Computer Networks

Fall 2024

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Assignment 02

Due: **2024/12/19 23:59**

General policy:

- No delay unless you have good reasons to explain.
- The report must be converted into .PDF file (Don't use Microsoft Docx or other formats)
- Please pack all your submissions in one zip file with name "COMNET2024-HW2-StudentID", upload to Ecourse2
- Copy and paste from others **are not allowed**. If you have extensive resources to refer, please cite the source. I highly recommend the answer/code in your own words (English).
- I can randomly pick someone in our class to demonstrate the homework results and answer questions. The demonstration will get additional 10-20 points (if it works).
- If there is any question on the homework, you can email TA.

1. Advanced Network Simulation (40pts)

In our class and shared documents, we have learned about using Ns3 or OMNet++ to simulate a network architecture and measure key metrics, e.g., throughput, delay. In this homework, you are requested to install a 5G simulation platform (e.g., NS3 5G LENA, https://apps.nsnam.org/app/nr/ or https://gitlab.com/cttc-lena/nr/-/tree/master?ref_type=heads, or OMNet++ Simu5G, http://simu5g.org), and do the following requirements:

1. Create a small 5G network with two base stations and 10 UEs (10 pts)
2. Test an application (in examples/test folders) and validate its throughput, delay, jitter metrics (30 pts):

Hints: you can test the following examples

- 5G channel performance simulation (e.g., examples/cttc-3gpp-channel-example.cc)
- 5G MIMO-based network simulation (e.g., examples/cttc-nr-mimo-demo.cc)
- 5G resource allocation simulation (e.g., test/system-scheduler-ofdma-test)

Expected Output: a report file Hw2-report.pdf with **detail descriptions of how you find out the information and** screenshots of successful testing with clear values of throughput, delay, jitter. Note that the screenshots must have **window time at the bottom right of your PC.**

2. Congestion control and network security (20pts)

In our lesson (e.g., Lesson 10), I have introduced that there many congestion control and congestion avoidance mechanisms in computer networks. In this assignment, please use the installed platform to simulate the following requirements:

- ✓ Simulate a rate control or RL-TCP (10pts)
- ✓ Simulate a low-rate attack (10pts)

Expected Output: Append your installation steps + screenshots to Hw2-report.pdf.

Hints:

+ For NS3, you can refer Ns3-AI plugin https://github.com/hust-diangroup/ns3-ai

+ For OMNet++, you may refer Raynet: https://github.com/giacomoni/raynet

+ For the attack simulation, you may google it (Low-Rate TCP DoS Attack in ns-3).

3. Firewall configuration (40pts)

In our lesson on network security, we have learned about stateful and stateless firewall to block specific network traffic to access our network. By using your Internet network design in HW1 (HW1-Internet.pkt), please configure a firewall to do the following requirements:

- Deny all FTP connections from outside to access NYCU FPT servers (20 pts)
- Deny all remote control (SSH) connections from outside to access CCU server (20pts)

Expected Output: Please append your installation steps/screenshots to Hw2-report.pdf.