**Practical No.3**

**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/netanim-module.h"

#include "ns3/ipv4-global-routing-helper.h"

#include "ns3/csma-module.h"

using namespace ns3;

NS\_LOG\_COMPONENT\_DEFINE("Bustopologyexample");

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

uint32\_t nCsma = 3;

CommandLine cmd(\_\_FILE\_\_);

cmd.AddValue("nCsma","Number of \"extra\"CSMA nodes/devices",nCsma);

cmd.Parse(argc,argv);

Time::SetResolution(Time::NS);

LogComponentEnable("UdpEchoClientApplication",LOG\_LEVEL\_INFO);

LogComponentEnable("UdpEchoServerApplication",LOG\_LEVEL\_INFO);

NodeContainer p2pNodes;

p2pNodes.Create(2);

PointToPointHelper pointToPoint;

pointToPoint.SetDeviceAttribute("DataRate",StringValue("5Mbps"));

pointToPoint.SetChannelAttribute("Delay",StringValue("2ms"));

NetDeviceContainer p2pDevices;

p2pDevices = pointToPoint.Install(p2pNodes);

InternetStackHelper stack;

stack.Install(p2pNodes.Get(0));

nCsma=nCsma==0?1:nCsma;

NodeContainer csmaNodes;

csmaNodes.Add(p2pNodes.Get(1));

csmaNodes.Create(nCsma);

CsmaHelper csma;

csma.SetChannelAttribute("DataRate",StringValue("100Mbps"));

csma.SetChannelAttribute("Delay",TimeValue(NanoSeconds(6560)));

NetDeviceContainer csmaDevices;

csmaDevices=csma.Install(csmaNodes);

stack.Install(csmaNodes);

Ipv4AddressHelper address;

address.SetBase ("10.1.1.0", "255.255.255.0");

Ipv4InterfaceContainer p2pInterfaces;

p2pInterfaces = address.Assign(p2pDevices);

address.SetBase ("10.1.2.0", "255.255.255.0");

Ipv4InterfaceContainer csmaInterfaces;

csmaInterfaces = address.Assign(csmaDevices);

UdpEchoServerHelper echoServer (9);

ApplicationContainer serverApps = echoServer.Install (csmaNodes.Get (nCsma));

serverApps.Start (Seconds (1.0));

serverApps.Stop (Seconds (10.0));

UdpEchoClientHelper echoClient (csmaInterfaces.GetAddress (nCsma), 9);

echoClient.SetAttribute ("MaxPackets", UintegerValue (1));

echoClient.SetAttribute ("Interval", TimeValue (Seconds (1.0)));

echoClient.SetAttribute ("PacketSize", UintegerValue (1024));

ApplicationContainer clientApps = echoClient.Install (p2pNodes.Get (0));

clientApps.Start (Seconds (2.0));

clientApps.Stop (Seconds (10.0));

Ipv4GlobalRoutingHelper::PopulateRoutingTables();

pointToPoint.EnablePcapAll("second");

csma.EnablePcap("second",csmaDevices.Get(1),true);

AnimationInterface anim("bustopology.xml");

anim.SetConstantPosition(p2pNodes.Get(1),6,12);

anim.SetConstantPosition(csmaNodes.Get(0),30,12);

anim.SetConstantPosition(csmaNodes.Get(1),40.0,12.0);

anim.SetConstantPosition(csmaNodes.Get(2),50.0,12.0);

anim.SetConstantPosition(csmaNodes.Get(3),60.0,12.0);

Simulator::Run ();

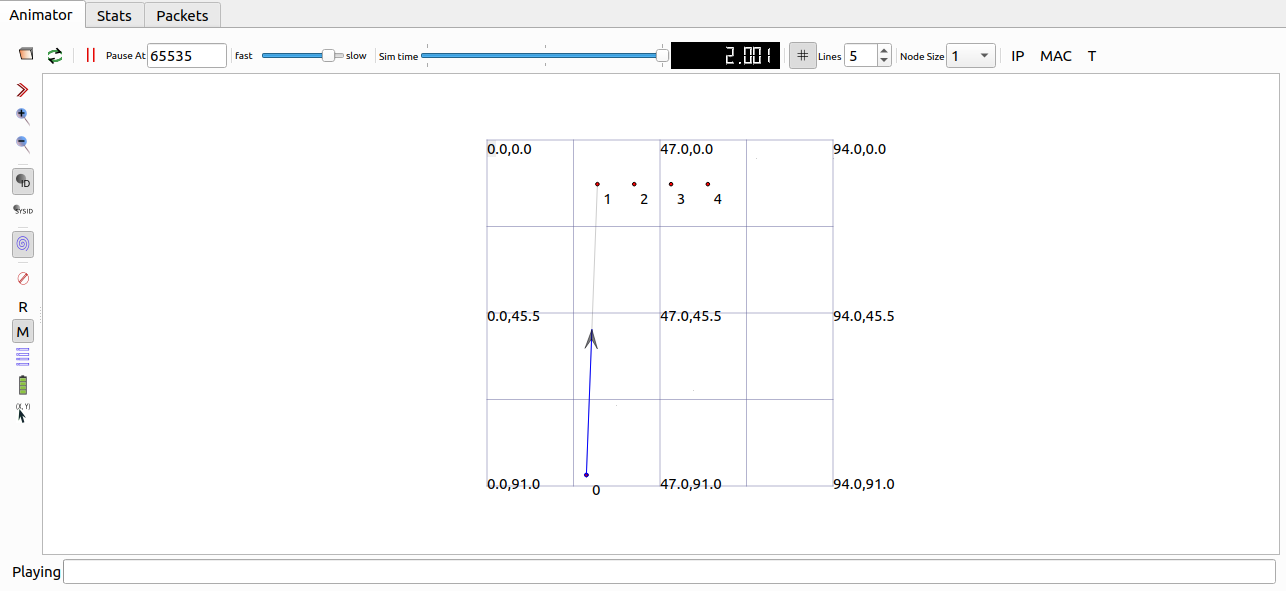
Simulator::Destroy ();

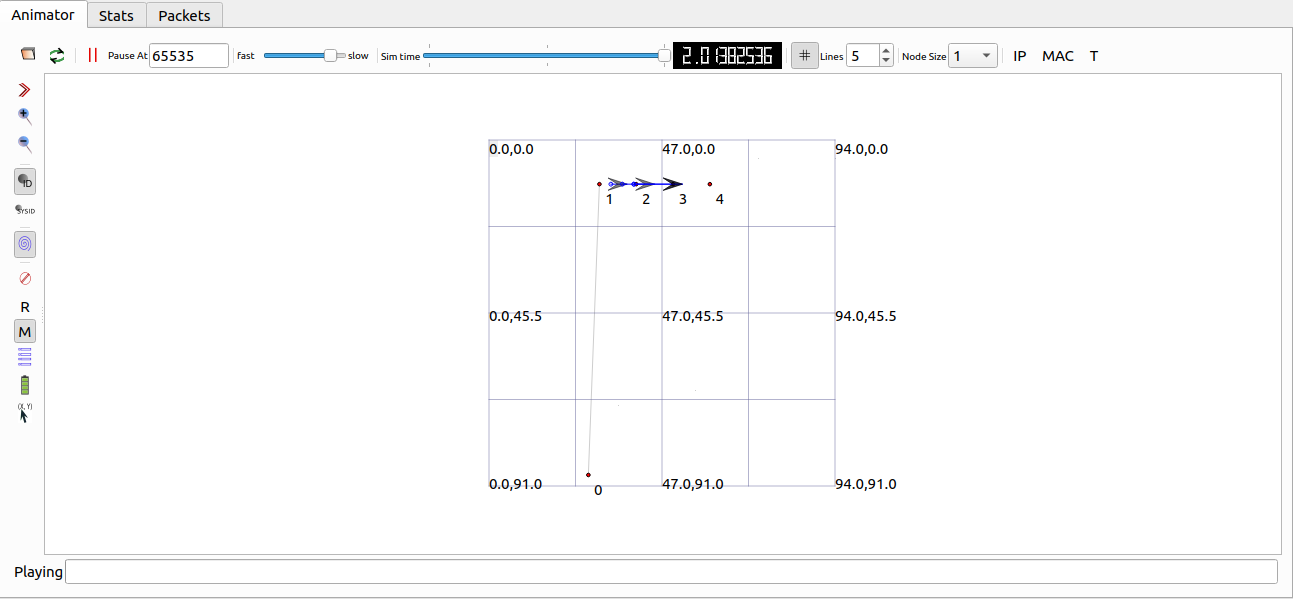
return 0;

}

**Output:**

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