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UNIVERSITI TEKNOLOGI MALAYSIA

Department of  
Software Engineering  
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**UNIVERSITI TEKNOLOGI MALAYSIA SCHOOL OF COMPUTING  
SECR1213-09 KOMUNIKASI RANGKAIAN  
(NETWORK COMMUNICATION)**

**SEMESTER 2022/2023**

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**Phase 6 - DOCUMENTATION AND REFLECTION**

**Section 09**

**Lecture name: MOHD. MURTADHA BIN MOHAMAD**

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## **Abstract**

SECR1213 Network communication is the first in a long series of networking courses; students must complete this introductory course before proceeding to concurrent courses. One of the course's main projects is a real-life application of basic networking skills that spans several phases. This report serves as the final and recompiled version of previous phases; within, you will find compiled solutions from task 1 to task 5, as well as reflections on what those tasks teach the student. Based on a real-life case study, this project report walks the reader through the intricacies of designing a network system. The early stages of the project discuss designing a lab layout. And locations. It then discusses how to apply networking knowledge to construct the designed lab with networking capabilities. First and foremost, the system that we provided must be simple to manage and scale. It is critical that we consider something that will be simple for the user to manage without the need for user training; they already know how to use the system. Second, we must boost overall performance and protect against network breaches such as Internet Worms, denial-of-service attacks, and e-business application attacks. They want everything to be safe, so we must devise the best antivirus defender to protect the software from viruses and attacks. The ability to support high-performance to the core backbone, as well as features such as Quality of Service and hardware security, comes next.

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- Subnet#7

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## **Introduction**

There will be individual reviews of this group project. Its goal is to translate what you learned in class into how it appears in the outside world. The goal of this group project is to construct a small network with all of its necessary components, which entails understanding user or customer needs and planning them within the available budget, planning and designing a network infrastructure for current and future needs, researching and using available network devices, applying network IP addressing, and reporting your findings to the client. The assignments that were to be finished in the allotted time.

Since the group has been assigned this IP address (192.16.0.0/8) for our network strategy, it must be effectively partitioned. It will be challenging with 2 labs, 2 video conferencing rooms, and a public wifi that also needs to be addressed. The first step in segmenting subnets is to determine the hosts that can connect to the IP that has been provided, and then determine whether it may be subnetted further. The group will then carry out this identical action and record its results in this report. This assignment has a

total of 6 tasks that must be finished in the allotted time. The project's scope is for us to design a two-story building layout with four labs and other additional facilities on our own, and then to draft a floor plan in accordance with the specifications.

In task 4, we begin to link the PC, servers, network, and other gadgets. We must guarantee that the connections work properly. When planning, the devices must take into account four physical areas: the work space, the communications room, the backbone or vertical cabling, and the distribution or horizontal cabling. Setting the IP addressing scheme is task number five. During this task. We must investigate the most effective way to segment the subnetwork using the Network Address given to our team. Last but not least, Task 6 requires us to finish our group report for customer assessment. The report's goal is to summarize the work done and offer suggestions for improvement.

Task 2 requires us to conduct a preliminary analysis, with a focus on the devices to be utilized and the requirements both present and future. This part is typically completed in real life through meetings and interviews. You can decide whether the project is doable once you have this information. Task 3 requires us to pick the proper LAN equipment for the labs. We must take into account all factors, including the effectiveness of the hardware that we choose to use in every lab and floor.

## **Project background and an overview of the client's current status and issue**

### **Project Background:**

This project involves the design and implementation of a network system for a two-story building that consists of four labs, video conferencing rooms, public Wi-Fi, restrooms, and a café. The objective is to meet the client's requirements for a simple to manage and scalable system with high performance, protection against network breaches, and support for advanced features such as Quality of Service and hardware security.

### **Client's Current Status and Issues:**

The client is in need of a new network system to support their operations in the building. The existing system is outdated and does not meet their current needs in terms of performance, security, and scalability. The client is facing issues such as slow network speed, frequent network outages, and security breaches, which are affecting their day-to-day operations. The client requires a solution that addresses these issues and provides them with a reliable and secure network system.

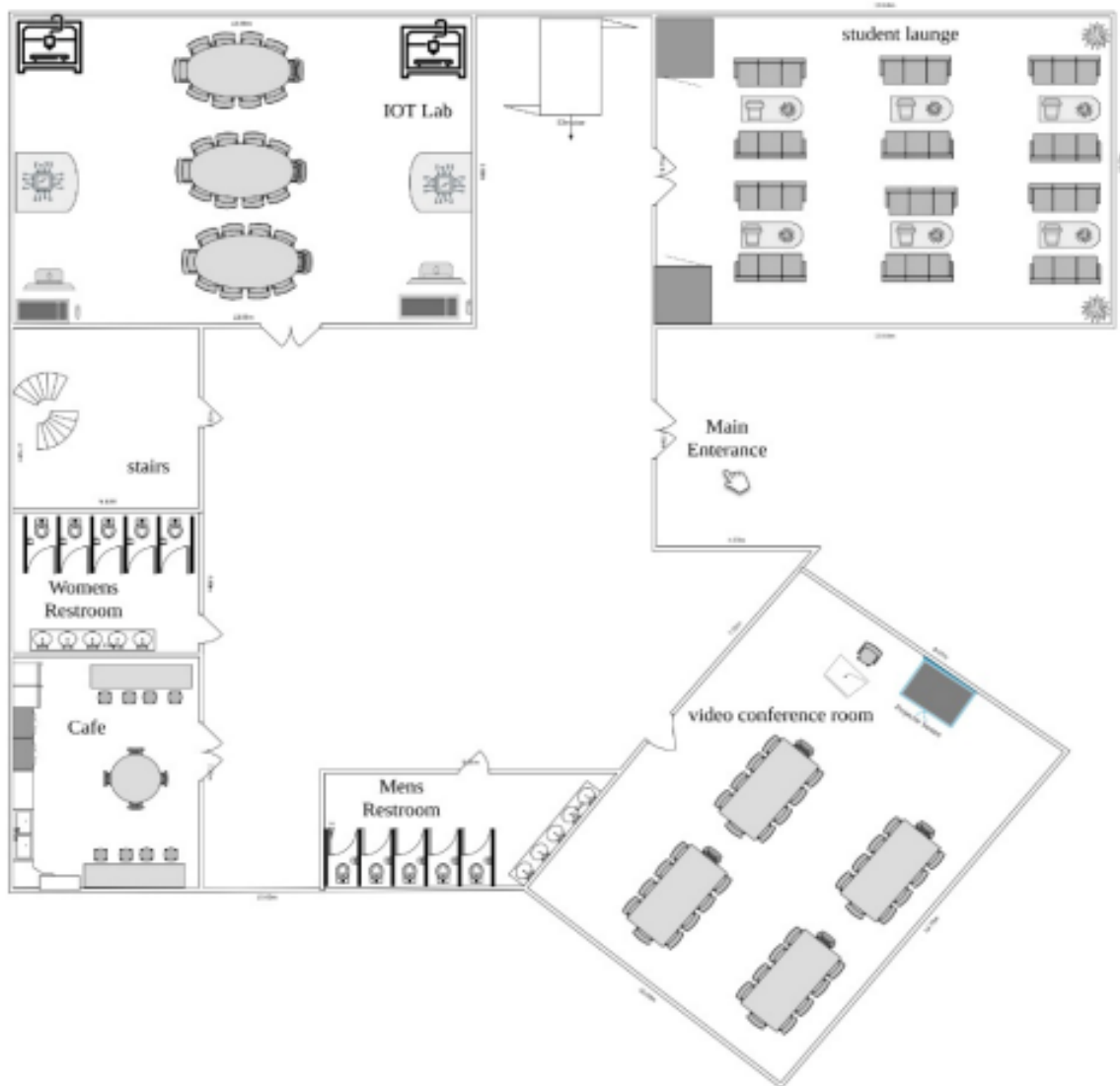
# TASK 1

## Project Setup



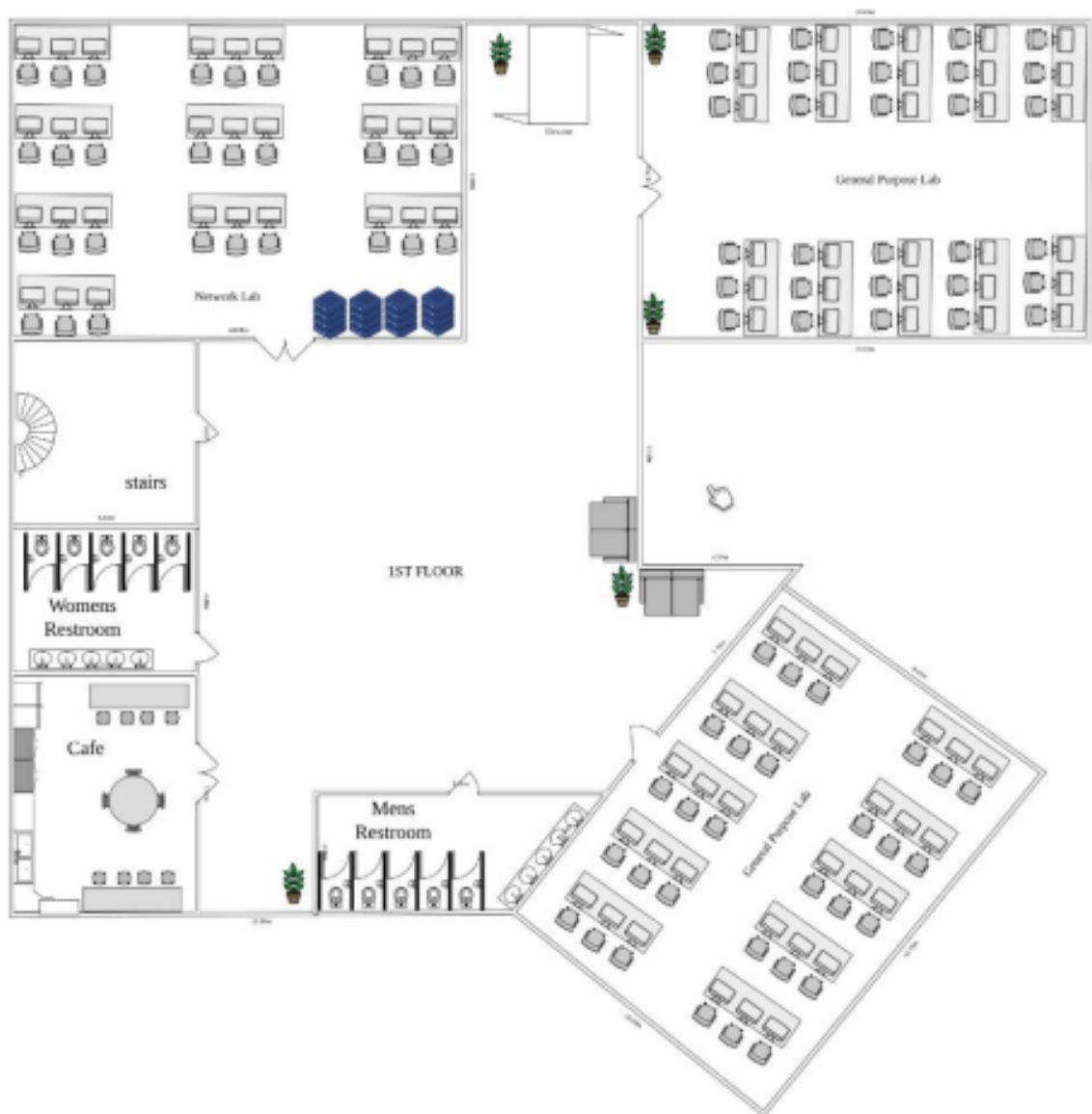
we discussed the case study as well as how to make a floor plan than we decided a we will use lucidchart for creating floor plan each member were assigned their work maysara was assigned with ground floor daniyal was assigned with 1<sup>st</sup> floor and marzouq was responsible for report generating for personal reason Philip was not available for the first part of the project.

## Ground Floor



On the ground floor we have a video conference room with an IOT lab and student lounge. The IOT lab is equipped with 2 3d printers, 30 workstations, 2 circuit board printers and 2 computers. We also have restrooms and café.

## 1st floor



On 1<sup>ST</sup> floor we have 2 general purpose labs with 30 workstations and a network lab with servers inside.

# **TASK 2**

**Initial Design – Preliminary Analysis**

## Meeting Minutes

Meeting was held on 10 November at N28a from 11:00 am to 2:30 pm



### **Task(2): INITIAL DESIGN - PRELIMINARY ANALYSIS**

#### **Part (a),(b):**

First of all , we will provide a few questions to ask the users about the requirements and other information that is necessary to develop a network plan based on the case study.

**(Q1): how many access points does each of the labs require?**

**(A1):** 1200 sq feet requires 1 access point , the labs are 14x10 which is roughly 1600 sq feet , so 2 access points should provide good coverage .

**(Q2):how many switches are needed to future proof the labs?**

**(A2):** In each lab there are 30 workstations and there are 4 labs so  $30 \times 4 = 120$  PC , with a future proofing we need to provide at least 150 ports in total. Lets say each individual switch contains 20 ports ,  $150/20 = 7.5$  . So in total we need at least 8 switches for each lab. Now the staff members require their own ports too. There are 35 staff , let's say each is provided with 2 devices each .  $35 \times 2 = 70 \rightarrow 70/20 = 3.5 = 4$  switches for the staff . In total 12 switches (minimum) .

**(Q3):Future proofing for the IoT devices ?**

**(A3):** we would provide overhead for our access points at 6GHz so we don't need to upgrade them when we upgrade to Wifi 6e , WPA3 protocol will be enabled in the network for wifi 6e.

**(Q4):What type of network would we use in the building?**

**(A4):** actually we will use the (LAN) network in the building which is a local area network .

**(Q6) : Minimum size of data center required to be implemented ?**

**(A6):** At minimum 20 TB of server space must be allocated for  $1200 + 35$  users . The staff will be allocated with 30GBs at minimum and the students will be provided with 15GBs.

**(Q7): How can the distribution layer be implemented ?**

**(A7):** first of all the distribution layer will be aggregating the data received from the access layer switches before it is transmitted to the core layer for routing and in this process we will be using UTP and ethernet for example(RJ-45)connecter and jack.

**(Q8):How many routers are required to support the system ?**

**(A8):** at least 11 to 15 routers because each router will handle 250 device

**(Q9): How many firewalls are required ?**

**(A9):** 4 labs will include 1 firewall each and 1 lounge room with 1 firewall as

well , 1 firewall for the (WAN) wide area network .

**(Q10): How should the firewall be implemented ?**

**(A10):** actually we will be implementing the firewall with software or hardware form for example(Bitdefender BOX,Cisco Firepower,Netgear ProSAFE)

**(Q11): How many access points does the hallway require ?**

**(A11):** the hallway is roughly 2600 sq feet , and a 1200 sq feet room requires 1 access point ,  $2600/1200 = 2.16$  , so to provide the best coverage we need 3 access points.

**Task(2): Determine the feasibility of the project, explain your reasons.**

**Part (C):**

**Economically :**

To determine if it was economically feasible we first performed a Cost Benefit Analysis which produced a positive outcome which is  $CP > 1$ . When they calculated the profitability index using this data and it too turned out positive ,  $PI > 1$ . Thus the project is viable , economically.

# **TASK 3**

**Choosing the Appropriate Lan Devices**

### **a) Research on the different network devices that needed to accomplish the objective**

One of the most crucial decisions for the technology infrastructure is selecting network devices, which will have a lasting impact. It's an option that has to be carefully considered in order to make the appropriate choice straight away and avoid making costly mistakes if you choose the wrong choice. When choosing network equipment, there are some things to take into account:

1. Ease of use - Professors, staff, and students should be able to utilize the devices without difficulty.
2. Compatibility - They should also be compatible and able to connect to a network.
3. Maintenance & installation - they should be simple to install and maintain.

In a LAN or WAN network, data cannot be transported from one computer to another without the use of network equipment including routers, hubs, switches, and more. To enable data communication from one network segment to another, these devices will link all local and remote network segments. Routers and switches are two crucial hardware components for a large network. A well-built, appropriately positioned, and designed computer network can assist lower operating costs and boost performance, manageability, and dependability.

### **b) Decide which LAN devices needed to accomplish the needs as mentioned in the case study**

Hardware components and software components are two categories into which LAN devices can be divided. The hardware components, which include the following, are the most crucial.

1. Workstations and servers
2. Network Interface Card (NIC)
3. Cabling and connectors (Twisted Pair Cable)
4. Hub
5. Switch
6. Router

### **Switches**

After receiving a frame, a switch regenerates every bit of the frame and sends it to the correct destination port. This apparatus divides a network into various collision domains. Switches are typically chosen when connecting devices to a LAN. One or more hubs or switches will be located inside the LAN to link the end devices to it.

A network switch in a network performs the same functions as a hub, with the exception that it is a standalone switch and does not broadcast the data packets across all computers in the network like a hub. A network switch has many ports, including 4, 8, 16, and 24, among others. All of the computers in a wired network are connected to the switch directly by the Ethernet connection. Switches limit traffic to and from each port and provide all connected devices access to the entire available bandwidth. Switch does not support the router-like built-in firewall functionality.

In both packet switching and telephony, infrastructure switches are crucial. They convey the data in the direction of their destination based on the IP address. Data connections form the foundation of how switches work.

## **Routers**

The main hardware needed to connect networks is the router. A router's ports connect to several networks, which are used to route packets. Broadcast domains can be split up by routers. Networks using various technologies are connected via routers as well. Both LAN and WAN interfaces are possible for them. A router will serve as the gateway for each LAN, linking it to other networks.

We must match a router's expandability to its intended use when choosing one. Extra attention must be given while choosing the right kinds of router because they can be used to link various network types. Additionally, the IOS operating system is already embedded into routers.

We decided on network-edge routers because they play a crucial role as more services and applications start to be handled on the network edge of a business rather than in its data center or in the cloud. The management of edge routers can make use of wireless capabilities, which are frequently included into network edge devices, Dynamic Host Configuration Protocol (DHCP) services, and domain name system (DNS) services.

## **Workstations and servers**

A workstation is a personal computer that runs specialized software, such as graphic design, video editing, CAD, 3-D design, or other CPU and RAM-intensive applications. A workstation typically has a top-of-the-line, quick processor, many hard drives, and plenty of RAM memory. A workstation may also feature specialized audio, video, or processing cards for editing tasks. The server is more of a utility device, whereas workstations are sold to technical users by computer makers.

As part of the client-server architecture, a server is an application or device that provides a linked client service. It might also be a computer system set up to run a specific application for the server. A server can also provide users with apps on an intranet.

Even while other users can often still use workstations remotely when necessary, they are typically only meant to be used by one person at a time. The servers that perform the user link

operation typically have zero or one user. UNIX is the preferred operating system for workstations, while FreeBSD, Solaris, and Linux are the most common choices for servers.

## **Network Interface Card (NIC)**

Without a network interface card (NIC), it is not feasible to connect a device to the internet. The circuit board that gives the computer a specialized network connection is inserted during manufacturing. The terms network interface controller, LAN adapter, and network adapter are frequently used to describe it. NIC makes it possible for computers linked to local area networks (LANs) and large-scale networks to communicate via Internet Protocol (IP).

## **Firewall**

A security system designed to prevent unauthorised access to or from a computer network. It operates by examining and blocking incoming or outgoing network traffic based on predetermined security rules. They are used to protect networks from unwanted or malicious traffic, such as malware, hackers, and other forms of cyberattacks. They can be hardware-based or software-based, and are typically placed at the perimeter of a network to monitor incoming and outgoing traffic. Firewalls use a set of rules, also known as policies, to determine what traffic is allowed to pass through and what traffic should be blocked. These policies can be based on various criteria, such as IP addresses, ports, and type of data. Firewalls play a crucial role in ensuring the security and integrity of networks, and are an essential component of any comprehensive security strategy.

## **Cabling and connectors (Twisted Pair Cable)**

Both wired and wireless communications are possible via NIC. NIC is both a physical layer and a data link layer unit, i.e. it provides the hardware circuitry required so that it can operate on the physical layer processes and certain data link layer processes.

Twisted pair cable is a pair of wires running through a flat and lightweight cable. It is lighter than any cables so it is easier to install. It has phone-style plugs at the end of the cable that can easily put into jacks of computer, switches, hub or more

## **c) Information on the devices that have chosen**

## Switches

### **D-Link PoE+ Switch, 24 28 Port Fast Ethernet Managed Web Smart 2 Gigabit**



- Web Smart Switch with 24 10/100Mbps Ports
- For security it can access control list, D-Link Safeguard Engine and Port Security
- Intuitive Management: SmartConsole or Web-Based GUI, Built-in MIB Browser for SNMP, D-View 6.0 Module Support and Compact CLI through Telnet
- support for 802.3af and 802.3at up to 193W
- Fast Ethernet with 4 Gigabit Ethernet ports (including 2 Combo SFP) (24 x PoE ports, smart fans).
- Cost for this switches is around RM500-1500

### **D-Link DGS-1210-10P Smart Gigabit Ethernet Switch 10 port**



- 2 10/100Mbps Fast Ethernet ports
- 2 10/100Mbps copper gigabit ports

- Full/half-duplex support for each port
- Flow control for protection against data loss for each port
- Auto-learning of network configuration
- Secure store and forward switching scheme
- Per port auto correction of reverse twisted pair polarity
- Standard 19 inch rack mount size Non-Blocking and wire speed
- Cost for these switches is around 300 RM-1000.

### **CISCO Four port 10/100/1000 Ethernet switch interface card EHWIC-4ESG**



- 4 x RJ-45 10/100/1000Base-T Network WAN
- 4-Port Gigabit Ethernet Enhanced High-Speed WAN Interface Card
- IEEE 802.1Q VLAN, IEEE 802.1P QoS
- Talnet
- CiscoWorks LAN Management Solution
- Price : 200-500 RM

## Routers

### **business dual wan gigabit vpn router**



- Dual gigabit ethernet WAN ports for load balancing and / or business continuity
- Build-in 4-port gigabit ethernet switch
- Strong security : proven stateful packet inspection (SPI) firewall and hardware encryption
- High-capacity , high-performance
- IP security
- VPN capabilities
- Price : 900-1300 RM

## ORBI PRO WIFI 6 AX6000 TRI-BAND MESH ADD-ON SATELLITE (SXS80)



- Able to cover a wide area
- Allow a large number of connections up to 80 connections
- High performance and easy setup
- High secure connection
- Dedicated portal : to be able to separate the traffic from employees , guests and admins
- tri - band wifi : to maximize the internet speed
- Price : 2500-4000 RM

## Firewall

### FPR1140-NGFW-K9

FPR1140-NGFW-K9 - Cisco Firepower 1000 Series Appliances



Model	FPR1140-NGFW-K9
NGFW	2.2 Gbps
Next-Generation Intrusion Prevention System (NGIPS)	2.2 Gbps
Interfaces	8 x RJ45, 4 x SFP
Form factor (rack units)	1RU
Dimensions (H x W x D)	1.72 x 17.2 x 10.58 in.

<b>Features</b>	<b>1140</b>
Throughput: Firewall (FW) + Application Visibility and Control (AVC) (1024B)	2.2 Gbps
Throughput: FW + AVC + Intrusion Prevention System (IPS) (1024B)	2.2 Gbps
Maximum concurrent sessions, with AVC	400K
Maximum new connections per second, with AVC	22K
Transport Layer Security (TLS)	1 Gbps
Throughput: NGIPS (1024B)	2.2 Gbps
IPSec VPN throughput (1024B TCP w/Fastpath)	1.2 Gbps
Maximum VPN Peers	400
Cisco Firepower Device Manager (local management)	Yes

FPR1140-NGFW-K9 Specification	
NGFW	2.2 Gbps
Next-Generation Intrusion Prevention System (NGIPS)	2.2 Gbps
Dimensions (H x W x D)	1.72 x 17.2 x 10.58 in.
Form factor (rack units)	1RU
Integrated I/O	8 x RJ-45, 4 x SFP
Integrated network management ports	1 x 10M/100M/1GBASE-T Ethernet port (RJ-45)
Serial port	1 x RJ-45 console
USB	1 x USB 3.0 Type-A (500mA)
Storage	1 x 200 GB
Power supply configuration	+12V
AC input voltage	100 to 240V AC
AC maximum input current	< 2A at 100V, < 1A at 240V
AC maximum output power	100W
AC frequency	50 to 60 Hz
AC efficiency	>85% at 50% load
Redundancy	None
Fans	1 integrated fan
Noise	34.2 dBA @ 25C, 56.8 dBA at highest system performance
Rack mountable	Yes. Fixed mount brackets included (2-post).
Weight	8 lb (3.63 kg)
Temperature: operating	32 to 104°F (0 to 40°C)
Temperature: nonoperating	-13 to 158°F (-25 to 70°C)
Humidity: operating	90% noncondensing
Humidity: nonoperating	10 to 90% noncondensing
Altitude: operating	9843 ft (max) 3000 m (max)
Altitude: nonoperating	15,000 ft (max)

## Network Interface Card (NIC)

### TP-Link AX3000 WiFi 6 & Bluetooth 5.2 PCIe Wireless Adapter (PCI-E Wi-Fi Card For Desktop PC) Archer TX55E



- Built in Bluetooth 5.2
- Speeds up to 2400 Mbps (5Ghz)
- 802.11ax 2x2 160 Mhz
- 1024-QAM
- Price - RM 135

- Ultra Fast 10/100/1000 Mbps PCIe
- Supports IEEE 802.3x Flow Control
- Voltage 220
- Wattage 3600
- Price - RM 58

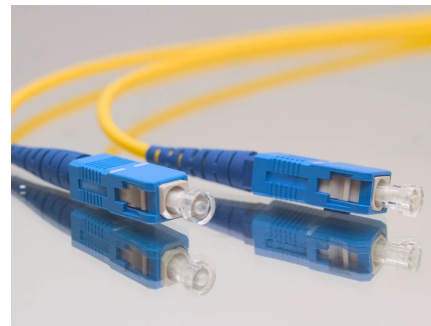
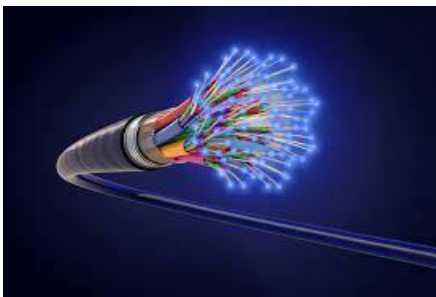
## Cabling and connectors(Twisted Pair Cable)

### EZ RJ45 CAT6 connector with 3U gold RJ45 pass through connector



- 250V AC max at 2 amps.
- Dielectric withstanding 500 volts AC.
- Insulation Resistance: 500 megaohms.
- Termination Resistance: 35 megaohms.
- Cable-to-plug tensile strength-20lbs ( 89N ) min.
- 500 mating cycles
- Price 200 - 400 RM

### Fiber Optic Cable



- **Bigger bandwidth** :Older metal data cables, primarily made of copper, offer a relatively low bandwidth in comparison to fiber optics. Initially, voice signals that do not require nearly as much bandwidth for mass data transfer as is currently required by many modern applications were intended to be transmitted using copper-type communication wiring.
- **faster speed**: Fiber optic cables have a substantial speed advantage over other data transfer methods since information is transmitted primarily through light signals. In this regard, fiber typically outperforms even high-grade (Cat5 or Cat6) copper cables' expected output by a significant margin.
- **Longer distance** : Due to their low rate of signal power loss and lightning speed, fiber optic cables can transmit signals over much greater distances than traditional types of cabling. According to conventional estimates, copper cables can only transmit signals of reasonable quality 328 feet away. In contrast, some single fiber optics can transmit signals hundreds of kilometers away with the correct materials, signal shape (wavelength), and network setup.
- Higher resistance

- High security
- **Interface:** Fiber optics have much better interference protection than traditional metal cable types because they do not actually carry an electrical signal. This improves their capacity to send data over far greater distances without suffering significant signal loss.
- Price : 25-30 RM per meter .

### Workstations and servers



Network Interface Card (NIC)

**HPE Z1 G5 i7-9700 8G 1TB SATA Integrated Graphics DVDRW-HPE Z Series**

**Workstation**

**MAIN SPECS:**

- Operating System: Windows 10 Pro
- Processor: Intel Core i7-9700 Processor, 3.0 GHz, up to 4.8 GHz with Intel Turbo Boost technology, 12 MB cache, 8 cores, Intel UHD Graphics 630, Supports Intel vPro technology
- Memory: 8GB RAM, 1TB SATA
  - set display
  - DVDRW

**PRICE/PCS (RM): 4,145.64**

**QUANTITY NEEDED: 124**

**TOTAL**

**AMOUNT (RM): 514,059.36**

## Server



### Dell PowerEdge T30

#### **MAIN SPECS:**

- **CPU: Intel Xeon E3-1225 v5 Graphics: Intel HD Graphics P530 RAM: 64GB**
- **Storage: Up to six SATA HDD**
- **Connectivity: 10 x USB ports, HDMI, DisplayPort, VGA, serial, PS2, Gigabit Ethernet**

**PRICE/PCS (RM): 3540.40**

**QUANTITY NEEDED: 4**

#### **TOTAL**

**AMOUNT (RM): 14,161.60**

### **Fast and Smooth Networking**

With data transfer speeds of up to 2000 Mbps on Gigabit Ethernet, the D-Link DGS-108 8-Port Gigabit Desktop hub is ideal for all types of networking tasks. Support for 802.3x Flow Control means smoother network traffic, resulting in an overall boost in performance and reliability. Featuring QoS, the DGS-108 prioritizes network traffic by type so that time sensitive data is delivered efficiently, even during bursts of high data traffic.

### **Versatile Business-friendly Features**

The DGS-108 features front, easy-to-access Ethernet ports with two color LED indicators per port to easily distinguish link status. Cable Diagnostics simplifies

troubleshooting for defective network cables at a glance of the LED panel and plug-and-play lets administrators quickly connect the hub to devices with no hassles. Additionally, the DGS-108 features a Kensington Security Slot on the rear panel where users can fasten the unit to a shelf or desk so the device won't be accidentally moved or stolen.

### **Conserve Energy**

The 8-Port Gigabit Desktop hub features D-Link's Green Technology to save energy and reduce heat, which in turn extends product life without sacrificing performance or functionality.

The hub supports IEEE 802.3az Energy-Efficient Ethernet (EEE) which cuts down on power consumption during periods of low data activity, and will proceed to put the unused port into sleep mode, saving a substantial amount of power. In addition, the switch can also save energy by detecting the length of cable connected to a port and using as little power as possible. Both of these features work together to help you save power automatically.

### **Environmentally-friendly**

QoS prioritizes network traffic so that time-sensitive data is delivered efficiently, even during bursts of high data traffic.

### **Environmentally Friendly**

The 8-Port Gigabit Desktop hub was designed with the environment in mind. It is compliant with Energy Star Level VI, CEC, and MEPS regulations which require the use of energy efficient power adapters. The switch is built to comply with RoHS standards to

minimize use of hazardous materials and is packaged with an Energy Star Level VI qualified power adapter in a recyclable packaging making this product truly environmentally friendly.

**PRICE/PCS (RM): 120**

**QUANTITY NEEDED: 20**

**TOTAL**

**AMOUNT (RM): 2400**

<b>DEVICES</b>	<b>QUANTITY</b>	<b>PRICE/PCS (RM)</b>	<b>TOTAL PRICE (RM)</b>
<b>Router</b>	<b>6</b>	<b>5,900</b>	<b>35,400</b>
<b>Switches (48 ports)</b>	<b>4</b>	<b>3,000</b>	<b>12,000</b>
<b>Hub (8 ports)</b>	<b>20</b>	<b>120</b>	<b>2400</b>
<b>Server</b>	<b>4</b>	<b>3540.40</b>	<b>14,161.60</b>
<b>Cables and connectors</b>	<b>176</b>	<b>250</b>	<b>44,000</b>
<b>Workstation</b>	<b>124</b>	<b>4,145.64</b>	<b>514,059.36</b>
<b>NIC Wifi</b>	<b>124</b>	<b>135</b>	<b>16,740</b>
<b>NIC Ethernet</b>	<b>124</b>	<b>58</b>	<b>7,192</b>
<b>Total</b>			<b>645,952.96</b>
<b>Budget</b>			<b>1,000,000</b>

Balance	354,047.04
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## References

<https://www.amazon.com/malaysia/s?k=malaysia>

[https://www.cisco.com/c/en\\_my/index.html](https://www.cisco.com/c/en_my/index.html)

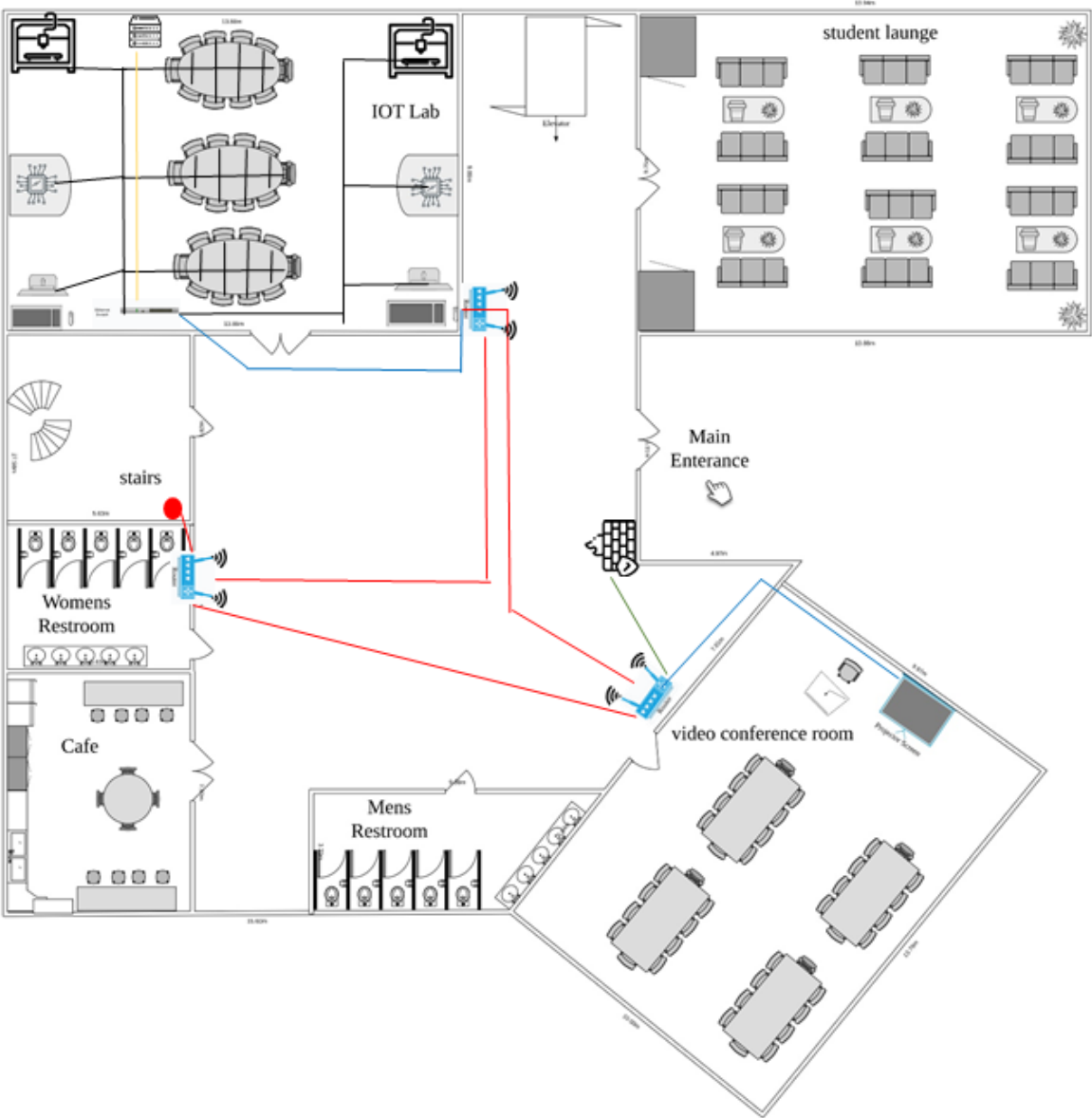
<https://www.lazada.com.my/>

<https://www.amazon.sg>

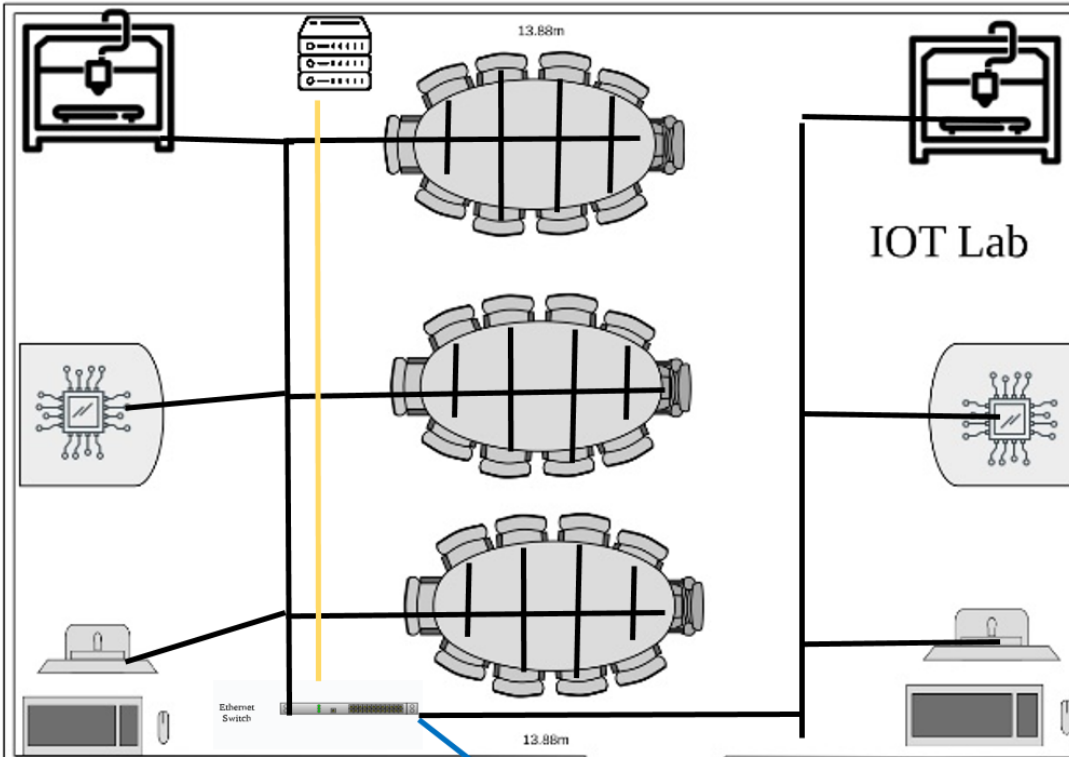
# **TASK 4**

## **Making the Connections**

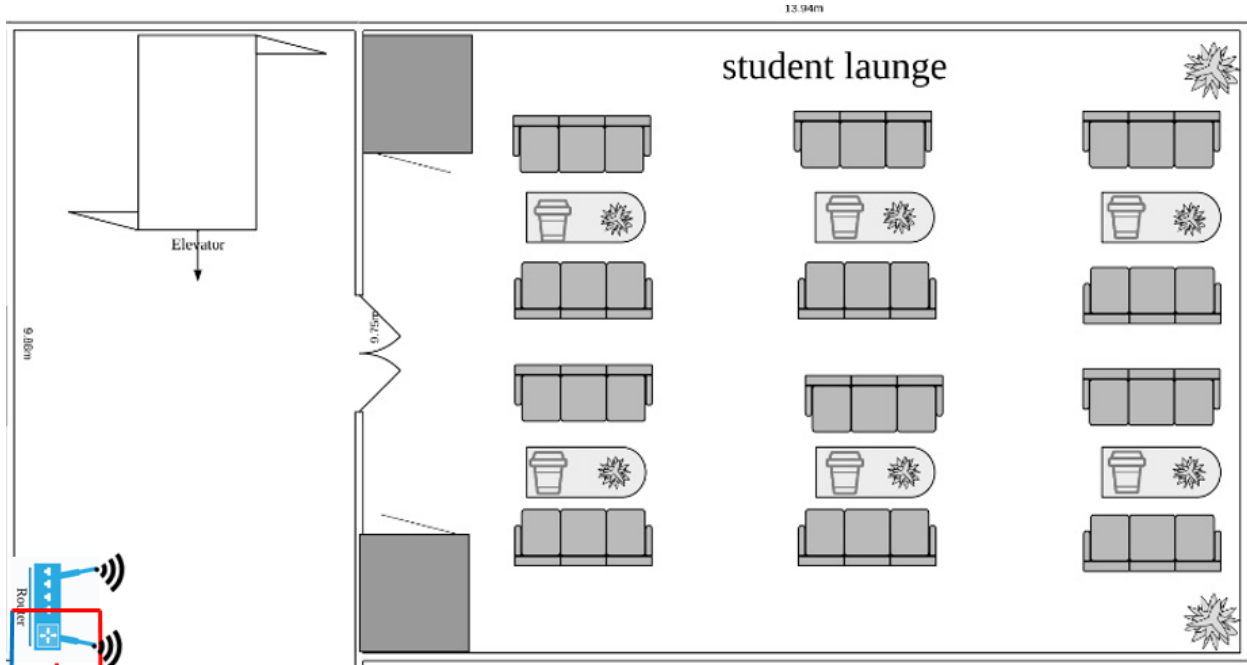
# GROUND FLOOR:-



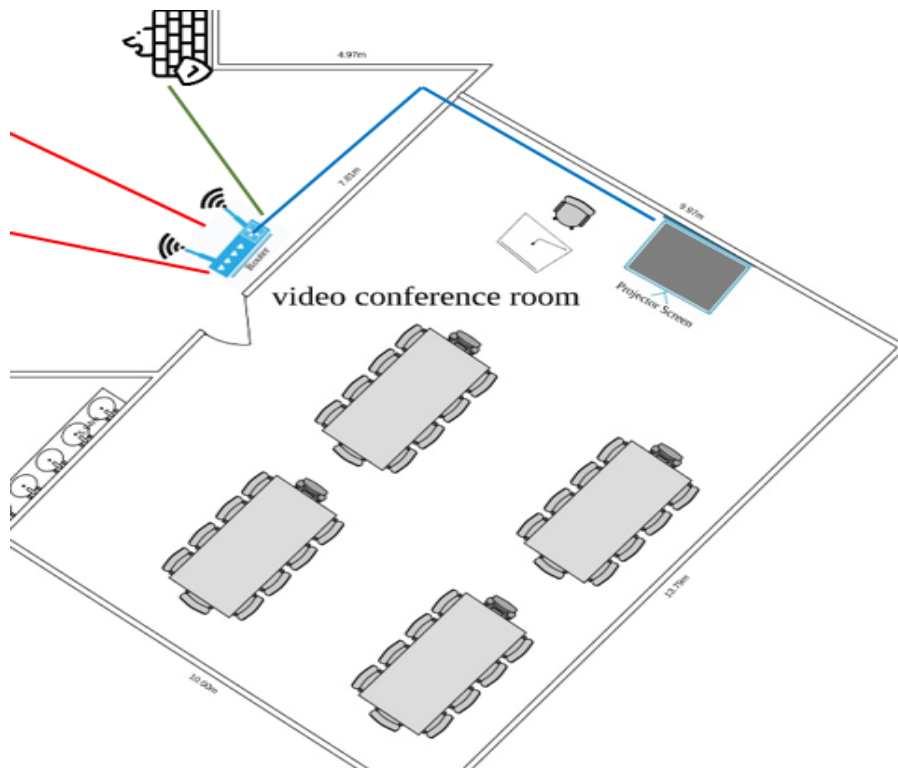
## IOT Lab :-



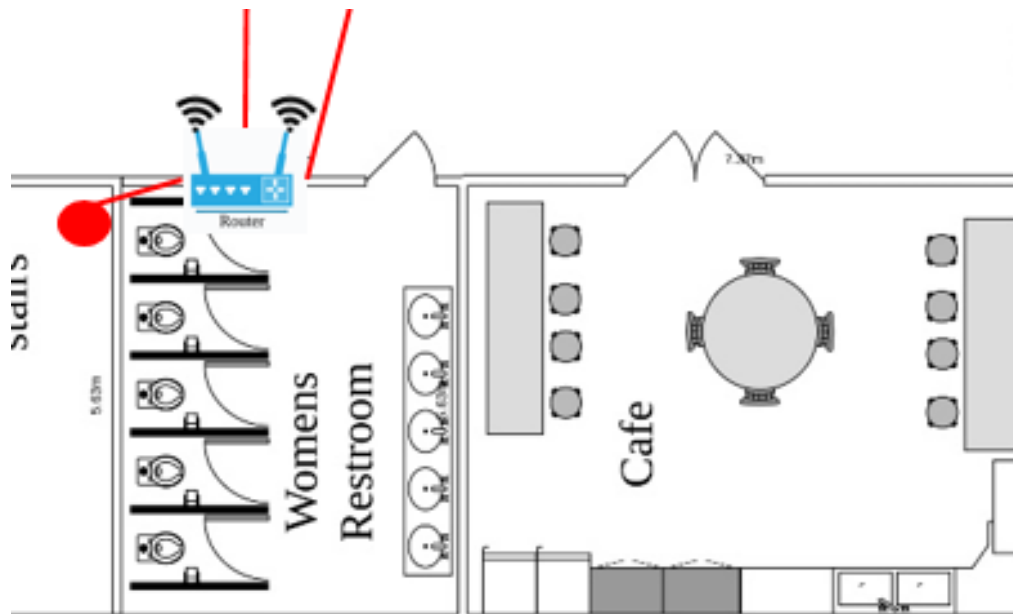
## Student Lounge:



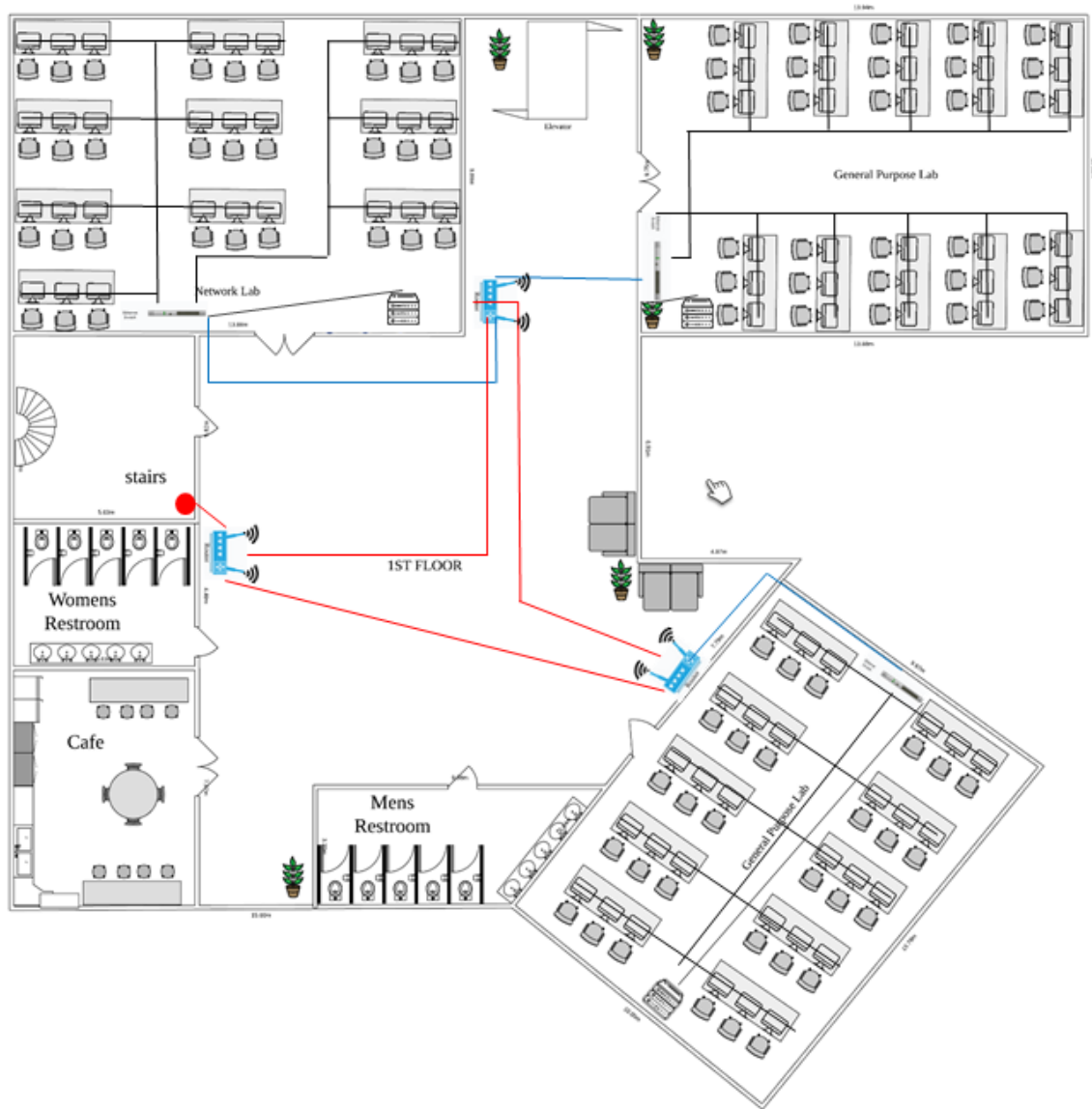
## Video Conference Room:-



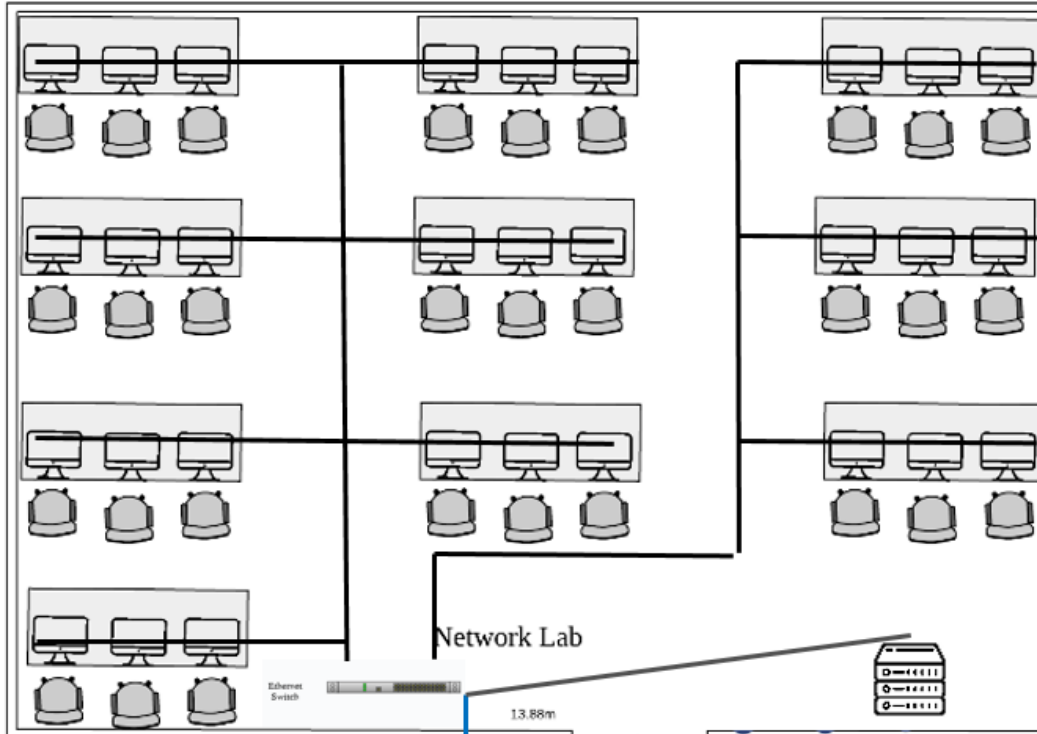
## Cafe Ground Floor:



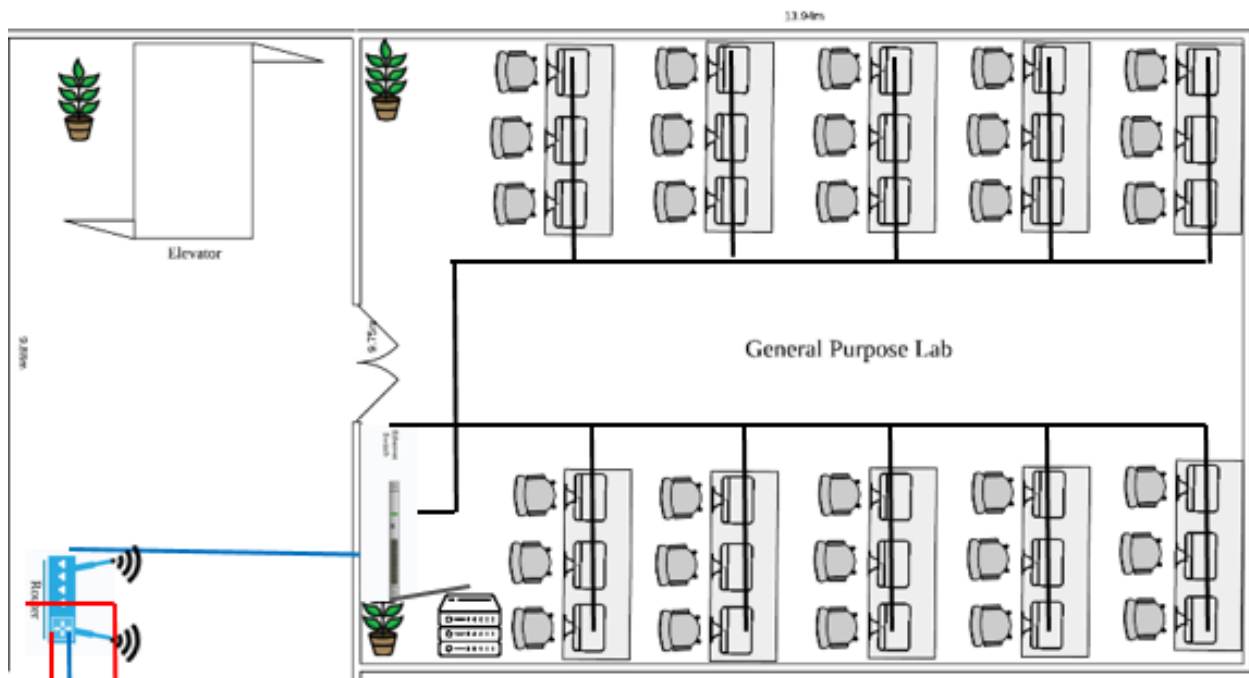
1ST FLOOR:



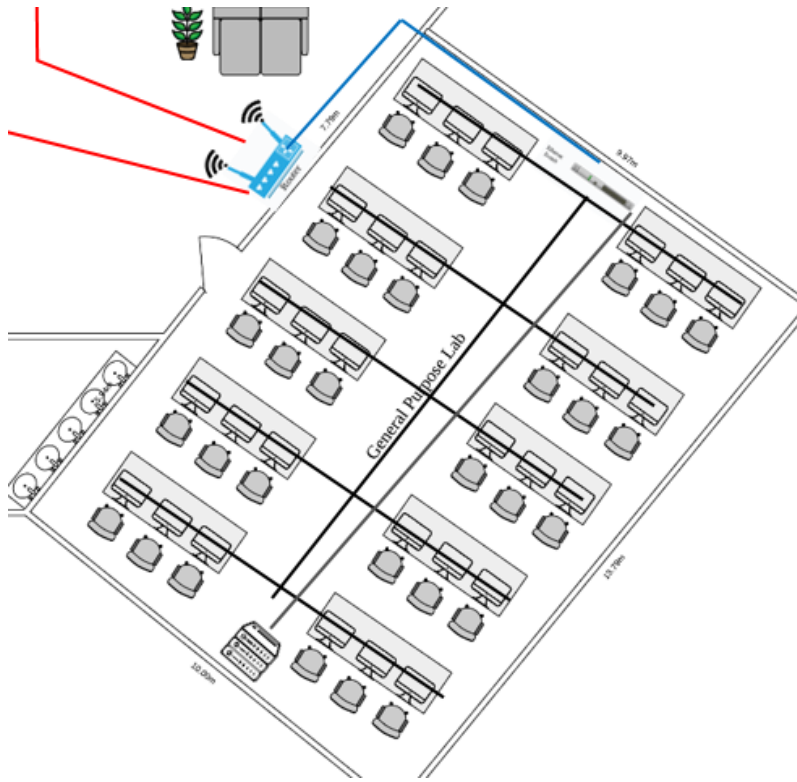
Network Lab :



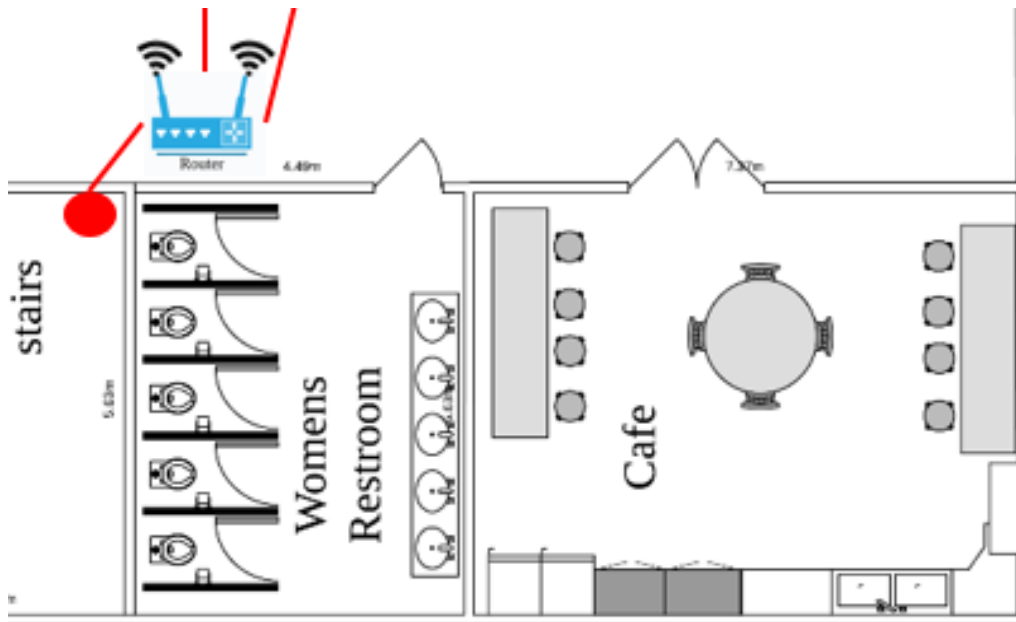
General Purpose Lab 1:



General Purpose Lab 2:



Cafe 1st Floor :-



b) How many connections, patch cords and switch ports have you determined you need?

<i>Lab</i>	<i>Workstation</i>	<i>Cables</i>	<i>Switches</i>	<i>Cable type</i>	<i>Connection type</i>
General purpose	30	30	1		Horizontal
General purpose	30	30	1		Horizontal
IOT	30	30	1		Horizontal
Network	30	30	1		Horizontal
1st Hallway Router & 2nd Hallway Router					Vertical
Total	120	120	4 (48 ports each)		2 Types

c) Identify cable types and length.

Source	Destination	Cable	Length (meters)
Ground Floor			
UTM ISP	Firewall	Optic fiber	Depends on the location
Firewall	Conf-Router	Optic fiber	6
Conf-Router	IOT-Router	Optic fiber	15
Conf-Router	Hallway-Router-1	Optic fiber	15
Hallway-Router-1	IOT-Router	Optic fiber	15
Hallway-Router-1	Hallway-Router-2	Optic fiber	10
Conf-Router	Conf-Projector	Twisted-Pair	8
IOT-Router	Switch-IOT	Twisted-Pair	6
Switch-IOT	30* IOT-WorkStation	Twisted-Pair	4-16
Switch-IOT	IOT-Server	Twisted-Pair	14
First Floor			
Hallway-Router-2	Network-Router	Optical fiber	15
Hallway-Router-2	General-Purpose	Optical fiber	15
Network-Router	General-Purpose	Optical fiber	15

Network-Router	Network-Switch	Twisted-Pair	6
Network-Router	General-1-Switch	Twisted-Pair	6
General-Purpose	General-2-Switch	Twisted-Pair	6
Network-Switch	Network-Server	Twisted-Pair	6
General-1-Switch	General-1-Server	Twisted-Pair	2
General-2-Switch	General-2-Server	Twisted-Pair	8
Network-Switch	30* Netw-WorkStation	Twisted-Pair	4-16
General-1-Switch	30* Gene-WorkStation	Twisted-Pair	4-16
General-2-Switch	30* Gene-WorkStation	Twisted-Pair	4-16

# TASK 5

## IP Addressing Scheme

Group : Innovators

192.16.0.0/8

The Network address allocated to us is 192.16.0.0 which allows for up to 16,777,214 hosts to be allocated. We also have 8 subnets which means our borrowed bits are  $2^4 = 0000 - 1111$

IP Address:	192.16.0.0
Network Address:	192.0.0.0
Usable Host IP Range:	192.0.0.1 - 192.255.255.254
Broadcast Address:	192.255.255.255
Total Number of Hosts:	16,777,216
Number of Usable Hosts:	16,777,214
Subnet Mask:	255.0.0.0
Wildcard Mask:	0.255.255.255
Binary Subnet Mask:	11111111.00000000.00000000.00000000
IP Class:	A
CIDR Notation:	/8
IP Type:	Public
Short:	192.16.0.0 /8
Binary ID:	11000000000100000000000000000000
Integer ID:	3222274048
Hex ID:	0xc0100000
in-addr.arpa:	0.0.16.192.in-addr.arpa
IPv4 Mapped Address:	::ffff:c010.00
6to4 Prefix:	2002:c010.00::/48

Subnet	Room	Borrowed Bits
0	IOT Labs	0000
1	Video Conference Room	0001
2	Student Lounge	0010
3	GF - CAFE	0011
4	Network Lab	0100
5	General Lab 1	0101
6	General Lab 2	0110
7	1F - CAFE	0111
10-16	Future use (dynamically)	1000 - 1111

**Table 1 : Determine the subnet**

### Obtaining a block of addresses

192.16.0.0/8 - 11111111.00010000.00000000.00000000

Subnet#0= 192.0.0.0/8

1111 1111.0000 0000.0000 0000.0000 0000  
 1111 1111.0000 0000.0000 0000.1111 1111

Subnet#1= 192.1.0.0/8

1111 1111.0000 0001.0000 0000.0000 0000  
 1111 1111.0000 0001.0000 0000.1111 1111

Subnet#2= 192.2.0.0/8

1111 1111.0000 0010.0000 0000.0000 0000  
1111 1111.0000 0010.0000 0000.1111 1111  
Subnet#3= 192.3.0.0/8

1111 1111.0000 0011.0000 0000.0000 0000  
1111 1111.0000 0011.0000 0000.1111 1111

Subnet#4= 192.4.0.0/8

1111 1111.0000 0100.0000 0000.0000 0000  
1111 1111.0000 0100.0000 0000.1111 1111

Subnet#5= 192.5.0.0/8

1111 1111.0000 0101.0000 0000.0000 0000  
1111 1111.0000 0101.0000 0000.1111 1111

Subnet#6= 192.6.0.0/8

1111 1111.0000 0110.0000 0000.0000 0000  
1111 1111.0000 0110.0000 0000.1111 1111

Subnet#7= 192.7.0.0/8

1111 1111.0000 0111.0000 0000.0000 0000  
1111 1111.0000 0111.0000 0000.1111 1111

***Now we will divide the IP addresses according to our floor plan***

### **1. First Floor**

- 1 Lab ( 30 x 2 = 60 host)

- Video Conference hall (1 host)
  - (other will be dynamically allocated 192.1.0.2 - 192.1.255.255)
- Student Lounge ( 36 hosts)
- Cafe (12 host)

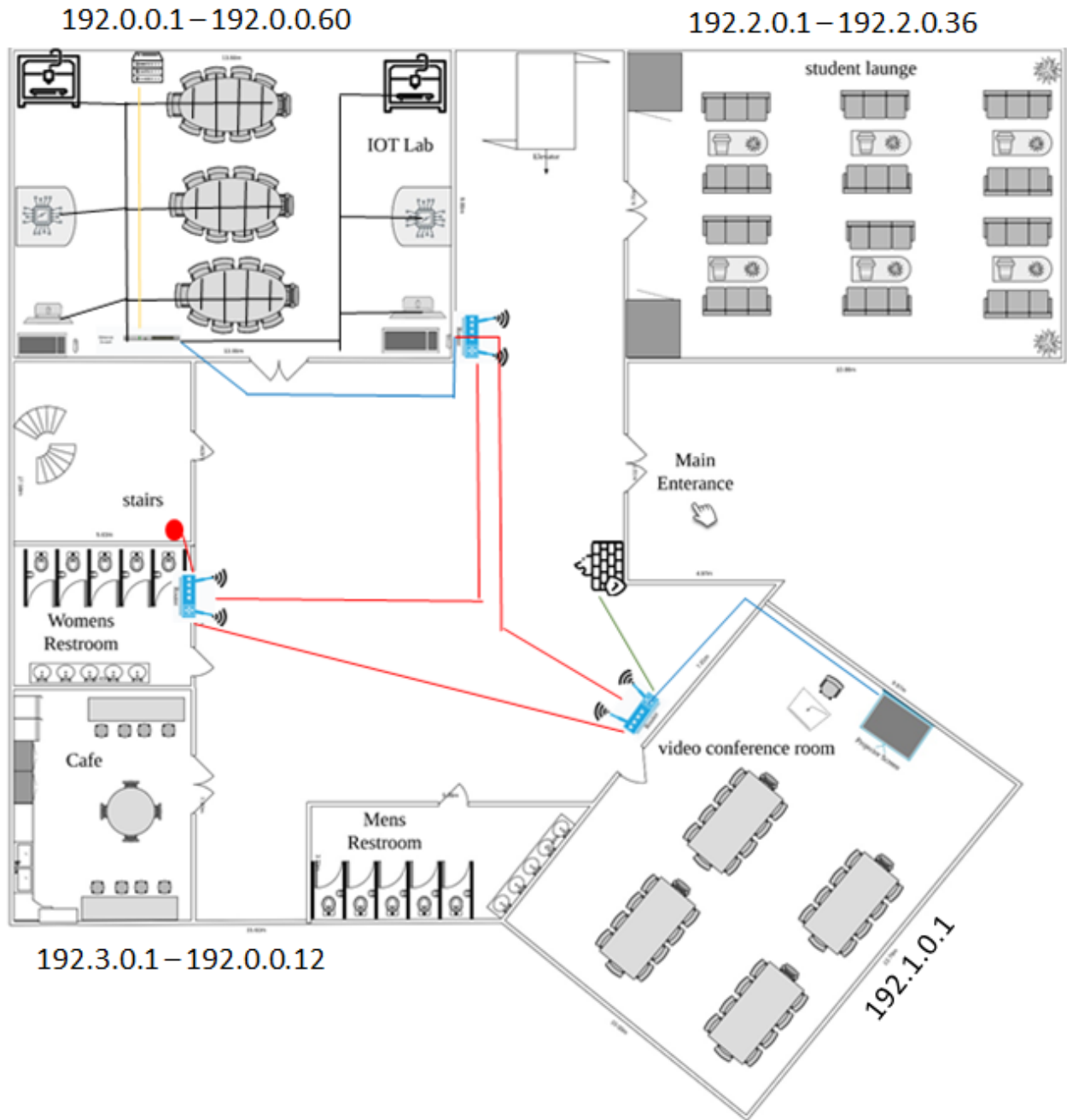
## 2. Second Floor

- 3 Lab ( 30 x 2 x 3 = 180 host)
- Cafe (12 hosts)

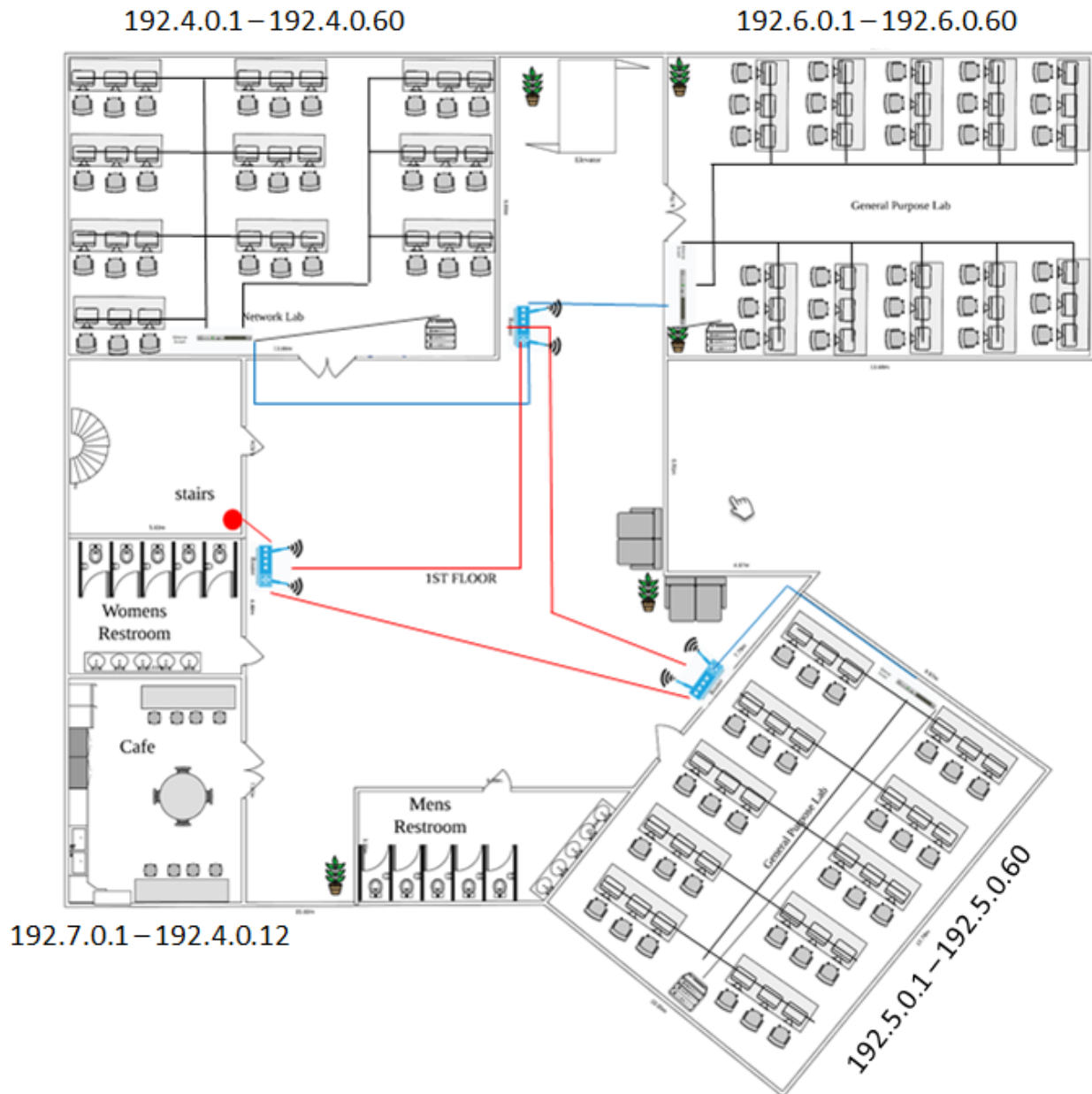
Room	Subnet	Network Address	Broadcast Address	IP Address Range
IOT lab	0	192.0.0.0	192.0.0.61	192.0.0.1 - 192.0.0.60
Video Conference	1	192.1.0.0	192.1.0.2	192.1.0.1
Student Lounge	2	192.2.0.0	192.2.0.37	192.2.0.1 - 192.2.0.36
CAFE	3	192.3.0.0	192.3.0.13	192.3.0.1 - 192.3.0.12
Network Lab	4	192.4.0.0	192.4.0.61	192.4.0.1 - 192.0.0.60
General Lab 1	5	192.5.0.0	192.5.0.61	192.5.0.1 - 192.0.0.60
General Lab 2	6	192.6.0.0	192.6.0.61	192.6.0.1 - 192.0.0.60
CAFE	7	192.7.0.0	192.7.0.13	192.7.0.1 - 192.7.0.12

**Table 2 : IP addressing table**

# Ground Floor



## First Floor



**A compiled solution of Task 1-5**

The following table acts as a summary for our subnetting process.

Subnet	Room	Borrowed Bits
0	IOT Labs	0000
1	Video Conference Room	0001
2	Student Lounge	0010
3	GF - CAFE	0011
4	Network Lab	0100
5	General Lab 1	0101
6	General Lab 2	0110
7	1F - CAFE	0111
10-16	Future use (dynamically)	1000 - 1111

**Table 1 : Determine the subnet**

Room	Subnet	Network Address	Broadcast Address	IP Address Range
IOT lab	0	192.0.0.0	192.0.0.61	192.0.0.1 - 192.0.0.60
Video Conference	1	192.1.0.0	192.1.0.2	192.1.0.1
Student Lounge	2	192.2.0.0	192.2.0.37	192.2.0.1 - 192.2.0.36
CAFE	3	192.3.0.0	192.3.0.13	192.3.0.1 - 192.3.0.12
Network Lab	4	192.4.0.0	192.4.0.61	192.4.0.1 - 192.0.0.60
General Lab 1	5	192.5.0.0	192.5.0.61	192.5.0.1 - 192.0.0.60
General Lab 2	6	192.6.0.0	192.6.0.61	192.6.0.1 - 192.0.0.60
CAFE	7	192.7.0.0	192.7.0.13	192.7.0.1 - 192.7.0.12

**Table 2 : IP addressing table**

## **Reflection**

The team has learned new things while they worked on job 5, particularly about the IP addressing system, which is essential for ensuring that every host can join the network without encountering address conflicts. Using packet tracer, we may learn about each device's IP address without conflicting with the addresses provided in the inquiry. We will be able to distribute the IP addresses with ease if we implement creating the work area for the labs and addressing the IP address in each host by using the timetable on the report.

## **Conclusion**

As a result, the group has successfully completed the assigned duties, and this experience has been a wonderful introduction to the world of networking. In each of the numerous stages the Students are required to research outside of the classroom and think critically about their answers for the assignment. Along with the success of the project, we gained a lot of knowledge about group collaboration. Although it's not always sunny and warm throughout, it teaches a lot about making compromises and tolerating one another. It also emphasizes the value of working as a team to accomplish a shared objective. Moving ahead, it should be noted that the team's communication needs to be improved. Without face-to-face communication, it is evident that information is frequently received incorrectly and that one's effort may not be in line with another's vision. Fortunately, the team was able to find solutions to most of the issues and still effectively collaborate to complete the project. A word of appreciation for the lectures that have guided and taught us throughout the course will never be enough, and we hope that the information will be useful in the future and help us develop our professions.

## **Extra Information Regarding Project process for Clients**

As far as we are aware, modern technology, particularly the Internet, has reached its pinnacle of advancement. Technology now plays a significant role in our ability to connect with one another and with our communities. These days, Internet connectivity has progressed beyond only giving us access to the web to running intricate infrastructure. In order to give them a better performance of the outcome, our group would like to advise that the School of Computing be willing to spend more money. We are confident that this initiative will be extremely beneficial to not just the School of Computing but also the Faculty of Engineering and Universiti Teknologi Malaysia (UTM).

Even though the project solutions provided in this report are valid and usable, they are not the best that we can do. Because technology scales and evolves so quickly, it is critical to invest a lot of money and get a bit more specs than you think you need. This is the case with computers; due to our limited budget, the consultant can only recommend a basic specification that will perform most tasks today but will have questionable performance in the future. Increasing the budget will provide the client with better equipment that will perform much better in the future. Furthermore, if our group is successful in providing and carrying out this project, it will be a significant contribution to the Universiti Teknologi Malaysia (UTM) community because it will make UTM the first university in Malaysia to offer and supply their students with one of the best services available. As a result, in order to provide our client, the School of Computing, with a higher quality and performance of the outcome, we believe that spending a little more on this project would benefit the Universiti Teknologi Malaysia (UTM) community, particularly the students, by providing them with the best service.

### **Team Members and responsibilities.**

<b><i>Task</i></b>	<b><i>Responsibilities</i></b>	<b><i>Member</i></b>
<b><i>Task 1</i></b>	Floor 1 Design	<b>MAYSARA &amp; PHILIP</b>
	Floor 2 Design	<b>DANIYAL &amp; MARZOUQ</b>
<b><i>Task 2</i></b>	Finding Questions	<b>MARZOUQ</b>
	Answering Q1 & Q2 & Q3 & Q4	<b>DANIYAL &amp; MAYSARA</b>
	Answering Q5 & Q6 & Q7	<b>DANIYAL &amp; MARZOUQ</b>
	Answering Q8 & Q9 & Q10	<b>MAYSARA &amp; PHILIP</b>
	Feasibility	<b>DANIYAL</b>
<b><i>Task 3</i></b>	Find Needed Equipment	<b>MAYSARA &amp; PHILIP</b>

	Workstations PC & Monitors	<b>DANIYAL &amp; MARZOUQ</b>
	Keyboards & Mouses & Headphones & Projectors	<b>MAYSARA</b>
	Networking Equipment & UPS & TVs	<b>DANIYAL</b>
<b>Task 4</b>	Network Subareas	<b>DANIYAL &amp; MARZOUQ</b>
	Floor 1 Connections	<b>MAYSARA</b>
	Floor 2 Connections	<b>PHILIP</b>
	Redesign of IOT Lab	<b>DANIYAL &amp; MARZOUQ</b>

<b>Task 5</b>	Decide on the Number of subnet	<b>DANIYAL &amp; MARZOUQ</b>
	Subnet the 1 <sup>st</sup> Floor	<b>MAYSARA &amp; PHILIP</b>
	Subnet the 2 <sup>nd</sup> Floor	<b>MAYSARA &amp; PHILIP</b>
<b>Task 6</b>	Introduction	<b>MAYSARA</b>
	Project Background and Overview	<b>MAYSARA &amp; PHILIP</b>
	Table of Figures	<b>DANIYAL &amp; MARZOUQ</b>
	Compiled Solutions of Tasks 1-5	<b>MARZOUQ</b>
	Conclusion Minute Meeting	<b>PHILIP &amp; DANIYAL &amp; MARZOUQ &amp; MAYSARA</b>

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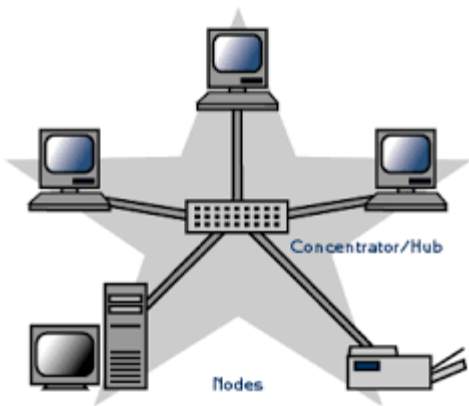
## Appendices

### A. Glossary of Technical Terms

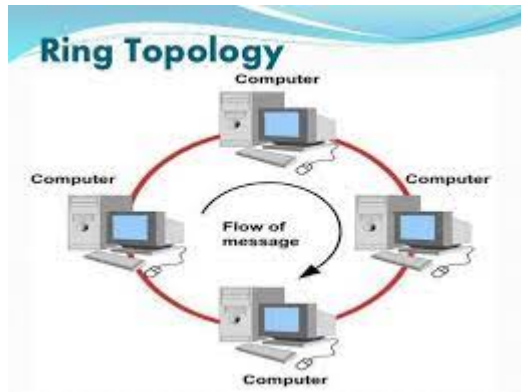
1. **Bandwidth:** the amount of data that can be transmitted over a network in a given time period.
2. **Latency:** the time delay between sending a request and receiving a response over a network.
3. **Network Protocol:** a set of rules that govern the communication between devices on a network.
4. **Firewall:** a network security system that monitors and controls incoming and outgoing network traffic based on predetermined security rules.
5. **Antivirus Software:** a program designed to prevent, detect, and remove malicious software (malware) on a computer or network.
6. **Encryption:** the process of encoding information so that it can only be accessed by authorized parties.
7. **Access Control:** the process of restricting access to resources, such as files, networks, and devices, based on predefined rules and policies.
8. **Quality of Service (QoS):** the guarantee of a certain level of performance and reliability for a network service, such as bandwidth and latency.

### B. Sample Network Diagrams

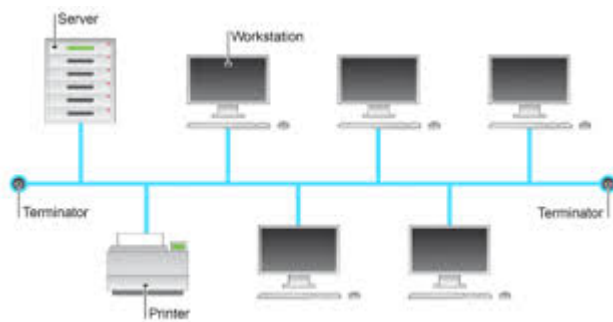
1. **Star Topology**



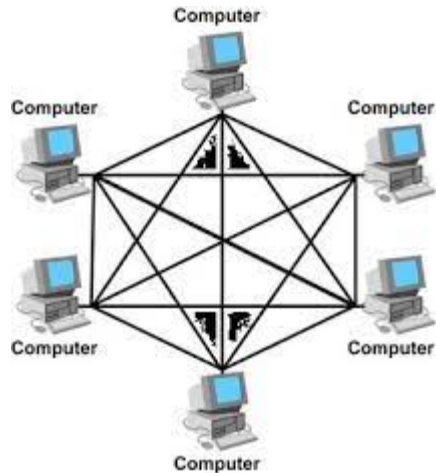
## 2. Ring Topology



## 3. Bus Topology



## 4. Mesh Topology



## C. Additional Resources

### 1. Books

- "Networking Fundamentals" by J.F. Kuo
- "Computer Networks" by A.S. Tanenbaum

### 2. Websites

- [www.howtogeek.com/computer-networks/](http://www.howtogeek.com/computer-networks/)
- [www.cisco.com/c/en/us/support/docs/networking/index.html](http://www.cisco.com/c/en/us/support/docs/networking/index.html)
- [www.techopedia.com/definition/27355/network](http://www.techopedia.com/definition/27355/network)

## D. Technical Specifications

### Network Hardware:

#### 1. Routers:

- A router is a networking device that forwards data packets between computer networks.
- Key specifications to consider when choosing a router include the number of LAN and WAN ports, Wi-Fi standards supported, security features, and the type of antenna.
- Routers also typically offer features such as parental controls, Quality of Service (QoS), and VPN support.

#### 2. Switches:

- A switch is a networking device that connects devices together on a computer network by using packet switching to forward data to its destination.
- Key specifications to consider when choosing a switch include the number of ports, speed, and management features.
- Switches may also support Power over Ethernet (PoE) for powering network devices such as cameras or phones.

#### 3. Modems:

- A modem is a device that modulates and demodulates analog signals to provide internet connectivity.
- Key specifications to consider when choosing a modem include the network standard supported, download and upload speeds, number of Ethernet ports, and voice support.

## Networking Software:

### 1. Operating Systems:

- Operating systems provide a platform for running applications and services on a computer or server.
- Key specifications to consider when choosing an operating system for networking purposes include the hardware requirements, networking features such as DHCP and VPN, and the version of the operating system.

### 2. Network Configuration Software:

- Network configuration software is used to manage and configure networking devices such as routers and switches.
- Key specifications to consider when choosing network configuration software include the type (e.g. web-based or desktop), features offered (e.g. IP address management, network monitoring), and platforms supported.
- Network configuration software may be licensed commercially or be open source.

## Other Network Components:

### 1. Network Interface Cards (NICs):

- A NIC is a hardware component that provides a computer with the ability to connect to a network.
- Key specifications to consider when choosing a NIC include the speed, number of ports, and supported standards such as Ethernet.

### 2. Firewalls:

- A firewall is a network security system that monitors and controls incoming and outgoing network traffic based on predetermined security rules.
- Key specifications to consider when choosing a firewall include the type (e.g. hardware or software), level of security offered, and compatibility with other network components.

### 3. Wireless Access Points (WAPs):

- A WAP is a networking device that allows wireless devices to connect to a wired network.
- Key specifications to consider when choosing a WAP include the number of ports, Wi-Fi standards supported, and security features.

## E. Detailed Step-by-Step Instructions

### 1. Setting up a physical network:

- a. Gather the required hardware components: switches, routers, Ethernet cables, and access points.
- b. Connect devices using Ethernet cables or access points, following the recommended network topology.
- c. Assign IP addresses to each device, configure subnets, default gateways, and DNS servers.
- d. Verify network connectivity by pinging devices from each other.

### 2. Securing a network:

- a. Install a firewall appliance or software to block unauthorized access.
- b. Install antivirus software on all devices to protect against malware.
- c. Enable encryption for data transmission to secure sensitive information.
- d. Set up user accounts with permissions to control access to network resources.

3. Optimizing network performance:

- a. Allocate bandwidth to different applications based on their priority using bandwidth management.
- b. Reduce network latency by optimizing routing and avoiding congestion.
- c. Set up Quality of Service (QoS) rules to prioritize critical network traffic.
- d. Continuously monitor network performance and troubleshoot any issues that arise.

4. Managing network devices:

- a. Backup device configurations regularly to protect against data loss.
- b. Keep network devices and software up-to-date with the latest security patches and firmware updates.
- c. Monitor network usage and performance to identify and resolve issues.
- d. Plan for network expansion and upgrades to accommodate future needs.