Computer Assignment – Throughput Analysis

The goal of this assignment is to get familiar with NS3 using a simple program. You will implement a network which is composed of peer to peer, WiFi and Ethernet connections. You will calculate the throughput of the traffics in this example.

To get familiar with NS3 simulations, an example program with name CSMAexample.cc is placed on the cecm. It is also available on the following path in the virtual machine:

/ns-allinone-2.26/ns-3.26/scratch/CSMAexample.cc

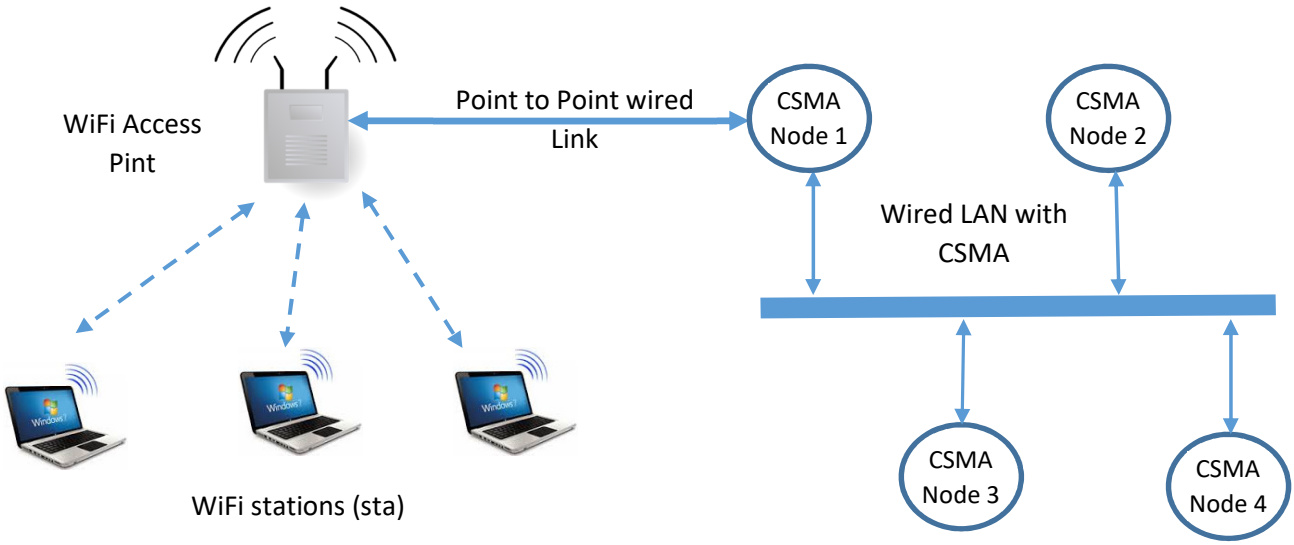
To compile this file, open a terminal, go to folder /ns-allinone-2.26/ns-3.26 and type:

./waf --run scratch/CSMAexample

You should be able to see “build finished successfully”.

In this example, there are four nodes connected via a CSMA LAN. NS3 CSMA LAN is a classical LAN. However, when the channel is busy, it assumes all the nodes can hear. Therefore, it assumes there is no collision. The LAN speed is 10 Mbps and propagation delay between any two nodes is 2 msec. One of these nodes has another interface card and through that interface, it is connected to a WiFi access point. Three wireless stations are connected to this access point. This is a point to point connection with speed 10Mbps and delay 6.50 msec.

Figure below shows the network configuration for the CSMA example file:



CSMA node 1 is part of CSMA LAN network and also is one of the point to point nodes. In this example, WiFi station 3 sends packets to CSMA node 4. Then, CSMA node 4 sends back that packet to Wifi station 3.

There are some comments in the file such that you will be able to better understand the operation of code.

After successful simulation, all the packet transmission over the CSMA network are logged in a file with name “results.tr” in folder “ns-3.26”. For every operation of the network, you can see one entry in this file. You should use this file to analyze the performance. You can get more information about the content and structure of this file here:

https://www.nsnam.org/docs/release/3.9/tutorial/tutorial_23.html#ASCII-Tracing

If you need more information, you can check the ns3 manual or you can check the examples in links below:

NS3 Manual: https://www.nsnam.org/docs/manual/ns-3-manual.pdf

Getting started: https://www.nsnam.org/docs/tutorial/html/conceptual-overview.html

CSMA and wireless examples: https://www.nsnam.org/docs/tutorial/html/building-topologies.html

Computer Assignment:

Create a network with 7 CSMA nodes where the first CSMA node is connected to a WiFi access point via a point to point link. There are 4 wifi stations connected to the wifi access point. Use the delay and data rate in example file for the LAN and point to point link.

Create five traffic flows (UDP echo traffic) as follows:

CSMA node 2 to CSMA node 3: this flow starts at 1 and stops at 2.

WiFi station 1 to CSMA node 4: this flow starts at 1 and stops at 2.

WiFi station 2 to CSMA node 5: this flow starts at 1 and stops at 2.

WiFi station 3 to CSMA node 6: This flow starts at 1 and stops at 2.

WiFi station 4 to CSMA node 7: This flow starts at 1 and stops at 2.

You need to stop simulation at 2.

Choose a high number of packets for transmission (e.g. MaxPackets = 1,000). Depending on the simulation time and the interval between packet transmissions, the actual number of transmitted packets can be less than MaxPackets.

By varying the interval between packet transmissions (attribute Interval), you can increase the packet transmission rate of each session. For example, if interval is 1 second, the packet transmission rate is 1024*8 bits per seconds in each direction. Pick six different transmission rates for the clients by varying the interval. Use the same data rate for all the flows at any time. Plot the throughput of each flow (number of bits divided by the time) versus the data rates for one direction. It means, find the number of bytes received successfully by CSMA nodes three to seven separately and plot them versus transmission rate.

To find the throughput of the LAN, you need to write a program (C++ or MATLAB) which reads the results.tr file. You need to count the number of packets of size 1024 bytes successfully received by all the CSMA nodes between times 1 to 2.

What to deliver:

- All the codes including the codes used to analyze the result file.
- A report file which includes the throughput curves.
- Some explanation for the behavior of the throughput in each part.