Implement1:

```
15  class Lab2_Topo( Topo ):
16      def __init__( self ):
17          Topo.__init__( self )
18
19          h1 = self.addHost( 'h1' )
20          h2 = self.addHost( 'h2' )
21          h3 = self.addHost( 'h3' )
22          h4 = self.addHost( 'h4' )
23          h5 = self.addHost( 'h5' )
24          h6 = self.addHost( 'h6' )
25          h7 = self.addHost( 'h7' )
26          h8 = self.addHost( 'h8' )
27          h9 = self.addHost( 'h9' )
28
29          s1 = self.addSwitch( 's1' )
30          s2 = self.addSwitch( 's2' )
31          s3 = self.addSwitch( 's3' )
32          s4 = self.addSwitch( 's4' )
33          s5 = self.addSwitch( 's5' )
34          s6 = self.addSwitch( 's6' )
35
```

```
36          self.addLink( h1, s1 )
37          self.addLink( h2, s1 )
38          self.addLink( s1, s2 )
39          self.addLink( s2, h3 )
40          self.addLink( s2, s3 )
41          self.addLink( s3, h4 )
42          self.addLink( s3, h5 )
43          self.addLink( s1, s4 )
44          self.addLink( s4, h6 )
45          self.addLink( s4, s5 )
46          self.addLink( s5, h7 )
47          self.addLink( s5, s6 )
48          self.addLink( s6, h8 )
49          self.addLink( s6, h9 )
```

```
58  def createTopo():
59      topos = Lab2_Topo()
60
61      net = Mininet(topo=topos, controller=None, switch=OVSSwitch, link=TCLink)
62
63      REMOTE_CONTROLLER_IP = "127.0.0.1"
64      net.addController("c0",
65                        controller=RemoteController,
66                        ip=REMOTE_CONTROLLER_IP,
67                        port=6653)
```

Implement 2:

```
148     # TODO (Set up iperf sessions)
149     iperf_session1 = dict(src='h1',dst='h2',bw_limit=5)
150     iperf_session2 = dict(src='h1',dst='h3',bw_limit=10)
151     iperf_session3 = dict(src='h4',dst='h5',bw_limit=15)
152     iperf_session4 = dict(src='h6',dst='h8',bw_limit=20)
```

Implement 3:

```
45  def runIperf(net:Mininet, iperf_session:dict, duration=10):
46      print("Starting iperf session from {} to {} with bandwidth limit {} Mbps".format(
47          iperf_session['src'], iperf_session['dst'], iperf_session['bw_limit']))
48      # TODO (runIperf function)
49      client, server = net.get(iperf_session['src'], iperf_session['dst'])
50
51      server.cmd( 'killall -9 iperf' )
52      client.cmd( 'killall -9 iperf' )
53
54      server.cmd("iperf -s -D")
55      print(client.cmd("iperf -c %s -b %sMb" % (server.IP(), iperf_session['bw_limit'])))
```

Iperf function

1. 先按照spec規範的輸出iperf server, client and limit bandwidth 的 information
2. 透過 net.get 得到要執行 iperf 的兩個 node
3. server 跟 client 先透過 cmd 將之前可能執行的 iperf proccess kill 掉
4. server 透過 cmd 設置為 iperf server 且透過背景執行
5. client 透過 cmd 設置 iperf client 跟 server 的 ip, 並設定他的bandwidth limit不會超過限制

Result

```
[sudo] password for ubuntu:
*** Creating network
*** Adding hosts:
h1 h2 h3 h4 h5 h6 h7 h8 h9
*** Adding switches:
s1 s2 s3 s4 s5 s6
*** Adding links:
(h1, s1) (h2, s1) (s1, s2) (s1, s4) (s2, h3) (s2, s3) (s3, h4) (s3, h5) (s4, h6) (s4, s5) (s5, h7) (s5, s6) (s6, h8) (s6, h9)
*** Configuring hosts
h1 h2 h3 h4 h5 h6 h7 h8 h9
Starting network
*** Starting controller
c0
*** Starting 6 switches
s1 s2 s3 s4 s5 s6 ...
Starting iperf session from h1 to h2 with bandwidth limit 5 Mbps
------------------------------------------------------------
Client connecting to 10.0.0.2, TCP port 5001
TCP window size: 85.3 KByte (default)
------------------------------------------------------------
[  3] local 10.0.0.1 port 47076 connected with 10.0.0.2 port 5001
[ ID] Interval       Transfer     Bandwidth
[  3]  0.0-10.0 sec  6.38 MBytes  5.35 Mbits/sec

Starting iperf session from h1 to h3 with bandwidth limit 10 Mbps
------------------------------------------------------------
Client connecting to 10.0.0.3, TCP port 5001
TCP window size:  170 KByte (default)
------------------------------------------------------------
[  3] local 10.0.0.1 port 57898 connected with 10.0.0.3 port 5001
[ ID] Interval       Transfer     Bandwidth
[  3]  0.0-10.0 sec  12.6 MBytes  10.6 Mbits/sec

Starting iperf session from h4 to h5 with bandwidth limit 15 Mbps
------------------------------------------------------------
Client connecting to 10.0.0.5, TCP port 5001
TCP window size: 85.3 KByte (default)
------------------------------------------------------------
[  3] local 10.0.0.4 port 39794 connected with 10.0.0.5 port 5001
[ ID] Interval       Transfer     Bandwidth
[  3]  0.0-10.0 sec  18.9 MBytes  15.8 Mbits/sec

Starting iperf session from h6 to h8 with bandwidth limit 20 Mbps
------------------------------------------------------------
Client connecting to 10.0.0.8, TCP port 5001
TCP window size:  170 KByte (default)
------------------------------------------------------------
[  3] local 10.0.0.6 port 54070 connected with 10.0.0.8 port 5001
[ ID] Interval       Transfer     Bandwidth
[  3]  0.0-10.0 sec  25.1 MBytes  21.1 Mbits/sec
```