Assignment Briefing Sheet (2020/21 Academic Year)

Section A: Assignment title, important dates and weighting

Assignment title:	7COM1076 Coursework	Group or individual:	Individual
Module title:	Wireless Mobile and Multimedia Networking	Module code:	7COM1076
Module leader:	Dr Tazeen Syed	Moderator's initials:	Dr Joe Spring
Submission deadline:	**04-January-2021 23:59**	Target date for return of marked assignment:	Within 4 weeks of hand in

You are expected to spend about 50 hours to complete this assignment to a satisfactory standard.

This assignment is worth **30 %** of the overall assessment for this module.

Section B: Student(s) to complete

Student ID number	Year Code

Notes for students

- For undergraduate modules, a score of 40% or above represents a pass performance at honours level.
- For postgraduate modules, a score of 50% or above represents a pass mark.
- Late submission of any item of coursework for each day or part thereof (or for hard copy submission only, working day or part thereof) for up to five days after the published deadline, coursework relating to modules at Levels 0, 4, 5, 6 submitted late (including deferred coursework, but with the exception of referred coursework), will have the numeric grade reduced by 10 grade points until or unless the numeric grade reaches or is 40. Where the numeric grade awarded for the assessment is less than 40, no lateness penalty will be applied.
- Late submission of referred coursework will automatically be awarded a grade of zero (0).
- Coursework (including deferred coursework) submitted later than five days (five working days in the case of hard copy submission) after the published deadline will be awarded a grade of zero (0).
- Regulations governing assessment offences including Plagiarism and Collusion are available from https://www.herts.ac.uk/about-us/governance/university-policies-and-regulations-uprs/uprs (please refer to UPR AS14)
- Guidance on avoiding plagiarism can be found here: https://herts.instructure.com/courses/61421/pages/referencing-avoiding-plagiarism?module_item_id=779436
- Modules may have several components of assessment and may require a pass in all elements. For further details, please consult the relevant Module Handbook (available on Studynet/Canvas, under Module Information) or ask the Module Leader.

Assignment Briefing Sheet (2020/21 Academic Year)

This Assignment assesses the following module Learning Outcomes (from Definitive Module Document):

Successful students will typically:

LO1: have a knowledge and understanding of the complex problems and issues arising when mobility occurs in networks.

LO2: have a knowledge and deep understanding of the complex problems and issues arising when network applications have different quality of service requirements.

LO3: be able to discuss and critically evaluate protocols intended to solve problems or address new applications that arise in mobile networking.

LO4: be able to articulate and critically evaluate protocols intended to solve complex problems or address new applications that arise in multimedia networking.

Assignment Brief:

Please see the attached file

Submission Requirements:

Please submit the following components via StudyNet module website.

- One zipped file of all source files in mininet using your student number as the filename.
- Report. You are required to submit the report via StudyNet in a PDF format using your student number as the filename.

The final report is an academic report in a PDF and as such the following report structure is expected:

1. Introduction (keep it brief)
2. Main sections of the report on system modelling, simulations, and results analysis.
3. References: one fused reference list.
4. Appendixes

Marks awarded for:

Please see the attached file

Type of Feedback to be given for this assignment:

Formative feedback will be given for the coursework during the scheduled sessions as per the module delivery plan. Individual personalised summative feedback will be given through StudyNet for the final submission. Feedback is not just the marks and the commentary at the end of the module – it is also the regular advice about your work as you undertake the practical activities. If you fail to undertake the practical activities and you fail to engage with the class and with the instructors, you will disadvantage yourself.

ASSIGNMENT BRIEFING SHEET (2020/21 Academic Year) 7COM1076
THE ASSIGNMENT TASK:

The goal of this coursework is to apply the knowledge and the understanding form the classroom and understand the application of it in a real scenario. There are two tasks, one on wireless and mobile networking, and the other on multimedia networking.

TASK 1

Write a python script to emulate the following environment. Completion of this task will require the knowledge and understanding of the lab material and will require extra knowledge that can be obtained through self-study and research. The topology should be as the following illustration.

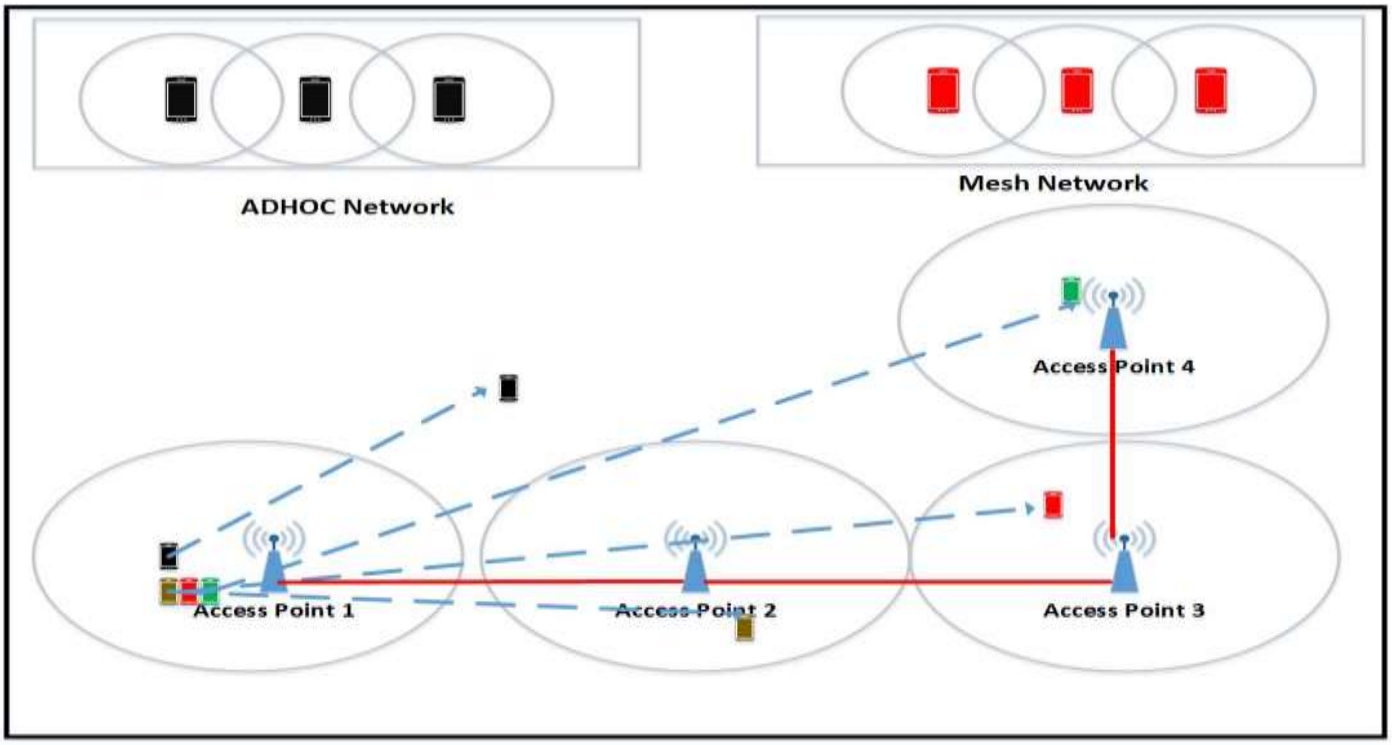

Figure 1: Topology

The illustrated topology in Figure 2 consists of 5 access points and 4 stations. The stations can represent a smart hand-held device which can vary from to a laptop, UE or to any WiFi compatible device. The topology above should be pushed towards the Mininet API using a python script with the following information and criteria. Please adhere to the mentioned settings and configurations and deviating from the given settings may reduce the full marks given.

Name	MAC	IP Address	(X,Y) coordinates	SSID	Password	Range	Channel
AP1	00:00:00:00:10:02	N/A	(50,50,0)	ap1	*studentID*	25	1
AP2	00:00:00:00:10:03	N/A	(100,50,0)	ap2	*studentID*	25	6
AP3	00:00:00:00:10:04	N/A	(150,50,0)	ap3	*studentID*	25	2
AP4	00:00:00:00:10:05	N/A	(150,90,0)	ap4	*studentID*	25	3
STA1	00:00:00:00:00:02	10.0.0.2/8	(30,40,0)	N/A	*studentID*	20	N/A
STA2	00:00:00:00:00:03	10.0.0.3/8	(30,40,0)	N/A	*studentID*	20	N/A
STA3	00:00:00:00:00:04	10.0.0.4/8	(30,40,0)	N/A	*studentID*	20	N/A
STA4	00:00:00:00:00:05	10.0.0.5/8	(30,40,0)	N/A	*studentID*	20	N/A

Table 1: MAC, IP, SSID, coordinates and other information of the nodes

Encryption type for the communication is **wpa2** and the failMode is **standalone**. The stations are in mobility state. Add mobility to your script adhering to the following variables. Links are marked in **RED** where AP1<- - ->AP2 ,AP2<- - ->AP3 and AP3<- - ->AP4 are connected using physical links.

The mobility of the station nodes will be in the following sequence.

Name	Start Location	End Location	Start Time – End Time	Moving Speed (min-max)
STA1	(30,40,0)	(100,40,0)	10s-20s	min_v=1, max_v=5
STA2	(30,40,0)	(150,60,0)	15s-21s	min_v=5, max_v=10
STA3	(30,40,0)	(150,100,0)	16s-22s	min_v=2, max_v=7
STA4	(30,40,0)	(50,100,0)	3s-10s	min_v=2, max_v=7

Table 2: Mobility of the Nodes

Deliverable:

- Python script that you utilized to push to configurations towards the Mininet API
- Screenshot from the Mininet WiFI GUI
    - Prior Mobility
    - At the completion of mobility
- Ping STA1<- - - > STA2 , STA2<- - - > STA3, STA1<- - -> STA3. Provide the screenshot of your successful pings. You may use the Mininet commands line or the x-Term CLI
- Initiate a TCP Flow between the assigned server and client. Send a TCP flow of 1GB using the socket assigned to you. Capture the server and the client statistics to two text files in the following format.
    - Server - - > *stduentID*-ServerTCP.txt
    - Client - - > *stduentID*-ClientTCP.txt
        - Capture the transfer using Wireshark and filter TCP flagged packets and TCP packets
        - Provide a screenshot at the end of the transfer.

TASK 2

Create a new file from the existing python script, rename this to highlight T4. To your existing emulation, add three more stations ADHOC mode. The emulation environment and the configurations for the same are as follows.

Name	IPv6	MAC	Position	Range	Antenna Height	Antenna Gain	Protocol	SSID	HT_CAP
sta4ad	fe80::4	00:00:00:00:00:06	150,150,0	30	1	5	olsr	adhocUH	HT40+
sta5ad	fe80::5	00:00:00:00:00:07	170,150,0	30	2	6	olsr	adhocsUH	HT40+
sta6ad	fe80::6	00:00:00:00:00:08	200,150,0	30	3	7	olsr	adhocUH	HT40+
sta7M	fe80::7'	00:00:00:00:00:09	25,150,0	30	3	7	N/A	mesh	HT40+
sta8M	fe80::8	00:00:00:00:00:10	50,150,0	30	3	7	N/A	mesh	HT40+
sta9M	fe80::9	00:00:00:00:00:11	75,150,0	30	3	7	N/A	mesh	HT40+

Table 3: MAC, IP, SSID, coordinates and other information of the nodes for Task 2

Deliverable:

- Python script that you utilized to push the configurations towards the Mininet-WiFi
- Initiate an ICMP stream between sta4ad < - - -> sta5ad, sta5ad < - - -> sta6ad and sta4ad < - - -> sta6ad and produce three screenshots for each

Report:

Your report must include the following:

- Modelling
    - Screenshots as mentioned in the deliverable section in each task, totalling the number of screenshots but not limited to 14

- Results
    - Throughput, I/O graph, Total number of TCP packets and Total number of TCP flagged packets
    - Screenshot of the statistic file from Wireshark
- Analysis
    - Calculate TCP Success rate, this can be done by the statistics collected
    - Critically evaluate the reason for success or failure of the ICMP streams between sta4ad < - - -> sta6ad and sta7M < - - -> sta9M. Conduct a discussion of the results with evidence (screenshots) and reference.
    - If the nodes are in mobility during the transmission of the TCP stream, will the performance deviate from the collected in any way? Conduct a discussion based on this experiment. If needed add reference from background research to further support your claims.
    - Critically evaluate why STA1 < - - > STA4 ping fail in Task 1? How can a successful ping be achieved?

There is a maximum of 10-page limit (A4 size) excluding appendices and references, although marginal excess can be condoned. Python file, server and client text files, screenshots should be in the Appendix section which doesn't reflect on the page count.

Please note that the report must be a pdf file separately uploaded. Do NOT place the report in a zip file. If the report is hidden in a zip file to avoid Turnitin similarity checking, then the submission will be scored zero.

TASK 3

Write a python script to illustrate the following topology with SDN Controller (ONOS) available to you. The controller IP address is 127.0.0.1. Completion of this task will require the knowledge and understanding of the lab material and will require extra knowledge through self-study and research. The topology should be as the following illustration.

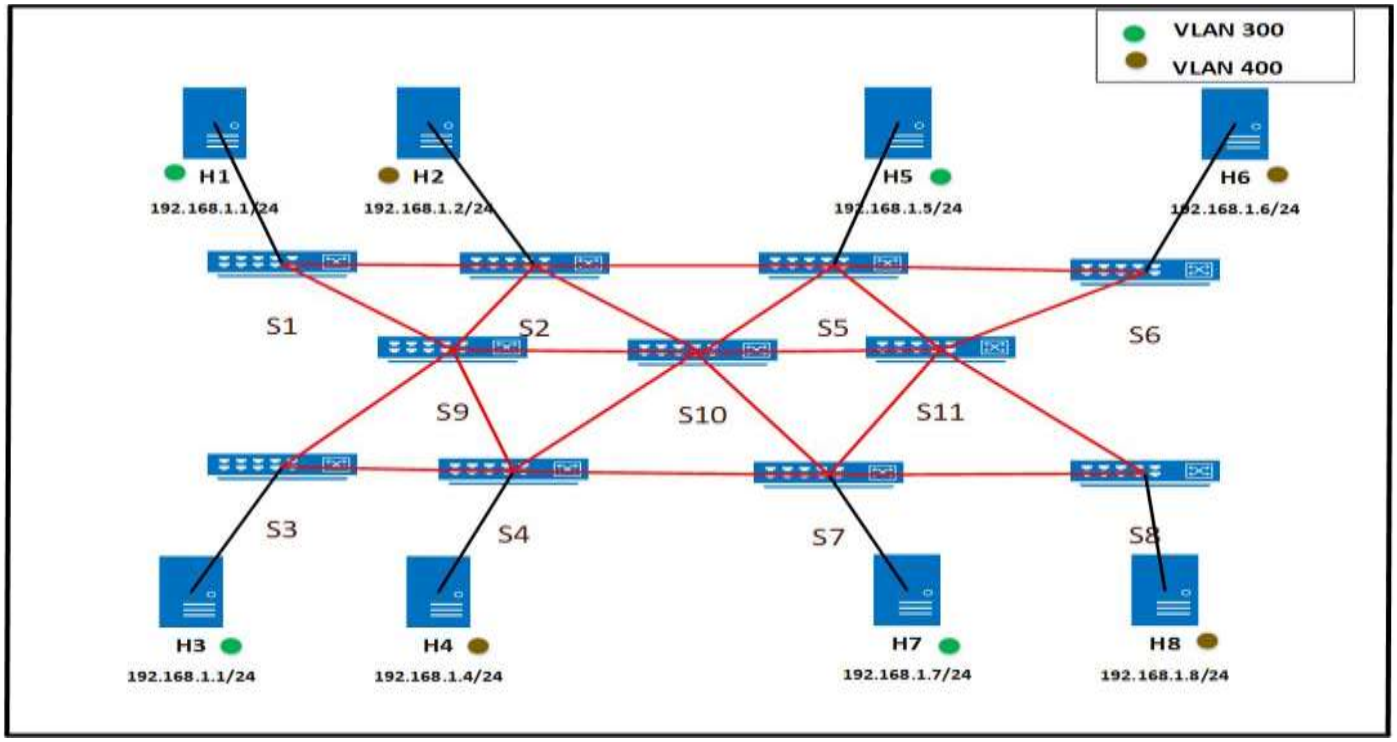

Figure 2: Network Topology

The Topology should consist of the following information and modification.

IP, MAC and VLAN, CPU configuration Table

Name	IP Address	MAC	VLAN	CPU
H1	147.197.29.1/24	00:00:00:00:00:01	300	N/A
H2	147.197.29.2/24	00:00:00:00:00:02	400	N/A
H3	147.197.29.3/24	00:00:00:00:00:03	300	N/A
H4	147.197.29.4/24	00:00:00:00:00:04	400	0.5
H5	147.197.29.5/24	00:00:00:00:00:05	300	N/A
H6	147.197.29.6/24	00:00:00:00:00:06	400	N/A
H7	147.197.29.7/24	00:00:00:00:00:07	300	N/A
H8	147.197.29.8/24	00:00:00:00:00:08	400	N/A

Table 4: Network configurations

The links between hosts and switches have the following modifications and information.

Link	Bandwidth (Mb/s)	Delay (ms)	Loss
Red	**1000 MB/s**	**1**	**0.5%**
Black	**1000 MB/s**	**0**	**0**

Table 5: Link configurations and modifications

Please adhere to the above-mentioned settings and configurations and deviating from the above may reduce the full marks given. Upon successful completion of the configurations above your python script must be able to push to the Mininet environment with the use of the SDN controller (ONOS).

Deliverable:

- Python script that you utilised to emulate the environment
- Screenshot from the ONOS GUI (Move the nodes in the environment to iterate the topology at Figure 1)
- Screenshot of the ICMP stream (pingall) to iterate the VLAN functionality
- Screenshot of the Link configurations (printed on the CLI at the start of Mininet)

TASK 4

Upon successful completion of the above task, please use the video and the host assigned by your Tutor to conduct the rest of the tasks.

1. Initiate a UDP flow between **Server/UDP** and **Host** to total of 2GB traffic using the port assigned to you. Collect the output of your client and server to a text file. Name these files as following. Server -> Server*stduentID*-UDP.txt and for Client-> Client*stduentID*-UDP.txt
2. Use the video that have been assigned to you, host it at the assigned Server and stream it at the assigned Host. Collect the transfer in the Wireshark.

Deliverable:

- Two text files from the Task 4.1(Client statistic and Server statistic collected via iPerf)
- Screenshot of the video stream at any location of the video iterating the successful stream
- Wireshark I/O graph from the video stream
- Wireshark throughput graph
- Screenshot of the Route that the packets are traversing using the ONOS GUI

Report:

- Your report must include the following:
  - Modelling
    - A brief introduction to the environments (Mininet, ONOS, Wireshark, iPerf) not exceeding half a page.
    - Screenshots as mentioned in the deliverable section in each task, totalling the number of screenshots but not limited to 6
  - Results
    - Mean throughput and mean jitter of the UDP transfer according to your statistic files in Task 4.1
    - Throughput graph obtained from video stream using Wireshark.
    - Total number of Packet loss from the video stream, screenshot of the statistic file from Wireshark
  - Analysis
    - Should there be more packet loss and delay, should you expect the results to deviate from what you have acquired? Evaluate with references.
    - Comment on how the variables such as packet loss and delay have contributed towards the overall performance of your network. Evaluate with reference

There is a maximum of 10-page limit (A4 size) excluding appendices and references, although marginal excess can be condoned. Python file, screenshot and two text files of the client and server statistics should be in the Appendix section which doesn't reflect on the page count.
Python file, server and client text files, screenshots should be in a ZIP folder named after your student ID.

Please note that the report must be a pdf file separately uploaded. Do NOT place the report in a zip file. If the report is hidden in a zip file to avoid Turnitin similarity checking, then the submission will be scored zero.

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Marking Criteria

	Modelling and Emulation	Theory and Analysis	Quality of Report
Outstanding (90-100)	Flawless modelling and configuration. Visual results are presented clearly as required. All required tasks are fully accomplished, with clear stepping beyond expectation using sophisticated solutions.	Detailed demonstration of the theoretical calculation process, which matches the practical results. In-depth analysis of the results that covers different perspectives. Insightful understanding of the practical at theoretical level.	Outstanding writing skills. Zero typo. Decent academic language used. Nice and neat format presented. Well structured. References used properly.
Excellent (80-89)	Flawless modelling and configuration. Visual results are presented clearly as required. All required tasks are fully accomplished.	Detailed demonstration of the theoretical calculation process, which matches the practical results. In-depth analysis of the results that covers different perspectives.	Excellent writing skills. Zero or very little typo. Decent academic language used. Nice and neat format presented. Well structured. References used properly.
Very good (70-79)	Comprehensive modelling and configuration. Visual results are presented clearly as required. All required tasks are fully accomplished.	Clear demonstration of the theoretical calculation process, which matches the practical results. In-depth analysis of the results that covers different perspectives.	Very good writing skills. Few typos. Decent academic language used. Nice and neat format presented. Well structured. References used properly.
Good (60-69)	Successful network modelling and configurations. Full results are collected. Maybe missed one or two small points.	Convincing theoretical calculation and result analysis, but maybe involving some inappropriate statements. Some improvements needed.	Good writing skills. Some minor adjustments needed for the language and structure. Formatting ok. Some typos. Healthy amount of references, but maybe not cited properly.
Clear pass (50-59)	Successful network modelling. Some adjustments needed. Partial results are collected. Visual presentation may be in question.	Good attempt in the theory. The theoretical calculation may be wrong, or there is somehow mismatching between results and theory. Good effort in discussions, but maybe too superficial.	Relatively good attempt on the writing, but not quite presentable. Academic language needs improving. Reasonable structure. Maybe weak style and formatting. Proofreading still would help. Partial references.
Marginal fail (40-49)	Good attempt on the network modelling, although major errors exist. Doubtable results.	Incomplete theoretical calculation process. Major mismatch between theory and result. Result analysis too brief.	Some effort in writing. Maybe too verbose. Poor academic language. Too many typos. Poorly structured. Lack of formatting. Little or no references.
Clear fail (20-40)	Unsuccessful modelling process. No results or completely wrong results.	Lack of contents. Academic dishonesty.	Totally unpresentable. Academic dishonesty.
Little or nothing of merit (0-19)	Little or nothing of merit	Little or nothing of merit. Academic dishonesty.	Little or nothing of merit. Academic dishonesty.

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Marking Breakdown

Task			Marks allocated	Marks awarded
Wireless and Mobile Networking	System Modelling	WiFi networking	7.5	
		Ad Hoc networking	7.5	
	Simulation Result	WiFi Networking	7.5	
		Ad Hoc networking	7.5	
	Result Analysis	WiFi networking	7.5	
		Ad Hoc Networking	7.5	
	Quality of Report		5	
	Total		50	

Task			Marks allocated	Marks awarded
Multimedia Networking	System Modelling	SDN networking	7.5	
		Applications	7.5	
	Simulation Result	SDN networking	7.5	
		Applications	7.5	
	Result Analysis	SDN networking	7.5	
		Applications	7.5	
	Quality of Report		5	
	Total		50	