Computer Networks

Programming Assignment 3 - Routing Protocols

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Problem Statement

Open Shortest Path First (OSPF) [1] is a link state routing protocol. It is designed to be run internal to a single network. Each OSPF router maintains an identical database describing the network's topology.

• Download NS3, build it and run the hello world example.

• Create a script that simulates the following topology, with those nodes having point to points links, and internet stack installed.

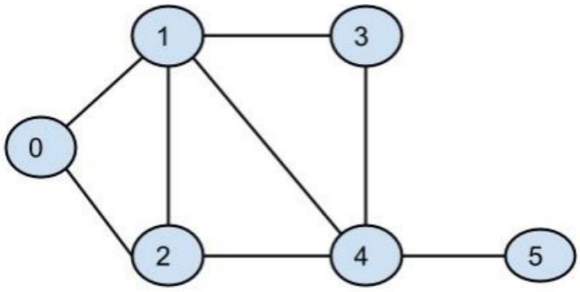


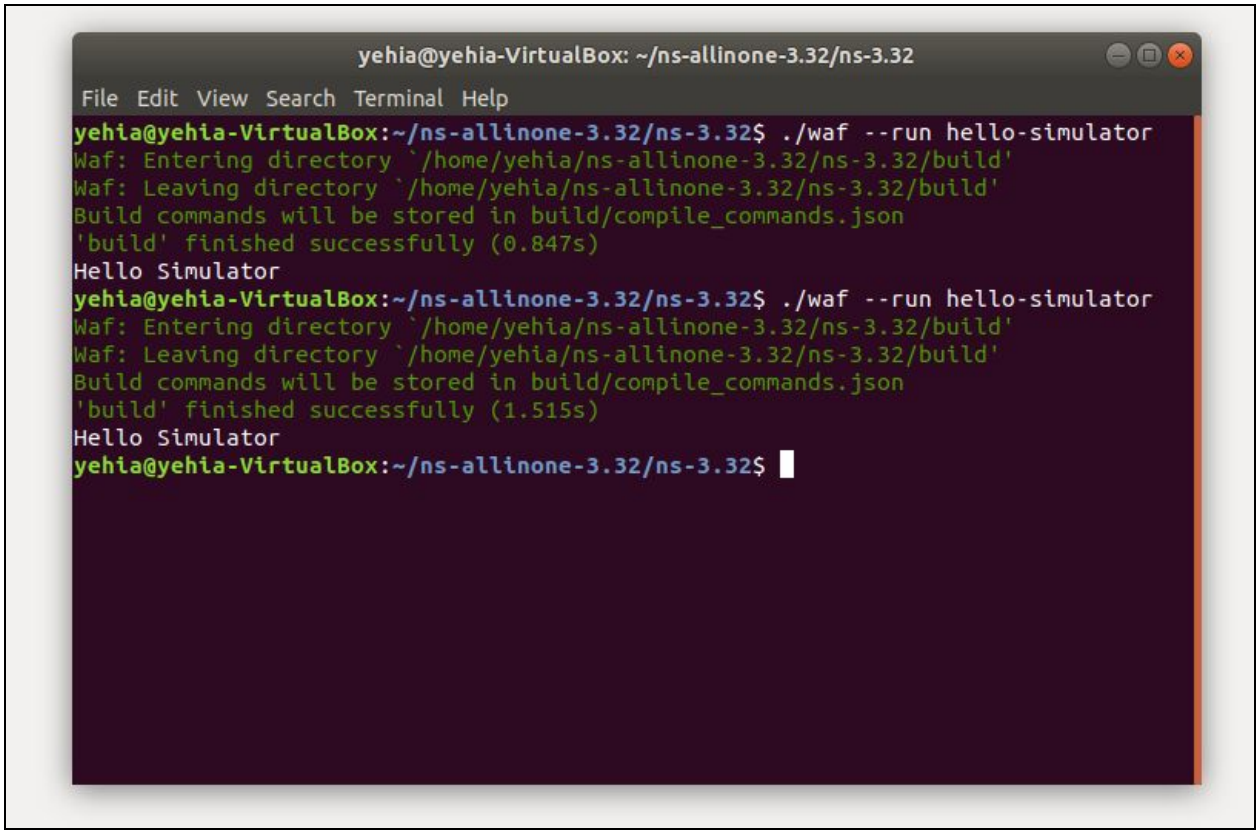
Figure 1: Network topology.

• When the internet stack gets installed, it automatically has OSPF (named Global Routing in NS3) deployed to the nodes.

• Get the nodes to build their routing tables and update the NS3 source code to print host routes.

• When computing the routes, the Global Routing implementation in NS3 keeps all routes to the node in the database. You are required to update this part to filter the routes keeping only the route with the min number of hops (least cost).

Installing the program and run hello world



Summary Of Code Design

1. Creating a NodeContainer for the graph of the nodes and the edges.
2. Add the edges to the container.
3. Creating and Installing internet stack.
4. Create a Device Container that will help in assigning IPs and routes.
5. Assigning IP addresses to the container members.
6. Code to print the routing table and create a file of it.
7. Create a small server-client program for simulation as exist in the examples files.
8. Create Animation File XML for the simulation.
9. Start the simulation of the program.

Screenshots for the 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"
#include "ns3/flow-monitor-helper.h"
#include "ns3/ipv4-global-routing-helper.h"
#include "ns3/netanim-module.h"


using namespace ns3;


NS_LOG_COMPONENT_DEFINE ("Point to Point Graph Simulation Assignment 3");

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

  // Allow the user to override any of the defaults
  CommandLine cmd;
  cmd.Parse (argc, argv);

  // for the simulation like in first.cc
  Time::SetResolution (Time::NS);
  LogComponentEnable("UdpEchoServerApplication", LOG_LEVEL_INFO);
  LogComponentEnable("UdpEchoClientApplication", LOG_LEVEL_INFO);



  // Here, we will explicitly create four nodes.  In more sophisticated
  // topologies, we could configure a node factory.
  NS_LOG_INFO ("Create nodes.");
  NodeContainer nodes_container;
  nodes_container.Create (6);  // six nodes in the given graph and eight edges.
  NodeContainer n0_1 = NodeContainer (nodes_container.Get (0), nodes_container.Get (1));
  NodeContainer n0_2 = NodeContainer (nodes_container.Get (0), nodes_container.Get (2));
  NodeContainer n1_2 = NodeContainer (nodes_container.Get (1), nodes_container.Get (2));
  NodeContainer n1_3 = NodeContainer (nodes_container.Get (1), nodes_container.Get (3));
  NodeContainer n1_4 = NodeContainer (nodes_container.Get (1), nodes_container.Get (4));
  NodeContainer n2_4 = NodeContainer (nodes_container.Get (2), nodes_container.Get (4));
  NodeContainer n3_4 = NodeContainer (nodes_container.Get (3), nodes_container.Get (4));
  NodeContainer n4_5 = NodeContainer (nodes_container.Get (4), nodes_container.Get (5));
```

```
//Creating and Installing Stack Helper for the nodes container.
NS_LOG_INFO ("Create stack.");
InternetStackHelper internet_stack;
internet_stack.Install (nodes_container);

//Creating Net Device Containers for the n's
NS_LOG_INFO ("Create channels.");
PointToPointHelper p2p;
NetDeviceContainer d0_1 = p2p.Install (n0_1);
NetDeviceContainer d0_2 = p2p.Install (n0_2);
NetDeviceContainer d1_2 = p2p.Install (n1_2);
NetDeviceContainer d1_3 = p2p.Install (n1_3);
NetDeviceContainer d1_4 = p2p.Install (n1_4);
NetDeviceContainer d2_4 = p2p.Install (n2_4);
NetDeviceContainer d3_4 = p2p.Install (n3_4);
NetDeviceContainer d4_5 = p2p.Install (n4_5);



// Later, we add IP addresses and assign interfaces.
Ipv4AddressHelper ipv4_helper;
ipv4_helper.SetBase ("10.1.1.0", "255.255.255.0");
Ipv4InterfaceContainer i0i1 = ipv4_helper.Assign (d0_1);
ipv4_helper.SetBase ("10.1.2.0", "255.255.255.0");
Ipv4InterfaceContainer i0i2 = ipv4_helper.Assign (d0_2);
ipv4_helper.SetBase ("10.1.3.0", "255.255.255.0");
Ipv4InterfaceContainer i1i2 = ipv4_helper.Assign (d1_2);
ipv4_helper.SetBase ("10.1.4.0", "255.255.255.0");
Ipv4InterfaceContainer i1i3 = ipv4_helper.Assign (d1_3);
ipv4_helper.SetBase ("10.1.5.0", "255.255.255.0");
Ipv4InterfaceContainer i1i4 = ipv4_helper.Assign (d1_4);
ipv4_helper.SetBase ("10.1.6.0", "255.255.255.0");
Ipv4InterfaceContainer i2i4 = ipv4_helper.Assign (d2_4);
ipv4_helper.SetBase ("10.1.7.0", "255.255.255.0");
Ipv4InterfaceContainer i3i4 = ipv4_helper.Assign (d3_4);
ipv4_helper.SetBase ("10.1.8.0", "255.255.255.0");
Ipv4InterfaceContainer i4i5 = ipv4_helper.Assign (d4_5);
```

```
//printing the routing table
Ipv4GlobalRoutingHelper::PopulateRoutingTables ();
OutputStreamWrapper wrapper = OutputStreamWrapper (&std::cout);
Ipv4GlobalRoutingHelper::PrintRoutingTableAllAt(Time(), &wrapper, Time::NS);
Ipv4GlobalRoutingHelper g;
Ptr<OutputStreamWrapper> routingStream = Create<OutputStreamWrapper>("assign3-routing-table.routes", std::ios::out);
g.PrintRoutingTableAllAt(Seconds(12), routingStream);


// server
uint16_t port = 9;
UdpEchoServerHelper server(port);
ApplicationContainer serverApp = server.Install(nodes_container.Get(5));
serverApp.Start(Seconds (1.0));
serverApp.Stop(Seconds (10.0));
// client
UdpEchoClientHelper client(i4i5.GetAddress(1), port);
client.SetAttribute("MaxPackets", UintegerValue(1));
client.SetAttribute("Interval", TimeValue(Seconds (1.0)));
client.SetAttribute("PacketSize", UintegerValue(1024));
ApplicationContainer clientApp = client.Install(nodes_container.Get(0));
clientApp.Start(Seconds (2.0));
clientApp.Stop(Seconds (10.0));



//creating the animation xml file
AnimationInterface anim ("assign3_anim.xml");
anim.SetConstantPosition(nodes_container.Get(0),10.0,50.0);
anim.SetConstantPosition(nodes_container.Get(1),40.0,20.0);
anim.SetConstantPosition(nodes_container.Get(2),40.0,80.0);
anim.SetConstantPosition(nodes_container.Get(3),70.0,20.0);
anim.SetConstantPosition(nodes_container.Get(4),70.0,80.0);
anim.SetConstantPosition(nodes_container.Get(5),100.0,80.0);
//run simulator
Simulator::Run ();
Simulator::Destroy ();
return 0;
}
```

Routing Table Result

```
Node: 0, Time: +12s, Local time: +12s, Ipv4ListRouting table
  Priority: 0 Protocol: ns3::Ipv4StaticRouting
Node: 0, Time: +12s, Local time: +12s, Ipv4StaticRouting table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
        127.0.0.0         0.0.0.0       255.0.0.0     U      0-      -   0
         10.1.1.0         0.0.0.0   255.255.255.0     U      0-      -   1
         10.1.2.0         0.0.0.0   255.255.255.0     U      0-      -   2

  Priority: -10 Protocol: ns3::Ipv4GlobalRouting
Node: 0, Time: +12s, Local time: +12s, Ipv4GlobalRouting table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
10.1.1.2        10.1.1.2        255.255.255.255 UH    -      -      -   1
10.1.3.1        10.1.1.2        255.255.255.255 UH    -      -      -   1
10.1.4.1        10.1.1.2        255.255.255.255 UH    -      -      -   1
10.1.5.1        10.1.1.2        255.255.255.255 UH    -      -      -   1
10.1.2.2        10.1.2.2        255.255.255.255 UH    -      -      -   2
10.1.3.2        10.1.2.2        255.255.255.255 UH    -      -      -   2
10.1.6.1        10.1.2.2        255.255.255.255 UH    -      -      -   2
10.1.4.2        10.1.1.2        255.255.255.255 UH    -      -      -   1
10.1.7.1        10.1.1.2        255.255.255.255 UH    -      -      -   1
10.1.5.2        10.1.1.2        255.255.255.255 UH    -      -      -   1
10.1.5.2        10.1.2.2        255.255.255.255 UH    -      -      -   2
10.1.6.2        10.1.1.2        255.255.255.255 UH    -      -      -   1
10.1.6.2        10.1.2.2        255.255.255.255 UH    -      -      -   2
10.1.7.2        10.1.1.2        255.255.255.255 UH    -      -      -   1
10.1.7.2        10.1.2.2        255.255.255.255 UH    -      -      -   2
10.1.8.1        10.1.1.2        255.255.255.255 UH    -      -      -   1
10.1.8.1        10.1.2.2        255.255.255.255 UH    -      -      -   2
10.1.8.2        10.1.1.2        255.255.255.255 UH    -      -      -   1
```

```
10.1.8.2        10.1.2.2        255.255.255.255 UH    -      -      -   2
10.1.1.0        10.1.1.2        255.255.255.0   UG    -      -      -   1
10.1.3.0        10.1.1.2        255.255.255.0   UG    -      -      -   1
10.1.4.0        10.1.1.2        255.255.255.0   UG    -      -      -   1
10.1.5.0        10.1.1.2        255.255.255.0   UG    -      -      -   1
10.1.4.0        10.1.1.2        255.255.255.0   UG    -      -      -   1
10.1.7.0        10.1.1.2        255.255.255.0   UG    -      -      -   1
10.1.5.0        10.1.1.2        255.255.255.0   UG    -      -      -   1
10.1.5.0        10.1.2.2        255.255.255.0   UG    -      -      -   2
10.1.6.0        10.1.1.2        255.255.255.0   UG    -      -      -   1
10.1.6.0        10.1.2.2        255.255.255.0   UG    -      -      -   2
10.1.7.0        10.1.1.2        255.255.255.0   UG    -      -      -   1
10.1.7.0        10.1.2.2        255.255.255.0   UG    -      -      -   2
10.1.8.0        10.1.1.2        255.255.255.0   UG    -      -      -   1
10.1.8.0        10.1.2.2        255.255.255.0   UG    -      -      -   2
10.1.8.0        10.1.1.2        255.255.255.0   UG    -      -      -   1
10.1.8.0        10.1.2.2        255.255.255.0   UG    -      -      -   2
10.1.2.0        10.1.2.2        255.255.255.0   UG    -      -      -   2
10.1.3.0        10.1.2.2        255.255.255.0   UG    -      -      -   2
10.1.6.0        10.1.2.2        255.255.255.0   UG    -      -      -   2

Node: 1, Time: +12s, Local time: +12s, Ipv4ListRouting table
  Priority: 0 Protocol: ns3::Ipv4StaticRouting
Node: 1, Time: +12s, Local time: +12s, Ipv4StaticRouting table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
127.0.0.0       0.0.0.0         255.0.0.0       U     0      -      -   0
10.1.1.0        0.0.0.0         255.255.255.0   U     0      -      -   1
10.1.3.0        0.0.0.0         255.255.255.0   U     0      -      -   2
10.1.4.0        0.0.0.0         255.255.255.0   U     0      -      -   3
```

```
10.1.5.0        0.0.0.0         255.255.255.0   U     0      -      -   4

  Priority: -10 Protocol: ns3::Ipv4GlobalRouting
Node: 1, Time: +12s, Local time: +12s, Ipv4GlobalRouting table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
10.1.1.1        10.1.1.1        255.255.255.255 UH    -      -      -   1
10.1.2.1        10.1.1.1        255.255.255.255 UH    -      -      -   1
10.1.2.2        10.1.3.2        255.255.255.255 UH    -      -      -   2
10.1.3.2        10.1.3.2        255.255.255.255 UH    -      -      -   2
10.1.6.1        10.1.3.2        255.255.255.255 UH    -      -      -   2
10.1.4.2        10.1.4.2        255.255.255.255 UH    -      -      -   3
10.1.7.1        10.1.4.2        255.255.255.255 UH    -      -      -   3
10.1.5.2        10.1.5.2        255.255.255.255 UH    -      -      -   4
10.1.6.2        10.1.5.2        255.255.255.255 UH    -      -      -   4
10.1.7.2        10.1.5.2        255.255.255.255 UH    -      -      -   4
10.1.8.1        10.1.5.2        255.255.255.255 UH    -      -      -   4
10.1.8.2        10.1.5.2        255.255.255.255 UH    -      -      -   4
10.1.1.0        10.1.1.1        255.255.255.0   UG    -      -      -   1
10.1.2.0        10.1.1.1        255.255.255.0   UG    -      -      -   1
10.1.2.0        10.1.3.2        255.255.255.0   UG    -      -      -   2
10.1.3.0        10.1.3.2        255.255.255.0   UG    -      -      -   2
10.1.6.0        10.1.3.2        255.255.255.0   UG    -      -      -   2
10.1.4.0        10.1.4.2        255.255.255.0   UG    -      -      -   3
10.1.7.0        10.1.4.2        255.255.255.0   UG    -      -      -   3
10.1.5.0        10.1.5.2        255.255.255.0   UG    -      -      -   4
10.1.6.0        10.1.5.2        255.255.255.0   UG    -      -      -   4
10.1.7.0        10.1.5.2        255.255.255.0   UG    -      -      -   4
10.1.8.0        10.1.5.2        255.255.255.0   UG    -      -      -   4
10.1.8.0        10.1.5.2        255.255.255.0   UG    -      -      -   4
```

```
Node: 2, Time: +12s, Local time: +12s, Ipv4ListRouting table
  Priority: 0 Protocol: ns3::Ipv4StaticRouting
Node: 2, Time: +12s, Local time: +12s, Ipv4StaticRouting table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
127.0.0.0       0.0.0.0         255.0.0.0       U     0      -      -   0
10.1.2.0        0.0.0.0         255.255.255.0   U     0      -      -   1
10.1.3.0        0.0.0.0         255.255.255.0   U     0      -      -   2
10.1.6.0        0.0.0.0         255.255.255.0   U     0      -      -   3

  Priority: -10 Protocol: ns3::Ipv4GlobalRouting
Node: 2, Time: +12s, Local time: +12s, Ipv4GlobalRouting table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
10.1.1.1        10.1.2.1        255.255.255.255 UH    -      -      -   1
10.1.2.1        10.1.2.1        255.255.255.255 UH    -      -      -   1
10.1.1.2        10.1.3.1        255.255.255.255 UH    -      -      -   2
10.1.3.1        10.1.3.1        255.255.255.255 UH    -      -      -   2
10.1.4.1        10.1.3.1        255.255.255.255 UH    -      -      -   2
10.1.5.1        10.1.3.1        255.255.255.255 UH    -      -      -   2
10.1.5.2        10.1.6.2        255.255.255.255 UH    -      -      -   3
10.1.6.2        10.1.6.2        255.255.255.255 UH    -      -      -   3
10.1.7.2        10.1.6.2        255.255.255.255 UH    -      -      -   3
10.1.8.1        10.1.6.2        255.255.255.255 UH    -      -      -   3
10.1.4.2        10.1.3.1        255.255.255.255 UH    -      -      -   2
10.1.4.2        10.1.6.2        255.255.255.255 UH    -      -      -   3
10.1.7.1        10.1.3.1        255.255.255.255 UH    -      -      -   2
10.1.7.1        10.1.6.2        255.255.255.255 UH    -      -      -   3
10.1.8.2        10.1.6.2        255.255.255.255 UH    -      -      -   3
10.1.1.0        10.1.2.1        255.255.255.0   UG    -      -      -   1
10.1.2.0        10.1.2.1        255.255.255.0   UG    -      -      -   1
```

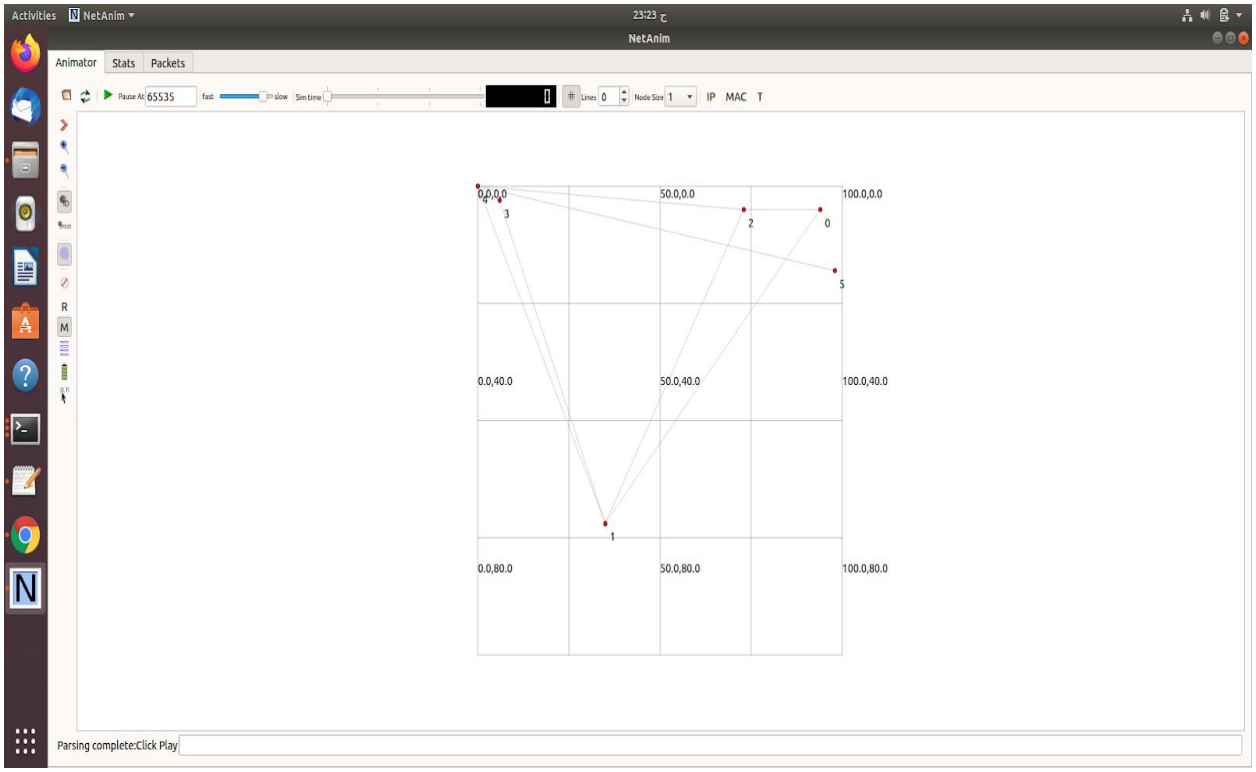
```
10.1.1.0        10.1.3.1        255.255.255.0   UG    -      -      -   2
10.1.3.0        10.1.3.1        255.255.255.0   UG    -      -      -   2
10.1.4.0        10.1.3.1        255.255.255.0   UG    -      -      -   2
10.1.5.0        10.1.3.1        255.255.255.0   UG    -      -      -   2
10.1.4.0        10.1.3.1        255.255.255.0   UG    -      -      -   2
10.1.4.0        10.1.6.2        255.255.255.0   UG    -      -      -   3
10.1.7.0        10.1.3.1        255.255.255.0   UG    -      -      -   2
10.1.7.0        10.1.6.2        255.255.255.0   UG    -      -      -   3
10.1.5.0        10.1.6.2        255.255.255.0   UG    -      -      -   3
10.1.6.0        10.1.6.2        255.255.255.0   UG    -      -      -   3
10.1.7.0        10.1.6.2        255.255.255.0   UG    -      -      -   3
10.1.8.0        10.1.6.2        255.255.255.0   UG    -      -      -   3
10.1.8.0        10.1.6.2        255.255.255.0   UG    -      -      -   3

Node: 3, Time: +12s, Local time: +12s, Ipv4ListRouting table
  Priority: 0 Protocol: ns3::Ipv4StaticRouting
Node: 3, Time: +12s, Local time: +12s, Ipv4StaticRouting table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
127.0.0.0       0.0.0.0         255.0.0.0       U     0      -      -   0
10.1.4.0        0.0.0.0         255.255.255.0   U     0      -      -   1
10.1.7.0        0.0.0.0         255.255.255.0   U     0      -      -   2

  Priority: -10 Protocol: ns3::Ipv4GlobalRouting
Node: 3, Time: +12s, Local time: +12s, Ipv4GlobalRouting table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
10.1.1.2        10.1.4.1        255.255.255.255 UH    -      -      -   1
10.1.3.1        10.1.4.1        255.255.255.255 UH    -      -      -   1
10.1.4.1        10.1.4.1        255.255.255.255 UH    -      -      -   1
10.1.5.1        10.1.4.1        255.255.255.255 UH    -      -      -   1
```

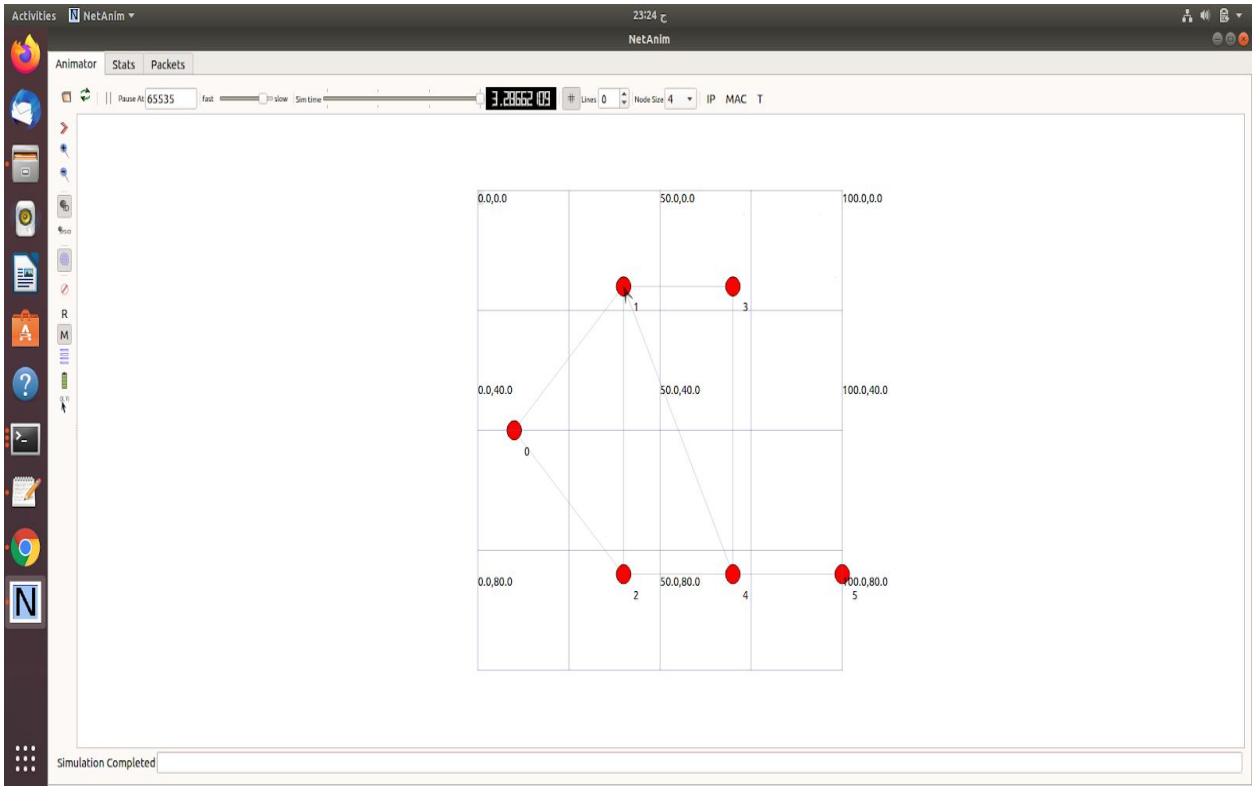
```
10.1.5.2        10.1.7.2        255.255.255.255 UH    -       -       -   2
10.1.6.2        10.1.7.2        255.255.255.255 UH    -       -       -   2
10.1.7.2        10.1.7.2        255.255.255.255 UH    -       -       -   2
10.1.8.1        10.1.7.2        255.255.255.255 UH    -       -       -   2
10.1.1.1        10.1.4.1        255.255.255.255 UH    -       -       -   1
10.1.2.1        10.1.4.1        255.255.255.255 UH    -       -       -   1
10.1.2.2        10.1.4.1        255.255.255.255 UH    -       -       -   1
10.1.2.2        10.1.7.2        255.255.255.255 UH    -       -       -   2
10.1.3.2        10.1.4.1        255.255.255.255 UH    -       -       -   1
10.1.3.2        10.1.7.2        255.255.255.255 UH    -       -       -   2
10.1.6.1        10.1.4.1        255.255.255.255 UH    -       -       -   1
10.1.6.1        10.1.7.2        255.255.255.255 UH    -       -       -   2
10.1.8.2        10.1.7.2        255.255.255.255 UH    -       -       -   2
10.1.1.0        10.1.4.1        255.255.255.0   UG    -       -       -   1
10.1.3.0        10.1.4.1        255.255.255.0   UG    -       -       -   1
10.1.4.0        10.1.4.1        255.255.255.0   UG    -       -       -   1
10.1.5.0        10.1.4.1        255.255.255.0   UG    -       -       -   1
10.1.1.0        10.1.4.1        255.255.255.0   UG    -       -       -   1
10.1.2.0        10.1.4.1        255.255.255.0   UG    -       -       -   1
10.1.2.0        10.1.4.1        255.255.255.0   UG    -       -       -   1
10.1.2.0        10.1.7.2        255.255.255.0   UG    -       -       -   2
10.1.3.0        10.1.4.1        255.255.255.0   UG    -       -       -   1
10.1.3.0        10.1.7.2        255.255.255.0   UG    -       -       -   2
10.1.6.0        10.1.4.1        255.255.255.0   UG    -       -       -   1
10.1.6.0        10.1.7.2        255.255.255.0   UG    -       -       -   2
10.1.5.0        10.1.7.2        255.255.255.0   UG    -       -       -   2
10.1.6.0        10.1.7.2        255.255.255.0   UG    -       -       -   2
10.1.7.0        10.1.7.2        255.255.255.0   UG    -       -       -   2
10.1.8.0        10.1.7.2        255.255.255.0   UG    -       -       -   2
```

```
10.1.8.0        10.1.7.2        255.255.255.0   UG    -      -      -   2

Node: 4, Time: +12s, Local time: +12s, Ipv4ListRouting table
  Priority: 0 Protocol: ns3::Ipv4StaticRouting
Node: 4, Time: +12s, Local time: +12s, Ipv4StaticRouting table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
127.0.0.0       0.0.0.0         255.0.0.0       U     0      -      -   0
10.1.5.0        0.0.0.0         255.255.255.0   U     0      -      -   1
10.1.6.0        0.0.0.0         255.255.255.0   U     0      -      -   2
10.1.7.0        0.0.0.0         255.255.255.0   U     0      -      -   3
10.1.8.0        0.0.0.0         255.255.255.0   U     0      -      -   4

  Priority: -10 Protocol: ns3::Ipv4GlobalRouting
Node: 4, Time: +12s, Local time: +12s, Ipv4GlobalRouting table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
10.1.1.2        10.1.5.1        255.255.255.255 UH    -      -      -   1
10.1.3.1        10.1.5.1        255.255.255.255 UH    -      -      -   1
10.1.4.1        10.1.5.1        255.255.255.255 UH    -      -      -   1
10.1.5.1        10.1.5.1        255.255.255.255 UH    -      -      -   1
10.1.2.2        10.1.6.1        255.255.255.255 UH    -      -      -   2
10.1.3.2        10.1.6.1        255.255.255.255 UH    -      -      -   2
10.1.6.1        10.1.6.1        255.255.255.255 UH    -      -      -   2
10.1.4.2        10.1.7.1        255.255.255.255 UH    -      -      -   3
10.1.7.1        10.1.7.1        255.255.255.255 UH    -      -      -   3
10.1.8.2        10.1.8.2        255.255.255.255 UH    -      -      -   4
10.1.1.1        10.1.5.1        255.255.255.255 UH    -      -      -   1
10.1.1.1        10.1.6.1        255.255.255.255 UH    -      -      -   2
10.1.2.1        10.1.5.1        255.255.255.255 UH    -      -      -   1
10.1.2.1        10.1.6.1        255.255.255.255 UH    -      -      -   2
```

```
10.1.1.0        10.1.5.1        255.255.255.0   UG    -      -      -   1
10.1.3.0        10.1.5.1        255.255.255.0   UG    -      -      -   1
10.1.4.0        10.1.5.1        255.255.255.0   UG    -      -      -   1
10.1.5.0        10.1.5.1        255.255.255.0   UG    -      -      -   1
10.1.1.0        10.1.5.1        255.255.255.0   UG    -      -      -   1
10.1.1.0        10.1.6.1        255.255.255.0   UG    -      -      -   2
10.1.2.0        10.1.5.1        255.255.255.0   UG    -      -      -   1
10.1.2.0        10.1.6.1        255.255.255.0   UG    -      -      -   2
10.1.2.0        10.1.6.1        255.255.255.0   UG    -      -      -   2
10.1.3.0        10.1.6.1        255.255.255.0   UG    -      -      -   2
10.1.6.0        10.1.6.1        255.255.255.0   UG    -      -      -   2
10.1.4.0        10.1.7.1        255.255.255.0   UG    -      -      -   3
10.1.7.0        10.1.7.1        255.255.255.0   UG    -      -      -   3
10.1.8.0        10.1.8.2        255.255.255.0   UG    -      -      -   4

Node: 5, Time: +12s, Local time: +12s, Ipv4ListRouting table
  Priority: 0 Protocol: ns3::Ipv4StaticRouting
Node: 5, Time: +12s, Local time: +12s, Ipv4StaticRouting table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
127.0.0.0       0.0.0.0         255.0.0.0       U     0      -      -   0
10.1.8.0        0.0.0.0         255.255.255.0   U     0      -      -   1

  Priority: -10 Protocol: ns3::Ipv4GlobalRouting
Node: 5, Time: +12s, Local time: +12s, Ipv4GlobalRouting table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0         10.1.8.1        0.0.0.0         UG    -      -      -   1
```

Simulation Animated Graph




Activities
NetAnim
23:24
NetAnim
Animator
Stats
Packets
Pause At 65535
fast
slow
Sim time
Lines 0
Node Size 4
IP
MAC
T
0.0,0.0
50.0,0.0
100.0,0.0
0.0,40.0
50.0,40.0
100.0,40.0
0.0,80.0
50.0,80.0
100.0,80.0
0
1
2
3
4
5
Simulation Completed