N Northeastern University

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

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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 "Lab Assignments" module on Canvas. If you still have problems setting up the environment, please contact the Teaching/Course Assistant.

For students who are not familiar with networking concepts, 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 contact the instructor.

Please use the report template available in the "Lab Assignments" module to prepare the report with your solution to this assignment.

Submission materials:
1. Generate a brief report following the report template in Canvas explaining:
   a. For each task, the experimental setup: <u>indicate</u> which part of the code you have modified
   b. For each task, the results: <u>comment</u> and include a screenshot of the result of the simulation and screenshots of the packet traces in Wireshark
   c. For each task, the conclusions: what did you learn?
2. In your submission, include also your modified .cc files properly named.

Remember: the lab assignments can be conducted either individually or in pairs. Either way, please enroll in a Lab Team in Canvas. Then, only one of the team members will need to submit the assignment.

Task 1 (30 points):

Modify the example *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 (70 points):

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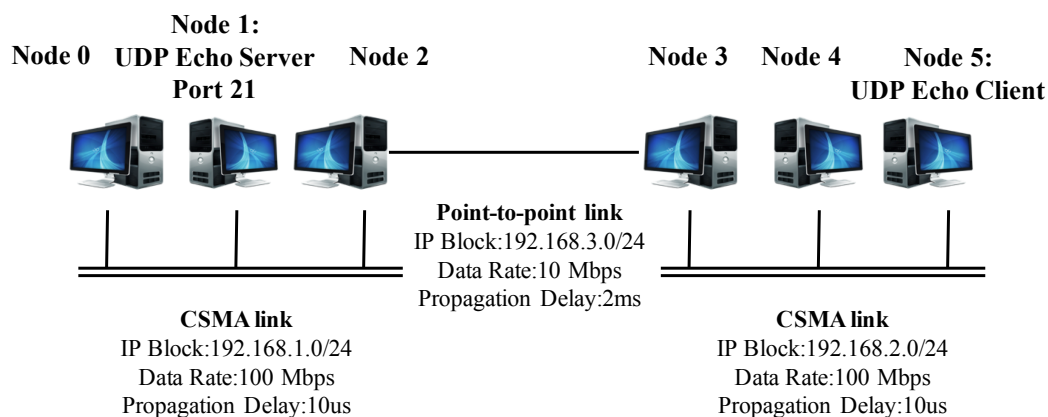

Figure 1: Network infrastructure

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 with promiscuous mode only in Node 2 in the point-to-point interface and Node 4.

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