EXPERIMENT3

CREATING SIMPLE TOPOLOGY IN NS-3

OBJECTIVE:

- Build and analyze simple topology using point to point link

BACKGROUND:

In this lab you are required to create a simple topology by modifying the code of experiment 2, in which two nodes were created and a point-to-point link was established between the two. Modify that scenario to add another node shown in figure 3.1:

1. Create a third node (node 2), and set it up with an Internet stack.
2. Create a point-to-point link from node 1 to node 2.
3. The devices on this new link need addresses. Assign addresses on this link.
4. Create a new echo server and client, install the client on node 0 and the server on node 2, and set up the necessary parameters for communication.
5. Modify the echo clients to send six packets each instead of a single packet.
6. Since we have more than just a single link, we need to set up routing. This can be done with the line:**Ipv4GlobalRoutingHelper :: PopulateRoutingTables();**

Put this line after you assign the IP addresses on the links.

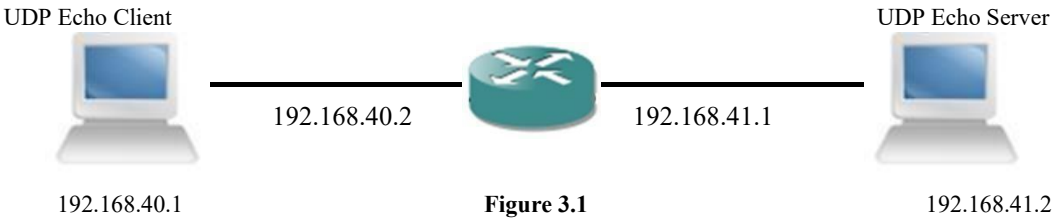


Figure 3.1

Code:

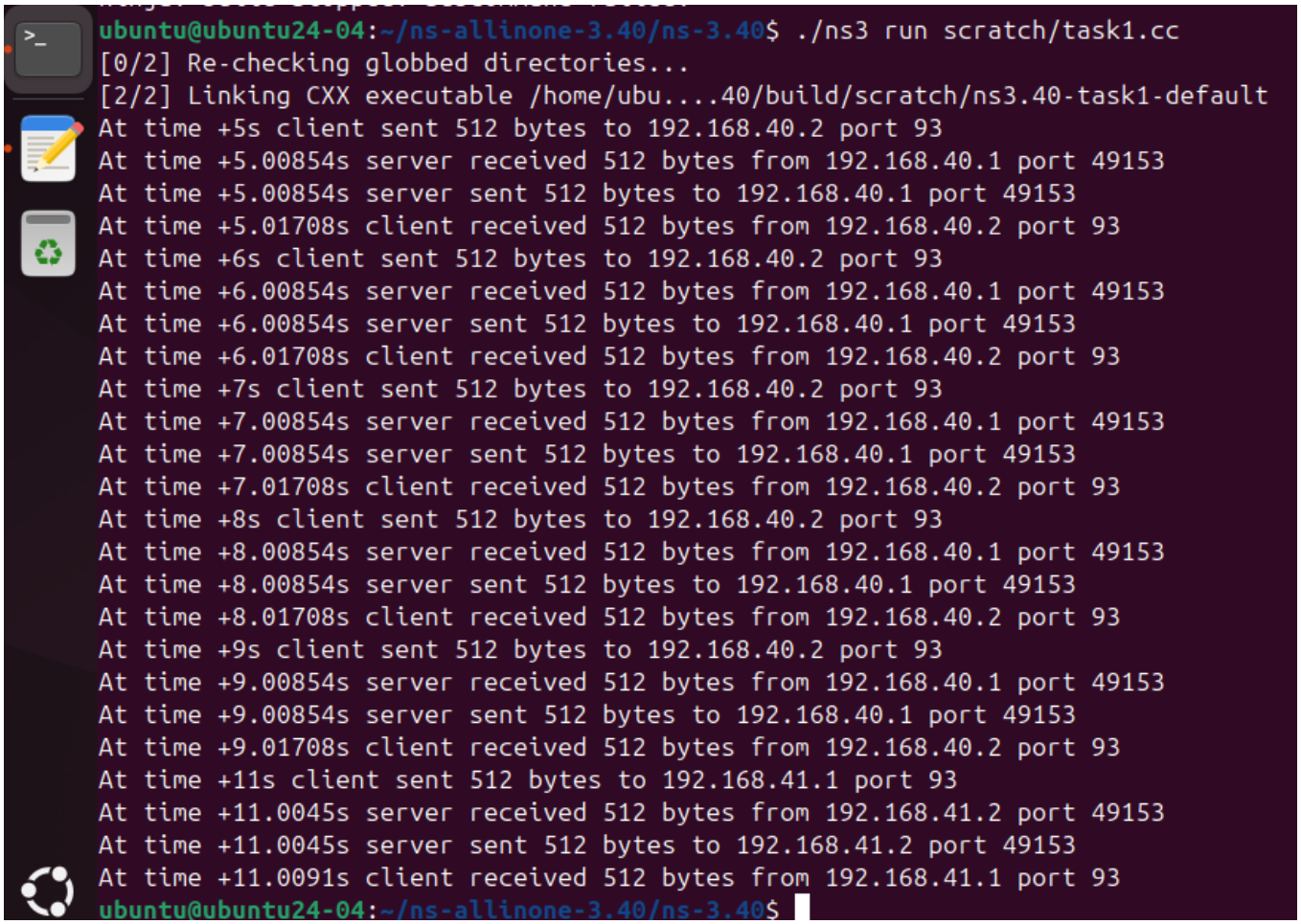
```
#include "ns3/core-module.h"
 #include "ns3/network-module.h"
 #include "ns3/internet-module.h"
 #include "ns3/point-to-point-module.h"
 #include "ns3/applications-module.h"

 using namespace ns3;

     NS_LOG_COMPONENT_DEFINE("FirstScriptExample");
   int main(int argc, char *argv[]) {

   Time::SetResolution(Time::NS);

 LogComponentEnable("UdpEchoClientApplication",LOG_LEVEL_INFO);
 LogComponentEnable("UdpEchoServerApplication",LOG_LEVEL_INFO);
   NodeContainer nodes;
```

```
nodes.Create(3);

PointToPointHelper pointToPoint1;
pointToPoint1.SetDeviceAttribute("DataRate",StringValue("8Mbps"));
pointToPoint1.SetChannelAttribute("Delay",StringValue("8ms"));
  NetDeviceContainer devices1;
devices1 = pointToPoint1.Install(nodes.Get(0),nodes.Get(1));

  PointToPointHelper pointToPoint2;
pointToPoint2.SetDeviceAttribute("DataRate",StringValue("8Mbps"));
pointToPoint2.SetChannelAttribute("Delay",StringValue("4ms"));
  NetDeviceContainer devices2;
devices2 = pointToPoint2.Install(nodes.Get(1),nodes.Get(2));
    InternetStackHelper stack;
stack.Install(nodes);


Ipv4AddressHelper address1;
address1.SetBase("192.168.40.0", "255.255.255.0");
Ipv4InterfaceContainer interfaces1 = address1.Assign(devices1);

Ipv4AddressHelper address2;
address2.SetBase("192.168.41.0", "255.255.255.0");
Ipv4InterfaceContainer interfaces2 = address2.Assign(devices2);
  UdpEchoServerHelper echoServer(93);
  ApplicationContainer serverApps = echoServer.Install(nodes.Get(2));


serverApps.Start(Seconds(1.0));
serverApps.Stop(Seconds(20.0));
  Ipv4GlobalRoutingHelper :: PopulateRoutingTables();

UdpEchoClientHelper echoClient1(interfaces1.GetAddress(1), 93);

echoClient1.SetAttribute("MaxPackets",UintegerValue(6));
echoClient1.SetAttribute("Interval",TimeValue(Seconds(1.0)));
echoClient1.SetAttribute("PacketSize",UintegerValue(512));
    ApplicationContainer clientApps1 = echoClient1.Install(nodes.Get(0));


clientApps1.Start(Seconds(5.0));
clientApps1.Stop(Seconds(10.0));

  UdpEchoClientHelper echoClient2(interfaces2.GetAddress(0), 93);
echoClient2.SetAttribute("MaxPackets",UintegerValue(1));
echoClient2.SetAttribute("Interval",TimeValue(Seconds(1.0)));
echoClient2.SetAttribute("PacketSize",UintegerValue(512));



ApplicationContainer clientApps2 = echoClient2.Install(nodes.Get(2));
  clientApps2.Start(Seconds(11.0));
clientApps2.Stop(Seconds(15.0));

// Run the simulation
Simulator::Run();
// Clean up and destroy the simulation
Simulator::Destroy();
return 0;
}
```

2.

3.

Output:



Exercise2:

Modified above code to implement the following topology shown in figure 3.2 and paste your code in the given space below.

1. Set node 3 and node 4 as 'UdpEchoServer' having port number 93 and 94 respectively.
2. Set node 1 as 'UdpEchoClient' and must send packet to both Node 3 and 4.

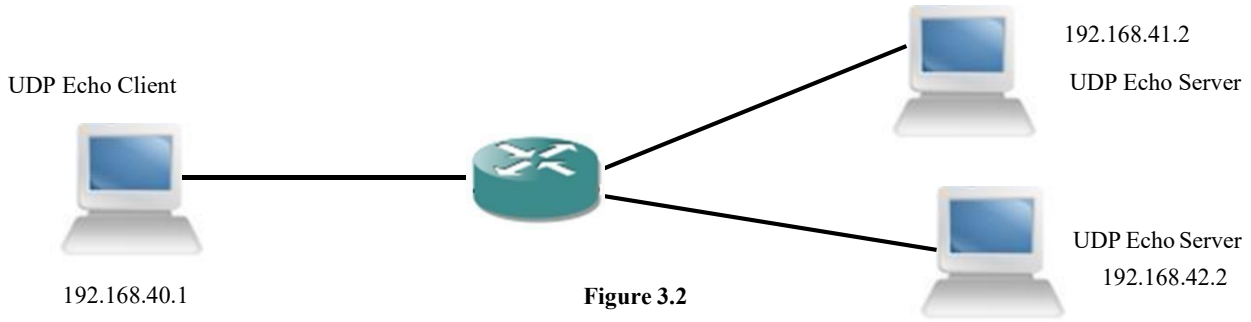
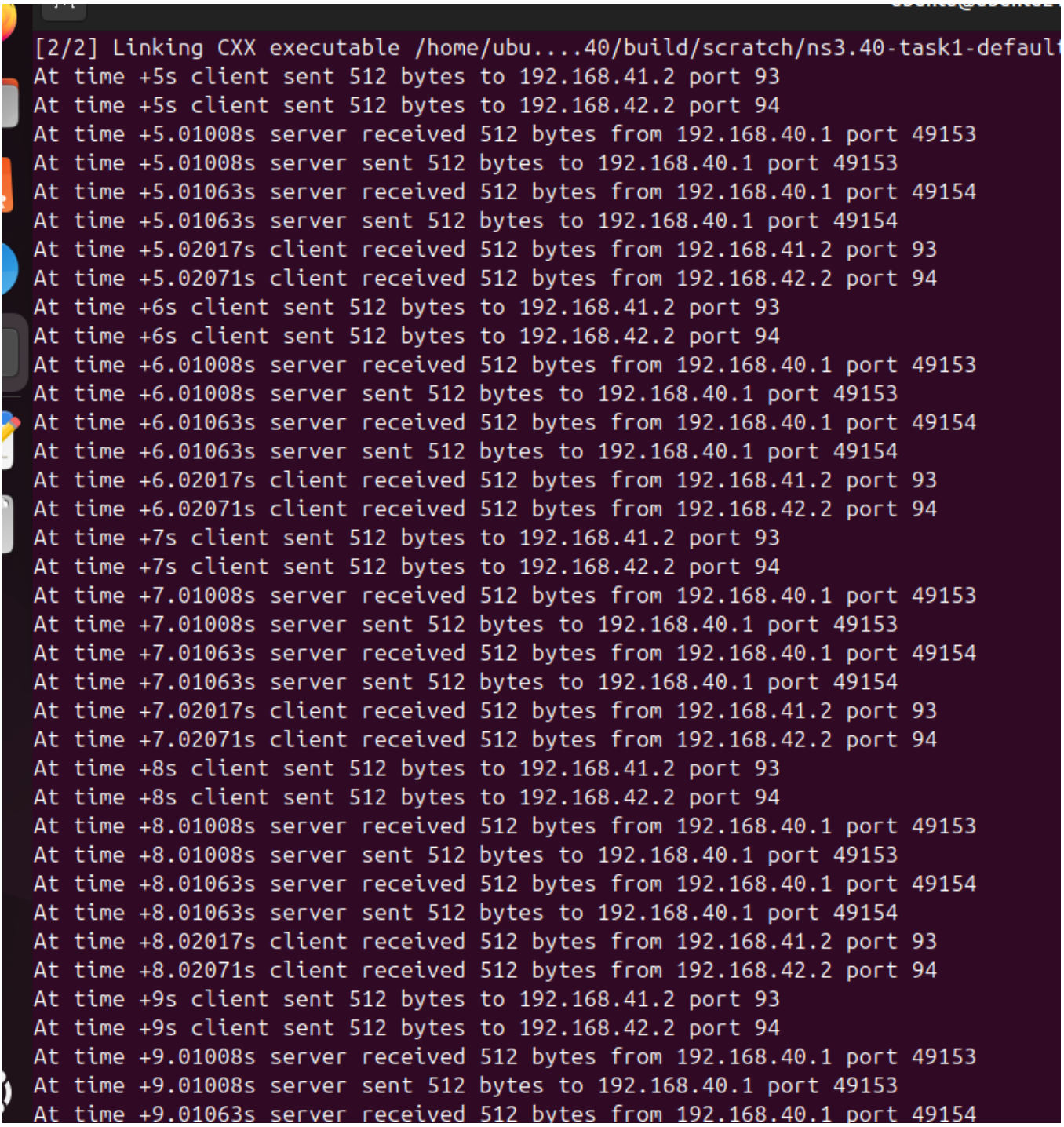


Figure 3.2

```
1.  #include "ns3/core-module.h"
```

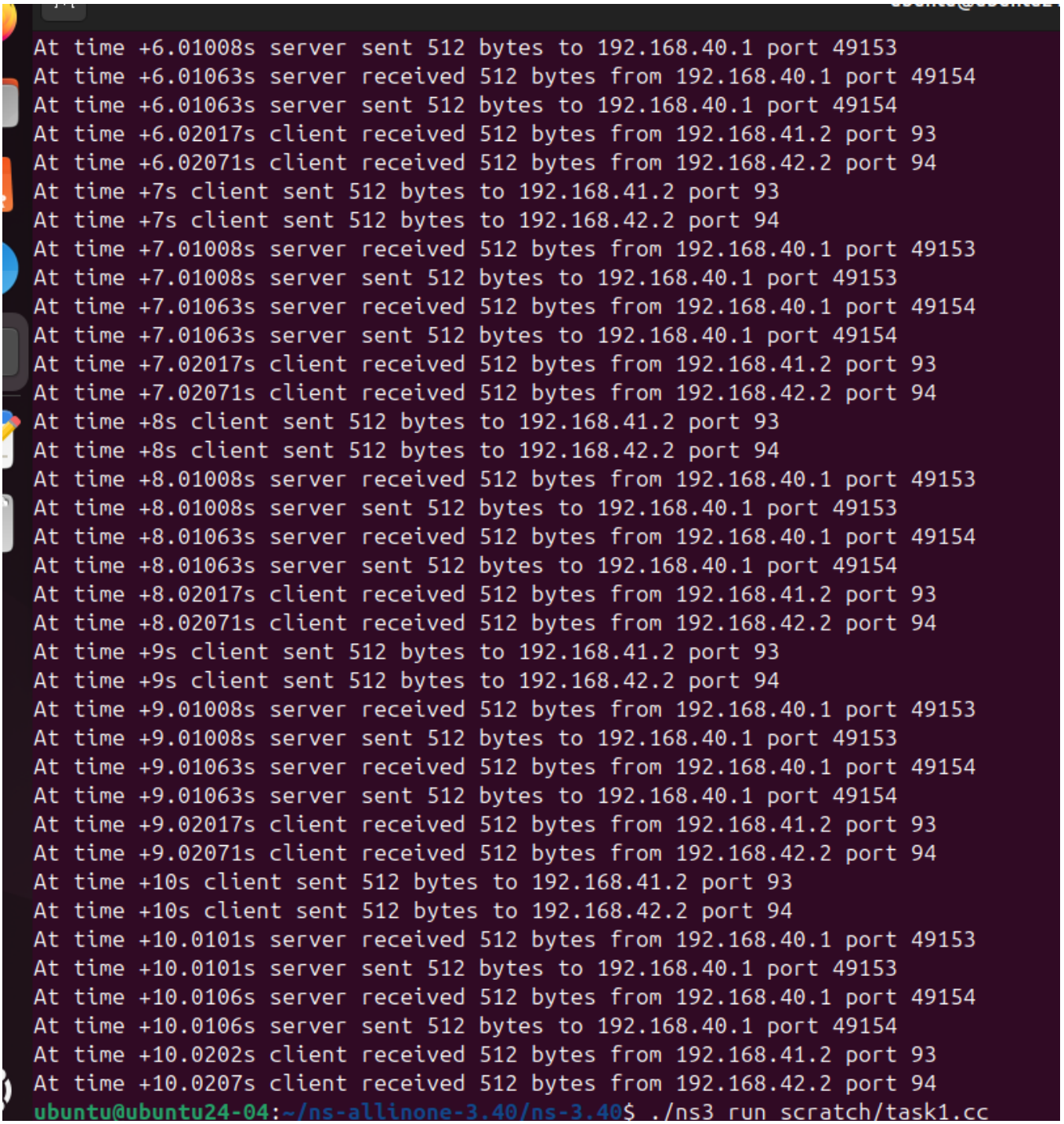
```
 #include "ns3/network-module.h" #include "ns3/internet-module.h" #include "ns3/point-to-point-module.h"
#include "ns3/applications-module.h"

using namespace ns3;

NS_LOG_COMPONENT_DEFINE("FirstScriptExample");

int main(int argc, char *argv[]) {

  Time::SetResolution(Time::NS);
 2.    LogComponentEnable("UdpEchoClientApplication", LOG_LEVEL_INFO);
  LogComponentEnable("UdpEchoServerApplication", LOG_LEVEL_INFO);

  // Create 4 nodes: Client (0), Router (1), Server1 (2), Server2 (3)
 3.    NodeContainer nodes;
       nodes.Create(4);

  // Link: Client (0) <-> Router (1)
 4.    PointToPointHelper c2r;
       c2r.SetDeviceAttribute("DataRate", StringValue("8Mbps"));
       c2r.SetChannelAttribute("Delay", StringValue("5ms"));
       NetDeviceContainer d01 = c2r.Install(nodes.Get(0), nodes.Get(1));

  // Link: Router (1) <-> Server1 (2)
 5.    PointToPointHelper r2s1;
       r2s1.SetDeviceAttribute("DataRate", StringValue("8Mbps"));
       r2s1.SetChannelAttribute("Delay", StringValue("4ms"));
       NetDeviceContainer d12 = r2s1.Install(nodes.Get(1), nodes.Get(2));

  // Link: Router (1) <-> Server2 (3)
 6.    PointToPointHelper r2s2;
       r2s2.SetDeviceAttribute("DataRate", StringValue("8Mbps"));
       r2s2.SetChannelAttribute("Delay", StringValue("4ms"));
       NetDeviceContainer d13 = r2s2.Install(nodes.Get(1), nodes.Get(3));

  // Install Internet stack
 7.    InternetStackHelper stack;
       stack.Install(nodes);

  // Assign IP addresses
 8.    Ipv4AddressHelper addr;
       addr.SetBase("192.168.40.0", "255.255.255.0");
       Ipv4InterfaceContainer if01 = addr.Assign(d01);

       addr.SetBase("192.168.41.0", "255.255.255.0");
       Ipv4InterfaceContainer if12 = addr.Assign(d12);

       addr.SetBase("192.168.42.0", "255.255.255.0");
       Ipv4InterfaceContainer if13 = addr.Assign(d13);

  // Populate routing tables
 9.    Ipv4GlobalRoutingHelper::PopulateRoutingTables();

  // ---- SERVERS ----
10.    // Server1 on Node2 (port 93)
11.    UdpEchoServerHelper echoServer1(93);
       ApplicationContainer s1 = echoServer1.Install(nodes.Get(2));
       s1.Start(Seconds(1.0));
       s1.Stop(Seconds(20.0));

  // Server2 on Node3 (port 94)
12.    UdpEchoServerHelper echoServer2(94);
       ApplicationContainer s2 = echoServer2.Install(nodes.Get(3));
       s2.Start(Seconds(1.0));
       s2.Stop(Seconds(20.0));

  // ---- CLIENTS ----
```

```
13.    // Client1 on Node0 -> Server1
  UdpEchoClientHelper c1(Ipv4Address("192.168.41.2"), 93);
  c1.SetAttribute("MaxPackets", UintegerValue(6));
  c1.SetAttribute("Interval", TimeValue(Seconds(1.0)));
  c1.SetAttribute("PacketSize", UintegerValue(512));
  ApplicationContainer ca1 = c1.Install(nodes.Get(0));
  ca1.Start(Seconds(5.0));
  ca1.Stop(Seconds(19.0));

  // Client2 on Node0 -> Server2
14.    UdpEchoClientHelper c2(Ipv4Address("192.168.42.2"), 94);
       c2.SetAttribute("MaxPackets", UintegerValue(6));
       c2.SetAttribute("Interval", TimeValue(Seconds(1.0)));
       c2.SetAttribute("PacketSize", UintegerValue(512));

       ApplicationContainer ca2 = c2.Install(nodes.Get(0));
       ca2.Start(Seconds(5.0));
15.    ca2.Stop(Seconds(20.0));


16.    Simulator::Run();
       Simulator::Destroy();

  return 0;
}

17.
```



```
[2/2] Linking CXX executable /home/ubu....40/build/scratch/ns3.40-task1-default
At time +5s client sent 512 bytes to 192.168.41.2 port 93
At time +5s client sent 512 bytes to 192.168.42.2 port 94
At time +5.01008s server received 512 bytes from 192.168.40.1 port 49153
At time +5.01008s server sent 512 bytes to 192.168.40.1 port 49153
At time +5.01063s server received 512 bytes from 192.168.40.1 port 49154
At time +5.01063s server sent 512 bytes to 192.168.40.1 port 49154
At time +5.02017s client received 512 bytes from 192.168.41.2 port 93
At time +5.02071s client received 512 bytes from 192.168.42.2 port 94
At time +6s client sent 512 bytes to 192.168.41.2 port 93
At time +6s client sent 512 bytes to 192.168.42.2 port 94
At time +6.01008s server received 512 bytes from 192.168.40.1 port 49153
At time +6.01008s server sent 512 bytes to 192.168.40.1 port 49153
At time +6.01063s server received 512 bytes from 192.168.40.1 port 49154
At time +6.01063s server sent 512 bytes to 192.168.40.1 port 49154
At time +6.02017s client received 512 bytes from 192.168.41.2 port 93
At time +6.02071s client received 512 bytes from 192.168.42.2 port 94
At time +7s client sent 512 bytes to 192.168.41.2 port 93
At time +7s client sent 512 bytes to 192.168.42.2 port 94
At time +7.01008s server received 512 bytes from 192.168.40.1 port 49153
At time +7.01008s server sent 512 bytes to 192.168.40.1 port 49153
At time +7.01063s server received 512 bytes from 192.168.40.1 port 49154
At time +7.01063s server sent 512 bytes to 192.168.40.1 port 49154
At time +7.02017s client received 512 bytes from 192.168.41.2 port 93
At time +7.02071s client received 512 bytes from 192.168.42.2 port 94
At time +8s client sent 512 bytes to 192.168.41.2 port 93
At time +8s client sent 512 bytes to 192.168.42.2 port 94
At time +8.01008s server received 512 bytes from 192.168.40.1 port 49153
At time +8.01008s server sent 512 bytes to 192.168.40.1 port 49153
At time +8.01063s server received 512 bytes from 192.168.40.1 port 49154
At time +8.01063s server sent 512 bytes to 192.168.40.1 port 49154
At time +8.02017s client received 512 bytes from 192.168.41.2 port 93
At time +8.02071s client received 512 bytes from 192.168.42.2 port 94
At time +9s client sent 512 bytes to 192.168.41.2 port 93
At time +9s client sent 512 bytes to 192.168.42.2 port 94
At time +9.01008s server received 512 bytes from 192.168.40.1 port 49153
At time +9.01008s server sent 512 bytes to 192.168.40.1 port 49153
At time +9.01063s server received 512 bytes from 192.168.40.1 port 49154
```

Other part Of output


At time +6.01008s server sent 512 bytes to 192.168.40.1 port 49153
At time +6.01063s server received 512 bytes from 192.168.40.1 port 49154
At time +6.01063s server sent 512 bytes to 192.168.40.1 port 49154
At time +6.02017s client received 512 bytes from 192.168.41.2 port 93
At time +6.02071s client received 512 bytes from 192.168.42.2 port 94
At time +7s client sent 512 bytes to 192.168.41.2 port 93
At time +7s client sent 512 bytes to 192.168.42.2 port 94
At time +7.01008s server received 512 bytes from 192.168.40.1 port 49153
At time +7.01008s server sent 512 bytes to 192.168.40.1 port 49153
At time +7.01063s server received 512 bytes from 192.168.40.1 port 49154
At time +7.01063s server sent 512 bytes to 192.168.40.1 port 49154
At time +7.02017s client received 512 bytes from 192.168.41.2 port 93
At time +7.02071s client received 512 bytes from 192.168.42.2 port 94
At time +8s client sent 512 bytes to 192.168.41.2 port 93
At time +8s client sent 512 bytes to 192.168.42.2 port 94
At time +8.01008s server received 512 bytes from 192.168.40.1 port 49153
At time +8.01008s server sent 512 bytes to 192.168.40.1 port 49153
At time +8.01063s server received 512 bytes from 192.168.40.1 port 49154
At time +8.01063s server sent 512 bytes to 192.168.40.1 port 49154
At time +8.02017s client received 512 bytes from 192.168.41.2 port 93
At time +8.02071s client received 512 bytes from 192.168.42.2 port 94
At time +9s client sent 512 bytes to 192.168.41.2 port 93
At time +9s client sent 512 bytes to 192.168.42.2 port 94
At time +9.01008s server received 512 bytes from 192.168.40.1 port 49153
At time +9.01008s server sent 512 bytes to 192.168.40.1 port 49153
At time +9.01063s server received 512 bytes from 192.168.40.1 port 49154
At time +9.01063s server sent 512 bytes to 192.168.40.1 port 49154
At time +9.02017s client received 512 bytes from 192.168.41.2 port 93
At time +9.02071s client received 512 bytes from 192.168.42.2 port 94
At time +10s client sent 512 bytes to 192.168.41.2 port 93
At time +10s client sent 512 bytes to 192.168.42.2 port 94
At time +10.0101s server received 512 bytes from 192.168.40.1 port 49153
At time +10.0101s server sent 512 bytes to 192.168.40.1 port 49153
At time +10.0106s server received 512 bytes from 192.168.40.1 port 49154
At time +10.0106s server sent 512 bytes to 192.168.40.1 port 49154
At time +10.0202s client received 512 bytes from 192.168.41.2 port 93
At time +10.0207s client received 512 bytes from 192.168.42.2 port 94
ubuntu@ubuntu24-04:~/ns-allinone-3.40/ns-3.40$ ./ns3 run scratch/task1.cc