EECE5155: Wireless Sensor Networks and the Internet of Things
Computer Laboratory Assignment 1

Given: Monday, September 21, 2020
Due: Sunday, October 4, 2020 (11:59 PM)

Josep Miquel Jornet, Ph.D.
Associate Professor, Department of Electrical and Computer Engineering
Director, Ultrabroadband Nanonetworking Laboratory
Core Member, Institute for the Wireless Internet of Things
Northeastern University
Office: 426 ISEC
E-mail: jmjornet@northeastern.edu
Web: http://www.unlab.tech

The objective of this first assignment is to become familiar with the ns-3 working environment and the simulation workflow. To complete this assignment, you need a working environment with ns-3 and Wireshark properly set up. Please follow the instructions in the Introduction to ns-3 and Wireshark in the first computer laboratory module (and its recording) on Canvas. If you still have problems setting up the environment, please contact the TA or the instructor for this course.

For students who have never taking a networking course, some of the protocols mentioned below might not be known (e.g., UDP, IP, CSMA). While it is not necessary for this assignment to know all the specifications of these protocols, if you need some specific pointers and additional information, please directly to the instructor.

Task 1:
Modify the example seen in class, *first.cc*, to simulate the following network:

- 2 nodes
  - 1 network interface at each node
- Point-to-point link:
  - Data Rate: 10 Mbps
  - Delay: 2 ms
- IP address assignment:
  - 192.168.2.0/24
- Application:
  - UDP Echo Server on port 63
  - Packet size: 256 bytes
- Use the same values as in the example for the rest of the parameters

Compile and run the simulation. Visualize the packet trace file with Wireshark. Confirm that everything works as you would expect.

Task 2:
Starting from *second.*cc in the Tutorials folder within your ns-3 installation, create and simulate a network with the following architecture:

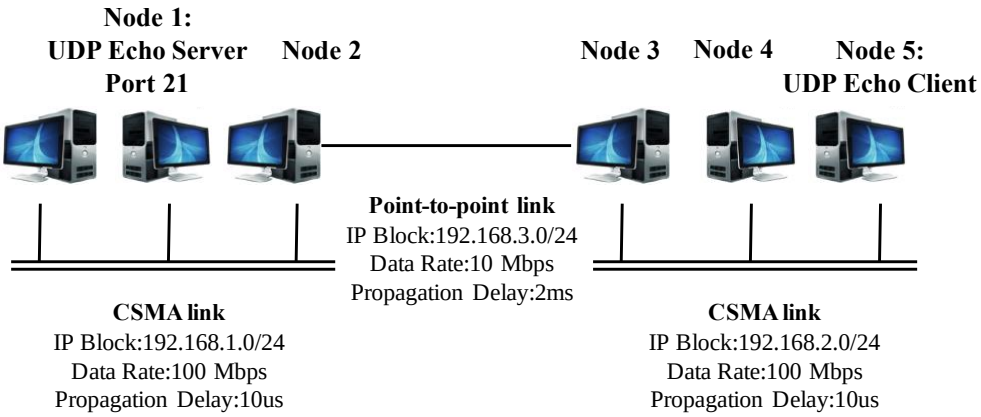

Figure 1: Network architecture

Detailed information:

- The network contains:
  - 3 nodes in the first shared bus operating under CSMA
  - 3 nodes in the second shared bus operating under CSMA
  - 2 nodes in the point-to-point link
    - Note that Nodes 2 and 3 in Figure 1 have two network interfaces, one for each link to which they are connected
- The applications running in the network are:
  - UDP Echo Server at Node 1:
    - Listening on port 21
  - UDP Echo Client at Node 5:
    - Sends 2 UDP Echo packets to the server at times 4s and 7s
- Enable packet tracing only in Nodes 2 and 4.

Verify that the network behavior is as expected, by capturing the packet traces and utilizing Wireshark to analyze them.

Submission materials:
Generate a brief report explaining:

1) the experimental setup: indicate which part of the code have you modified
2) the results: comment and include a screenshot of the packet traces in Wireshark
3) the conclusions: what did you learn

for each of the two tasks.

In your submission, include also your modified .cc files.

Remember: the laboratory assignments can be conducted either individually or in couples. If you want to work in couples, please enroll in a Computer Lab Team in Canvas. Then, only one of the team members will need to submit the assignment.