Lab 3B - Sliding windows, throughputs, delays using ns2

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Goal of the lab

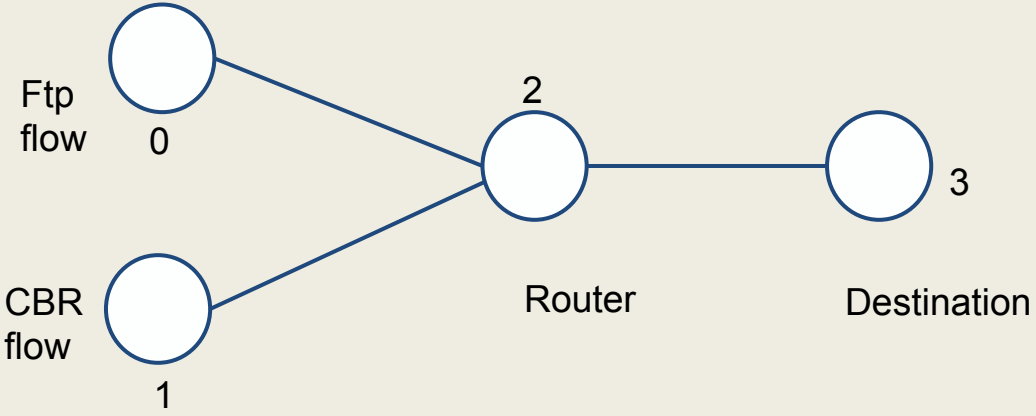
- To see sliding window protocol in action using ns and nam
- To see how round-trip delays affect throughput when using sliding window protocols
- To compare the performance of a flow which does not use sliding windows vs one that does

Files for Lab 3B

- This file (lab description)
- ftpDelays.awk : an awk file that will help process the simulation output trace for finding packet delays for the FTP flow
- ftpTput.awk: an awk file that will help process the simulation output trace for finding throughput of the FTP flow
- lab3b.tcl : ns2 scripting file for you to start with, which you have to modify.

For the rest of the lab, divide your screen into two: have these slides open in one half, and open the code files in the other half. For now
OPEN in a text editor (e.g gedit) the file lab3b.tcl.
The subsequent slides explain this file, and will ask you to make modifications and run it.

The ns2 setup



Topology:

- Two source nodes (hosts)
- One intermediate router node
- One destination node (host)

The flows

- An FTP flow between hosts 0 and 3
  - start and end time mentioned in the tcl file
  - Packets are assumed to be ALWAYS AVAILABLE TO SEND, THROUGHOUT THE DURATION OF THE FLOW
  - Size is a default (figure it out!)
- A Constant Bit Rate (CBR) flow between hosts 1 and 3
  - start and end time mentioned in tcl file
  - packets from source are separated by a fixed interval, and a size given in tcl file

- The Link 2-3 is common to these flows, hence contention expected at this link

The flows..

FTP flow is Over TCP

- Uses sliding window protocol **between the two ends (0 and 3), i.e. over this “logical connection”**
- **TCP Sliding window size is given using two parameters which should have the same value. Do not worry about the meaning of these parameters. For now yhey are just the window size.**

CBR flow is Over UDP.

- NO ACKs. NO SLIDING WINDOW.
- FIXED SIZE PACKET ARRIVES AT ONE EVERY FIXED INTERVAL , SENT AS SOON AS IT ARRIVES

No sliding windows going on over the direct links

Your tasks: Task 0

- Familiarize yourself with the tcl script file, open it in a text editor, make sure you found all the lines which the previous slides were refering to.

- run it
  - ns lab3b.tcl
  - This will start a nam animation
  - Watch the flows, the queues, the packet drops (if any)

Your tasks: Task 0

- View the trace file “simple.tr” by typing this in the terminal:
  - more simple.tr (spacebar for page down, ‘b’ for page up)
- Familiarize yourself with the trace file format (next slide, and in Lab 3A tutorial)
- View and understand the coding in the two awk files given
  - CONFIRM FOR YOURSELF THAT CODE IS CORRECT
  - *YOU MAY USE YOUR OWN SCRIPT TO CALCULATE THE SAME METRICS*
- Run them in the terminal as
  - awk -f ftpTput.awk simple.tr
  - awk -f ftpDelays.awk simple.tr

Trace file format

1 Type Identifier:

“+”: a packet enque event
“-”: a packet deque event
“r”: a packet reception event
“d”: a packet drop (e.g., sent to dropHead_) event

2. Time: at which the packet tracing string is created.
3-4. Source Node and Destination Node (link level)
5. Packet type: tcp/cbr
6. Packet Size: Size of the packet in bytes.
7. Flags: A 7-digit flag string: "-------".
8. Flow ID: 1 is ftp and 2 is cbr in our case.
9-10. Source Address and Destination Address: addresses of the CONNECTION end-points in a "node_id.port_number" format.
In our case: ftp: (0.0, 3.0), cbr: (1.0, 3.1)
11. Sequence Number
12. Packet Unique ID

Task 1: Only FTP flow

- Modify the script to shut out the CBR flow for now. (You can play with the numbers, or comment things out using “#”)
- Play with the sliding window size of the ftp flow to see its impact on its throughput (always change BOTH the parameters). (Calculate throughput using the awk command)
- Keep increasing the window size to increase the throughput. Enter throughput obtained for 3 different window sizes. Answer the following questions on bodhitree
  - What is the maximum throughput the ftp flow can achieve?
  - What is minimum window size at which this throughput was obtained?
  - How does this compare with the raw data rate of the bottleneck link?

Task 2: Only CBR Flow

- Now shut out the FTP flow and only have the CBR flow
- START WITH THE AWK SCRIPTS GIVEN AND MODIFY THEM TO CALCULATE **CBR** THROUGHPUT AND DELAYS (OR WRITE YOUR OWN)
- Play with the CBR flow parameters and check the throughput and delays
- Give the following answers
  - Enter 3 different throughput values (in increasing order), for 3 different sets of flow parameters
  - What is the maximum throughput this flow can achieve?
  - How does this compare with the raw data rate of the bottleneck link?

Task 3: Both flows - baseline

- Now activate both flows, and configure start/stop times such that both the CBR and FTP flows are running simultaneously for during the simulation.
- Set the CBR flow to packet size 1000 bytes, and interval to 0.01
- Set the tcp sliding window size (both parameters) to the value which gave you the maximum ftp throughput in Task 1
- Calculate CBR throughput, CBR delay, FTP throughput, FTP Delay
- Note all the flow parameters, and the corresponding metrics
  - CBR packet size
  - CBR interval
  - FTP window size
  - CBR throughput, delay
  - FTP throughput, delay

Task 4:
Impact of high CBR on FTP

- Keep increasing the CBR flow *offered** rate and see its impact on the FTP flow throughput and delay. Do not change any ftp flow parameter.
  - **Offered rate means the rate that a flow "offers" i.e. brings to the network. This is different from the rate (throughput) it will actually get.*
- Write the same parameters and metrics as described in the previous question for at least three set of parameters such that CBR offered rate is increasing
- Write down conclusions regarding how
  - The increase affects CBR's own throughput and delay
  - How the increase affects FTP's throughput and delay

Task 5: Impact of high FTP on CBR

- Now keep increasing the bandwidth of the 0-2 link (and correspondingly the window size so as to keep utilizing the link fully). *This is the way to increase ftp flow "offered load".* Do not change any CBR flow parameter.
- Write down the parameters and metrics as before (now include 0-2 link bandwidth as a parameter) for at least three values of 0-2 link bandwidths (increasing)

- Write down conclusions regarding how
  - The increase affects FTP's own throughput and delay
  - How the increase affects CBR's throughput and delay

Last Task

- Create a directory “lab03”. Put the following files ONLY in it:
  - lab3a.tcl
  - lab3b.tcl (any one of your versions)
  - All trace-processing script files
- tar as lab03.tar.gz and submit on bodhitree1