Computer NetworksLABNITSilcharJul-Dec-2020

Aim of Computer Networks LAB

What is Computer Network?

Understanding about Network Programming (Sockets) & Network Simulators (NS-3). Point to point and CSMA Links.

IP and ARP traffic generation in view of 802.3

Understanding working procedures of Layer-4 through socket programming, Layer-2 & Layer -3 traffic analysis through NS-3

Exp -1

Implement "TCP client server" architecture using socket programming in C / C++. Description: retrieve information (any text or system info) from TCP server to TCP client.

Exp -2

Implement "TCP chat server" using socket programming in C / C++.

Exp -3

Implement "UDP client server" architecture using socket programming in C / C++. Description: send information (any text or system info) from UDP client to UDP server.

Exp -4

Implement "FTP server" (TCP / UDP) using socket programming in C / C++.

Exp -5

Use the file */ns-allinone-3.28/ns-3.28/examples/tutorial/first.cc. This example file creates a simple network topology with a few nodes. Study the source code of this example to find out different configuration parameters. With reference to this code, evaluate the following variants with the help of flow monitors. (Throughput: the amount of bytes transmitted over channel by total time).

Design and Implementation Instructions:

Calculate Throughput with "FlowMonitorHelper Class Reference".

Pass the input values of MaxPackets, Interval & PacketSize through Command line Arguments only.

Using the [128, 256, 512, 1024, 2048, 4096 bytes] size packet flows for certain application layer traffic generation rate measure the link layer performance or the network layer performance. Therefore, consider all the point-to-point frames from all the communication pairs while calculating the performance metrics. Consider appropriate simulator stop time.
Your laboratory report should include NS3 code, the graph (generated using "GnuPlot" only) and a discussion on the interpretation of the graph with respect to the experiment.
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Exp -6

Use the file ns- 3.*/examples/udp/udp- echo.cc. This example file creates a simple network topology with a few nodes with udp client and server. The udp client sends an echo request which is forwarded back by the server. Study the source code of this example to find out different configuration parameters.
Now, copy this file to the scratch folder under your ns3 installation directory and execute it with the waf command. The script generates an ascii trace file and a set of pcap trace files that contains the packet tracing details for the execution script. The pcap files and the .tr trace files have a format of their own. Find out the tracing formats and the meaning of different fields in the trace. The user can extract all the network statistics from these files using flow monitors. However we would not use the flow monitor here as our prime purpose is to know what all information is there in these files and where.
Now figure out the format of the trace files and the information that they give you. Use tcpdump for analyzing .pcap files. The udp- echo.cc script needs to be changed in order for it to accept the parameters from command line arguments. Modify the script such that you are able to tweak the various attributes from command line arguments. We shall tweak and work with three parameters – MaxPackets (denotes maximum number of echo packets forwarded by the client), Interval (time interval between two consecutive echo packets), and PacketSize (payload size of the echo packets). Use following configurations of these parameters, and execute the script by supplying these parameters as a command line argument.
MaxPackets=1000
Interval=0.01 sec
PacketSize = {64, 128, 256, 512, 1024} KB
For every individual packet size, find out the statistics parameters given below and tabulate the results.
a) timeFirstTPacket: when the first packet in the flow was transmitted;
b) timeLastTPacket: when the last packet in the flow was transmitted;

c) timeFirstRPacket: when the first packet in the flow was received by an end node; d) timeLastRPacket: when the last packet in the flow was received;
e) delaySum: the sum of all end- to- end delays for all received packets of the flow; f) tBytes, tPackets: total number of transmitted bytes / packets for the flow; g) rBytes, rPackets: total number of received bytes / packets for the flow;
h) lostPackets: total number of packets that are assumed to be lost (not reported over 10 seconds);
i) timesForwarded: the number of times a packet has been reportedly forwarded; j) packetsDropped, bytesDropped: the number of lost packets and bytes.
k) transmitterThroughput : the throughput of the transmitter, calculated as amount of bytes transmitted divided by total time
l) recieverThroughput : the throughput of the receiver, calculated as amount of bytes received divided by total time
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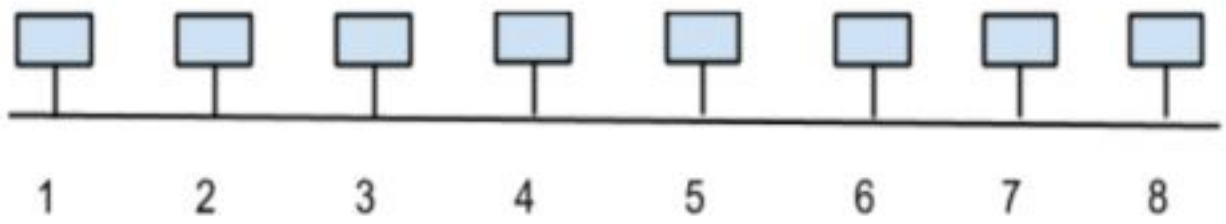
Repeat the same experiment of following configuration parameters.
MaxPackets = 1000
PacketSize = 128KB
intervals = {0.02, 0.05, 0.1, 1} sec
Your laboratory report should include NS3 code, tabulated results and a discussion on the interpretation of the experiment.

Exp – 7

Consider the following network topology,



The nodes use CSMA protocol for channel access at the link layer. The CSMA link bandwidth is 1024 Kbps and the one- way link delay is 2 msec. Every node uses IPv4 at the Internet layer. The application layer uses UDP echo application where the echo messages are generated at different data generation rate. There are four different UDP flows in this network as given below,
Flow 1 : Node 1 - > Node 5

Flow 2: Node 2 - > Node 6
Flow 3: Node 7 - > Node 3
Flow 4: Node 8 - > Node 4
Measure the performance of the CSMA network in NS3 with respect to following performance metrics:
a) Throughput: Average amount of data bits successfully transmitted per unit time. b) Forwarding Delay: Average end- to- end delay (including the queuing delay and the transmission delay) experienced by the CSMA frames.
c) Jitter: Jitter is the variation in individual frame delay.
Using the [16 Kbps, 32 Kbps, 64 Kbps, 128 Kbps, 256 Kbps, 512 Kbps, 1024 Kbps] application layer traffic generation rate measure the link layer performance or the network performance, **not per node performance**. Therefore, consider all the CSMA frames from all the communication pairs while calculating the performance metrics.
Your laboratory report should include NS3 code, the graph (generated using "GnuPlot" only) and a discussion on the interpretation of the graph with respect to the experiment.
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Exp- 8

Consider a network topology of 8 nodes with CSMA channel, Create four (04) different applications with following instructions, and write detailed observations after successful execution with respective to different TCP & UDP flows.
Architecture: (only CBR flows)
Application 1: Create TCP flow between node 1 & 2
Application 2: Create UDP flow between node 3 & 4
Application 3: Create TCP flow between node 5 & 6
Application 4: Create UDP flow between node 7 & 8
Start and Stop time between Application 1 & 2 are different
Start and Stop time between Application 3 & 4 are same
Constant parameters:
Channel data rate – 50 Mbps
Channel Delay – 2 ms
Flow time interval for each application – 2 seconds
Packet size – 1024
Application data rate for first iteration 20 Mbps and for second iteration 30 Mbps Output:
Clearly tabulate per flow performance (use flow monitors). Write detailed observations of TCP &

UDP traffic generation in-view of CBR Traffic, with influence of traffic generation time.

Exp- 9

Generate CBR flows between two different Networks
Design and Implementation Instructions:

(1.1) 10.1.1.0 (1.2) (2.1) 10.1.2.0 (2.2) N-0 ---------- N-1
---------- N-2

Design above topology with CSMA, and Route CBR-UDP traffic from Node-1 (N-0) to Node-3 (N-2) by using Ipv4GlobalRoutingHelper classes / libraries.
Consider all other required parameters in feasible ranges, generate trace file and verify required flows are generating or not. Write detailed observations of traffic generation in-view of Routing parameters.