

Networks Lab

Assignment 4

Note:

1. You should have NS-3 installed for this assignment.
2. Refer to www.nsnam.org for all the information about NS-3.
3. Also install tcpdump on your machines.
4. Refer to www.tcpdump.org/ for tcpdump.
5. Assuming your installation directory is ns-allinone-*. We call it the home directory of NS-3.
6. Make suitable assumptions unless specified in the question or discuss with TAs.
7. Do not copy the solutions from others. Cases of plagiarism will be treated seriously.
8. Path for CSMA protocol source code: *ns-allinone-3.21/ns-3.21/src/csma*

Carrier Sense Multiple Access(CSMA):

CSMA is a media access control protocol used on shared network topologies like Ethernet to control access to the network. When a station attached to the network wants to transmit data, it first listens to the channel to see if anyone else is transmitting at that moment. If the channel is busy, the station waits for a back off time and checks again. If the channel is idle, it transmits the data. If a collision occurs while transmitting, the station waits for a back off time and attempts to transmit again.

When the station transmits the data unconditionally given that the channel is idle, is called 1-persistent.

When the station transmits the data with a probability p given that the channel is idle, is called p -persistent.

In the theory course, you have learned about CSMA/CD where CSMA is coupled with collision detection (CD) mechanism. However, since today's Ethernet speed is very high, the probability of frame collision given the channel is idle is almost tending to 0. So, NS-3 doesn't consider collision detection for wired networks.

Problem Statement:

Consider the same network topology, communication architecture and bandwidth as given in **Assignment 3**. NS-3 source code has an implementation of 1-persistent CSMA with exponential back-off. The exponential back-off algorithm increases the back-off value in the power of 2. For example, after the first busy sensing, the node waits for 2 units of time before going for the next sensing attempt. After the second busy sensing, it waits for 4 units of time,

after the third it waits for 8 units of time and so on, until it senses the channel to be idle. You have to modify the NS-3 source code with following special features.

- 1) Implement CSMA with additive back-off by making changes to the source code. The additive back-off increases the waiting/back-off time in multitude of 2. That means after (1,2,3,4...) attempts of busy sensing, the waiting/backoff time will be (2,4,6,8,...) unit time, i.e. $2 \times N$ at the Nth channel sensing attempt. Measure the performance parameters similar to Assignment 3: throughput, forwarding delay and jitter (variation in forwarding delay) for both the protocols - exponential back-off and additive back-off. Plot the comparison graphs for these performance parameters with different traffic generation rate as given in Assignment 3.
- 2) Implement p-persistent CSMA with exponential back-off and additive back-off by making changes to the source code. Plot the comparison graphs for throughput, forwarding delay and jitter (variation in forwarding delay) for $p = 0.1, 0.5, 0.9$ with different traffic generation rate as given in Assignment 3.

State your observations on the impact of different data rates for exponential/additive back-off along with p-persistent CSMA.

NOTE for Submission:

1. You need to do this experiment in a group of two (same group as previous lab).
2. After the experiment, prepare a report with the results and analysis.
3. Submit the .cc file along with script, parameter values, plots and your analysis of the results.
4. Create a gzipped tarball file (tar.gz) containing the data analysis files and plots and the report. The name of the compressed file should be `assign_3_<roll_number_member_1>_<roll_number_member_2>.tar.gz`. For example, if the members of a group are 12CS10001 and 12CS10002, then the file name should be `assign_3_12CS10001_12CS10002.tar.gz`.
5. One of the member of the group should upload the assignment to the Moodle course web page by the submission deadline.
6. Submission deadline: 9 Feb, 2015, 11:59 pm.