**Aim:** To study and construct a star topology with 9 nodes by making one node as the hub.

**Description:** We are developing a virtual star network and observing how the packets are travelling from one node to other. In the above program we are considering 9 nodes in which 1 node is taken as HUB and the others are client. When we perform the star topology it will generate packetcapture(pcap) files which are used to know the internal information's of packet transfer (e.g. sequence, length etc.).We use the tcpdump command to check it.

Config::SetDefault ("ns3:: OnOffApplication::Packet Size", UintegerValue (1024));

Config::SetDefault ("ns3:: OnOffApplication::DataRate", StringValue ("14kb/s"));

These OnOffApplication class are used for setting the packet size and data rate at which these are transmitting.

**Algorithm:**

1. Start
2. Create 9 nodes
3. Create 1 node as a HUB.
4. Configure remaining nodes as clients with attributes.
5. Establish a point to point connection between Hub and the other 8 nodes.
6. Assign ip addresses to each one of them.
7. Start transmitting data.
8. End

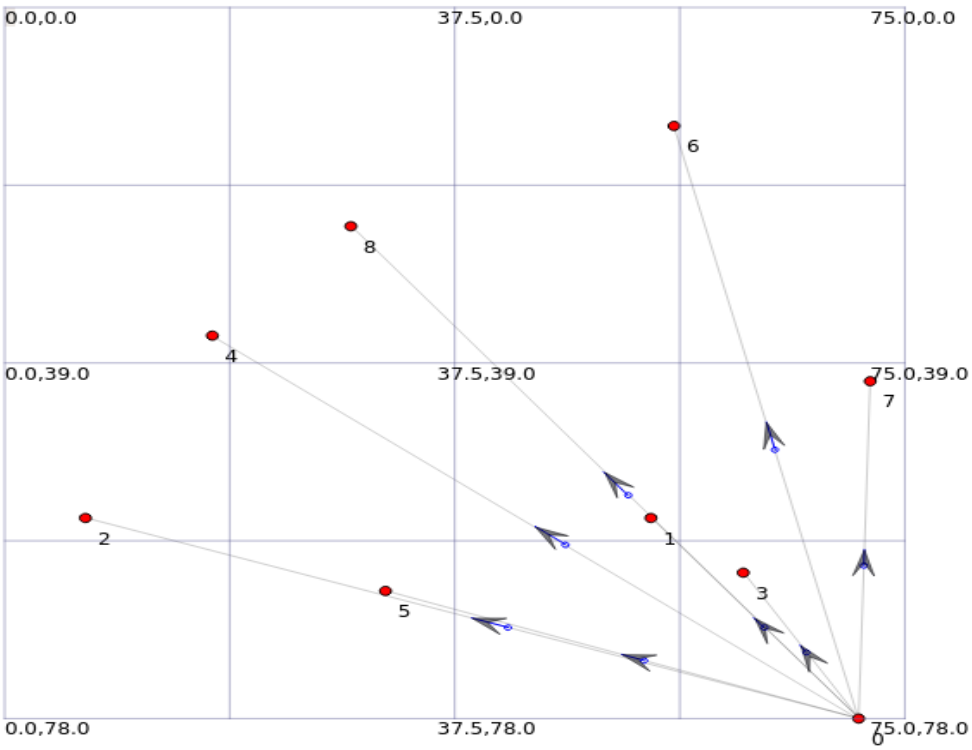
**Source Code:**

```
#include "ns3/core-module.h"
#include "ns3/network-module.h"
#include "ns3/netanim-module.h"
#include "ns3/internet-module.h"
#include "ns3/point-to-point-module.h"
#include "ns3/applications-module.h"
#include "ns3/point-to-point-layout-module.h"
using namespace ns3;

NS_LOG_COMPONENT_DEFINE ("Star");

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

  Config::SetDefault ("ns3::OnOffApplication::PacketSize", UintegerValue (1024));
```

```
  Config::SetDefault ("ns3::OnOffApplication::DataRate", StringValue ("14kb/s"));


  uint32_t nSpokes = 8;

  CommandLine cmd;
  cmd.AddValue ("nSpokes", "Number of nodes to place in the star", nSpokes);
  cmd.Parse (argc, argv);

  NS_LOG_INFO ("Build star topology.");
  PointToPointHelper pointToPoint;
  pointToPoint.SetDeviceAttribute ("DataRate", StringValue ("5Mbps"));
  pointToPoint.SetChannelAttribute ("Delay", StringValue ("2ms"));
  PointToPointStarHelper star (nSpokes, pointToPoint);

  NS_LOG_INFO ("Install internet stack on all nodes.");
  InternetStackHelper internet;
  star.InstallStack (internet);

  NS_LOG_INFO ("Assign IP Addresses.");
  star.AssignIpv4Addresses (Ipv4AddressHelper ("10.1.1.0", "255.255.255.0"));

 // packetSinkHelper.Install (star.GetHub ());
  NS_LOG_INFO ("Create applications.");

  uint16_t port = 50000;
  Address hubLocalAddress (InetSocketAddress (Ipv4Address::GetAny (), port));
  PacketSinkHelper packetSinkHelper ("ns3::TcpSocketFactory", hubLocalAddress);
  ApplicationContainer hubApp = packetSinkHelper.Install (star.GetHub ());
  hubApp.Start (Seconds (1.0));
  hubApp.Stop (Seconds (10.0));


  OnOffHelper onOffHelper ("ns3::TcpSocketFactory", Address ());
  onOffHelper.SetAttribute ("OnTime", StringValue
("ns3::ConstantRandomVariable[Constant=1]"));
  onOffHelper.SetAttribute ("OffTime", StringValue
("ns3::ConstantRandomVariable[Constant=0]"));

  ApplicationContainer spokeApps;

  for (uint32_t i = 0; i < star.SpokeCount (); ++i)
    {
      AddressValue remoteAddress (InetSocketAddress (star.GetHubIpv4Address (i), port));
      onOffHelper.SetAttribute ("Remote", remoteAddress);
      spokeApps.Add (onOffHelper.Install (star.GetSpokeNode (i)));
    }
  spokeApps.Start (Seconds (1.0));
  spokeApps.Stop (Seconds (10.0));

  NS_LOG_INFO ("Enable static global routing.");
```

```
  Ipv4GlobalRoutingHelper::PopulateRoutingTables ();

  NS_LOG_INFO ("Enable pcap tracing.");

  pointToPoint.EnablePcapAll ("star");

  NS_LOG_INFO ("Run Simulation.");
  AnimationInterface anim ("startopology.xml");
  Simulator::Run ();
  Simulator::Destroy ();
  NS_LOG_INFO ("Done.");

  return 0;
}
```

**Outputs:**



```
root@cbit-OptiPlex-3060:/home/student/Desktop/cse1-301/ns-allinone-3.28/ns-3.28# tcpdump -n -tt -r star-0-2.pcap
reading from file star-0-2.pcap, link-type PPP (PPP)
1.002092 IP 10.1.3.2.49153 > 10.1.3.1.50000: Flags [S], seq 0, win 65535, options [TS val 1000 ecr 0,wscale 2,sackOK,eol], length 0
1.002092 IP 10.1.3.1.50000 > 10.1.3.2.49153: Flags [S.], seq 0, ack 1, win 65535, options [TS val 1002 ecr 1000,wscale 2,sackOK,eol], length 0
1.006271 IP 10.1.3.2.49153 > 10.1.3.1.50000: Flags [.], ack 1, win 32768, options [TS val 1004 ecr 1002,eol], length 0
1.588086 IP 10.1.3.2.49153 > 10.1.3.1.50000: Flags [.], seq 1:537, ack 1, win 32768, options [TS val 1585 ecr 1002,eol], length 536
1.588086 IP 10.1.3.1.50000 > 10.1.3.2.49153: Flags [.], ack 537, win 32768, options [TS val 1588 ecr 1585,eol], length 0
1.593040 IP 10.1.3.2.49153 > 10.1.3.1.50000: Flags [.], seq 537:1025, ack 1, win 32768, options [TS val 1590 ecr 1588,eol], length 488
1.793040 IP 10.1.3.1.50000 > 10.1.3.2.49153: Flags [.], ack 1025, win 32768, options [TS val 1793 ecr 1590,eol], length 0
2.173229 IP 10.1.3.2.49153 > 10.1.3.1.50000: Flags [.], seq 1025:1561, ack 1, win 32768, options [TS val 2170 ecr 1793,eol], length 536
2.174096 IP 10.1.3.2.49153 > 10.1.3.1.50000: Flags [.], seq 1561:2049, ack 1, win 32768, options [TS val 2170 ecr 1793,eol], length 488
2.174096 IP 10.1.3.1.50000 > 10.1.3.2.49153: Flags [.], ack 2049, win 32768, options [TS val 2174 ecr 2170,eol], length 0
2.758372 IP 10.1.3.2.49153 > 10.1.3.1.50000: Flags [.], seq 2049:2585, ack 1, win 32768, options [TS val 2755 ecr 2174,eol], length 536
2.759239 IP 10.1.3.2.49153 > 10.1.3.1.50000: Flags [.], seq 2585:3073, ack 1, win 32768, options [TS val 2755 ecr 2174,eol], length 488
2.759239 IP 10.1.3.1.50000 > 10.1.3.2.49153: Flags [.], ack 3073, win 32768, options [TS val 2759 ecr 2755,eol], length 0
3.343515 IP 10.1.3.2.49153 > 10.1.3.1.50000: Flags [.], seq 3073:3609, ack 1, win 32768, options [TS val 3340 ecr 2759,eol], length 536
3.344382 IP 10.1.3.2.49153 > 10.1.3.1.50000: Flags [.], seq 3609:4097, ack 1, win 32768, options [TS val 3340 ecr 2759,eol], length 488
3.344382 IP 10.1.3.1.50000 > 10.1.3.2.49153: Flags [.], ack 4097, win 32768, options [TS val 3344 ecr 3340,eol], length 0
```

```
Build commands will be stored in build/compile_commands.json
'build' finished successfully (0.986s)
AnimationInterface WARNING:Node:0 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:1 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:2 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:3 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:4 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:5 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:6 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:7 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:8 Does not have a mobility model. Use SetConstantPosition if it is stationary
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AnimationInterface WARNING:Node:6 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:7 Does not have a mobility model. Use SetConstantPosition if it is stationary
AnimationInterface WARNING:Node:8 Does not have a mobility model. Use SetConstantPosition if it is stationary
root@cbit-OptiPlex-3060:/home/student/Desktop/cse1-055/ns-allinone-3.28/ns-3.28#
```

**Analysis :**We have successfully completed the construction of the star topology, with eight nodes and studied it.