

Exp -5 (FlowMonitorHelper)

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 (handwritten only), the graph (generated using “GnuPlot” only) and a discussion on the interpretation of the graph with respect to the experiment.

Exp -6 (Network Traffic Analysis)

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
- m) `recieverThroughput` : the throughput of the receiver, calculated as amount of bytes received divided by total time

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 (handwritten only), tabulated results and a discussion on the interpretation of the graph with respect to the experiment.