



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF COMPUTING
UTM Johor Bahru

Project

Network Design for Faculty of Computing Block N28B

SECR1213-NETWORK COMMUNICATIONS

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Abstract

In this project, we received about 1.3 million Ringgit Malaysia as our Budget to design a network and floor plan for Faculty of Computing Block N28B. We designed a floor plan for a double-storey building in the first task. This building will have a few work areas on the ground floor: a general-purpose lab, a network lab, video conferencing rooms, a server room, a meeting room, a library, and a maintenance room. The toilet and cafeteria are on the ground floor of this building. Then, we designed the IoT labs and network labs on the first floor. Secondly, a preliminary analysis was performed based on the current and future requirements and devices. The analysis would be conducted through meetings and research, followed by a feasibility study including technical, economic, legal, and operational feasibility. In task 3, we surveyed the LAN devices such as routers, modems, switches, patch panels, network cables, network cable connectors and wireless access points through multiple sellers in Malaysia or overseas. The main point we made in the surveying is to compare the price and capabilities of the devices. The expected cost would be calculated after the devices are fully surveyed and selected. Next, we identified the work area of the floor plan and its connections, patch cords, switch, and fibre cable needed for the work area. The length of the cable would be calculated. Lastly, an IP addressing scheme was developed without conflicting the addresses, including subnet and IP assignation for every lab and workspace.

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1.0 Introduction

This project was aimed to help the faculty of Computing to build a local area network (LAN) for the new 2-storey building. The new building will consist of 3 kinds of labs, which are 2 general labs, 2 network labs and 3 IoT labs, a video conferencing room, a student lounge and some facilities and stores which will provide students and staff with a better environment and convenience. Each lab will provide a comfortable space for both working and learning space and a suitable space for 30 workstations inside every lab.

This project's scope is to provide a system that includes a scalable network for future growth and wireless connectivity in the future and yet a manageable system. In fact, the system should be able to improve the overall performance not only in solving the growth of the Faculty of Computing (FC) but also in protecting the system from network breaches, including denial-of-service, Internet Worms and e-business application attacks. The system can also support the high performance of the core backbone and features such as Quality of Service and security in hardware via access control lists (ACLs). Nevertheless, the proposed system will enable a secure VPN connection from remote locations, providing a more satisfying environment for both staff and students of the faculty. This project will also include the design of the floor plan for the new building and the implementation of the network devices required for the new building through the investigation of the knowledge and case study for the design process. In fact, the calculation of the connection between the devices and the network, which is the length of the wired connection, will also be considered to ensure that all the network devices in the new building can function.

The objective of this project is to provide better equipment and an environment that allows the FC growth, together with taking steps into the future with cutting-edge technology without doing any other upgrades for the next 20 years. The system will prepare the lab with the concept of 4th Industrial Revolution (4th IR) and ensure that the network designed will be cost-effective and compatible with this project's scope.

2.0 Project Background and an overview of the client's current status and issue

Until 2022, the Faculty of Computing (FC) has 1200 undergraduate and postgraduate students, 97 academic and 35 supporting staff. In the future 3 years, there will be 10% increases in the number of students and staff. To give everyone the best facility and environment that can sustain for a long time, FC is planning to build a double-storey building around the UTM Skudai campus. Inside the building will be four new labs: two general-purpose labs, one network lab and one IoT lab. Each lab must be equipped with 30 workstations and a high-speed internet connection to prepare the students and staff to face the 4th Industrial Revolution in the future. Besides the lab inside the buildings, the faculty also plan to build one video conferencing room to make the virtual project meetings easier and more official. The student lounge should also be included in this building design plan to give students an area to work and relax while connecting to the network via Wi-Fi.

Since FC wants to let the setup last longer for the next 20 years, some essential elements must be noted to help FC reach a higher-speed internet connection. First and foremost, The network infrastructure needs to be flexible and simple for FC staff and students to manage. Then, the overall performance of the system must be improved. In addition to supporting high performance to the core backbone, the system can offer security from network breaches such as Internet worms, denial-of-service assaults, and attacks on e-business applications. In addition, it should be able to provide certain functions like Quality of Service and hardware security via access control lists (ACLs). Furthermore, the network system must provide secure VPN connections, especially from remote locations, so students and lecturers can access the Internet without any restrictions.

3.0 Solution of each Task

3.1 Task 1

3.1.1 Floor Plan Design

3.1.1.1 Ground Floor's Floor Plan

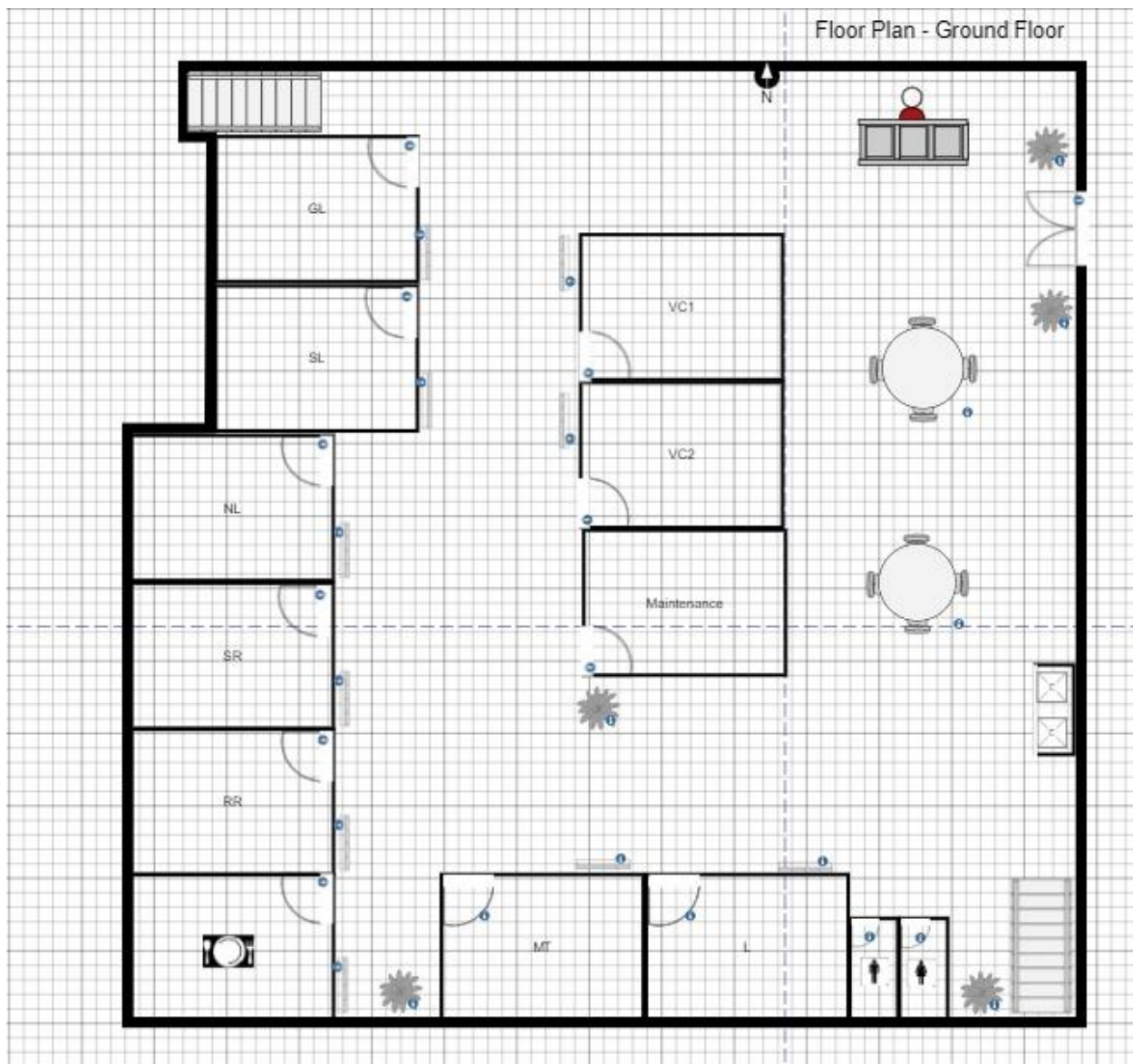


Figure 1: Ground Floor Floor Plan

3.1.1.2 First Floor's Floor Plan



Figure 2: First Floor Floor Plan

3.1.1.3 Floor Plan for General Purpose Lab & Network Lab

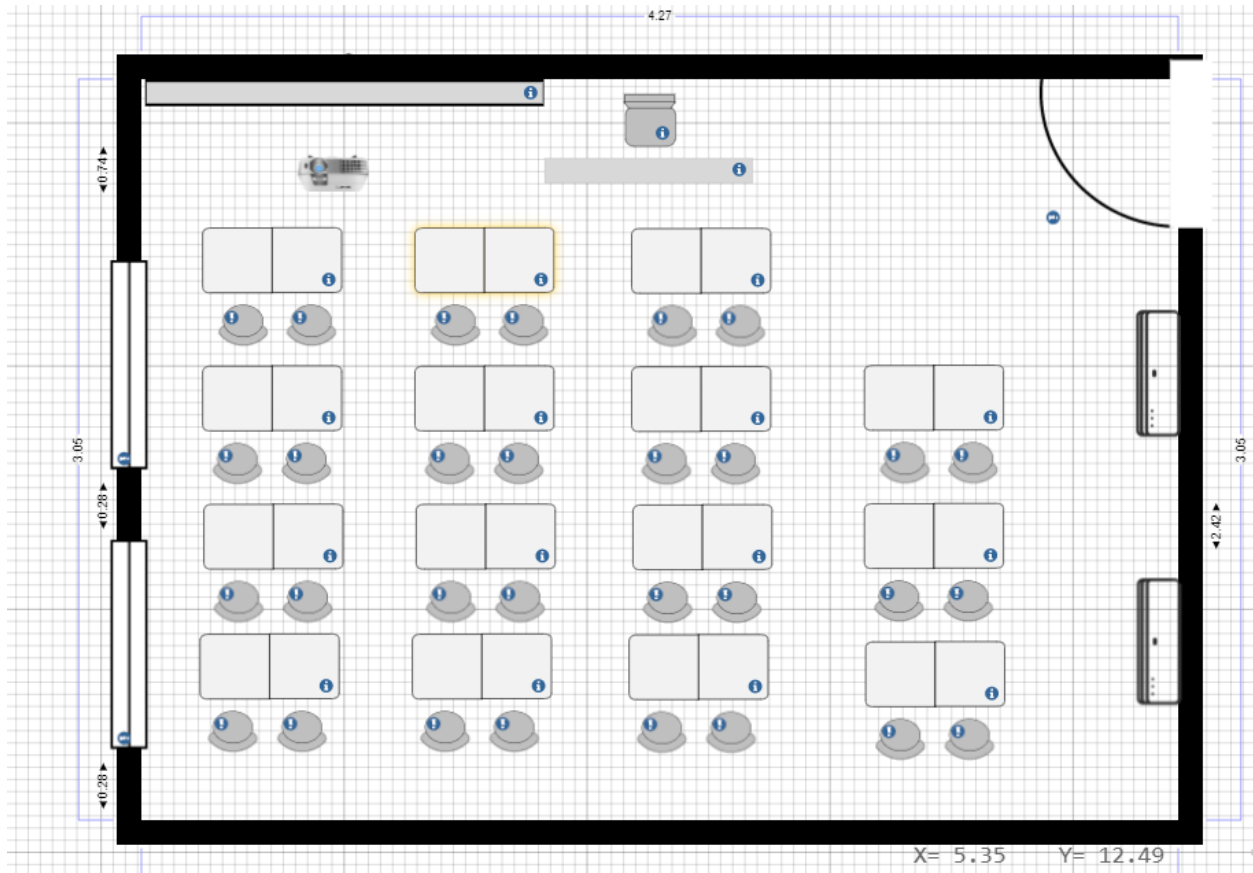


Figure 3: General Purpose Lab & Network Lab's Floor Plan

3.1.1.4 Floor Plan for IoT Lab

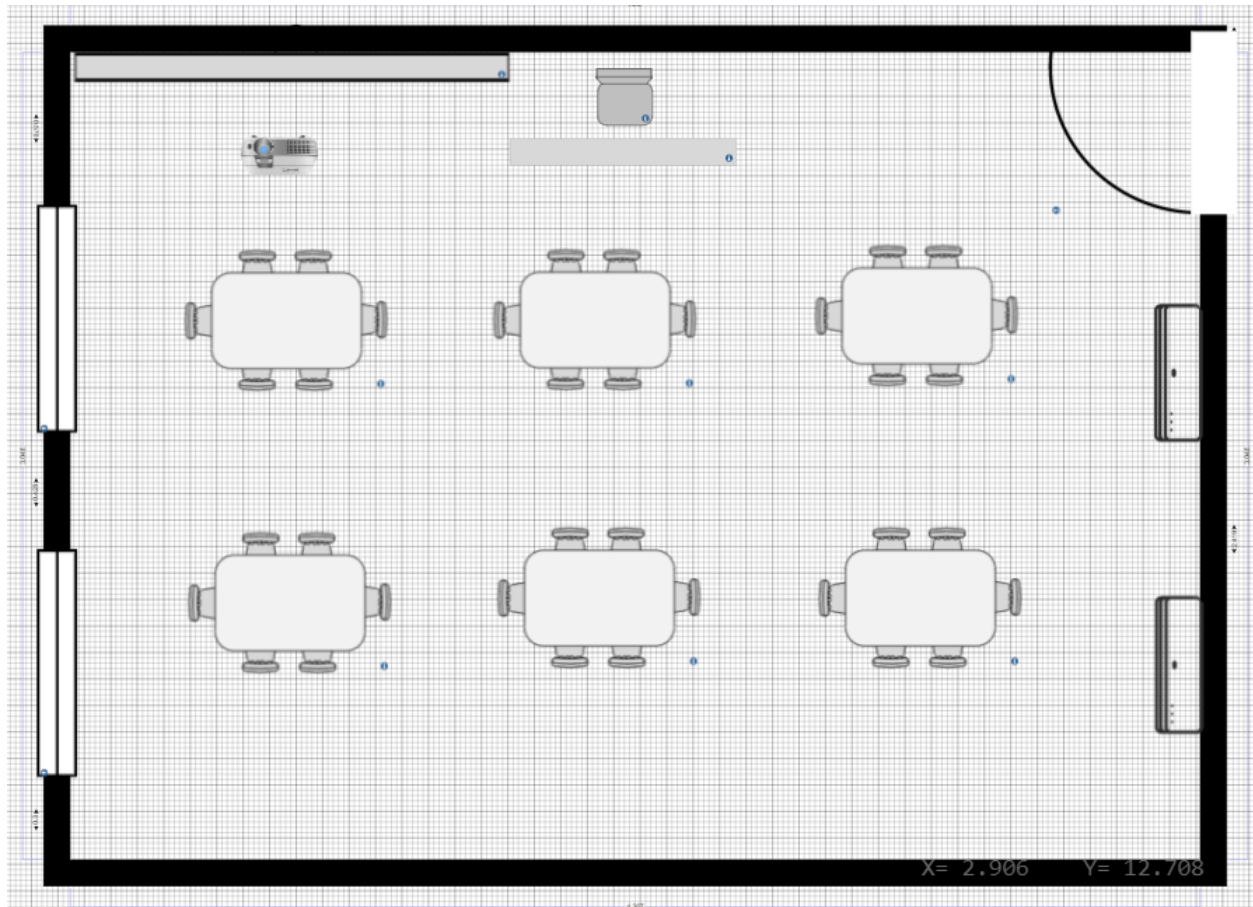


Figure 4: IoT Lab Floor Plan

3.1.1.5 Video Conferencing Room

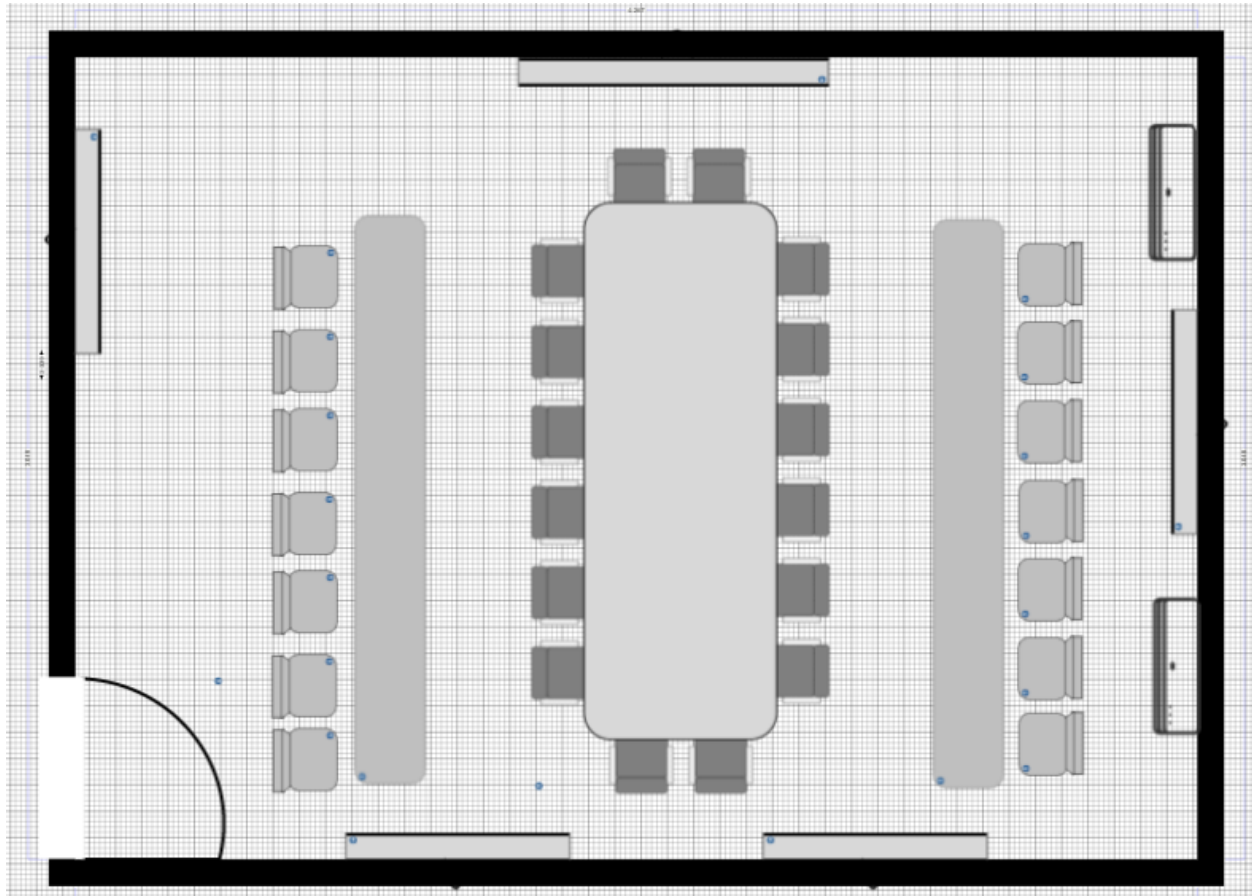


Figure 5: Video Conferencing Room Floor Plan

3.1.1.6 Symbol List

NL- Network Lab

GL- General purpose Lab

RR - Reserve Room

SR - Server room

SL - Student lounge

VC - Video Conferencing

L - Library

MT - Meeting Room

E – Elevator

Maintenance- Maintenance room



-Cafeteria



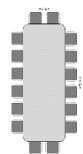
- Elevator



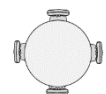
- Stair



-Toilet



- Conferencing Table



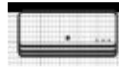
- Round table



- Reception



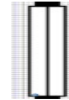
- Projector



- Air Conditioner



- Plant



- Window



- Screen/TV



- PC (Workstation)



- Long table



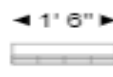
- Chair



- Router



- Door



- Shoe rack

3.2 Task 2

3.2.1 List of Questions and Answers

3.2.1.1 *Do you think we need to install some computer security aid software on our computers?*

Yes, installing some computer security aid software is compulsory, especially for the computer inside the building. It is to ensure that the computer is not having the virus or Trojan horse virus didn't exist around the computer inside the lab's computers. Besides that, we also need to uninstall malware and prevent advertisement pop-ups. Besides that, we also need to make the virus scan routine.

3.2.1.2 *What is the network topology?*

The network topology refers to the layout of a computer network, and the network topology applied to the network is the tree network. This type of network requires the backbone and the other devices. It obtains the central nodes that can control the other devices. There are two approaches to network topology, which are physical and logical.

The physical network topology approach uses the cable to describe the interconnections between the network and the nodes. Moreover, It shows the physical layout of how devices and cables connect with each other, and how they connect with each other.

The logical network topology approach is more similar to strategic and abstract because we can refer to the conceptual understanding of why the network is arranged in the way it is and how data passes through it.

3.2.1.3 *What is the function of a Server Room? Do we need to consider this room important?*

It is important to have the main server room and a standby server room since server rooms provide the central point for organisations to manage their network server resources.

Server rooms shall always be kept simple and enclosed since it was just housing the servers, backup room, and some of the necessary network electronics for establishing a local

computer network in the server room. When designing the server room environments, some considerations need to be taken, such as the power connection, room temperature control and ventilation, network connectivity, room security, and the fire protection

Besides the main server room, it is good to have another standby server room equipped and ready to maintain the necessary functions if the main room is out of function. For example, suppose a fire disaster occurs and causes the server room to be burnt. In that case, the standby backup room that is a part of the server room will be the saviour of this company since all the data and other important things will be on standby and backup in advance and earlier. The standby server rooms and the main server room should be located in different buildings.

3.2.1.4 What are the ideal computer specifications for each lab?

The ideal computer specification for each lab uses Windows 11 as the operating system, and then the processor is recommended to use i9-12900H with RTX 3090 graphics card. Then, the system memory is 32GB, and the storage uses a Solid State Drive (SSD) with 512GB.

3.2.1.5 Why should we connect LAN to every device?

When we talk about LAN, we will relate it with ethernet connection as we know that ethernet highlights its high transfer speed and reliability; a high data transfer rate is the key point of an ethernet connection. Ethernet allows you to hit incredible data transfer speeds of up to 100Gbps despite sacrificing flexibility. On the other hand, ethernet cables can reduce electricity usage. We can enable the ethernet if we want to save on power together with a higher and more reliable network connection, while we can disable it when you do not need extra speed. The energy consumption is lower than other cabling and even a Wi-Fi connection. Besides reducing electricity usage, ethernet is also the most reliable network regarding data security. Ethernet connection provides higher data security than Wi-Fi or any other wireless network connection.

3.2.1.6 What is an IP address? Is there a difference between public and private IP addresses?

IP address contains information about wrenching a specific host, especially outside the LAN. An IP address is a 32-bit unique address having an address space of 2³². Generally, there are two notations in which the IP address is written, dotted decimal notation and hexadecimal notation. Generally, we will have two kinds of IP addresses, which are public and private.

A public IP address, which is also known as an external IP address, is an IP address that can be directly accessed over the Internet. Our internet service provider (ISP) has assigned it to our network router. While talking about a private IP address known as the internal IP address, our network router assigns it to our device.

The major difference between public and private IP addresses is what they are connected to. A public IP address is assigned to the wider Internet in case all information we search for can find us. In contrast, a private IP address is used internally in a private network, providing a more secure connection with other devices within the same network.

3.2.1.7 What physical media do you want to use for the network plan?

We want to use wired and wireless. Wired are much faster than wireless networks, although moving is not easy. In addition, it is more secure. It can monitor who is using the network and prevent security vulnerabilities. Of course, we also use wireless networks because wireless networks allow multiple devices to connect to the same Internet remotely simultaneously. It also allows connected devices to move freely.

3.2.1.8 To construct the network infrastructure, what devices are needed?

Network infrastructure devices are the components of a network that transport communications needed for data, applications, services, and multimedia. These devices include routers, firewalls, switches, servers, load balancers, intrusion detection systems, domain name systems, and storage area networks.

3.2.1.9 What is the total bandwidth required in the building? Is it a 4G network or a 5G?

After considering the requirement in the case study, each computer should meet an average bandwidth of 20 Mbps. Each lab has 30 workstations, and the total bandwidth required for each lab is 600 Mbps. There is one multi-terabyte storage server in the lab, and we need to achieve the minimum requirement of the client stated. The recommended bandwidth is 100 Mbps. Thus, the total bandwidth for each lab is 700 Mbps, and the four labs are 2800 Mbps. There are also two video conferencing rooms, and we need to provide a consistent and best internet experience to the user; the suggested bandwidth of Wi-Fi is around 300 Mbps. In addition, we need to ensure the study room is equipped with better Internet to ensure the students have the study experience smoothly. We suggested that the bandwidth for the study room is 300 Mbps. Overall, the total bandwidth for the whole building is recommended to be around 3 Gbps.

Besides that, we are planning to make the building fully with 5G internet, but if the building has done construction still needs to be equipped with the 5G internet services by UTM Digital. We will update the 4G internet once the 5G is ready around UTM.

3.2.1.10 What measurements need to be taken to ensure the physical security of the building?

The building will install servers containing important user information and school data activity. It is a very essential practice to ensure that the servers are not directly exposed to physical cyber-attacks such as stealing the hard disk from the server. The "Zero trust" method is taken in this case to ensure no unauthorised access to the server.

Next, we will apply for CCTV coverage on the building and the lab to record the activity inside the building and become a backup when the incident occurs. If some area is in the blind spot, we will attach one concave mirror to ensure that the blind spot can also be recorded by the CCTV.

There is also a need to put the access card at every access door to ensure that only authorised persons like students, lecturers, staff or contractors are allowed to enter the lab.

This method can ensure that the public is not allowed to enter the lab without permission from the faculty, especially the server room, to avoid the data has been stolen by others.

3.2.1.11 Where should the devices be bought from?

After the discussion, the best way to buy the devices and equipment is to engage with the administration of Universiti Teknologi Malaysia (UTM), especially UTM Digital, to get the contact of the best seller to ensure the products received are safe and have been verified by UTM team.

3.2.2 Project Feasibility

After determining the project's requirements, our group members chose to assess the project's viability from three different angles: technical, economic, and legal. After executing the feasibility analysis, we believed this project would be practicable in all necessary respects.

3.2.2.1 Technical feasibility

The technical feasibility study must be carried out to ascertain whether we have the necessary technical resources to complete the project and whether we can actually turn our ideas into reality.

According to the technical feasibility study we completed, we can buy most of the hardware and software required for this project from the seller the UTM team recommended, allowing us to confirm the product's quality and receive our product at a competitive price.

The UTM Digital team may provide Microsoft products for subscription-based applications like antivirus. The professionals from the UTM Digital Department will install all the necessary software and hardware to function properly and not encounter any issues when the student uses it during lab class.

3.2.2.2 Economic feasibility

The Budget allocated for this project is RM 1.3 million, and this Budget needs more to conduct our project. Aspects related to the cost of the project, such as the length of cables, the number of access points and the number of routers, are taken into consideration when designing the floor plan of the building.

So to make sure the cost of production is at most the Budget has given, we will try to make the Wi-Fi connection up to a lower price package that purpose in the question, but we still ensure the Wi-Fi speed is fast.

3.2.2.3 Legal Feasibility

All hardware and software used in this project are guaranteed to be original and completely obey the laws of law following the concept of protecting intellectual property (IP) rights. For example, routers will be acquired legally, and licensing keys for software such as Microsoft products, antivirus, and other licensed software will be obtained from authorities (UTM), primarily the responsibility of the UTM Digital Department. In addition, a firewall and online screening are in place to prevent anyone from accessing illicit websites that may break the law.

3.3 Task 3

3.3.1 List of devices

3.3.1.1 Modem

The modem is essential in any network topology because it can translate the analogue signal of networking into the digital signal of networking format for consumption by the other endpoint devices to facilitate the transmission rate. The considerations that we need to take on when choosing a suitable modem in setting up the networking to maximise the performance in making Wi-Fi faster are the ports number, the prices, the channels like the upload speed and download speed, and DOCSIS Support. The product that will be quantified to set up the network according to some of the considerations and the criteria listed below: Motorola MB8611 Ultra-Fast DOCSIS 3.1 Cable Modem with 2.5Gb Ethernet, NetGear Nighthawk CM1200 Multi-Gig Speed DOCSIS® 3.1 Cable Modem, and NetGear CM500 High-Speed Cable Modem. The channel specification acts like a highway in a network that allows and provides the late path for transmitting the data by permitting the bits to pass through it. The more channels available, the faster the connection will be provided. DOCSIS is known as data over cable service interface specification, which is a standard to allow the communication of data for cable systems; in terms of comparison, DOCSIS 3.1 is ten times faster at up to 10Gbps, but DOCSIS 3.0 performs up to 1Gbps. Definitely, DOCSIS 3.1 will be great for some people who are required to maximise their gigabit service plans and are ready to get faster in the future in terms of speeds.

Product	Motorola MB8611 Ultra-Fast DOCSIS 3.1 Cable Modem with 2.5Gb Ethernet	NetGear Nighthawk CM1200 Multi-Gig Speed DOCSIS® 3.1 Cable Modem	NetGear CM500 High- Speed Cable Modem
Specification	• DOCSIS Support: DOCSIS 3.1,3.0,2.0 and 1.1 service • Ports: 1x 2.5 Gigabit Ethernet Port • Download Speed: Up to 2.5 Gb/s • Upload Speed: Up to 0.8 Gb/s • IPv4 and IPv6 support	• DOCSIS Support: DOCSIS 3.1 • Ports: 4x Gigabit Ethernet Port, 1x WAN Cable Coaxial Port • Download Speed: Up to 2Gb/s • Upload Speed: 0.8 Gb/s • IPv6 support	• DOCSIS Support: DOCSIS 3.0 • Channels: 16x4 • Ports: 1x Gigabit Ethernet Port, 1x Cable Port • Download Speed: 680Mb/s • IPv6 support
Price	RM 839.76 (189.99 USD)	RM 1061.24 (239.99 USD)	RM221.06 (49.99 USD)
Reference	https://www.motorola.com/us/mb8611/p	https://www.netgear.com/home/wifi/modems/cm1200/	https://www.netgear.com/home/wifi/modems/cm500/

3.3.1.2 Switch

The network switch is used to connect and forward data packets to the other devices within the network. But It was not the same as a router; it could only send the data to a single device. The Ethernet port numbers will become one of the considerations in selecting the suitable switch since it was used to decide the number of wired connections that can pass through the switch. There is also some other performance that needs to be considered: the performance, like the maximum forwarding rate and the switching capacity. Here are the three most suitable that was selected to set up the network: D-LINK DGS-1024C 24 Port Gigabit Port Rackmount Unmanaged Network Switch in Metal case, Tenda TEF1024D 24 Port 10/100 Network Ethernet Switch and TP-Link TL-SG1016D 16 Rackmount Switch.

Product	D-LINK DGS-1024C 24 Port Gigabit Port Rackmount Unmanaged Network Switch in Metal case	Tenda TEF1024D 24 Port 10/100 Network Ethernet Switch	TP-Link TL-SG1016D 16 Rackmount Switch
Specification	• Ports: 24x Gigabit Ethernet Ports • Maximum Power Consumption: 13.3 W • Maximum Heat Dissipation: 45.35BTU/h • Switching Capacity: 48 Gbps • Maximum	• Ports: 24x Gigabit Ethernet Ports • Maximum Power Consumption: 6W • Switching Capacity: 4.8 Gbps • Maximum Forwarding Rate: 3.57 Mpps	• Ports: 16x Gigabit Ethernet Ports • Maximum Power Consumption: 9.95W • Maximum Heat Dissipation: 33.93BTU/h • Switching Capacity: 32 Gbps • Maximum

	Forwarding Rate: 35.71 Mpps		Forwarding Rate: 23.8 Mpps
Price	RM345.00	RM 155.00	RM 229.00
Reference	https://shopee.com.my/D-LINK-DGS-1016C-DGS-1024C-DGS-1024D-DGS-1016D-16-24-Port-Gigabit-Port-Rackmount-Unmanage-Network-Switch-in-Metal-case-i.323465763.5457793359?sp_atk=e402c665-93e7-45bc-8d42-6bde0a8ead2d&xptdk=e402c665-93e7-45bc-8d42-6bde0a8ead2d	https://shopee.com.my/Tenda-TEF1016D-TEF1024D-24-16-Port-10-100-Network-Ethernet-Switch-i.180984.1871982639?sp_atk=ed1b4124-597a-4d3a-aae4-cfb91f0dee8d&xptdk=ed1b4124-597a-4d3a-aae4-cfb91f0dee8d	https://shopee.com.my/TP-Link-TL-SG1016D-TL-SG116-TL-SF1016D-16-Port-Gigabit-Non-Gigabit-Desktop-Rackmount-Switch-i.18799831.14540742294?sp_atk=132e4d8b-09fa-4f76-bd72-16b546eb366b&xptdk=132e4d8b-09fa-4f76-bd72-16b546eb366b

3.3.1.3 Router

A router is a hardware device that connects two or more networks and acts as a gateway between networks. It is a special intelligent network device that reads each packet's address and decides how to transmit it. It can understand different protocols, such as the Ethernet protocol used by a local area network and the TCP/IP protocol used by the Internet. A router connects to two or more data lines from different IP networks. When a packet enters through one of the routes, the router reads the network address information in the packet header to determine the final destination. Then, using the information in its routing table or routing policy, it directs the packet to the next network on its journey.

Product	TP-Link Archer AX72 AX5400 Dual-Band Gigabit Wi-Fi 6 Router	Xiaomi Mi Router AX1800 Dual Band 2.5GHz/5GHz 4 Antenna Strong Signal 5-core WiFi6 256MB Memory Global	TP-Link Archer AX73 [AX5400] Wi-Fi 6 Wireless Mesh Router, TP-Link AX Wi-Fi 6 For UniFi Fiber, Max.s Fiber, Time Fibre
Specification	● Processor: 1 GHz Dual-Core CPU ● Ports: 1x Gigabit WAN Port, 4x Gigabit LAN Ports, 2x LAN Ports, 1x USB3.0 Port ● Wi-Fi 6 supported	● Processor: IPQ6000 Quad-Core A53 1.2GHz CPU ● 2.5GHz and 5GHz bandwidth supported ● 4x external antennas ● Passive cooling ● Ports: 1x WAN Port, 3x LAN ports	● Processor: 1.5 GHz Triple-Core CPU ● Ports: 1x Gigabit WAN Port, 4x Gigabit LAN Ports, 2x LAN Ports, 1x USB 3.0 Port ● Wi-Fi 6 supported

Price	RM399.00	RM 144.88	RM 495.00
Reference	https://shopee.com.my/T-P-Link-Archer-AX72-AX5400-Dual-Band-Gigabit-Wi-Fi-6-Router-i.2302204.13246504063?sp_atk=1f02ff53-a3fd-46a1-b4e5-c13bb01eddd4&xptdk=1f02ff53-a3fd-46a1-b4e5-c13bb01eddd4	https://shopee.com.my/Xiaomi-Mi-Router-AX1800-Dual-Band-2.5GHz-5GHz-4-Antenna-Strong-Signal-5-core-WiFi6-256MB-Memory-Global-i.2302204.8238192396?sp_atk=9d46d134-72e1-41ad-a02d-e08f520341ce&xptdk=9d46d134-72e1-41ad-a02d-e08f520341ce	https://shopee.com.my/T-P-Link-Archer-AX73-AX5400-WiFi-6-Wireless-Mesh-Router-TP-Link-AX-Wi-Fi6-For-UniFi-Fiber-Max.s-Fiber-Time-Fibre-i.2302204.4678295371?sp_atk=5638caba-293c-45c7-9c15-43b6eb171dbc&xptdk=5638caba-293c-45c7-9c15-43b6eb171dbc

3.3.1.4 Network Cables

Network cables are hardware used to connect one network device to other network devices or two or more computers to share devices such as printers or scanners. Depending on the network's topology, protocol, and size, different network cables are used, such as coaxial, fibre, and twisted pair cables. These devices can be separated by a few meters or almost unlimited distances. There are a variety of technologies for network connectivity. Jumpers are used for short-distance transmission between the office and wiring. Use of electrical connections using twisted pairs or coaxial cable within the building. Fibre optic cables are used over long distances or for applications requiring high bandwidth or electrical isolation. Many installations use structured wiring practices to improve reliability and maintainability. Power lines are used as network wiring in some household and industrial applications.

Product	KYD CAT6 UTP Network Ethernet Cable	HIKVISION CAT6 UTP Network Cable Solid Bare Copper 305M DS-1LN6U- SC0	Dintek PowerMAX500 CAT.6 U/UTP 23AWG LSZH Solid Cable 305M Box
Specification	● Length: 305m ● Material: 100% full copper cable ● Category: CAT6e ● Types: 4 twisted-pair cable	● Length: 305m ● Material: Solid-bare Copper (99.95%) ● Category: CAT6 ● Stable electrical performance, compliant with ANSI/TIA-568-C.2, IEC61156, ISO/IEC11801 ● Compliant with RoHS 2.0	● Length: 305m ● Material: Pure Annealed Copper ● Category: CAT6 ● Capable of handling the latest versions of Power over Ethernet

Price	RM360.00	RM 492.00	RM 539.00
Reference	https://shopee.com.my/-Pure-Copper-CAT6-UTP-Network-Ethernet-Cable-(300m)-i.273535714.7242384278?sp_atk=c1ac42d3-30e9-4451-b350-7a37e51f71a7&xptdk=c1ac42d3-30e9-4451-b350-7a37e51f71a7	https://shopee.com.my/HIKVISION-CAT6-UTP-Network-Cable-Solid-Bare-Copper-305M-DS-1LN6U-SC0-i.80013324.2561103071?s_p_atk=54445dad-a918-4c08-86a8-4aacef783b2f&xptdk=5445dad-a918-4c08-86a8-4aacef783b2f	https://shopee.com.my/Dintek-PowerMAX500-CAT.6-U-UTP-23AWG-LSZH-Solid-Cable-305M-Box-i.44363104.18945037431?sp_atk=0a618ae3-0d09-403b-963c-8b5af04dd859&xptdk=0a618ae3-0d09-403b-963c-8b5af04dd859

3.3.1.5 Network Cable Connector

In network cabling, besides cables, there are also Network Cable Connectors. Connectors can be famous for their physical presence and mating features, and they are used to connect the guided transmission media to devices like the hub, server, workstations, etc. There are several types of network cables. Every network cable uses specific types of connectors to connect to another network cable or network interface card. Registered Jack 45 (RJ45), one of the most used networking connectors in the network world, is a connector made of plastic, and it is more significant than a classical telephone connector, RJ11. It is the connector of UTP and STP type cables located at the two sides of the cables, and with these connectors, we can connect the cable between any two network devices.

Product	AMP Tyco RJ45 CAT6 8P8C Modular Plug Network Connector	UGREEN RJ45 Connector Cat6 RJ45 Plug Ends Ethernet Cable Crimp Network LAN Connector Crystal Laptop Printer	Commscope AMP RJ45 CAT6 100pcs AMP Connector modular Jack faceplate
Specification	● RJ45 Connectors Modular Plug ● 8P8C Wiring ● Gold Plated Leads for better data transmitting and Higher signal Strength ● 100 pieces/box	● CAT6 RJ45 Connectors Modular Plug ● 8P8C Wiring ● Gold-plated contacts to ensure the more stable data transfer ● 100 pieces/box	● RJ45 Connectors Modular Plug ● 8P8C Wiring ● Gold Plated Leads for better data transmitting and Higher signal Strength ● 100 pieces/box
Price	RM28.00	RM 46.90	RM 75.00
Reference	https://shopee.com.my/pr	https://shopee.com.my/UG	https://shopee.com.my/C

	<u>oduct/141186850/4069255172?smtt=0.526985529-1671495939.9</u>	<u>REEN-RJ45-Connector-Cat6-RJ45-Plug-Ends-Ethernet-Cable-Crimp-Network-LAN-Connector-Crystal-Laptop-Printer-i.331309804.21631064555?sp_atk=81264b75-c2b4-4bdf-a82d-0e204e43a1c5&xptdk=81264b75-c2b4-4bdf-a82d-0e204e43a1c5</u>	<u>ommscope-AMP-RJ45-CAT6-CAT5-CAT5e-100pcs-AMP-Connector-modular-Jack-faceplate-i.18015099.3716261278?sp_atk=2bb26cfb-2de5-408c-ae7a-8a0116f69a98&xptdk=2bb26cfb-2de5-408c-ae7a-8a0116f69a98</u>
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3.3.1.6 Wireless Access Point

Wireless Access Point (WAP), also known as a hotspot, is a networking hardware device or configured node on a local area network that allows capable devices and wired networks to connect through a wireless standard, including Wi-Fi or Bluetooth. In computer networking, the Access Point (AP) may have a wired connection to a router;. At the same time, we look at the wireless router as a standalone device and can also be an integral component of the router itself. WAPs may provide network connectivity in office environments, allowing employees to work remotely as long as it remains connected to a network. It also offers flexible networking modes, including wireless client, wireless bridge and multipoint bridge to support a variety of wireless use cases for hybrid and remote work.

Product	Tp-link AX5400 Wireless Access Point	Tp-link Deco P9 AC1200 AV1000 Whole Home Powerline Mesh Wi-Fi System 3 Units Access Point
Specification	- Maximum Data Transfer Rate: 2976 Mbit/S - Maximum Data Transfer Rate (2.4 Ghz): 574 Mbit/S - Maximum Data Transfer Rate (5 Ghz): 2402 Mbit/S - Ethernet Lan Data Rates: 10,100,1000 Mbit/S - Frequency Band: 2.4 - 5 Ghz - Networking Standards: Ieee 802.11a, Ieee 802.11ac, Ieee 802.11ax, Ieee 802.11b, Ieee 802.11g, Ieee 802.11n, Ieee 802.1x, Ieee 802.3at - Mimo: Yes - Mimo Type: Multi User Mimo	● Wireless class: AC1200 + HomePlug AV1000 ● Wi-Fi + PLC Hybrid Mesh: Hybrid network boosts bandwidth effectively ● With powerline, there is no more walls or distance limits. Enjoy home Wi-Fi everywhere! ● Powerful Processing: Qualcomm Quad-core CPU ● Simple and Smart: Easily setup and manage your network with the Deco app ● Hardware is compatible with Amazon Alexa and IFTTT

	- Spread Spectrum Method: Ofdma - Modulation: 1024-Qam, Ofdm - Wi-Fi Multimedia (Wmm)/(Wme): Yes - Vlan Support: Yes - Rate Limiting: Yes - Wireless Isolation: Yes - Quality Of Service (Qos) Support: Yes - Transmitting Power (Ce): <20 Dbm(2.4 Ghz, Eirp) <23 Dbm(5 Ghz, Band1 & Band2, Eirp) <30 Dbm(5 Ghz, Band3, Eirp) - Transmitting Power (Fcc): <25 Dbm (2.4 Ghz) <25 Dbm (5 Ghz)	● Maximized Range: Wi-Fi coverage up to 6,000 ft2 / 560 m2 (3-pack) ● Supports connection to 100+ devices ● Power: - Power source type: AC - AC input voltage: 100 - 240 V - AC input frequency: 50/60 Hz - Output current: 0.5 A - Operational conditions: - Operating temperature (T-T): 0 - 40 °C - Storage temperature (T-T): -40 - 70 °C - Operating relative humidity (H-H): 10 - 90% - Storage relative humidity (H-H): 5 - 90%
Price	RM664.99	RM 920.49
Reference	https://www.tradeinn.com/techinn/en/tp-link-ax5400-wireless-access-point/139442229/p?queryID=46a7f75c0903b9182820e53b04cf9a51&buscador_searc h&_gl=1*1fpkdjz*_up*MQ..&gclid=CjwKCAiAhKycBhAQEiwAgf19eux3q-AueT3cqKWAwObFmrYPJOw_A_X-XupBTc8oEIOrncErJ7QacRoCW9gQAvD_BwE	https://www.tradeinn.com/techinn/en/tp-link-deco-p9-ac1200-av1000-whole-home-powerline-mesh-wifi-system-3-units-access-point/137663761/p

3.3.2 Expected Costs

No	Device	Quantity	Price/Unit (RM)	Total Price (RM)
1	Motorola MB8611 Ultra-Fast DOCSIS 3.1 Cable Modem with 2.5Gb Ethernet	2	839.76	1,679.52
2	TP-Link TL-SG1016D 16 Rackmount Switch	5	229.00	1,145.00
3	TP-Link Archer AX72 AX5400 Dual-Band Gigabit Wi-Fi 6 Router	4	399.00	1,596.00
4	KYD CAT6 UTP Network Ethernet Cable	8	360.00	2,880.00
5	UGREEN RJ45 Connector Cat6 RJ45 Plug Ends Ethernet Cable Crimp Network LAN Connector Crystal Laptop Printer	5	46.90	234.50
6	Tp-link Deco P9 AC1200 AV1000 Whole Home Powerline Mesh Wi-Fi System 3 Units Access Point	4	920.49	3,681.96
Total Cost				11,216.98

3.3.3 Reflection

3.3.3.1 Are you surprised by the price? How were you surprised?

Yes, we are surprised by the prices, especially regarding network cables, and the access point is totally out of our expectations. Although we are already expecting the network cables will not be cheap,. When the quantity required is large, the price of the cables is much higher than our expectation, and even the total cost that we need to spend on buying the router and modem. The prices that occupied the most to set up the networking in a building are not the main components like the router and the server. Since we know that the router and modem will not be required in large quantity, but there is not the same as a network cable or access point, these are the components that we need to use to complete the connection of network cabling. Hence we need them in large quantities, and we are surprised that the most expensive devices required for setting up in a building are not the modem and the server since they were just in smaller quantities. Still, many network cables and the access point become the main consumption in setting up the network. To ensure a good network setup, it is necessary to use a high-quality material network cable and the access point to improve capacitance and protection against cuts or breaks because the cost that we use to maintain it will definitely be higher than the cost to buy a new one.

3.3.3.2 Have you ever considered cost as a factor in choosing networking devices?

Yes, we use price as a factor, but it's not the main factor because we focus on the device's performance. According to our research, we found that some devices with the same specifications may have varying prices. The cost of a switch or router is determined by its capacity and features. The device capacity includes the number and types of ports available and the backplane speed. This is when we use price as a factor and try to pick the one that makes the most sense.

3.3.3.3 What are the major differences between the same devices from different brands? For example, Cisco and Huawei Routers.

Firstly, the major difference between the same devices from different brands will be the brand's reputation. Different brands will have different levels of reputation and positioning, which will differentiate the brands with different labels on themselves, starting from the first impression they give to the public until the after-sales service. On the other hand, different brands might have different designs of the same devices, which will affect the sales of the particular brand's devices even if it has the same functionality as other brands' devices. In fact, different kinds of designs might also affect the device's performance. Nevertheless, the device's build quality will also be one of the major differences between the same devices from different brands. The better build quality of the device, together with the brand's reputation, can offer a higher selling price.

3.4 Task 4

3.4.1 Work areas on the floor plan

3.4.1.1 Ground Floor

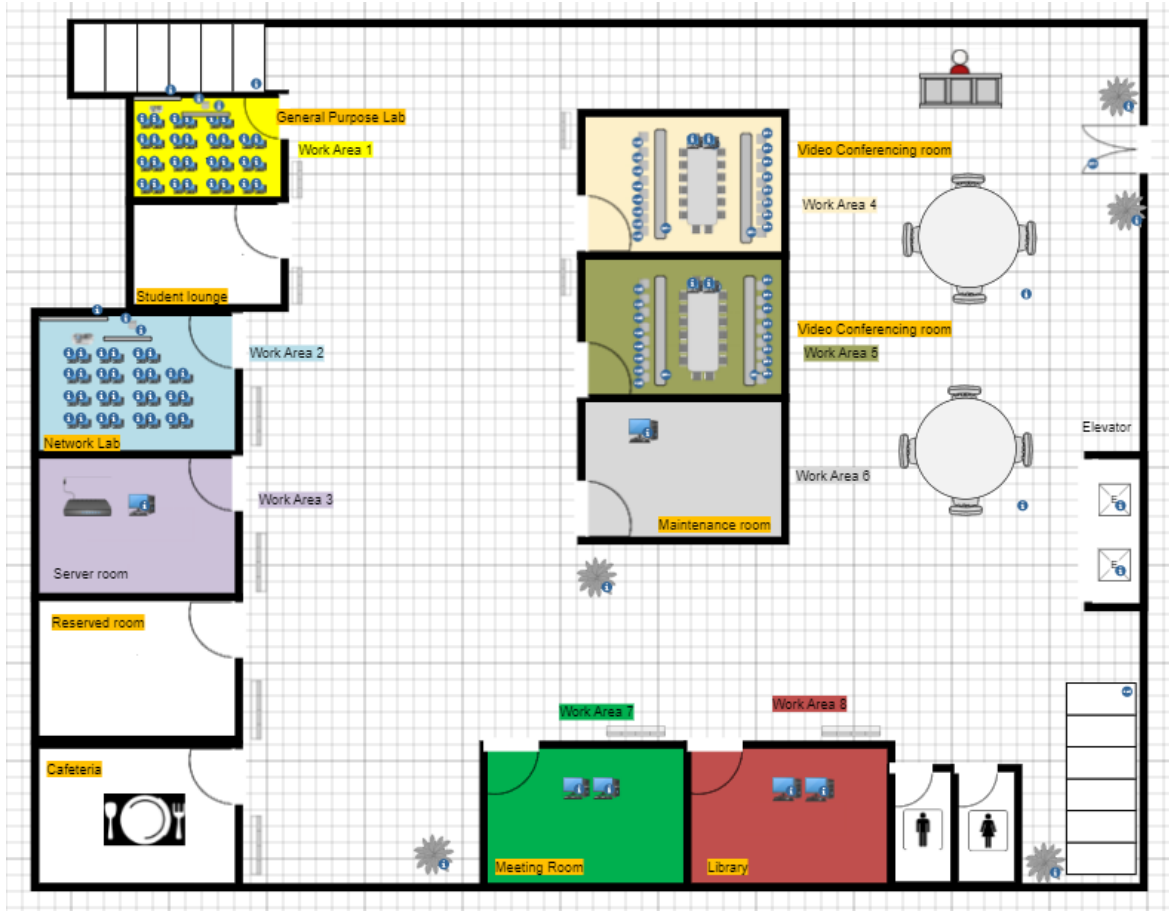


Figure 6: Ground Floor Floor Plan with Workspace

The ground floor consists of 8 work areas: general purpose lab, network lab, server room, video conferencing room, meeting room, and library. For the general-purpose lab and the network lab, there are 30 workstations. While for the video conferencing room, there are two workstations for monitoring and recording the whole discussion purpose. The meeting room and the library also have 2 working stations in each room. The workstations in the work area will all be connected to the switches and followed by the router. There will be a router and a workstation inside the server room as a network provider on the ground floor. For the maintenance room, there will be 1 workstation for the technician in case of any technical problem that makes the connection fail. The student lounge allows all the students to have a space to rest or discuss. The reserved room is idle

until any user needs to be held on the ground floor; then, the reserved room will be on demand. A cafeteria is designed for all the students and the staff to have their meals.

3.4.1.2 First Floor

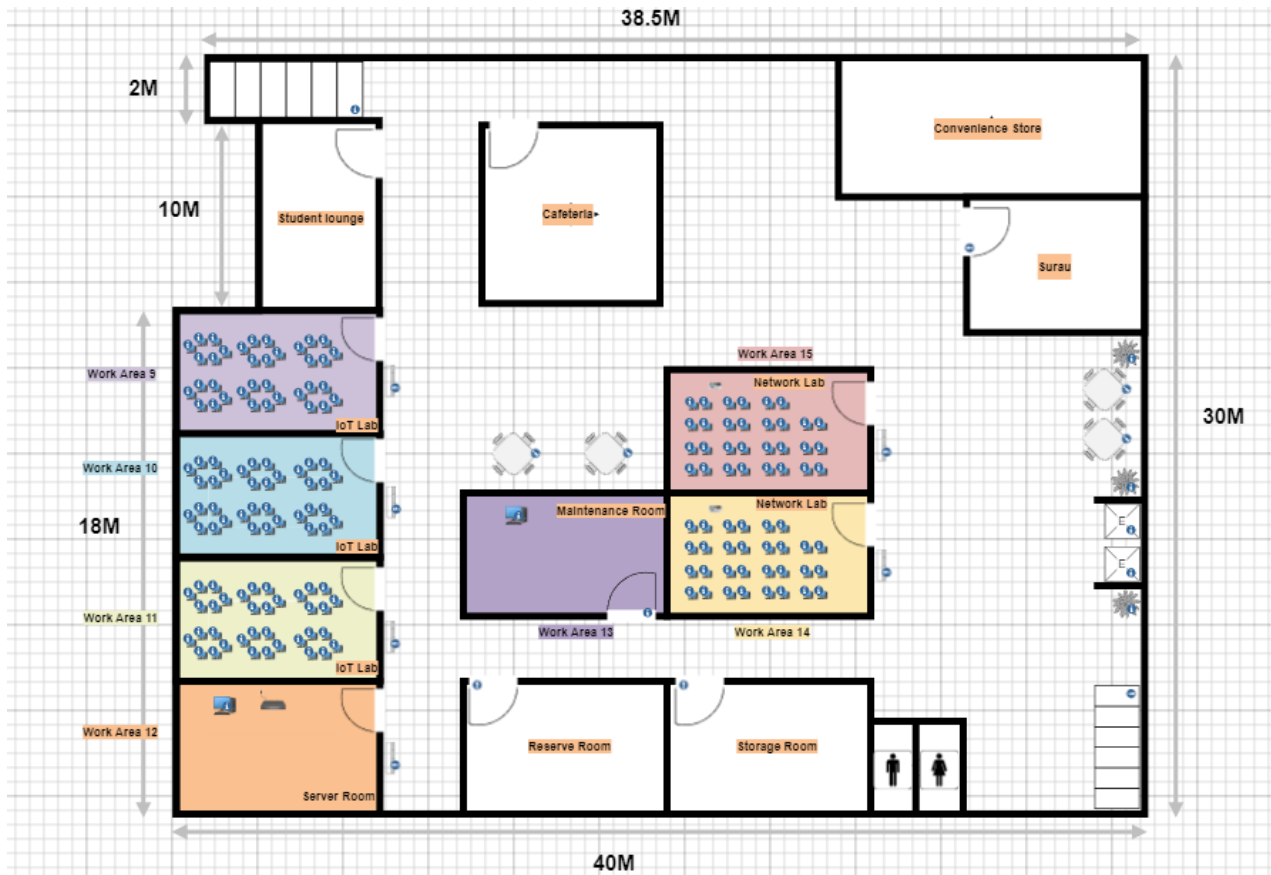


Figure 7: First Floor Floor Plan with Workspace

There will be 7 work areas on the first floor: the IoT lab, network lab, server room and maintenance room. For the IoT labs, there will be provided 36 workstations in each of the labs, while 30 workstations will be supplied in each of the network labs. All the workstations will be connected to the switches connected to the router respectively. The server room and maintenance room are provided for the technicians to fix any technical issues. There is also a storage room to store any items that might be needed in the building. There is also another room called a reserved room used as a backup room in case of any need. A student lounge is also provided for students to let them

have a space to hang around when they are waiting for the next class starts. A cafeteria and convenience store are also provided for students and staff to have a place to have their meals.

3.4.2 Network Diagram

3.4.2.1 Ground Floor

3.4.2.1.1 General Purpose Lab 1

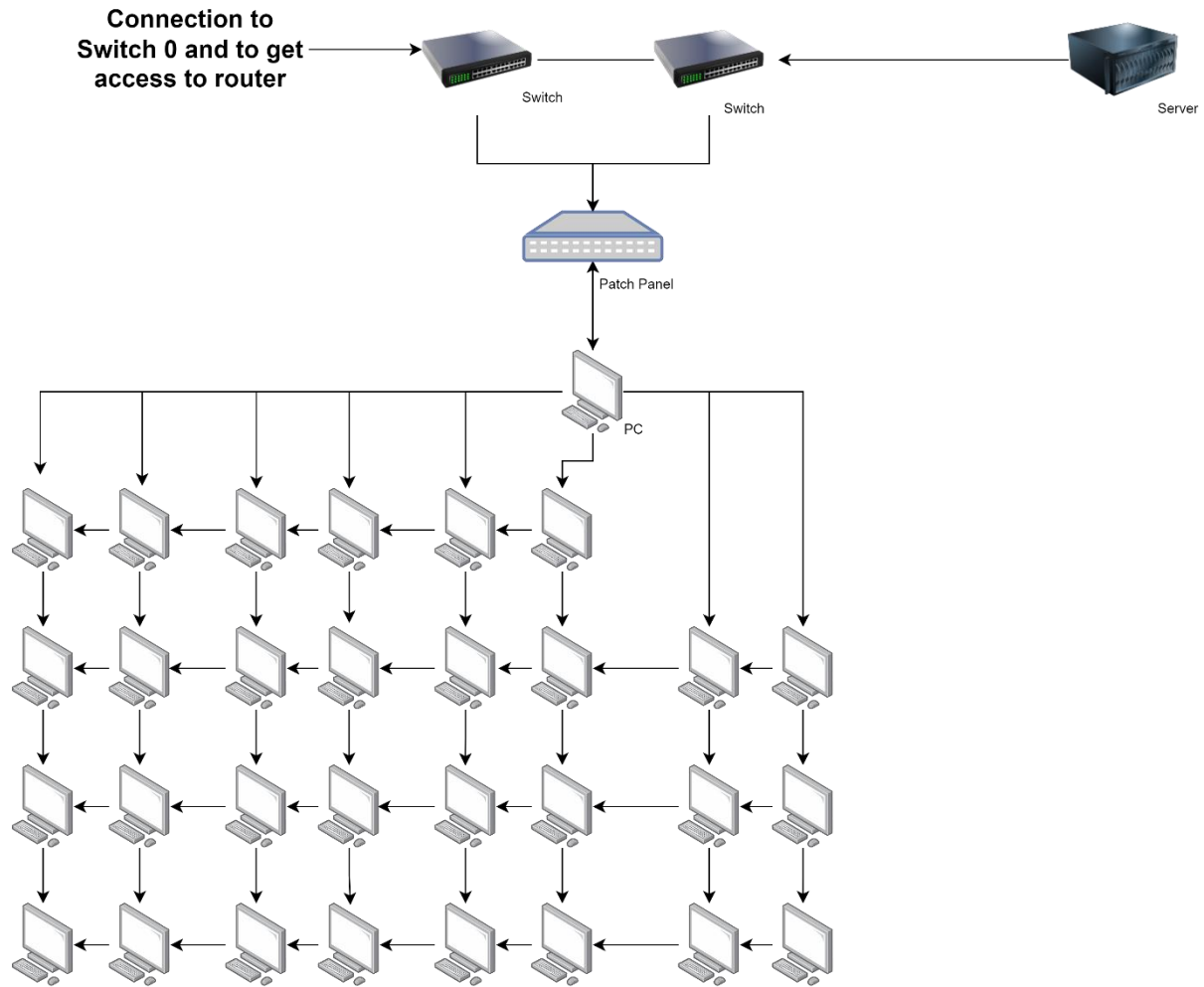


Figure 8: General Purpose Lab Network Diagram

3.4.2.1.2 Network Lab 1

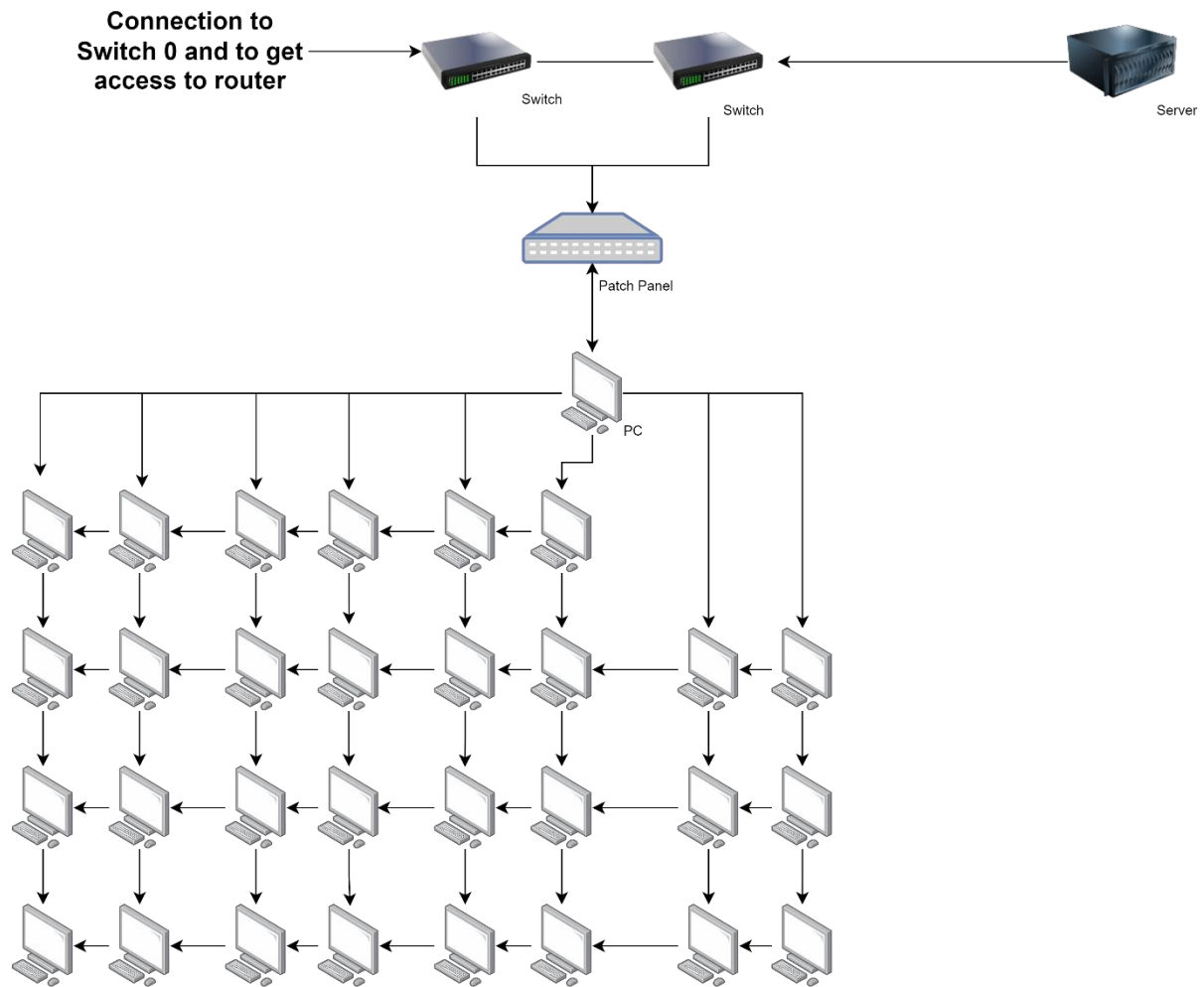


Figure 9: Network Lab 1 Network Diagram

3.4.2.1.3 Video Conferencing Room 1

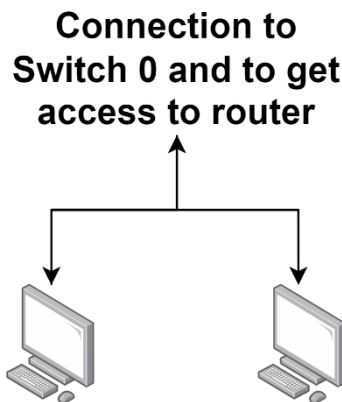


Figure 10: Video Conferencing Room 1 Network Diagram

3.4.2.1.4 Video Conferencing Room 2

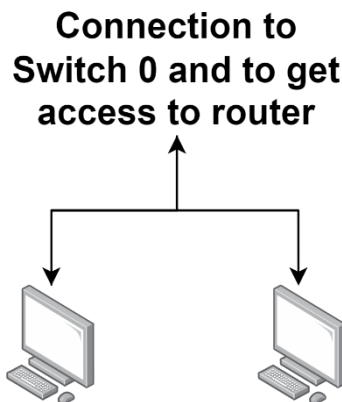


Figure 11: Video Conferencing Room 2 Network Diagram

3.4.2.1.5 Meeting Room

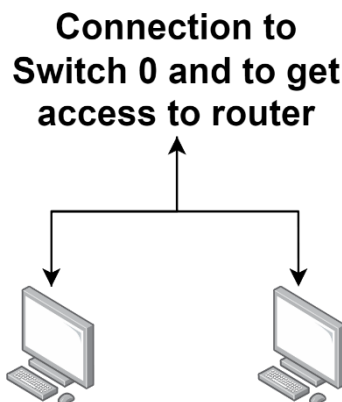


Figure 12: Meeting Room Network Diagram

3.4.2.1.6 Library

**Connection to
Switch 0 and to get
access to router**

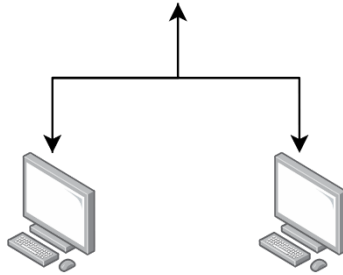


Figure 13: Library Network Diagram

3.4.2.1.7 Maintenance Room

**Connection to
Switch 0 and to get
access to router**



Figure 14: Maintenance Room Network Diagram

3.4.2.1.8 Server Room

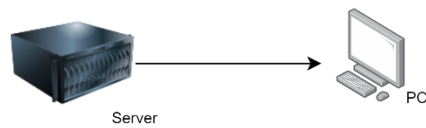


Figure 15: Server Room Network Diagram

3.4.2.2 First Floor

3.4.2.2.1 IoT Lab 1

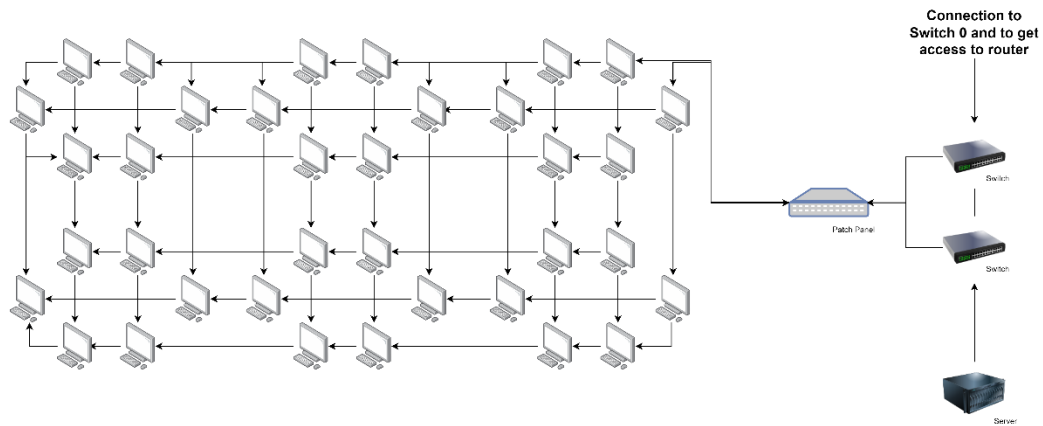


Figure 16: IoT Lab 1 Network Diagram

3.4.2.2.2 IoT Lab 2

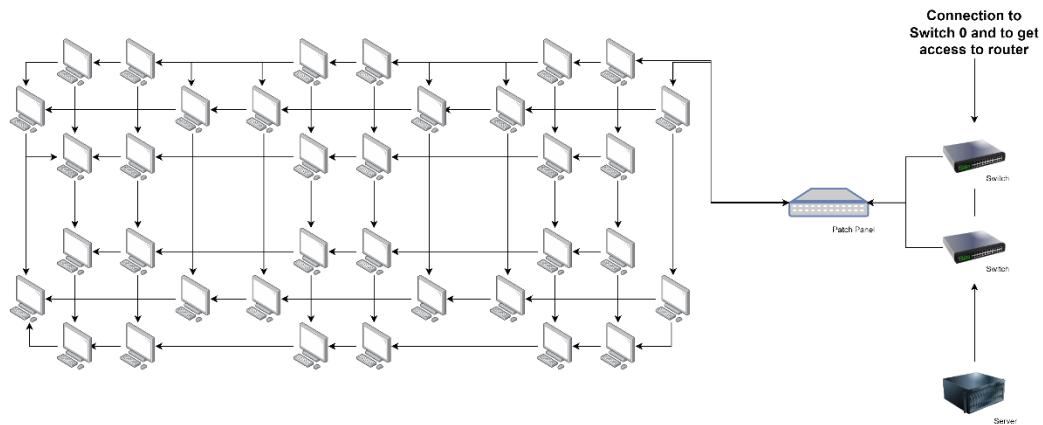


Figure 17: IoT Lab 2 Network Diagram

3.4.2.2.3 IoT Lab 3

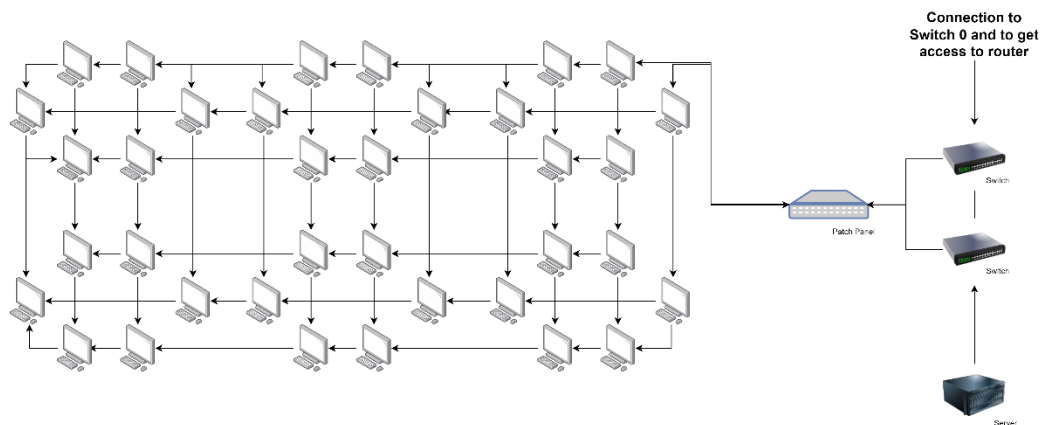


Figure 18: IoT Lab 3 Network Diagram

3.4.2.2.4 Server Room

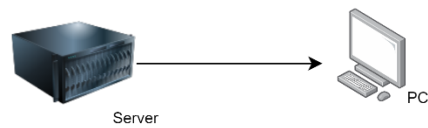


Figure 19: Server Room on First Floor Network Diagram

3.4.2.2.5 Maintenance Room

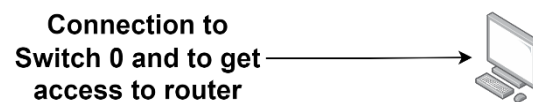


Figure 20: Maintenance Room on First Floor Network Diagram

3.4.2.2.6 Network Lab 2

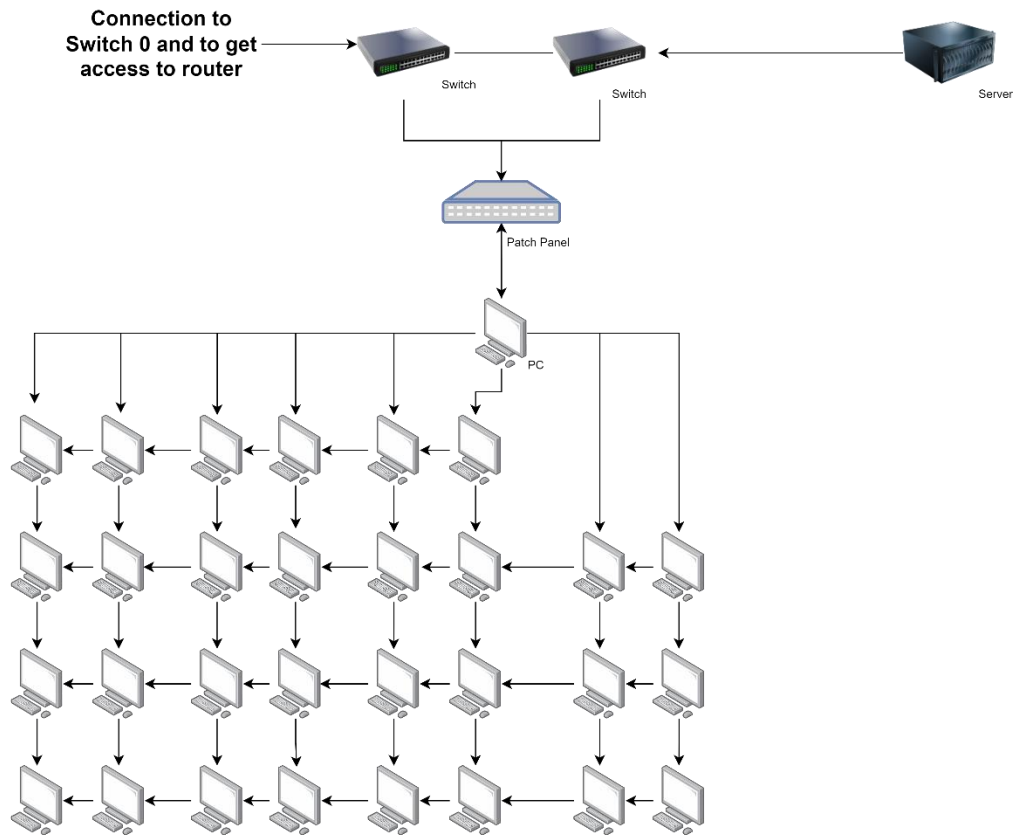


Figure 21: Network Lab 2 Network Diagram

3.4.2.2.7 Network Lab 3

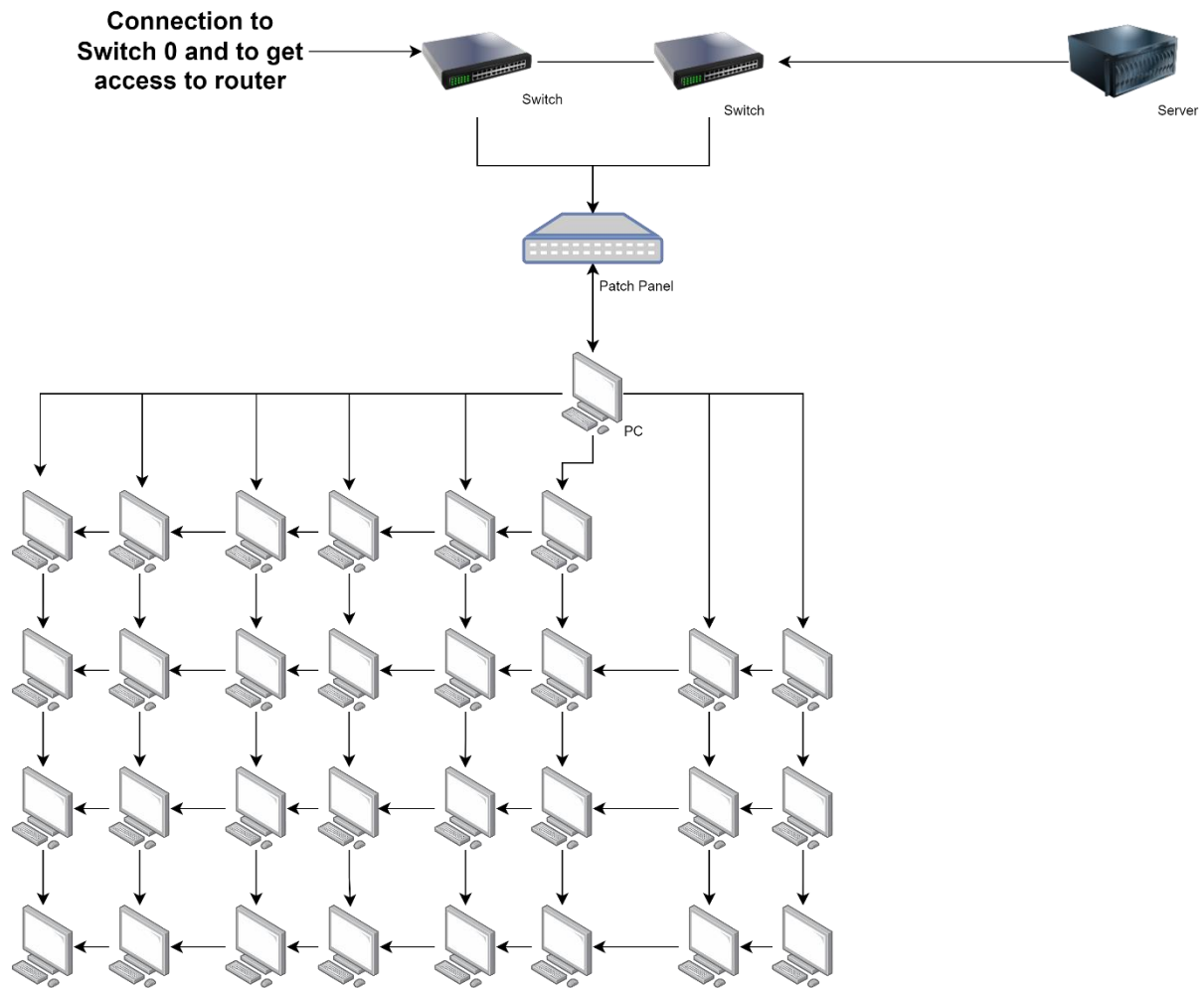


Figure 22: Network Lab 3 Network Diagram

3.4.3 Cables & Connections

3.4.3.1 Floor Plan

3.4.3.1.1 Ground Floor

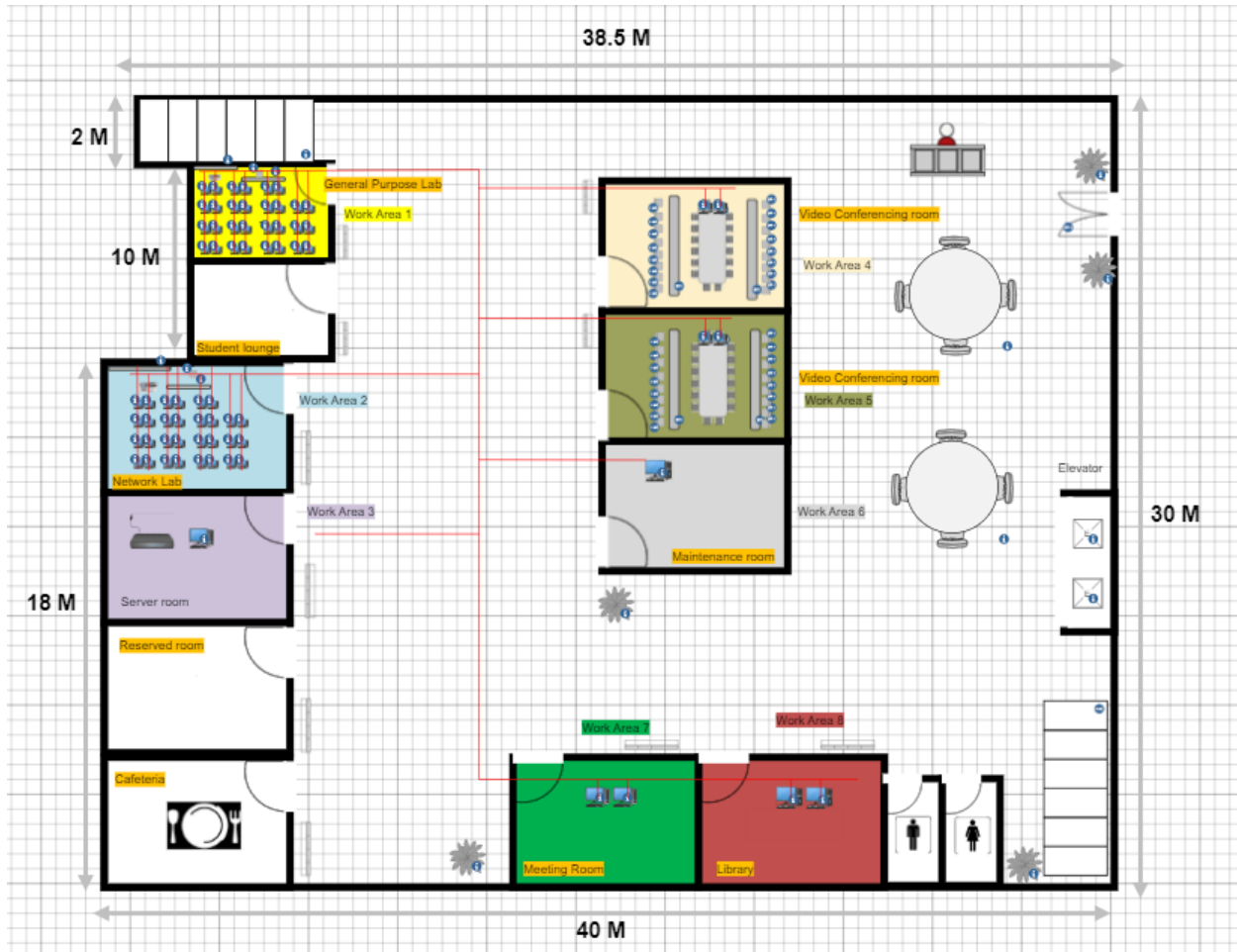


Figure 23: Ground Floor Plan with connection cable

3.4.3.1.2 First Floor

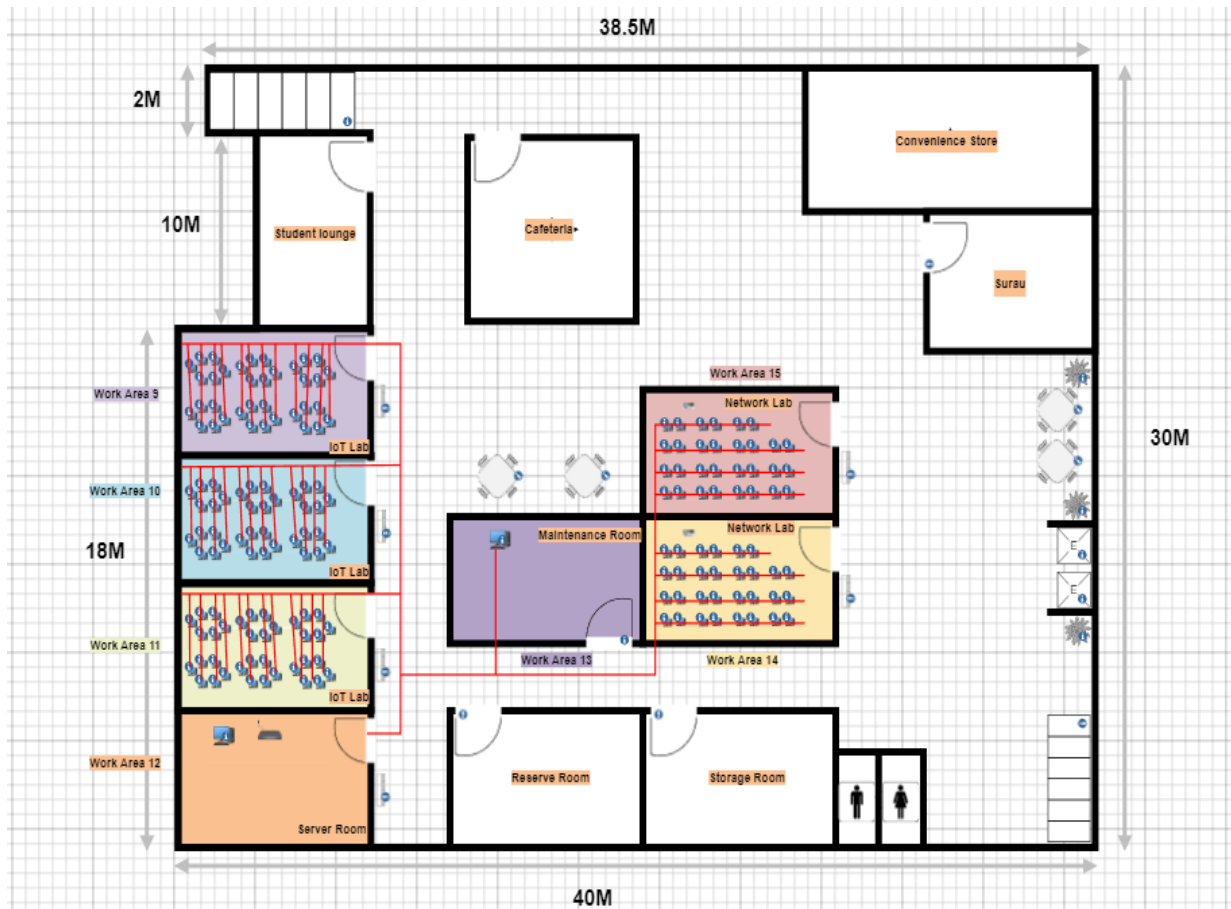


Figure 24: First Floor Plan with connection cable

In our planning, the cable that we used was CAT 6 cable. Based on the floor planning above, the CAT 6 cables are used on both floors. It is used throughout the whole building in every lab and to connect each server.

3.4.3.1.3 Cable lengths

Description	Cable Type	Length (m)
Ground Floor		
General Purpose Lab 1	CAT 6 cable	35
Network Lab 1	CAT 6 cable	35
Server Room	CAT 6 cable	9
Video Conferencing Room 1	CTA 6 cable	15
Video Conferencing Room 2	CAT 6 cable	15
Maintenance Room	CAT 6 cable	9
Meeting Room	CAT 6 cable	10
Library	CTA 6 cable	9
Peripheral connections	CTA 6 cable	20
The total length of the Ground Floor (m)		157 m
First floor		
Network Lab 2	CAT 6 cable	35
Network Lab 3	CAT 6 cable	35
IoT Lab 1	CAT 6 cable	25

IoT Lab 2	CAT 6 cable	25
IoT Lab 3	CAT 6 cable	25
Server Room	CAT 6 cable	7
Maintenance room	CAT 6 cable	5
Peripheral connections	CAT 6 cable	25
The total length of the First floor (m)		182 m
Fibre optic cable	Fibre optic cable	75
TOTAL LENGTH OF ALL USED CABLE		414 m

Description	Quantity	Total Ports
Switch	14 devices	336 ports

The total of cables is 414 meters in the overall floor plan, and the number of ports for used switches is 336. A patch cord, occasionally termed patch cable, is a copper cable with an RJ45 connector on both ends. It can link the router switch or hub to computers, printers, and other peripheral devices. For this network connection, we use a 339 meters patch cord. Switch ports are Layer-2-only interfaces related to a physical port. A switch port can be an access port, a trunk port, or a tunnel port. In this network, the number of switch ports used is 14, each having 24 ports.

3.4.3.2 Identifying the cable length & type

3.4.3.2.1 CAT 6 cable

For horizontal wiring, we choose to add type 6A twisted copper wire. Cat 6A is a stranded copper wire that can handle 10 gigabit Ethernet data speeds up to 100 meters, with a total bandwidth of 500 MHz for a single cable. We can ensure that the cable still provides high data transfer rates and Ethernet efficiency for the building network and that the access layer and network closet are less than 100 meters. In addition, it can support Ethernet applications in most buildings.

In addition, we determined that installing the unshielded cable was effective. This is because the building is located in an area with low electromagnetic interference (EMI), away from airports or medical centres, which can greatly impact cable performance. In addition, the wire itself minimises the effect of electromagnetic interference on the cable. Therefore, with the unshielded cable capability, it is guaranteed that Cat 6A cable will still maintain its high level of efficiency for at least the next five to ten years.

3.4.3.2.2 Fibre optic cable

Such fibre-optic cables are network wires that transmit data signals in the form of light along flexible glass wires. Such cables can transmit data over long distances at high speeds, typically around terabits per second (Tbps). With higher bandwidth, fibre optic cable is an acceptable choice for installation in network LABS, computer security LABS and entrance areas.

3.4.3.2.3 Wireless

Wireless networks allow devices to remain connected to the network without being connected to any cables. Wi-Fi signals are amplified through access points, so a computer can be far away from the router but still be connected to the network.

3.5 Task 5

3.5.1 Details of subnetting and IP assignation to each lab and room

Information Given

Network address: 192.22.0.0/8

1111 1111.0000 0000.0000 0000.0000 0000 = 255.0.0.0

3.5.1.1 Subnet Mask

192.0.0.0/8

1100 0000.0000 0000.0000 0000.0000 0000

Number of subnets = $2^3 = 8$

Subnet No	Area	IP Address/Subnet Mask (Binary)	IP Address/Subnet Mask (Decimal)
0	General Purpose Lab	1100 0000.0000 0000.0000 0000 0000	192.0.0.0/11
1	Network Lab 1	1100 0000.0010 0000.0000 0000.0000 0000	192.32.0.0/11
2	Server Room, Video Conferencing Rooms 1 & 2, Maintenance Room, Meeting Room, Library (Ground Floor)	1100 0000.0100 0000.0000 0000.0000 0000	192.64.0.0/11
3	Network Lab 2	1100 0000.0110 0000.0000 0000.0000 0000	192.96.0.0/11
4	Network Lab 3	1100 0000.1000 0000.0000 0000.0000 0000	192.128.0.0/11

5	IoT Lab 1	1100 0000.1010 0000.0000 0000.0000 0000	192.160.0.0/11
6	IoT Lab 2 & Server Room	1100 0000.1100 0000.0000 0000.0000 0000	192.192.0.0/11
7	IoT Lab 3 & Maintenance Room	1100 0000.1110 0000.0000 0000.0000 0000	192.224.0.0/11

3.5.1.2 Range of IP address, Network and Broadcast address for the subnet

Subnet No	Area	Network Address	Broadcast Address	Range of IP Address
0	General Purpose Lab	192.0.0.0	192.31.255.255	192.0.0.1 – 192.31.255.254 1100 0000.0000 0000.0000 0000.0000 0001 – 1100 0000.0001 1111.1111 1111.1111 1110
1	Network Lab 1	192.32.0.0	192.63.255.255	192.32.0.1 – 192.63.255.254 1100 0000.0010 0000.0000 0000.0000 0001 – 1100 0000.0011 1111.1111 1111.1111 1110
2	Server Room, Video Conferencing Rooms 1 & 2, Maintenance Room, Meeting Room, Library (Ground Floor)	192.64.0.0	192.95.255.255	192.64.0.1 – 192.95.255.254 1100 0000.0100 0000.0000 0000.0000 0001 – 1100 0000.0001 1111.1111 1111.1111 1110
3	Network Lab 2	192.96.0.0	192.127.255.255	192.96.0.1 – 192.127.255.254

				1100 0000.0000 0000.0000 0000.0000 0001 – 1100 0000.0101 1111.1111 1111.1111 1110
4	Network Lab 3	192.128.0.0	192.159.255.255	192.128.0.1 – 192.159.255.254 1100 0000.1000 0000.0000 0000.0000 0001 – 1100 0000.1001 1111.1111 1111.1111 1110
5	IoT Lab 1	192.160.0.0	192.191.255.255	192.160.0.1 – 192.191.255.254 1100 0000.1010 0000.0000 0000.0000 0001 – 1100 0000.1011 1111.1111 1111.1111 1110
6	IoT Lab 2 & Server Room	192.192.0.0	192.223.255.255	192.192.0.1 – 192.223.255.254 1100 0000.1100 0000.0000 0000.0000 0001 – 1100 0000.1101 1111.1111 1111.1111 1110
7	IoT Lab 3 & Maintenance Room	192.224.0.0	192.255.255.255	192.224.0.1 – 192.255.255.254 1100 0000.1110 0000.0000 0000.0000 0001 – 1100 0000.1111 1111.1111 1111.1111 1110

3.5.1.3 Range of IP address for user types based on the area

3.5.1.3.1 General Purpose Lab

User	IP Range
Student (PCs)	192.0.0.1 – 192.0.0.30
Lecturer (PCs)	192.0.0.31

3.5.1.3.2 Network Lab 1

User	IP Range
Student (PCs)	192.32.0.1 – 192.32.0.30
Lecturer (PCs)	192.32.0.31

3.5.1.3.3 Ground Floor

User	IP Range
Video Conferencing Room 1	192.64.0.1 – 192.64.0.2
Video Conferencing Room 2	192.64.0.3 – 192.64.0.4
Server Room	192.64.0.4
Maintenance Room	192.64.0.5
Meeting Room	192.64.0.6 – 192.64.0.7
Library	192.64.0.8 – 192.64.0.9

3.5.1.3.4 Network Lab 2

User	IP Range
Student (PCs)	192.96.0.1 – 192.96.0.30
Lecturer (PCs)	192.96.0.31

3.5.1.3.5 Network Lab 3

User	IP Range
Student (PCs)	192.128.0.1 – 192.128.0.30
Lecturer (PCs)	192.128.0.31

3.5.1.3.6 IoT Lab 1

User	IP Range
Student (PCs)	192.160.0.1 – 192.160.0.30
Lecturer (PCs)	192.160.0.31

3.5.1.3.7 IoT Lab 2 & Server Room

User	IP Range
Student (PCs)	192.192.0.1 – 192.192.0.30
Lecturer (PCs)	192.192.0.31
Server Room	192.192.0.32

3.5.1.3.8 IoT Lab 3 & Maintenance Room

User	IP Range
Student (PCs)	192.224.0.1 – 192.224.0.30
Lecturer (PCs)	192.224.0.31
Maintenance Room	192.224.0.32

4.0 Conclusion

The project is fully completed within a few weeks of work and tasks. Throughout this project, we faced a lot of problems and doubts when it came to designing a network. Although it was quite tough for us, we still managed to overcome the problems and complete all the tasks including fixing some errors we made while checking before submitting. The project that we made achieved the goals that we set for each of the tasks, and from this project, we learned a lot of knowledge and gained experience in designing and building a network system that can be proposed in real life. In fact, we learned how to research and make decisions on the appropriate network devices based on the given Budget and requirements. This will be our first experience designing a LAN system, including the floor plan drawing and determining the best position for each device. Nevertheless, we also learned how to set up the IP address scheme for every network in a system. We believe that this experience will definitely come in handy for us to design a network system again in the future.

Besides the knowledge of implementing a network system, we also learned soft skills, which is a team working, which can only be gained when it comes to teamwork. We noticed the importance of teamwork when doing this project as we might have made some mistakes throughout this project and we will discuss and point out our doubts on certain points we do not understand. After this project, we believed that communication within the team was the main key to completing a group project.

In conclusion, we appreciate this opportunity to design a network system to gain experience and apply the knowledge learned from this course. We believe that the knowledge is beneficial in this project or even in the future, and without the bits of knowledge learned in this course, the project might not be done with the requirements mentioned.

5.0 Team Members and Responsibilities

Team Member List: 1. LIM SHI KAI 2. PHANG SENG SOON 3. TAN CHUN MING 4. LI KAIEN	
LIM SHI KAI - Task 1: Lab Floor Design - Task 2: 3 Questions & feasibility - Task 3: List of devices (Specs & Price) - Task 4: Network Diagram - Task 5: Subnet Mask - Task 6: Abstract - Compile for whole task & project	LI KAIEN - Task 1: Directory for Floor Plan - Task 2: 4 Questions - Task 3: Explanation for network cable connector and wireless access point, with one reflection. - Task 4: Floor plan and workspace for the first floor - Task 5: Range of IP address for user types based on the area - Task 6:
PHANG SENG SOON - Task 1: Ground Floor's Floor Plan - Task 2: 2 Questions & feasibility - Task 3: Explanation for modem and router, and also one reflection - Task 4: Floor plan and workspace for ground floor - Task 5: Range of IP address for user types based on the area - Task 6:	TAN CHUN MING - Task 1: First Floor's Floor Plan - Task 2: 2 Questions - Task 3: Explanation for network cables and switch and also one reflection - Task 4: Cable lengths, Identifying the cable length & type - Task 5: Range of IP address, Network and Broadcast address for the subnet - Task 6:

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Appendix

1. First Minute Meeting

Meeting Name:	Network Communications Group 7 Meeting		
Date of Meeting:	27 th October 2022	Time:	9:00 pm
Minutes prepared by:	Tan Chun Ming	Location:	Discussion Room, PSZ
1. Meeting Objectives			
Assignment Discussion Meeting			
2. Attendees			
1. Lim Shi Kai A21EC0196 2. Phang Seng Soon A21EC0220 3. Tan Chun Ming A21EC0229 4. Li KaiEn A21EC4032			
3. Agenda and Notes, Decision, Issues			
Welcome and introducing	Lim Shi Kai opened the meeting and welcomed the teammates. Each teammate had started their introduction to other members.		
Introduction to the project phase 1	Lim Shi Kai introduce the case study and highlight the important point in the case study, especially the criteria needed for the floor plan.		
Assignment of task	The assignment of tasks as stated: 1. Lim Shi Kai – Meeting Minute 2. Phang Seng Soon – Ground Floor’s Floor Plan 3. Tan Chun Ming – First Floor’s Floor Plan 4. Li KaiEn – Directory for Floor Plan		
Discussion of Group Name	- Lim Shi Kai suggested that the group name can be named “Go Go FC !” - Phang Seng Soon suggested that the group name can be named “No Name” - Tan Chun Ming suggested that the group name can be named “Power of UTM”		

Confirmation of Group Name		Our group name for Group 7 in the Network Communications course project is “No Name”, which is confirmed by the vote by every member.		
4. Actions Items				
Action		Assigned	Due Date	Status
1.	Minute Meeting	Lim Shi Kai	28 th Oct 2022	Open
2.	Ground Floor’s Floor Plan	Phang Seng Soon	29 th Oct 2022	Open
3.	First Floor’s Floor Plan	Tan Chun Ming	29 th Oct 2022	Open
4.	Directory for Floor Plan	Li KaiEn	29 th Oct 2022	Open

2. Second Minute Meeting

Meeting Name:	Network Communications Group 7 Meeting		
Date of Meeting:	30 th October 2022	Time:	8:00 pm
Minutes prepared by:	Tan Chun Ming	Location:	Discussion Room, PSZ
1. Meeting Objectives			
Assignment Discussion Meeting			
2. Attendees			
1. Lim Shi Kai A21EC0196 2. Phang Seng Soon A21EC0220 3. Tan Chun Ming A21EC0229 4. Li KaiEn A21EC4032			
3. Agenda and Notes, Decision, Issues			
Introduction to the project phase 2	Lim Shi Kai explains the task that needs to be done for Task 2 and discusses assigning the task.		
Discussion of Questions Collected	Lim Shi Kai proposes 5 questions, Li KaiEn proposes 6 questions, Phang Seng Soon proposes 5 questions and Tan Chun Ming proposes 5 questions. Lim Shi Kai ask for opinions on analysing and filtering questions.		
List of Questions Confirmed	1. Do you think we need to install some computer security aid software on our computers? 2. What is the network topology? 3. What is the function of a Server Room? Do we need to consider this room as important? 4. What are the ideal computer specifications for each lab? 5. Why should we connect LAN to every device? 6. What is IP address? Is there a difference between public and private IP address? 7. What type of physical media do you want to use for network plan? 8. To construct the network infrastructure, what are the devices are needed?		

	9. What is the total bandwidth required in the building? Is it a 4G network or 5G? 10. What measurements need to be taken to ensure the physical security of the building? 11. Where should the devices be bought from?			
Assignment of task	The assignment of tasks as stated: 1. Lim Shi Kai – 3 Questions & feasibility 2. Phang Seng Soon – 2 Questions & feasibility 3. Tan Chun Ming – 2 Questions & meeting minutes 4. Li KaiEn – 4 Questions			
4. Actions Items				
Action		Assigned	Due Date	Status
1.	3 Questions & feasibility	Lim Shi Kai	2 nd Nov 2022	Open
2.	2 Questions & feasibility	Phang Seng Soon	2 nd Nov 2022	Open
3.	2 Questions & meeting minutes	Tan Chun Ming	2 nd Nov 2022	Open
4.	4 Questions	Li KaiEn	2 nd Nov 2022	Open

3. Third Minute Meeting

Meeting Name:	Network Communications No Name Group Meeting		
Date of Meeting:	12 th December 2022	Time:	9:00 pm
Minutes prepared by:	Phang Seng Soon	Location:	Student Lounge, FKA
1. Meeting Objectives			
Assignment Discussion Meeting			
2. Attendees			
1. Lim Shi Kai A21EC0196 2. Phang Seng Soon A21EC0220 3. Tan Chun Ming A21EC0229 4. Li KaiEn A21EC4032			
3. Agenda and Notes, Decision, Issues			
Welcome and introducing	Lim Shi Kai opened the meeting and welcomed the teammates.		
Introduction to the project phase 1	Lim Shi Kai introduce the case study and highlight the important point in the case study, especially the criteria needed for the report.		

Assignment of task	The assignment of tasks as stated: 1. Lim Shi Kai – List of Modem (Specification, Price) 2. Phang Seng Soon – Explanation for Modem and Router, and one from reflection 3. Tan Chun Ming – Explanation for Network cables and switch, and one from reflection 4. Li KaiEn – Explanation for Network Cable Connector and Wireless Access Point, and one from reflection
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4. Actions Items

Action		Assigned	Due Date	Status
1.	List of Modem (Specs, Price)	Lim Shi Kai	18 th Dec 2022	Open
2.	Explanation for modem and router, and also one reflection	Phang Seng Soon	18 th Dec 2022	Open
3.	Explanation for network cables and switch and also one reflection	Tan Chun Ming	18 th Dec 2022	Open
4.	Explanation for network cable connector and wireless access point, with one reflection.	Li KaiEn	18 th Dec 2022	Open

4. Forth Minute Meeting

Meeting Name:	Network Communications No Name Group Meeting		
Date of Meeting:	23 rd December 2022	Time:	9:00 pm
Minutes prepared by:	Li KaiEn	Location:	Student Room, FC
1. Meeting Objectives			
Assignment Discussion Meeting			
2. Attendees			
1. Lim Shi Kai A21EC0196 2. Phang Seng Soon A21EC0220 3. Tan Chun Ming A21EC0229 4. Li KaiEn A21EC4032			
3. Agenda and Notes, Decision, Issues			
Welcome and introducing	Lim Shi Kai opened the meeting and welcomed the teammates.		
Introduction to the project phase 4	Lim Shi Kai introduce the case study and highlight the important point in the case study, especially the criteria needed for the report.		
Assignment of task	The assignment of tasks as stated: 1. Lim Shi Kai – Network Diagram 2. Phang Seng Soon – Floor plan and workspace for the ground floor 3. Tan Chun Ming – Floor plan and workspace for the first floor 4. Li KaiEn – Cable lengths, Identifying the cable length & type		
4. Actions Items			
Action	Assigned	Due Date	Status

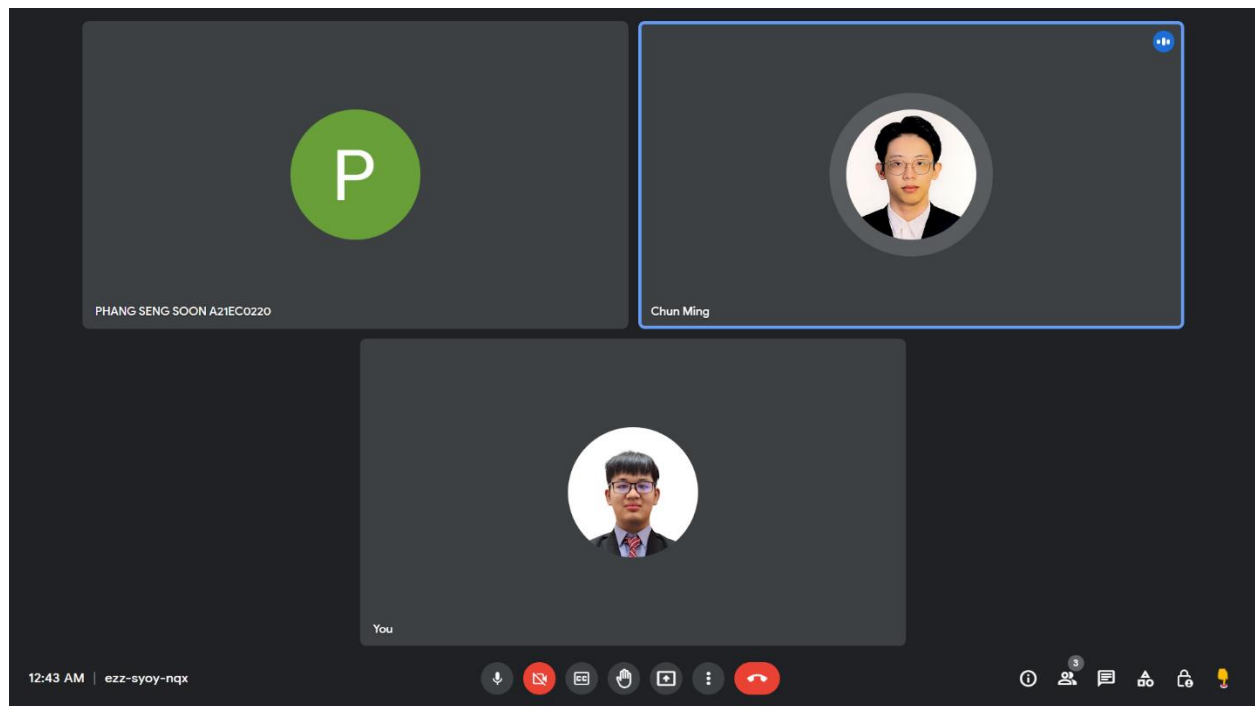
1.	Network diagram	Lim Shi Kai	28 th Dec 2022	Open
2.	Floor plan and workspace for ground floor	Phang Seng Soon	28 th Dec 2022	Open
3.	Floor plan and workspace for the first floor	Tan Chun Ming	28 th Dec 2022	Open
4.	Cable lengths, Identifying the cable length & type	Li KaiEn	28 th Dec 2022	Open

5. Fifth Minute Meeting

Meeting Name:	Network Communications No Name Group Meeting		
Date of Meeting:	28 th December 2022	Time:	9:00 pm
Minutes prepared by:	Tan Chun Ming	Location:	M01, KTDI
1. Meeting Objectives			
Assignment Discussion Meeting			
2. Attendees			
1. Lim Shi Kai A21EC0196 2. Phang Seng Soon A21EC0220 3. Tan Chun Ming A21EC0229 4. Li KaiEn A21EC4032			
3. Agenda and Notes, Decision, Issues			
Welcome and introducing	Lim Shi Kai opened the meeting and welcomed the teammates.		
Introduction to the project phase 4	Lim Shi Kai introduce the case study and highlight the important point in the case study, especially the criteria needed for the report.		
Assigation of task	The assignment of tasks as stated: 1. Lim Shi Kai – Subnet Mask 2. Phang Seng Soon – Range of IP address for user types based on the area 3. Tan Chun Ming – Range of IP address for user types based on the area 4. Li KaiEn – Range of IP address, Network and Broadcast address for the subnet		
4. Actions Items			

Action		Assigned	Due Date	Status
1.	Subnet Mask	Lim Shi Kai	30 th Dec 2022	Open
2.	Range of IP address for user types based on the area	Phang Seng Soon	30 th Dec 2022	Open
3.	Range of IP address for user types based on the area	Tan Chun Ming	30 th Dec 2022	Open
4.	Range of IP address, Network and Broadcast address for the subnet	Li KaiEn	30 th Dec 2022	Open

6. Pictures



7. Financial Budget

Details	Quantity	Amount (RM)
Income		
Sponsor from Universiti Teknologi Malaysia		1,300,000.00
Expenses		
Motorola MB8611 Ultra-Fast DOCSIS 3.1 Cable Modem with 2.5Gb Ethernet	2	1,679.52
TP-Link TL-SG1016D 16 Rackmount Switch	5	1,145.00
TP-Link Archer AX72 AX5400 Dual-Band Gigabit Wi-Fi 6 Router	4	1,596.00
KYD CAT6 UTP Network Ethernet Cable	8	2,880.00
UGREEN RJ45 Connector Cat6 RJ45 Plug Ends Ethernet Cable Crimp Network LAN Connector Crystal Laptop Printer	5	2,34.50
Tp-link Deco P9 AC1200 AV1000 Whole Home Powerline Mesh WiFi System 3 Units Access Point	4	3,681.96
Cat6 48 ports Network Patch Panel	7	1,085.00
Fibre optic cable	10	1,000.00
Labour Fee	1	75,000.00
TOTAL FOR EXPENSES		88,301.98
BALANCE (Income – Expenses)		1,211,698.02