- Title: To demonstrate point to point network using NS3 simulator using a suitable code.

- Objective: Design two wired nodes that can connect to each other through point-to-point network that handles data rate of 50 mbps and delay of 5ms. The first node acts as a source & second as client.

- Mode used: NS-3 simulator.

- Theory:

NS-3 simulator is an open-source discrete event-network simulator primarily used for research & simulation in computer networking. It provides platform for studying various network protocols like IPV4 IPV6, TCP, UDP, etc. routing protocols (BGP & OSPF) technologies scenarios in a controlled & reproducible environment.

Some key points about NS-3 simulator:

1. Modularity: designed to be modular & extensible allowing addition of new networks.

2. Programming interface: Are typically written in C++ & python using objectoriented API.

3. Visualization: Includes built-support for visualising simulation results using tools like NetAdmin and Pyviz.

It is a very variable platform for providing tools for conducting research and experimentation in computer Networking.

• Throughput : Refers to rate of successful data transmission over a communication channel. It is commonly measured in bps (bits per second)

In context of ns-3 simulator, throughput is calculated by measuring the amount of data successfully transmitted from source node within specified period

• Procedure :

1. copy first.cc file to ns-3.38/scratch
2. In order to run the file, open terminal:
   $ cd ns-allinone-3.38/ns-3.38
   $ ./ns3 run scratch/first.cc

change the 1024 to 512 as product size and change the 512 bytes in the trace file and compile it again
$./ns3 run scratch/first.cc

Open another terminal & go to $ cd ns-allinone-3.38/netanim-anim-3.109/ $./NetAnim

Open the XML file and check the output in the animator window.

Now find the throughput with help of software called tracemetrics which is already installed

opening another terminal or using the existing one
$ cd
$ cd tracemetrics-1.4.0
$ java -jar tracemetrics.jar

- Observation:

When the minimum packet size is 1024 bytes the throughput observed is:

0	957.28
1	957.28

When the maximum packet size is 512 bytes the throughput observed is:

0	492.27
1	492.27

- Conclusion:

This experiment in NS-3 illustrate the setup and analizes the point-to-point network, offering insights into network configuration and performance by configuring link parameters, assigning IP address & optionally enabling routing. This is achieved through analysis & simulation, exploring network impact of link characteristics on data transmission and latency for more complexing networks.

Questions:

Q.1] Explain the purpose of NS3 in network simulation and its advantages over other simulators. ~~Describe the process of installing NS3 on linux system, including any dependancies and recommended practices.~~

→ NS-3 is a robust network simulator used for modeling intricate network scenarios, offering realistic simulation and open-source extensibility. ~~To install NS-3~~ Its primary purpose is to provide a platform for networking networking & research.

- Advantages:

1) Realistic simulation: NS3 offers high level realism in network simulations.

2) Open-source and extensible

3) Active community support.

beginning with aquisition of source code users navigate through configuring dependancies, compiling & installing NS-3, ensuring adherence to the recommended practices outlined in the documentation.

Q.2] Describe the process of installing NS3 on Linux system, including any dependancies and recommended practices.

→ It involves several steps.

1) Install dependancies:- NS3 has several dependancies that need to be installed beforehand that need to be installed beforehand these include build tools, libraries, gcc, g++, python, etc.

2) Download NS3:- download official NS3 source code from website or repo

3) configure: Navigate to NS3 directory and run ./waf configure command.

4) build and install ./waf install

Q.3) Discuss concept of node mobility in NS3 simulation and provide examples of mobility models available in simulator.

→ i) Node mobility in ns-3 simulations refers to movement of network nodes (such as devices, routers, or vehicles) within a simulated network environment. Understanding node mobility is crucial for modelling real life scenarios and evaluating network protocols.

ii) The models track the maintain & kurrent cartesian position & speed of an objects.

iii) Coordinate system: ns-3 uses cartesian coordinate system for position tracking.

iv) Custom mobility models: users can create custom mobility models by subclassing ns-3::MobilityModel.

Q.4) Explain the process of creating a simple network topology in NS3, including adding nodes, configuring network interfaces and setting up communication links.

→ 1) Adding Nodes: Create node using NodeContainer.

NodeContainer nodes; nodes.Create(3);

2) Configuring Network interfaces

- Set up network interfaces for each using NetDeviceContainer

3) Set up Communication Links:

- establish using PointToPointHelper, CsmaHelper, etc

4) Simulation and Execution:

- Configure simulation using Simulator::Run() and retrieve results.

Remember to include necessary headers files.

2.] Discuss the role of trace files in NS3 simulations and explain how to generate and analyze traced data

→ i) Trace files in ns3 simulations record events packet transmissions & other network activities during simulation runtime.

ii) Generating Trace data:
Enable tracing for desired component in NS3 by Tracecontext.

iii) Visualization and validation:
Visualize trace data using plotting libraries or custom visualization tools to gain insights into network dynamics then validate results by comparing data with expected necessary data.