default)
[ 1] local 0.0.0.0 port 0 connected with 10.0.2.1 port 5001
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#
```

## H10 -> H3

The screenshot shows a Mininet CLI window and two terminal windows. The CLI window shows the setup of a network with 10 hosts (h1-h10) and 7 switches (s9-s15). The terminal windows show the results of an iperf test from H10 to H3.

```
ajinkya@ubuntuvm: ~/CCN/mininetassignment
***Linking host and switches***Linking Switches***
*** Starting network
*** Configuring hosts
h1 h2 h3 h4 h5 h6 h7 h8 h9 h10
*** Starting controller
c0
*** Starting 7 switches
s9 s10 s11 s12 s13 s14 s15 ...
*** Waiting for switches to connect
s9 s10 s11 s12 s13 s14 s15
*** Running CLI
*** Starting CLI:
mininet> xterm h10
mininet> xterm h1
mininet> h10 ping h1
ping: connect: Network is unreachable
mininet> xterm h10
mininet> xterm h2
mininet> h10 ping h2
ping: connect: Network is unreachable
mininet> xterm h3
mininet> h10 ping h3
ping: connect: Network is unreachable
mininet>

"Node: h10"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 65.5 KByte (default)
[ ]

"Node: h3"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.2.1
tcp connect failed: Network is unreachable
Client connecting to 10.0.2.1, TCP port 5001
TCP window size: -1.00 Byte (default)
[ 1] local 0.0.0.0 port 0 connected with 10.0.2.1 port 5001
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#
```

## H10 -> H4

The screenshot shows a Mininet CLI window and two terminal windows. The CLI window shows the setup of a network with 10 hosts (h1-h10) and 7 switches (s9-s15). The terminal windows show the results of an iperf test from H10 to H4.

```
ajinkya@ubuntuvm: ~/CCN/mininetassignment
h1 h2 h3 h4 h5 h6 h7 h8 h9 h10
*** Starting controller
c0
*** Starting 7 switches
s9 s10 s11 s12 s13 s14 s15 ...
*** Waiting for switches to connect
s9 s10 s11 s12 s13 s14 s15
*** Running CLI
*** Starting CLI:
mininet> xterm h10
mininet> xterm h1
mininet> h10 ping h1
ping: connect: Network is unreachable
mininet> xterm h10
mininet> xterm h2
mininet> h10 ping h2
ping: connect: Network is unreachable
mininet> xterm h3
mininet> h10 ping h3
ping: connect: Network is unreachable
mininet> h10 ping h4
ping: connect: Network is unreachable
mininet> xterm h4
mininet>

"Node: h10"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 65.5 KByte (default)
[ ]

"Node: h4"
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.2.1
tcp connect failed: Network is unreachable
Client connecting to 10.0.2.1, TCP port 5001
TCP window size: -1.00 Byte (default)
[ 1] local 0.0.0.0 port 0 connected with 10.0.2.1 port 5001
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#
```

## H10 -> H5

The screenshot shows a Mininet network simulation with three terminal windows. The main terminal window, titled 'ajinkya@ubuntuvm: ~/CCN/mininetassignment', shows the following commands and output:

```
mininet> xterm h10
mininet> xterm h2
mininet> h10 ping h2
ping: connect: Network is unreachable
mininet> xterm h3
mininet> h10 ping h3
ping: connect: Network is unreachable
mininet> h10 ping h4
ping: connect: Network is unreachable
mininet> xterm h4
mininet> xterm h10
mininet> xterm h5
mininet> h10 ping h5
PING 10.0.2.10 (10.0.2.10) 56(84) bytes of data.
64 bytes from 10.0.2.10: icmp_seq=1 ttl=64 time=3.30 ms
64 bytes from 10.0.2.10: icmp_seq=2 ttl=64 time=0.494 ms
64 bytes from 10.0.2.10: icmp_seq=3 ttl=64 time=0.050 ms
64 bytes from 10.0.2.10: icmp_seq=4 ttl=64 time=0.070 ms
64 bytes from 10.0.2.10: icmp_seq=5 ttl=64 time=0.052 ms
^C
--- 10.0.2.10 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4060ms
rtt min/avg/max/mdev = 0.050/0.793/3.303/1.265 ms
mininet>
```

The top-right terminal window, titled '"Node: h10"', shows the output of an iperf server running on port 5001:

```
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 65.3 KByte (default)
[ 1] local 10.0.2.1 port 5001 connected with 10.0.2.10 port 42596
[ ID] Interval      Transfer     Bandwidth
[ 1] 0.0000-10.0005 sec 84.8 GBytes 72.3 Gbits/sec
[ 1]
```

The bottom-right terminal window, titled '"Node: h5"', shows the output of an iperf client running on port 5001:

```
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.2.1
Client connecting to 10.0.2.1, TCP port 5001
TCP window size: 65.3 KByte (default)
[ 1] local 10.0.2.10 port 42596 connected with 10.0.2.1 port 5001
[ ID] Interval      Transfer     Bandwidth
[ 1] 0.0000-10.0031 sec 84.8 GBytes 72.8 Gbits/sec
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#
```

## H10->H6

The screenshot shows a Mininet network simulation with three terminal windows. The main terminal window, titled 'ajinkya@ubuntuvm: ~/CCN/mininetassignment', shows the following commands and output:

```
mininet> h10 ping h5
PING 10.0.2.10 (10.0.2.10) 56(84) bytes of data.
64 bytes from 10.0.2.10: icmp_seq=1 ttl=64 time=3.30 ms
64 bytes from 10.0.2.10: icmp_seq=2 ttl=64 time=0.494 ms
64 bytes from 10.0.2.10: icmp_seq=3 ttl=64 time=0.050 ms
64 bytes from 10.0.2.10: icmp_seq=4 ttl=64 time=0.070 ms
64 bytes from 10.0.2.10: icmp_seq=5 ttl=64 time=0.052 ms
^C
--- 10.0.2.10 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4060ms
rtt min/avg/max/mdev = 0.050/0.793/3.303/1.265 ms
mininet> xterm h10
mininet> xterm h6
mininet> h10 ping h6
PING 10.0.2.11 (10.0.2.11) 56(84) bytes of data.
64 bytes from 10.0.2.11: icmp_seq=1 ttl=64 time=3.63 ms
64 bytes from 10.0.2.11: icmp_seq=2 ttl=64 time=0.583 ms
64 bytes from 10.0.2.11: icmp_seq=3 ttl=64 time=0.077 ms
64 bytes from 10.0.2.11: icmp_seq=4 ttl=64 time=0.073 ms
^C
--- 10.0.2.11 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3055ms
rtt min/avg/max/mdev = 0.073/1.091/3.633/1.481 ms
mininet>
```

The top-right terminal window, titled '"Node: h10"', shows the output of an iperf server running on port 5001:

```
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 65.3 KByte (default)
[ 1] local 10.0.2.1 port 5001 connected with 10.0.2.11 port 53372
[ ID] Interval      Transfer     Bandwidth
[ 1] 0.0000-9.9992 sec 83.8 GBytes 72.0 Gbits/sec
[ 1]
```

The bottom-right terminal window, titled '"Node: h6"', shows the output of an iperf client running on port 5001:

```
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.2.1
Client connecting to 10.0.2.1, TCP port 5001
TCP window size: 65.3 KByte (default)
[ 1] local 10.0.2.11 port 53372 connected with 10.0.2.1 port 5001
[ ID] Interval      Transfer     Bandwidth
[ 1] 0.0000-10.0153 sec 83.8 GBytes 71.3 Gbits/sec
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#
```

## H10 -> H7

The screenshot shows a Mininet terminal window on the left and two iperf windows on the right. The terminal window shows the following commands and output:

```
mininet> xterm h10
mininet> xterm h6
mininet> h10 ping h6
PING 10.0.2.11 (10.0.2.11) 56(84) bytes of data.
64 bytes from 10.0.2.11: icmp_seq=1 ttl=64 time=3.63 ms
64 bytes from 10.0.2.11: icmp_seq=2 ttl=64 time=0.583 ms
64 bytes from 10.0.2.11: icmp_seq=3 ttl=64 time=0.077 ms
64 bytes from 10.0.2.11: icmp_seq=4 ttl=64 time=0.073 ms
^C
--- 10.0.2.11 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3055ms
rtt min/avg/max/mdev = 0.073/1.091/3.633/1.481 ms
mininet> xterm h10
mininet> xterm h7
mininet> h10 ping h7
PING 10.0.2.12 (10.0.2.12) 56(84) bytes of data.
64 bytes from 10.0.2.12: icmp_seq=1 ttl=64 time=2.94 ms
64 bytes from 10.0.2.12: icmp_seq=2 ttl=64 time=0.170 ms
64 bytes from 10.0.2.12: icmp_seq=3 ttl=64 time=0.031 ms
^C
--- 10.0.2.12 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2002ms
rtt min/avg/max/mdev = 0.031/1.046/2.938/1.338 ms
mininet>
```

The top iperf window, titled "Node: h10", shows the server listening on TCP port 5001 and receiving a connection from 10.0.2.12 port 47072. The output is:

```
root@ubuntu:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 65.3 KByte (default)
[ 1] local 10.0.2.1 port 5001 connected with 10.0.2.12 port 47072
[ ID] Interval      Transfer    Bandwidth
[ 1] 0.0000-0.3980 sec  87.9 GBytes  75.5 Gbits/sec
root@ubuntu:/home/ajinkya/CCN/mininetassignment#
```

The bottom iperf window, titled "Node: h7", shows the client connecting to 10.0.2.1, TCP port 5001. The output is:

```
root@ubuntu:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.2.1
Client connecting to 10.0.2.1, TCP port 5001
TCP window size: 65.3 KByte (default)
[ 1] local 10.0.2.12 port 47072 connected with 10.0.2.1 port 5001
[ ID] Interval      Transfer    Bandwidth
[ 1] 0.0000-10.0023 sec  87.9 GBytes  75.5 Gbits/sec
root@ubuntu:/home/ajinkya/CCN/mininetassignment#
```

## H10 -> H8

The screenshot shows a Mininet terminal window on the left and two iperf windows on the right. The terminal window shows the following commands and output:

```
rtt min/avg/max/mdev = 0.073/1.091/3.633/1.481 ms
mininet> xterm h10
mininet> xterm h7
mininet> h10 ping h7
PING 10.0.2.12 (10.0.2.12) 56(84) bytes of data.
64 bytes from 10.0.2.12: icmp_seq=1 ttl=64 time=2.94 ms
64 bytes from 10.0.2.12: icmp_seq=2 ttl=64 time=0.170 ms
64 bytes from 10.0.2.12: icmp_seq=3 ttl=64 time=0.031 ms
^C
--- 10.0.2.12 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2002ms
rtt min/avg/max/mdev = 0.031/1.046/2.938/1.338 ms
mininet> xterm h10
mininet> xterm h8
mininet> h10 ping h8
PING 10.0.2.13 (10.0.2.13) 56(84) bytes of data.
64 bytes from 10.0.2.13: icmp_seq=1 ttl=64 time=2.53 ms
64 bytes from 10.0.2.13: icmp_seq=2 ttl=64 time=0.466 ms
64 bytes from 10.0.2.13: icmp_seq=3 ttl=64 time=0.051 ms
^C
--- 10.0.2.13 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2034ms
rtt min/avg/max/mdev = 0.051/1.015/2.530/1.084 ms
mininet>
```

The top iperf window, titled "Node: h10", shows the server listening on TCP port 5001 and receiving a connection from 10.0.2.13 port 58722. The output is:

```
root@ubuntu:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 65.3 KByte (default)
[ 1] local 10.0.2.1 port 5001 connected with 10.0.2.13 port 58722
[ ID] Interval      Transfer    Bandwidth
[ 1] 0.0000-9.9979 sec  88.1 GBytes  75.7 Gbits/sec
root@ubuntu:/home/ajinkya/CCN/mininetassignment#
```

The bottom iperf window, titled "Node: h8", shows the client connecting to 10.0.2.1, TCP port 5001. The output is:

```
root@ubuntu:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.2.1
Client connecting to 10.0.2.1, TCP port 5001
TCP window size: 65.3 KByte (default)
[ 1] local 10.0.2.13 port 58722 connected with 10.0.2.1 port 5001
[ ID] Interval      Transfer    Bandwidth
[ 1] 0.0000-10.0179 sec  88.1 GBytes  75.6 Gbits/sec
root@ubuntu:/home/ajinkya/CCN/mininetassignment#
```



## H10 -> H9

The screenshot shows a terminal window titled 'ajinkya@ubuntuvm: ~/CCN/mininetassignment' and two Node.js windows titled 'Node: h10' and 'Node: h9'.

**Terminal Window:**

```
ajinkya@ubuntuvm: ~/CCN/mininetassignment
PING 10.0.2.12 (10.0.2.12) 56(84) bytes of data.
64 bytes from 10.0.2.12: icmp_seq=1 ttl=64 time=2.94 ms
64 bytes from 10.0.2.12: icmp_seq=2 ttl=64 time=0.170 ms
64 bytes from 10.0.2.12: icmp_seq=3 ttl=64 time=0.031 ms
^C
--- 10.0.2.12 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2002ms
rtt min/avg/max/mdev = 0.031/1.046/2.938/1.338 ms
mininet> xterm h10
mininet> xterm h8
mininet> h10 ping h8
PING 10.0.2.13 (10.0.2.13) 56(84) bytes of data.
64 bytes from 10.0.2.13: icmp_seq=1 ttl=64 time=2.53 ms
64 bytes from 10.0.2.13: icmp_seq=2 ttl=64 time=0.466 ms
64 bytes from 10.0.2.13: icmp_seq=3 ttl=64 time=0.051 ms
^C
--- 10.0.2.13 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2034ms
rtt min/avg/max/mdev = 0.051/1.015/2.530/1.084 ms
mininet> xterm h10
mininet> xterm h9
mininet> h10 ping h9
ping: connect: Network is unreachable
mininet>
```

**Node: h10 Window:**

```
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)
[ ]
```

**Node: h9 Window:**

```
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.2.1
tcp connect failed: Network is unreachable
Client connecting to 10.0.2.1, TCP port 5001
TCP window size: -1.00 Byte (default)
[ ] [ 1] local 0.0.0.0 port 0 connected with 10.0.2.1 port 5001
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#
```

## H10 -> H10

The screenshot shows a terminal window titled 'ajinkya@ubuntuvm: ~/CCN/mininetassignment' and two Node.js windows titled 'Node: h10'.

**Terminal Window:**

```
ajinkya@ubuntuvm: ~/CCN/mininetassignment
mininet> h10 ping h8
PING 10.0.2.13 (10.0.2.13) 56(84) bytes of data.
64 bytes from 10.0.2.13: icmp_seq=1 ttl=64 time=2.53 ms
64 bytes from 10.0.2.13: icmp_seq=2 ttl=64 time=0.466 ms
64 bytes from 10.0.2.13: icmp_seq=3 ttl=64 time=0.051 ms
^C
--- 10.0.2.13 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2034ms
rtt min/avg/max/mdev = 0.051/1.015/2.530/1.084 ms
mininet> xterm h10
mininet> xterm h9
mininet> h10 ping h9
ping: connect: Network is unreachable
mininet> xterm h10
mininet> h10 ping h10
PING 10.0.2.1 (10.0.2.1) 56(84) bytes of data.
64 bytes from 10.0.2.1: icmp_seq=1 ttl=64 time=0.039 ms
64 bytes from 10.0.2.1: icmp_seq=2 ttl=64 time=0.030 ms
64 bytes from 10.0.2.1: icmp_seq=3 ttl=64 time=0.029 ms
^C
--- 10.0.2.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2032ms
rtt min/avg/max/mdev = 0.029/0.032/0.039/0.004 ms
mininet>
```

**Node: h10 Window (Top):**

```
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -s
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)
[ ] [ 1] local 10.0.2.1 port 5001 connected with 10.0.2.1 port 35450
[ 10] Interval      Transfer    Bandwidth
[ 1] 0.0000-10.0001 sec  115 GBytes  98.9 Gbits/sec
[ ]
```

**Node: h10 Window (Bottom):**

```
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment# iperf -c 10.0.2.1
Client connecting to 10.0.2.1, TCP port 5001
TCP window size: 2.50 MByte (default)
[ ] [ 1] local 10.0.2.1 port 35450 connected with 10.0.2.1 port 5001
[ 10] Interval      Transfer    Bandwidth
[ 1] 0.0000-10.0009 sec  115 GBytes  98.8 Gbits/sec
root@ubuntuvm:/home/ajinkya/CCN/mininetassignment#
```

Host	IP address	Is this host pingable from h9?	Is this host pingable from h10?	Scenario: 1 Measure bw and delay using iperf on H9	Scenario: 2 Measure bw and delay using iperf on H10
H1	10.0.1.10	Yes	No	Bandwidth: 72.8Gbits/sec Delay: 3.56ms	Unreachable
H2	10.0.1.11	Yes	No	Bandwidth: 76.9Gbits/sec Delay: 5.82ms	Unreachable
H3	10.0.1.12	Yes	No	Bandwidth: 74.2Gbits/sec Delay: 3.95ms	Unreachable
H4	10.0.1.13	Yes	No	Bandwidth: 73.2Gbits/sec Delay: 3.25ms	Unreachable
H5	10.0.2.10	No	Yes	Unreachable	Bandwidth: 72.9Gbits/sec Delay: 3.30ms
H6	10.0.2.11	No	Yes	Unreachable	Bandwidth: 72.0Gbits/sec Delay: 3.63ms
H7	10.0.2.12	No	Yes	Unreachable	Bandwidth: 75.5Gbits/sec Delay: 2.94ms
H8	10.0.2.13	No	Yes	Unreachable	Bandwidth: 75.7Gbits/sec Delay: 2.53ms
H9	10.0.1.1	Yes	No	Bandwidth: 101Gbits/sec Delay: 0.021ms	Unreachable
H10	10.0.2.1	No	-	Unreachable	Bandwidth: 98.9Gbits/sec

					Delay: 0.039ms
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5. H9 is in subnet1 and H10 is in subnet 2 hence H1 cannot reach H10 or H6 cannot reach H9. It is similar to many other nodes. This is marked as unreachable in the above table.