Lab 03: NS2 Warm-up

OSL, Mon Aug 13, 2012

Objective:

1. Get familiarized with NS2 simulator.
2. Understand relation between delay, throughput and loss rates.

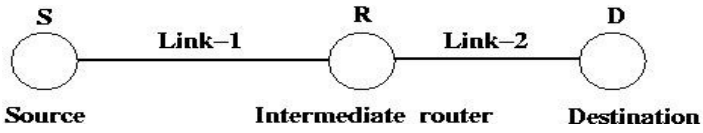
General instructions:

1. This lab is to be done in **groups of two students**
2. Download the file **ns-simple.tcl** to figure out the necessary commands to use in these exercises.
3. Create a directory called <rollnumber1>_<rollnumber2>_lab03. As you proceed with the lab instructions below, note down observations or relevant output from whatever you do in a file named ”lab03.txt” using a text editor.
4. Also add to this directory any written code along with output files. You will find more details of this in the specific exercises.

Lab Instructions:

Exercise 1: Warm Up

Name the tcl script created for this exercise as “ns-udp.tcl”. Create the following topology where you have a source node, a destination node, and an intermediate router (marked "S", "D", and "R" respectively). The link between nodes S and R (Link-1) has a bandwidth of 1Mbps and 50ms latency. The link between nodes R and D (Link-2) has a bandwidth of 100kbps and 5ms latency. Run the simulation and verify in NAM (for this you need to generate a trace for the nam using namtrace-all and execute nam when the simulation finishes) that the following topology is indeed generated.



Exercise 2: UDP Traffic

Let us now build on top of the above setup. Extend “ns-udp.tcl” as your proceed. Create a CBR connection from source to destination. Set packet size to 100 bytes and set the interpacket gap to 10ms. Use the “queue-limit” command to limit the bottleneck link (link-2) between node "R" and node "D" to 10 packets. Also, monitor the queue at Link-2 (between R and D) (use the *duplex-link-op* command). Have the simulation run from 0 to 11 sec and the CBR run from 0.5 to 10.5 seconds. Verify in NAM the flow of packets (for this you need to generate a trace for the nam using namtrace-all and later execute nam). Also generate a trace file “udp.tr” (using trace-all) for later processing.

Case1: Fixed Bottleneck bandwidth (100kbps between R & D), fixed packet interval gap of CBR traffic (10ms), Variable packet sizes: 50, 100, 150, 200 and 250 bytes
In this case, you fix the bandwidth and packet gap as above. For each experiment run, change the packet size to what is specified above. You will have 4 runs and hence 4 trace files (ensure proper

naming. Eg: udp-50b.tr, udp-100b.tr, udp-150b.tr and udp-200b.tr). Include a tcl file of one of the runs as ns-udp-case1.tcl in the directory.

For each run, calculate/measure the following metrics by processing the output trace file. You can use grep/awk etc to process this information:

1. Offered Load: The rate at which CBR traffic is being injected into the network. Express it in kbps (kilo bits per second).
2. Packet Loss: The number of packets that were sent by the sender, but didn't reach the destination. Express it in percentage.
3. Average end-to-end delay: If t1 is the time the packet was generated at the CBR source and t2 was the time the packet was received at the CBR destination. Delay of a packet is t2-t1. Calculate average of these values for packets that reached the destination. Express it in ms.
4. Throughput: The rate at which bits are being received at the destination? Eg: If 100 packets of size 100 bytes were received in a duration of 100 seconds, we say the throughput is 100 * 100 * 8/100 = 800bps or 0.8kbps. Express it in kbps.

Plot the following graphs. Ensure the axis are properly labelled, with proper legend and correct units.

1. Offered Load vs percentage packet loss
2. Offered Load vs Average end-to-end delay
3. Offered load vs throughput

In the report, comment on what you observe in the graphs and the reasons for the same.

Case2: Reapeat the experiment done in case1, but fix the bandwidth to 150kbps instead of 100kbps i.e. Fixed Bottleneck bandwidth (150kbps between R & D), fixed packet interval gap of CBR traffic (10ms), Variable packet sizes: 50, 100, 150, 200 and 250 bytes

You will have 4 runs and hence 4 trace files (ensure proper naming. Eg: udp-50b-150kbps.tr, udp-100b-150kbps.tr, udp-150b-150kbps.tr and udp-200b-150kbps.tr). Include a tcl file of one of the runs as ns-udp-case2.tcl in the directory.
Much, like in case1, calculate the different metrics and plot the 3 graphs.

In the lab report, apart from observations for a given graph (total of 6 graphs), also compare results across different cases and comment on what you infer.

Submission instructions

The directory named <rollnumber1>_<rollnumber2>_lab03 that you will submit should contain the following files:

1. lab03.txt
2. ns-udp.tcl, ns-udp-case1.tcl, ns-udp-case2.tcl
3. 8 trace files (4 for each case)
4. bash scripts (if used)
5. 6 plots (in eps format, properly named)

Now tar it as follows:
tar -zcvf <rollnumber1>_<rollnumber2>_lab3.tgz <rollnumber1>_<rollnumber2>_lab03/
Submit the file <rollnumber1>_<rollnumber2>_lab03.gz via moodle for grading.