University of Nottingham Ningbo China

SCHOOL OF COMPUTER SCIENCE

A LEVEL 1 MODULE, SPRING SEMESTER 2023–2024

COMP1047: Systems and Architecture (AE1SYS)

Coursework Part-2: Computer Networks

SUBMISSION DEADLINE: Thursday 2nd May 2024, 23:59:59 GMT+8

1 Synopsis

This is **Par-2** of the COMP1047 coursework. This Part is about network performance evaluation both simulation and report writing. You should answer the TWO (2) questions below, before submitting them in Moodle and CS repository. For the NS-2 coding problem, you are advised to develop and analyze your TRACE files using AWK adopted in the lab sessions in this module. The total mark of this Part is **[30 MARKS].**

Note that the nature of this Part of coursework is exploratory to a certain extent, given its time to complete (more than 2 weeks). Thus, the solutions of the questions cannot be directly obtained from the lecture or lab materials, but require students to explore further from public resources, or recall from what have been learnt from prerequisite modules. Nonetheless, the module content of COMP1047 should be recognized as the essential foundation to achieve the proper answering to the questions of this Part of coursework.

2 Deliverable

Submit the following **THREE (3)** *uncompressed* files to COMP1047 Moodle page, where you will find a submission portal named "Submission for Part-2: Computer Networks" to be opened later.

1. `COMP1047CWP2-'YourName'-'YourID'-Q1.tcl` for the code corresponding to Question 1. Example: `COMP1047CWP1-JaneDoe-20511234-Q1.tcl`

2. `COMP1047CWP2-'YourName'-'YourID'-Q2.xlsx,` in which you only need to write down your project name (AE1SYS-CWP2-YourID) in the csproject. Details can be found in Question 1's description.

3. `COMP1047CWP2-'YourName'-'YourID'-Q2.pdf,` in which you only need to write down your project name (AE1SYS-CWP2-YourID) in the csproject. Details can be found in Question 2's description.

Unable to follow the file naming conventions would lead to mark deduction. Late submission rules apply, as indicated in the accompanying coursework issue sheet.

3 Assessment

1. This Part has a total of 30 marks, which constitutes 60% of the total coursework marks, equivalent to 30% of the total module marks. Individual marks are shown along each question.

2. Evaluation rubrics for Questions is provided in their problem description.

3. For enquiries on doubts or issues encountered when doing your coursework, please use the Moodle discussion forum, or directly email Dr. Fazl Ullah

Question 1 [15 Marks]

Description

This project provides insights on analyzing network performances such as delay, throughput, and packet drops of your designed network. It presents an experimental methodology to obtain an estimate of average delay, throughput, and packet drops for packets of variable payload size. You are required to use the TWO transport layer protocols, the TCP and UDP as we studied in Week-3 class.

The Scenario   5 Marks

Implement a circular wireless network topology of at least 10 nodes. In these nodes 20% will be **sender nodes** and 20% will be **receiver nodes** and the remaining 60% nodes will be the **relay nodes**. You need to use **TCP** as transport layer protocol for **10%** *sender-receiver* pair and **UDP** for the ramming **10%** *sender-receiver* pair.

Note that the senders and receiver will be selected by a random function. You have to use the random function only once.

Simulation   3 Marks

You need to run your simulation for 1000 seconds to generate **TRACE** (.tr) and **NAM** (.nam) files of your designed scenario. Also, you are required to run the simulation with the same topology 20 times and find the use the average values in trace fie for performance analysis.

Hint: You can use shell script to automate simulation for 20 times.

Performance Analysis   1 Mark

You need to analyze your designed network based on delay, throughput, and packet drop using AWK or Shell or Perl scripts or scripting language you want.

Delay

You find the end-to-end delay in the network [**1 Mark**] and identified the reason [**2 Marks**]

Throughput

You find the total throughput in the network [**1 Mark**] and identified the reason of high or low throughput [**2 Marks**]

Packet Drop

You find the packet drop ratio in the network [**1 Mark**] and you identified the reason [**2 Marks**]

Excel File   [**2 Marks**]

Once you run and obtain the average simulation, then you need to analyze the Delay, Throughput, and Packet Drop. You need to save the values of Delay, Throughput, and Packet Drop in the Excel file.

Note: You can use any application for graph generation and data presentation.

Question 2 [10 Marks]

The Scenario
After performing the simulations and analyzing the designed networks, you are required to write a report using the attached template.

Your Task

Title [10-20 Words]
A nice title that reflect what you have written in this report.

Summary [150-250 words]
A short summary that give an idea of your work

Introduction [~600 words]
A brief introduction about the simulated network. You may giver references from the literature from similar networks.

Proposed Work [400 words]
Write about the designed network and the protocols used in it. The details about the simulation scenario and the working procedures.

Results and Discussion [500 words]
You obtained the results from simulation and need to present in the form of graphs. Explain the graphs and

Conclusion [100-150 words]
Write a short conclusion, what you did and how can you enhance the current work in the near future.

References (if any)

[1]. Reference 1
[2]. Reference [2], etc.

Also, it is important to submit **all your files** on time to our CS git server, namely csprojects.nottingham.edu.cn. To upload to csprojects, please:

a. Create a new project named **AE1SYS-CWP2-YourID**, e.g., AE1SYS-CWP2-20511234.

b. Upload your files into the project, and name them as **TCL-YourID, xlx-YourID** and **PDF-YourID**, respectively.

c. You must add Dr. Fazl Ullah as the project **Maintainer** in order for your project to be accessed. This can be done by `Project Information` → `Members` → `Invite member`, then input his email address (fazl.ullah@nottingham.edu.cn), and set him as the Maintainer in the 'Select a role' menu.

Evaluation

Basic marking criteria are **correctness, abundance,** and **depth.** For detailed rubrics, an example indicator is provided in the table below, to give you n direct impression on how much effort should be corresponding to which level of grades.

Level	Example indicator
Fail	Nothing done.
Poor	Provided the names only.
OK	Provided the names, with one or two sentences of description.
Good	In addition to OK level, provided extended elaboration trying to help the evaluator understand what is talked about.
Excellent	The information conveyed is correct and abundant. For question 2, in-depth discussion and/or analysis is provided. High quality usage of citations.

Besides the above, each item below will incur a penalty of -1 mark:

a. Not adding Dr. Fazl Ullah as the maintainer to access your project.

b. Wrong project name, or file names uploaded, especially not showing your student ID.

c. Any other factors that obviously lower down the submission quality, or make your project inaccessible.

Good luck! Remember to submit your coursework on time.

APPENDIX 1: Marking Rubrics for Question 2

	Zero (0%)	Poor (20%)	Pass (40%)	Good (60%)	Excellent (80%)	Outstanding (100%)
Report	No report	The template is not followed	The template is followed but report is not comprehensive and	A report fair enough to convey the idea of what is done in the simulation	The report is compresence and no similarity and use of AI tools. All analysis is explained very well.	The report can be published in a local conference in its current form

Supporting Marking Rubrics for Question 1

	Weight (100)	Zero (0%)	Poor (20%)	Pass (40%)	Good (60%)	Excellent (80%)	Outstanding (100%)
Executable files, TCL, AWK, Shell scripts, etc.	30	No files generated	Some files are generated	All files generated but with errors	All files generated and executed successfully	Simulation is automatically executing	Excellent level + special considerations in execution and data generation automation. No manual execution
Analysis	30	No analysis performed	Only one type of analysis is performed, i.e., Delay or Throughput, etc	Atleast two types of analysis is performed	All analysis is performed with mean values and	All analysis is performed after execution of simulation numerous times and getting the results from mean values	All analysis is performed after execution of simulation numerous times and getting the results from mean values. The data is shown in smooth graphs