
UTM

UNIVERSITI TEKNOLOGI MALAYSIA

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**FACULTY OF COMPUTING**

**SECR1213-06**

**TASK 6A:**

**NETWORK DESIGN FOR SCHOOL OF COMPUTING BLOCK N28B**

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**Course Code:** SECR1213

**Section:** 06

**Lecturer:** Assoc. Prof. Dr. Mohd Murtadha bin Mohamad

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**REPORT ABSTRACT**

This report documents our results and findings about the project's primary objective, which is to create and design a network. Our team is given the case study of planning a new building for the School of Computing dubbed N28B, that is Internet-ready and advanced, to accommodate future student and staff growth. We've followed a few procedures throughout this project in order to obtain relevant and precise data, and as a result an effective and prepared network structure is created. An interview with a user representative was used to conduct a preliminary study. Later, we did some research and studies about choosing appropriate network devices, making connections with cabling and IP addressing schemes after receiving the user's response in order we could fulfill the user's requirements. As a result, we came to a final decision and documented the outcomes in this report as a group. We may conclude that this targeted project provides us with valuable expertise in the areas of network design and network communications fundamentals.

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## 1.0 INTRODUCTION

Our group has been assigned a project based on a real life case study where we need to build a small network for an additional building. Based on the case study, we have to design the network and create our own 2-storey building layout which consists of four laboratories and two conference rooms while referring to the requirements given.

Feasibility study and preliminary analysis is also needed in order to get more information about the project. Next, we did some research and comparison before choosing the appropriate LAN devices we need in order to complete this project with a maximum budget of RM 900,000 given by our client assuming wages for any man-power working on this project is not included. In the meantime, we focused on designing the suitable network connection based on the environment of the floor plan and different utilities of each room. Designing the network connection includes choosing the best topology as the layout of our network by researching which topology can serve the best overall performance in our case. IP addressing is crucial in making sure that every device can connect to the network without conflict of addresses. Hence, based on our network connection designed previously, IP addresses were assigned to each device by exploring how the subnetwork can be divided from the Network Address given assuming there are no new LAN devices added.

The goal of this project is to implement the knowledge and insight that we have gained throughout the classes. The purpose of this report is to document the progress of this project starting from designing the floor plan until addressing the IP scheme.

## 2.0 PROJECT BACKGROUND

Based on the case study, we found that the problem of this project is to build a networking system for an additional building at the School of Computing that has to be able to support a projected increase of approximately 130 people in the next 3 years. Furthermore, the network connection in each lab needs to be aligned with the future requirement including being capable of providing high-speed internet connection for education purposes heading towards 4IR (4th Industrial Revolution). On top of that, the school requested to have the system ready for anything that can happen while at the same time be cost effective within the budget given. Lastly, the reliable system has to be secure while it can be easily managed by the staff.

## 3.0 COMPILED SOLUTION

### 3.1. Task 1 (Project Setup)

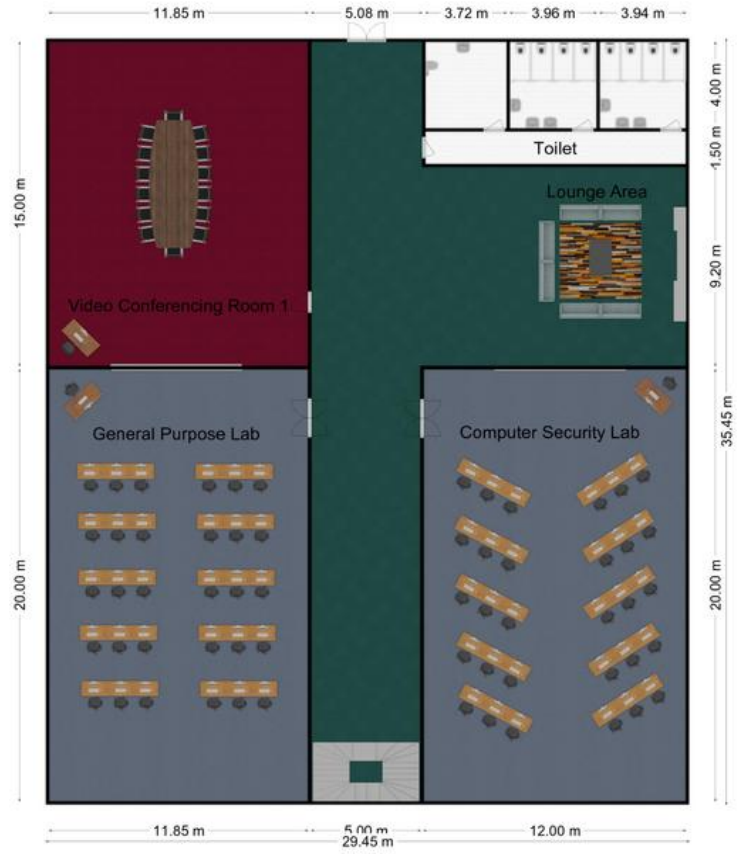


*Figure 1: 2D Floor Plan of Floor One*

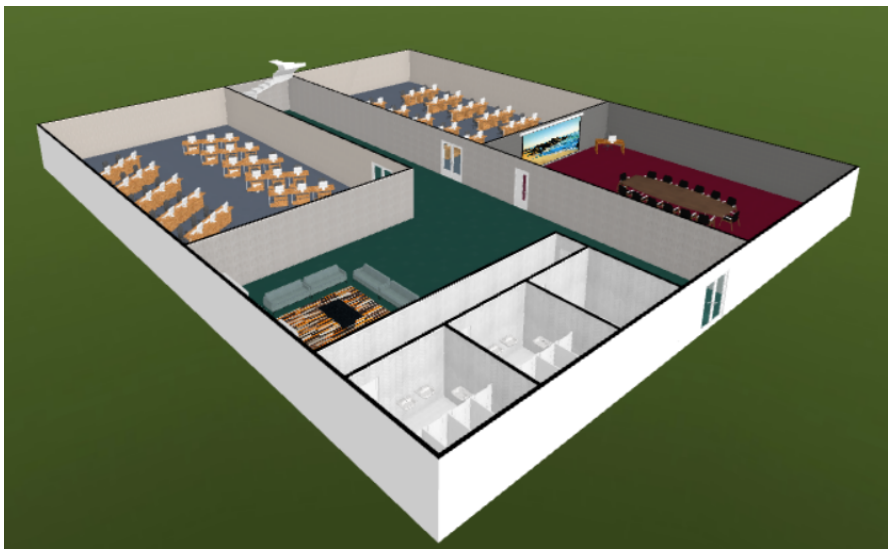

*Figure 2: 3D Floor Plan of Floor One*

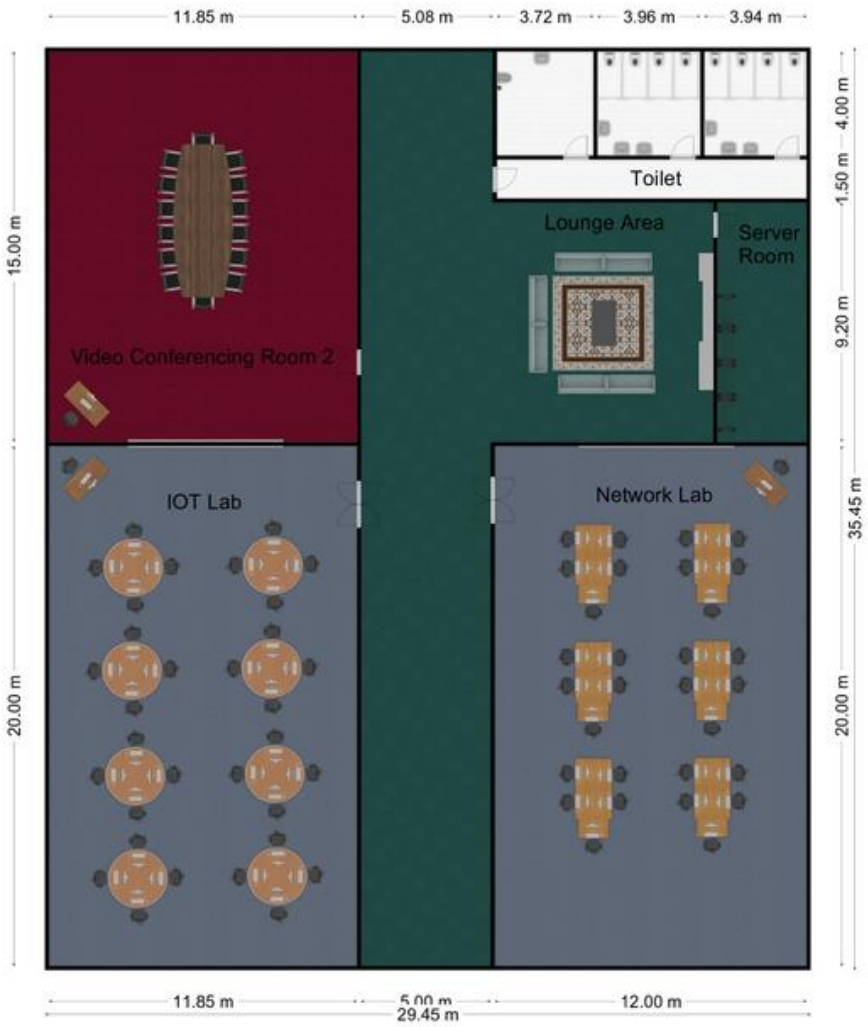


*Figure 3: 2D Floor Plan of Floor Two*

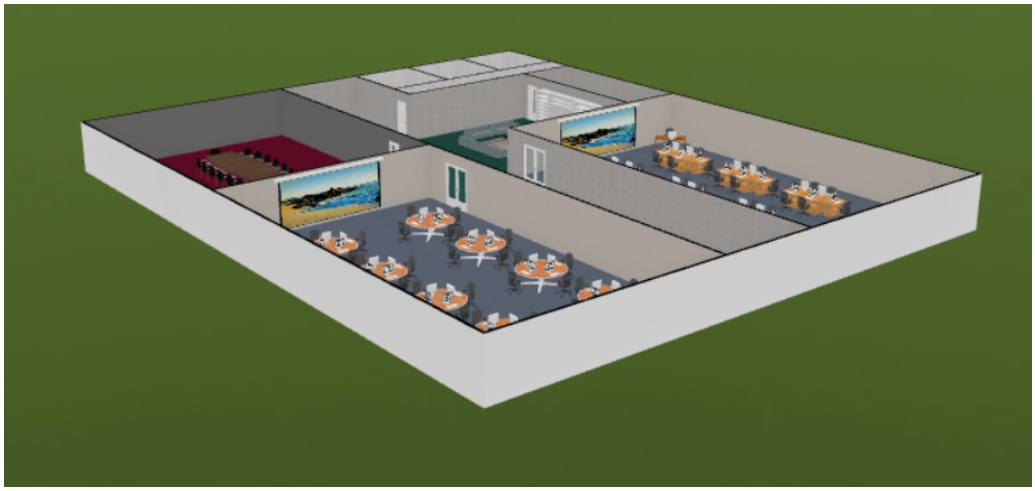

*Figure 4: 3D Floor Plan of Floor Two*

**Reflection on Task 1:**

During this task, we work together to design the labs and conference rooms needed. We found that designing a floor plan needs high creativity and good planning skills. In order to achieve that, we discuss it together through Discord and utilize a website called Floor Planner to make it possible.

### 3.2. Task 2 (Initial Design - Preliminary Design)

**QUESTIONS AND ANSWERS**

**Q1: What is the type of network used?**

- Local Area Network (LAN) as it is good for computers that are in close proximity such as the school labs. Not just that, LAN is good in resource sharing, software sharing, internet sharing and more[1]. Next, Wireless Local Area Network (WLAN) such as WIFI for the other parts of the building. WLAN uses less physical wires and gives out high rate connections due to the small area covered[2].

**Q2: What is the network security implemented?**

- Use routers with built-in firewalls and install antivirus software on each computer which is McAfee in order to provide protection from network breaches such as Internet Worms, viruses and DDOS attacks. Other than that, the network itself needs to be physically secured to prevent non-authoritative people from hacking it, by using locks and monitored by security camera CCTV.

**Q3: What type of connections are preferred, wired or wireless?**

- Both types of connections which are wired and wireless are required. In the labs, we will use a wired connection - Local Area Network (LAN) connection. But in other rooms such as the conference rooms and lounge areas, we will use wireless connection - Wireless Local Area Network (WLAN) such as WIFI.

**Q4: What is the type of cables or connectors preferred to build the network?**

- Fibre optic cables are recommended as they support very high bandwidth levels, can carry long distance signals, are inherently secure, intrinsically safe and immune to electromagnetic interference (EMI), are not impacted by temperature changes, bad weather or moisture [3]. Besides, they have lower total cost of ownership (TCO) and more flexibility for the future [4].

**Q5: Which type of server and network topology is preferable?**

- A hybrid topology is used as it is a type of network topology that uses two or more different network topologies. The combination of the star topology and bus topology is preferable in which two or more star topologies are connected together through a bus topology. In general, star topology is very reliable and can reduce data collisions. Bus topology however is easy to install, easy to add extra workstations and uses less cable [5].

**Q6: Where should the routers and access points be placed in the building?**

- The routers and access points should be placed in a higher in height location that is central to all the computers in the network to ensure each gets coverage. Physical obstructions and reflective surfaces should be avoided as they could reduce the network range and degrade the

signal [6]. APs or routers also should not be stacked on top of each other in multi-floor design (one on one floor and other one directly above on second floor) or next to each other to avoid coverage overlap.

**Q7: What is the recommended bandwidth for each lab and room?**

- As most of the labs and rooms in the building will be using the Internet for their activities, high speed bandwidth is recommended because the user needs to have a high data transfer to complete their task especially when a lot of people are connecting to the same network. The higher the bandwidth, the more data can be received and sent at one time.

**Q8: Is the main server needed to be in the building?**

- Having a main server in the same building will ease the job for maintenance and can be used to backup users' works and store their profile.

**Q9: Will there be the need for Virtual-Private-Network (VPN)?**

- Yes, VPNs are used to create a data tunnel between a local Network and an exit node in another location and will be needed in case there is any staff or users who are off-site and required to access the network [7].

**Q10: Standard software that will be installed in each of the workstations?**

- Browsers: Google Chrome
  - The most favorite browser is Google Chrome. It excels in terms of memory usage, graphical interface, friendliness usage and variety of features [8].
- Basic documentation purpose: Microsoft Office 365
  - Microsoft 365 is a bundle of services that includes Office 365, cloud-based suite of apps and services. It also includes Windows 10 Enterprise, Enterprise Mobility + Security (EMS), and machine learning. [9].
- Software to open pdf file: Adobe Acrobat Reader CD
- Virtual meeting and workgroup: Webex

## FEASIBILITY STUDY

The School of Computing estimated that there will be 10% growth in the numbers of students and staff in the next 3 years. Therefore, an expansion of a 2-storey building equipped with 4 new labs - general purpose lab, computer security lab, network lab, IOT lab and 2 new video conferencing rooms are needed. In the meantime, it is expected that the new labs and conferencing rooms have improved overall performance, capable of supporting high-performance and secure from malicious attacks. In order to tackle this project, a feasibility study is needed to lay out the cost, practicality of the proposed plan and benefit to the society.

As per client's requirement, we will be installing a firewall for the server, vpn connection and antivirus software for each computer to protect network and connections from network breaches. A server room is also needed to place the main server's database that is connected to each room in the building via routers. This server room will be placed on the second floor of the

same building to ease the process of maintenance and management. The addition of a server room in the floor plan will make it easier to access and monitor the server client and at the same time increase the level of protection. In this project, both wired and wireless connection are used, thus requiring ethernet cables to be connected to each computer and fibre optic cables connecting routers to the main server. Next, we were asked to install the router efficiently while at the same time reach all corners of the building for coverage while minimizing cost.

With a budget of RM900,000 to set up this network architecture with cutting-edge technology as well as installation of the required hardware and software, we are more than confident that this project is feasible, practical and will bring a lot of benefits to the user.

**Reflection on Task 2:**

We found that preliminary analysis and information gathering are very crucial steps that needed to be done before further proceeding this project. With the information in mind, we know what must be done next in order to complete this project successfully. But preliminary analysis is no easy task, we have to do some research that can benefit us and the customer at the end.

### 3.3. Task 3 (Choosing the Appropriate LAN Devices)

After having a preliminary analysis and the floor plan laid out, we began by researching the appropriate tools and devices needed to accomplish the networking task. At the same time, we did some price surveying when choosing the right devices as we need to meet the given budget which is RM900,000. Below are the chosen devices and items:

| No | Device | Detail/Characteristic | Price Per Unit (RM) | Quan-tity | Subtotal (RM) |
|---|---|---|---|---|---|
| 1. | Omada Gigabit VPN Router ER7206 (TL-ER7206)  | ● Highly Secure VPN: Supports up to 100× LAN-to-LAN IPsec, 50× OpenVPN*, 50× L2TP, and 50× PPTP VPN connections.<br>● Abundant Security Features: Advanced firewall policies, DoS defense,IP/MAC/URL filtering, and more security functions protect your network and data.<br>● Gigabit Ports: 1 gigabit SFP and 5 gigabit RJ45 ports provide high-speed wired connectivity. | 1399.00 | 1 | 1399.00 |
| 2. | Access point AX3600 Wireless Dual Band Multi-Gigabit Ceiling Mount Access Point  | ● Interface : 1× 2.5 Gbps Ethernet Port (supports IEEE802.3at PoE)<br>● Antenna Type Internal Omni : 2.4 GHz: 4× 5 dBi / 5 GHz: 4× 6 dBi<br>● Mounting : Ceiling /Wall Mounting (Kits included)<br>● Wireless Standards : IEEE 802.11ax/ac/n/g/b/a<br>● Frequency : 2.4 GHz and 5 GHz<br>● Signal Rate : 5 GHz: Up to 2402 Mbps / | 1299.00 | 2 | 2598.00 |

| | | | | | |
|---|---|---|---|---|---|
| | | 2.4 GHz: Up to 1148 Mbps<br>● Ultra-Fast Wi-Fi 6 Speeds<br>● High-Density Connectivity<br>● Integrated into Omada SDN<br>● Centralized Management<br>● 2.5G Port<br>● Seamless Roaming<br>● PoE+ Support:<br>● Secure Guest Network | | | |
| 3. | 48 port switch<br>Ubiquiti Switch Pro 48 PoE USW-Pro-48-PoE<br>  | ● Switch type: Managed,<br>● Switch layer: L2/L3. Basic switching RJ-45<br>● Ethernet ports type: Gigabit Ethernet (10/100/1000). Basic switching RJ-45<br>● Ethernet ports quantity: 48<br>● Installed SFP+ modules quantity: 4 Full duplex.<br>● Switching capacity: 176 Gbit/s<br>● Networking standards: IEEE 802.3af, IEEE 802.3at.<br>● 600W total PoE supply<br>● Near-silent cooling<br>● Layer 3 switching feature | 5190.49 | 4 | 20761.96 |
| 4. | TL-SG1005P V2<br>5-Port Gigabit Desktop Switch with 4-Port PoE+ | ● 5× 10/100/1000 Mbps RJ45 ports<br>● With four PoE+ ports, transfers data and power on one single cable<br>● Works with IEEE 802.3af/at compliant PDs<br>● 802.1p/DSCP QoS enable smooth | 174.99 | 2 | 349.98 |

| | | | | | |
|---|---|---|---|---|---|
| |  | latency-sensitive traffic<br>● Supports PoE Power up to 30 W for each PoE port<br>● Supports PoE Power up to 65 W for all PoE ports*<br>● Requires no configuration and installation | | | |
| 5. | 4 PORT RJ45 CAT6 LAN & RJ11 TEL Socket Floor Panel Ground Outlet Receptacle<br>  | ● Pop-up RJ11&RJ45 CAT6 Ground Plate included module<br>● Panel material: Brass<br>● Base Material: Metal<br>● Panel Size:120mm×120mm,<br>● Mounting box size:100mm×100mm×55mm | 154.51 | 8 | 1236.08 |
| 6. | 3 PORT RJ45 CAT6 Network LAN Floor Panel Ground Outlet Socket Receptacle<br>  | ● Pop-up CAT6 LAN Ground Plate included module<br>● Panel material: Brass<br>● Base Material: Metal<br>● Panel Size:120mm×120mm<br>● Mounting box size:100mm×100mm×55mm | 182.46 | 32 | 5838.72 |
| 7. | 1 PORT RJ45 CAT6 Network LAN wall face plate | ● Single gang module faceplate, supplied with one 50x25 Cat6 module. | 20.00 | 6 | 120.00 |

| | | | | | |
|---|---|---|---|---|---|
| |  | | | | |
| 8. | Cat6 RJ45 Ethernet Cable 50M  | • High performance CAT6 ethernet LAN cable provides universal connectivity for high-speed network<br>• Supports Gigabit Ethernet (1000 Base-T) standard with transmission bandwidth of up to 250MHz<br>• Future-proof your network for 10-Gigabit Ethernet<br>• 4-pair unshielded twisted pair (UTP) cable with 26 AWG conductor<br>• Thicker conductor diameter for higher reliability and higher data rates<br>• Higher signal-to-noise ratio | 50.00 | 8 | 400.00 |
| 9. | Cat6 RJ45 Ethernet Cable 30M  | • Connects all the hardware destinations on a Local Area Network (LAN)<br>• Perfect for use with 10 Base-T, 100 Base-T, 1000 Base-T networks and GigaBit Ethernet<br>• Transfer data up to 1000Mbps -such as rate of the 5E /6 class level required<br>• High transmission performance and low signal loss. | 30.00 | 128 | 3840.00 |
| 10. | UGREEN Cat6 RJ45 Ethernet Cable 3M | • 10Gbps Transfer Speed<br>• Stable Transmission<br>• Tiny & Durable | 8.39 | 128 | 1073.92 |

| | | | | | |
|---|---|---|---|---|---|
| |  | | | | |
| 11. | Dell SE2222H Monitor  | • 22" Inch FHD 1920x1080 LED Monitor | 559 | 128 | 71552.00 |
| 12. | Dell Optical Mouse MS116  | • Wired Connectivity<br>• Optical Detection Technology<br>• 1000 dpi Movement Resolution | 54 | 128 | 6912.00 |
| 13. | Dell Multimedia Keyboard KB216  | • Wired Connectivity<br>• Chiclet Keys Style<br>• 44.2 cm x 12.7 cm x 2.44 cm<br>• Weight - 503 g | 72 | 128 | 9216.00 |
| 14. | Dell XPS Desktop | • 11th Gen Intel® Core™ i5-11400 processor (6-Core, 12M Cache, 2.6GHz to 4.4GHz)<br>• Windows 11 Home | 4099 | 128 | 524672.00 |

| | | | | | |
|---|---|---|---|---|---|
| |  | • NVIDIA® GeForce® GTX 1650 SUPER™ 4GB GDDR6<br>• 8GB, 8Gx1, DDR4, 2933MHz<br>• 512 GB, M.2, PCIe NVMe, SSD<br>• Microsoft Office Home and Student 2021 | | | |
| 15. | ViewSonic PA503W 3,800 Lumens WXGA Business Projector<br>  | • Native Resolution: 1280x800<br>• Brightness: 3800 ANSI lumens<br>• Throw Distance: 1m-10.98m (100" @3.34m)<br>• Computer in (share with component): 2<br>• Composite: 1<br>• Audio-in (3.5mm): 1<br>• HDMI: 1 (Back)<br>• Monitor out: 1<br>• Audio out (3.5mm): 1<br>• Speaker: 2W | 1649 | 6 | 9894.00 |
| 16. | Brother MFC-L3750CDW Laser Printer<br>  | • Color LED Multi-Function Center with Wireless & Network Connectivity<br>• Automatic 2-sided Color Print,<br>• ADF- Multi-page Scan, Copy, Fax<br>• High Productivity with Fast Print Speeds & Multi-tasking<br>• Wi-Fi Direct, Mobile & USB Print<br>• Low Cost Quality Print Resolution with Affordable Toner | 2099 | 2 | 4198.00 |

| | | | | | |
|---|---|---|---|---|---|
| 17. | PowerEdge R440 Rack Server  | • Chassis: 2.5" Chassis with up to 8 Hot Plug Hard Drives, PERC/HBA11<br>• Processor: Intel Xeon Silver 4208 2.1G, 8C/16T, 9.6GT/s, 11M Cache, Turbo, HT (85W) DDR4-2400<br>• Memory DIMM Type and Speed: 3200 MT/s RDIMMs<br>• Memory: 8GB RDIMM, 3200 MT/s, Single Rank<br>• RAID: C7, Unconfigured RAID for HDDs or SSDs (Mixed Drive Types Allowed)<br>• Power Supply: Dual, Hot Plug, Redundant Power Supply (1+1), 550W | 13788.27 | 1 | 13788.27 |
| **TOTAL (RM) =** | | | | | 677,849.93 |

Reflection on Task 3:

1. Are you surprised by the prices? How were you surprised?

   - Yes, we were surprised by the total cost needed for all these LAN devices. We were expecting the overall cost to be a lot cheaper because we did not think some of the items such as the cable would cost as much. Furthermore, it is common to know that buying electronic devices will be expensive but we were surprised that buying in bulk would raise the cost sharply. Thankfully, we managed to list out all the devices within the allocated budget which is RM900,000.00 with RM222,150.07 to spare.

2. Have you ever considered cost as a factor for choosing networking devices?

   - Yes, because the allocated budget for purchasing networking devices for this project is limited to RM 900,000.00. We have to plan carefully for the items so it does not exceed the

budget. However, choosing devices with good specification is also one of our main factors in selecting the appropriate devices to ensure the project can be used in the long term.

3. What are the major differences between the same devices from different brands? For example, Cisco and Huawei Routers.
   - The same devices from different brands might be targeting different use cases and environments. For example Huawei routers are more suitable for home and family use as it is for less dense usage while Cisco routers on the other hand are mainly for high density usage such as business and industrial.

### 3.4. Task 4 (Making the Connection - LAN and WAN

After completing the previous task which is doing some research on selecting networking devices such as router, switches, and access points to be used for this whole project, we are required to make the connection for all the devices selected for the building. All of the details for each connection are provided for each section.

In completing this task, we are using several icons to describe the devices that we use for the connection. The indicators are as below:

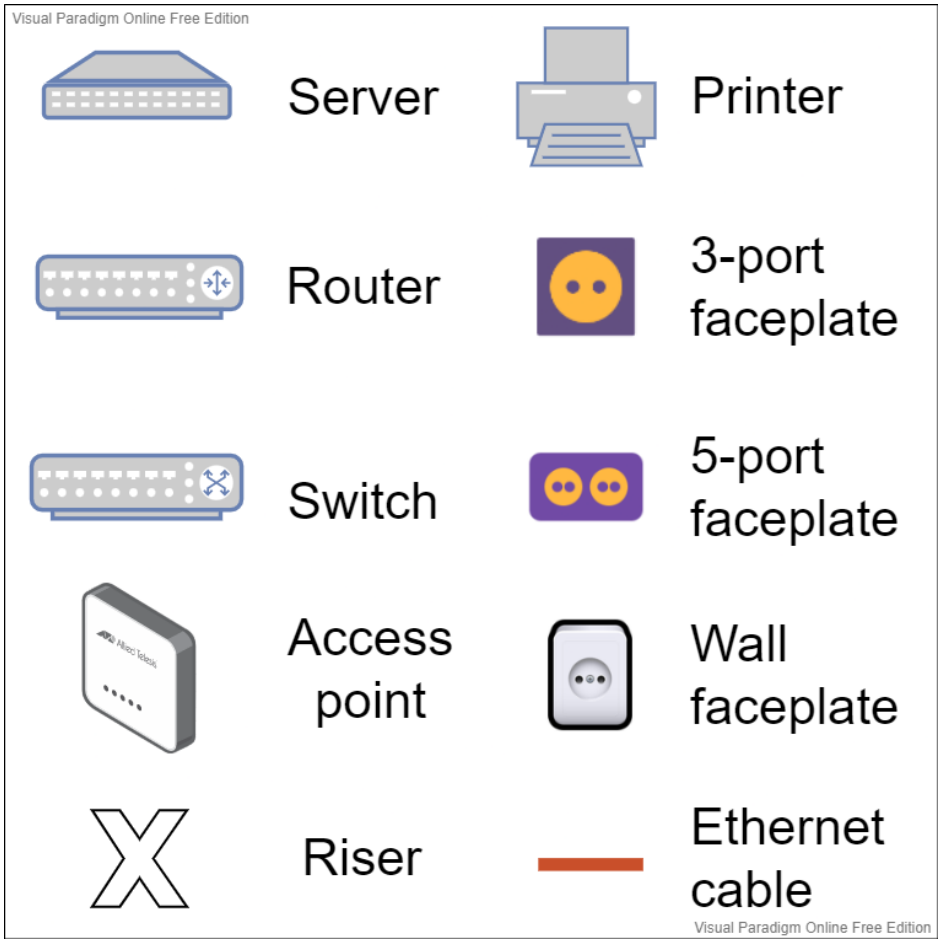


***Figure 5: Indicator icons for networking devices***

**Identifying the work areas**

Before we could link the devices, we had to first describe each area network and its requirements. The work area was the location within a building where network equipment was used by a person or group of individuals.

We divided the work area into two sections, each with its own floor.

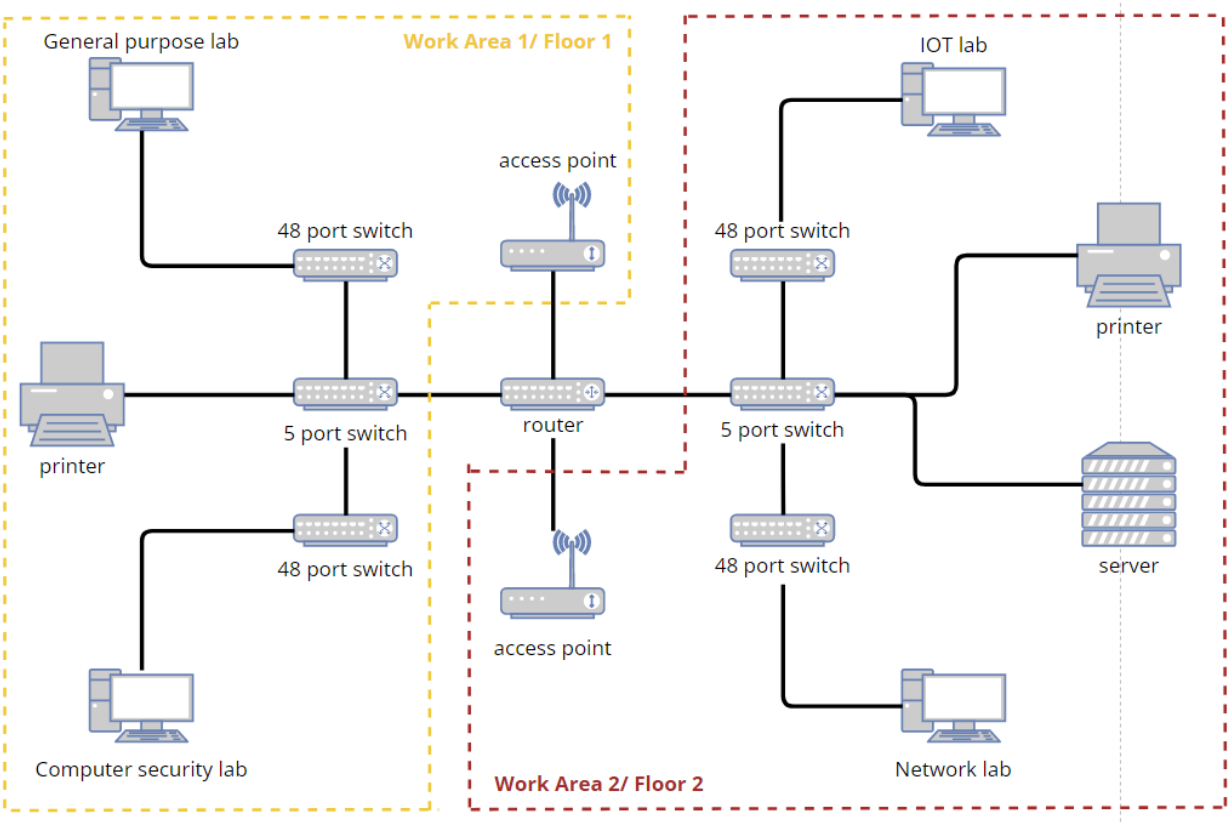


***Figure 6: Work area for each floor plan***

**Work Area 1/ Floor 1** - contains General Purpose Lab, Computer Security Lab and one video conferencing room. This floor also holds a lounge area and toilets.

**Work Area 2/ Floor 2** - accommodates IOT Lab, Network Lab and one video conferencing room. In addition, this floor also has a server room, a lounge area and toilets.

Both work areas/ floors are equipped with an all-in-one (multifunction) printer which is a piece of office equipment that combines a printer, scanner, copier, and fax into a machine and an access point for extending the wireless coverage of an existing network.

**Connections**

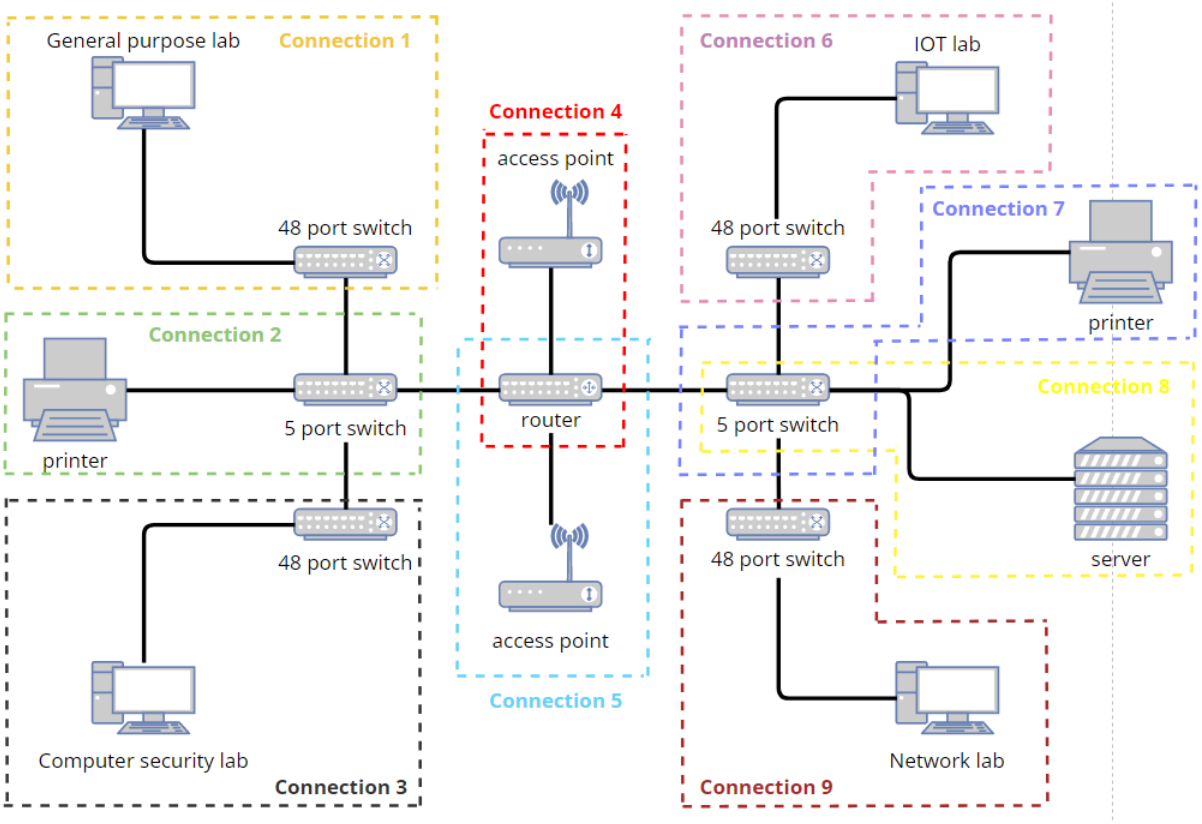


***Figure 7: Networking devices with identified connection***

We calculated that the building would require 9 connections based on the topology above.

The first four connections were for work area 1/ floor 1, while the next five were for work area 2/ floor two.

**Connection 1** - The network is connected to the General Purpose Lab.

**Connection 2** - The network is connected to the multifunction printer at floor 1.

**Connection 3** - The network is connected to the Computer Security Lab.

**Connection 4** - The network is connected to the access point located at floor 1.

**Connection 5** - The network is connected to the access point located at floor 2.

**Connection 6** - The network is connected to the IOT Lab.

**Connection 7** - The network is connected to the multifunction printer at floor 2.

**Connection 8** - The network is connected to the server room.

**Connection 9** - The network is connected to the Network Lab.

**Patch Cords**

For our patch cords, we have decided to use Cat6 RJ45 ethernet cable with three different lengths. During our research, we found that Cat6 is the most commonly used cable for networking and has a higher speed connection compared to Cat5 and Cat5e.

The shortest cable is 3 meter long which will be used to connect all computers to faceplates which are connected to switch ports by longer cables which are 30 meter long. The longest cable is 50 meter long and will be used for every other connection between every switch ports and access points to the router.

Overall, we will be using a total length of 2052 meter for the patch cords.

**Switch Ports**

For our switch ports, we intend to use two different switches which are four of 48-port switches and two of 5-port switches for this project . Both of the 5-port switches are connected to the routers and are used to connect with all remaining 48-port switches, printers, including server. Finally, the 48-port switches are used to connect with all computers.However, not all ports from the switch ports will be used as a few of them can be used as a backup in case another ports are damaged or new devices will be added in the future.

**Cable Types and Length**

For all of the connections inside the building, UTP/ Ethernet cable Cable will be used for all labs and rooms to connect with workspaces. Both work areas will use the same cable type as it is the best option for students' workspaces and PCs. The length for the cable for work area 1 on the first floor is 1014 meter while total cable length for work area 2 on the second floor is 1028. Lastly, the length for the cable that is going up the wall is 10 meter.

**Network Devices Arrangement**

All of the devices that will be used in the connection is shown as below:

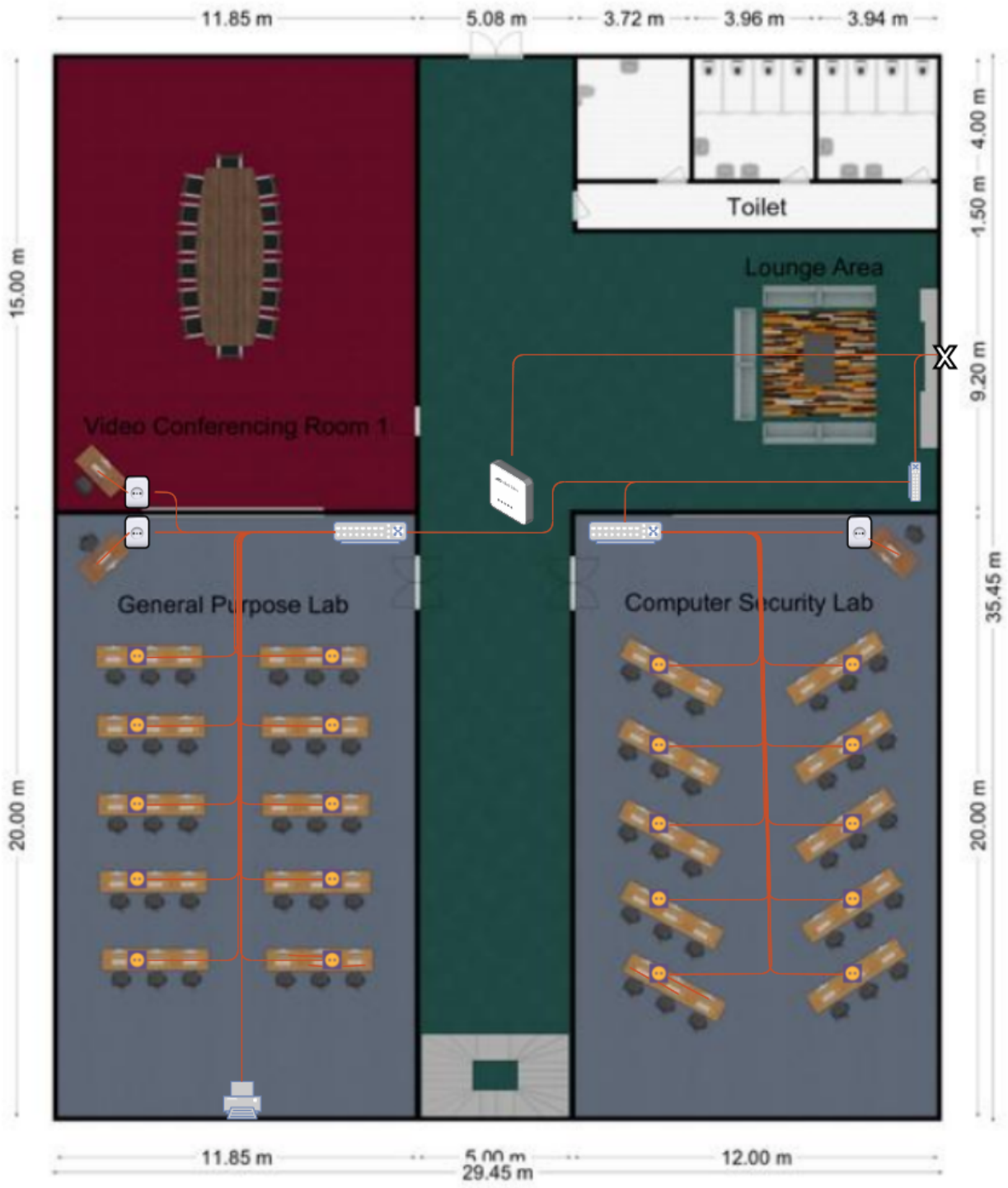


***Figure 8: Network Devices in the First Floor***

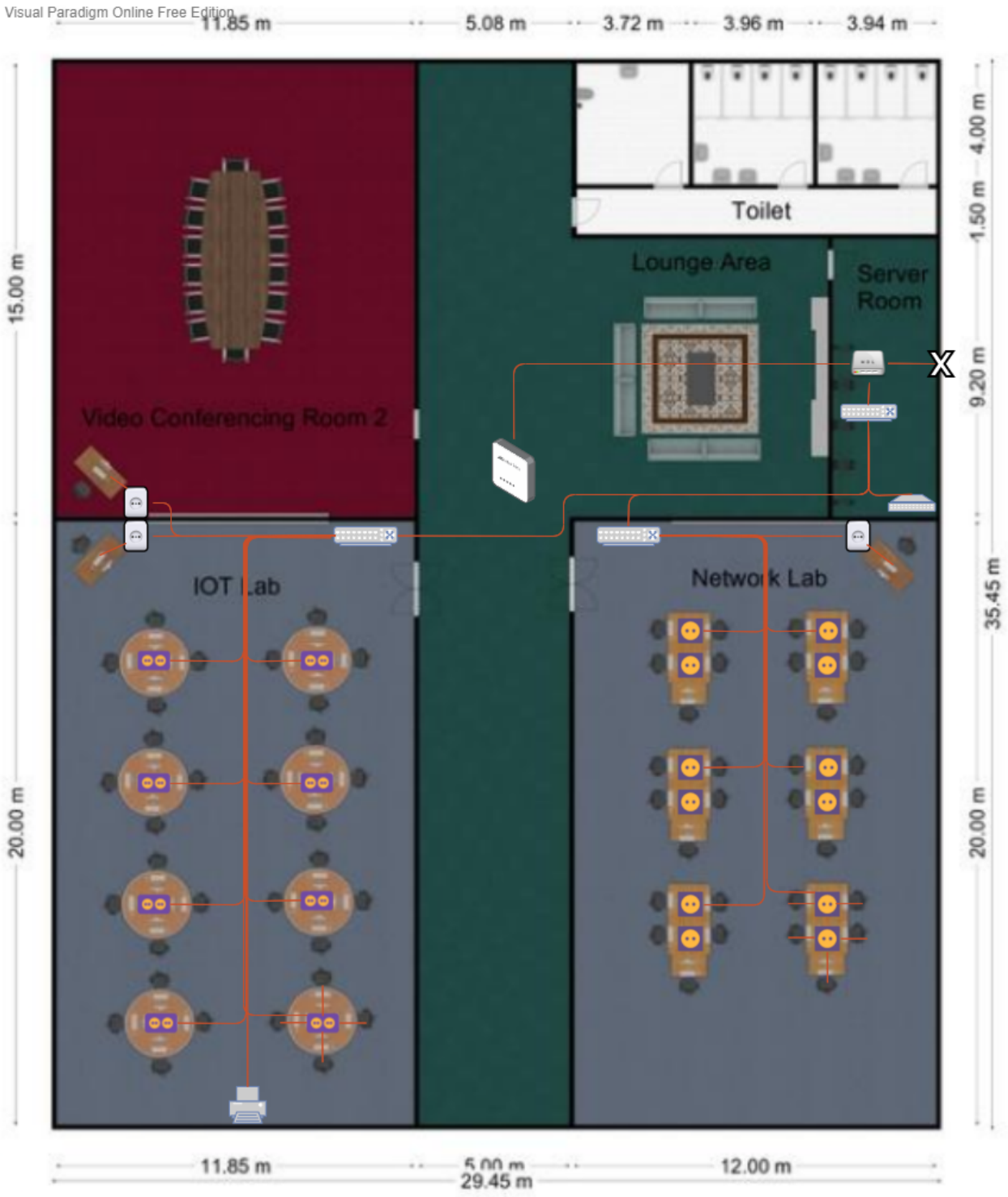


*Figure 9: Network Devices in the Second Floor*

**Reflection on Task 4:**

We found that it is important to arrange the networking devices efficiently so that everything is neat, easy to access and can be used to its maximum capability. Not just that, we also need to identify the connection between networking devices suitably as it will be implemented later in Task 5. Choice of patch cords, switch ports, cable types and length is crucial so that the network can operate smoothly.

## 3.5. Task 5 (IP Addressing Scheme)

**SECOND FLOOR**

- **Network Lab**

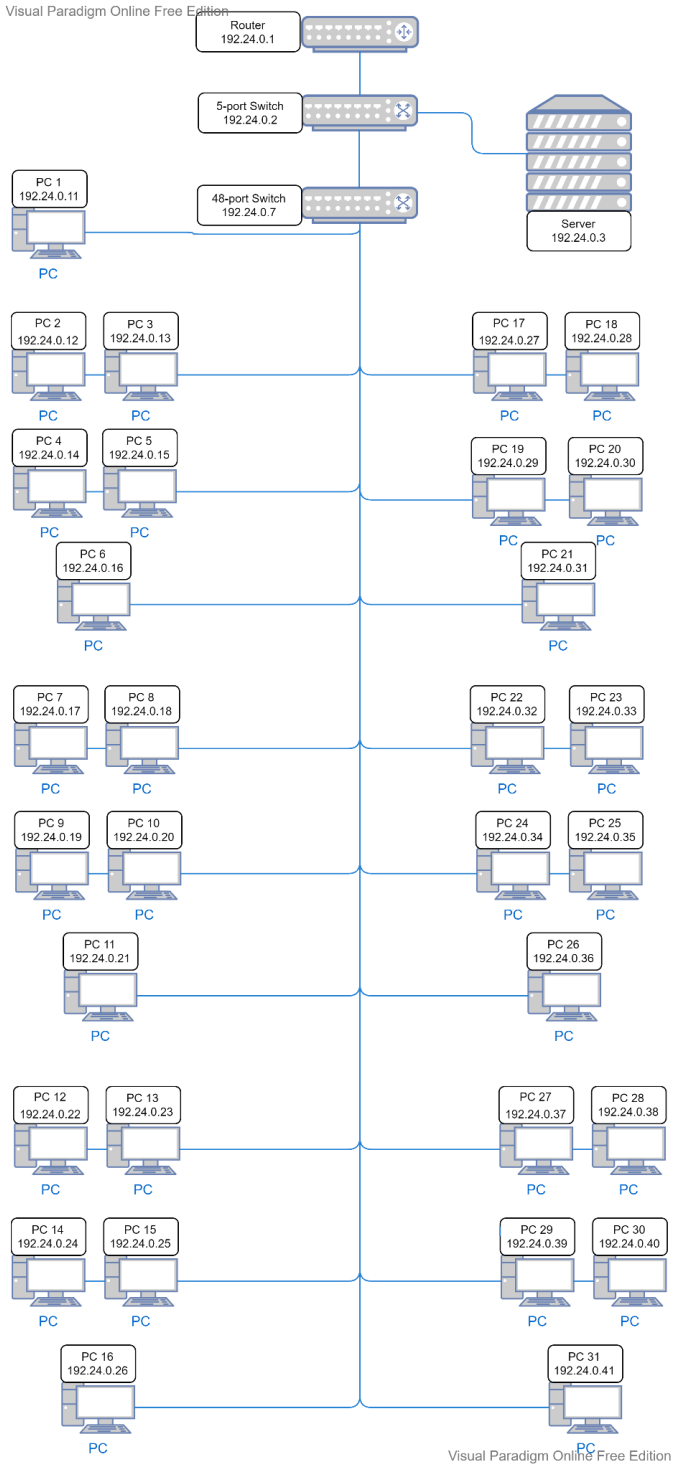


*Figure 10: Network Lab IP Addressing Scheme*

- **IOT Lab**

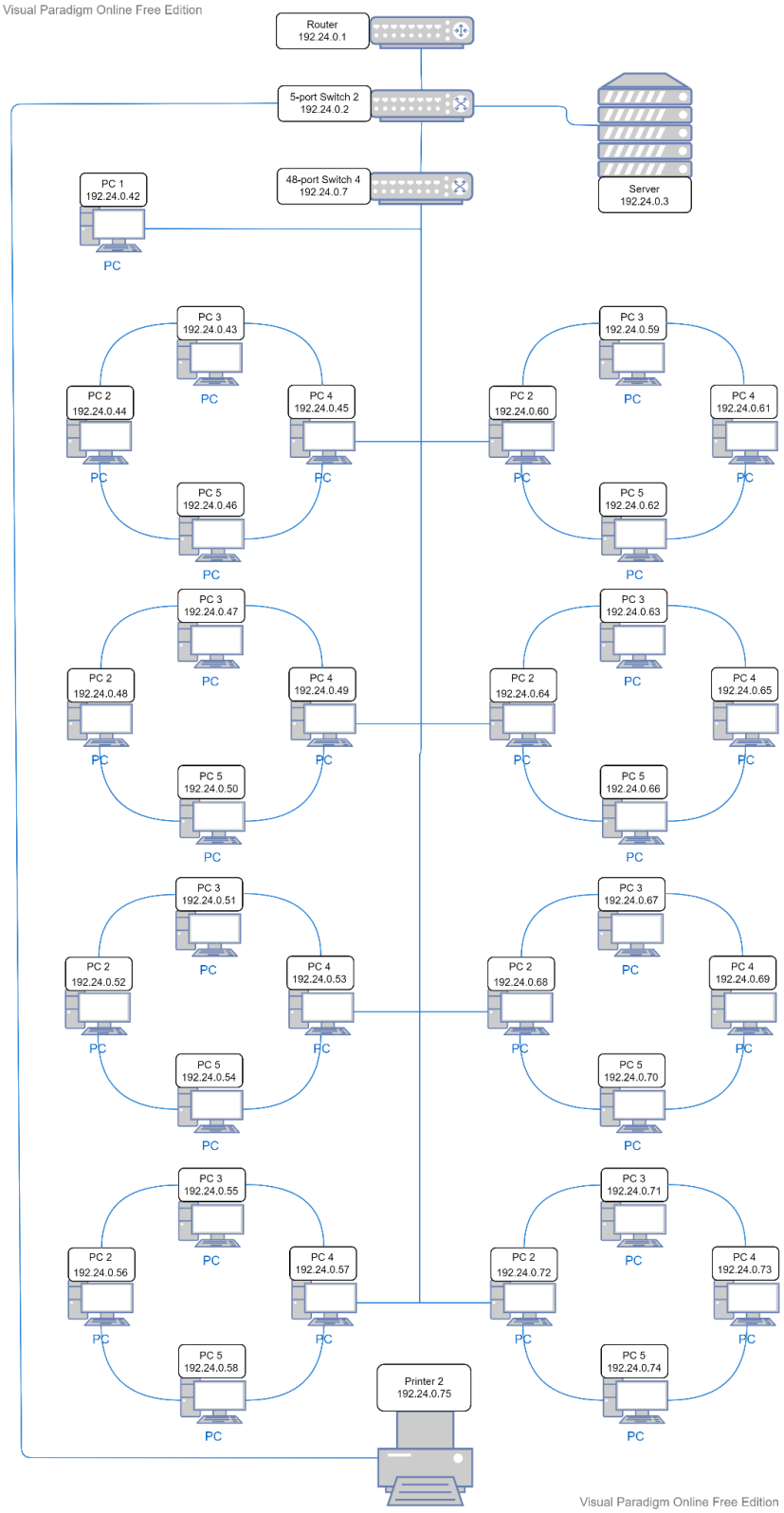


*Figure 11: IOT Lab IP Addressing Scheme*

- **Video Conferencing Room 2**

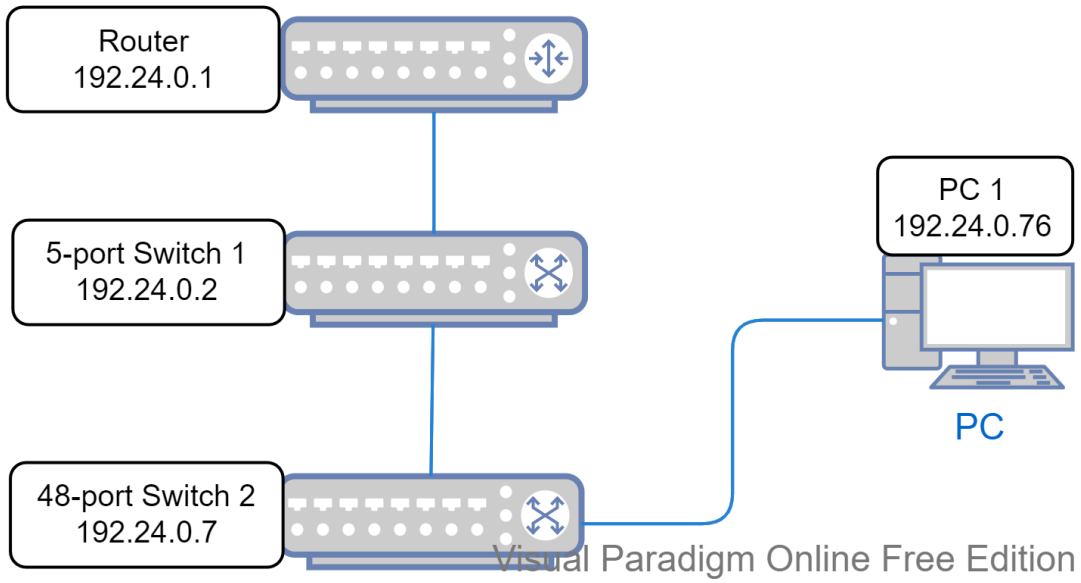


*Figure 12: Video Conferencing Room 2 IP Addressing Scheme*

- **Lounge Area 2**

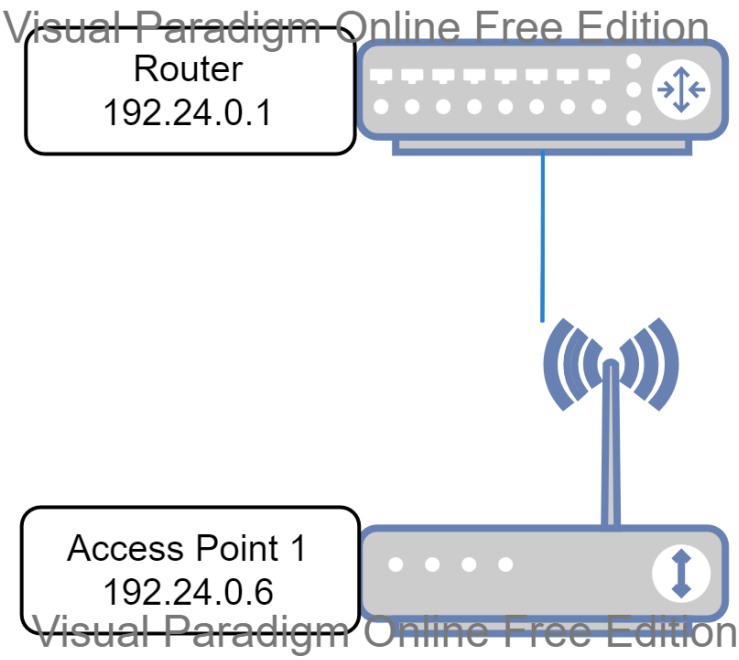


*Figure 13: Lounge Area 2 IP Addressing Scheme*

## FIRST FLOOR

- **General Purpose Lab**

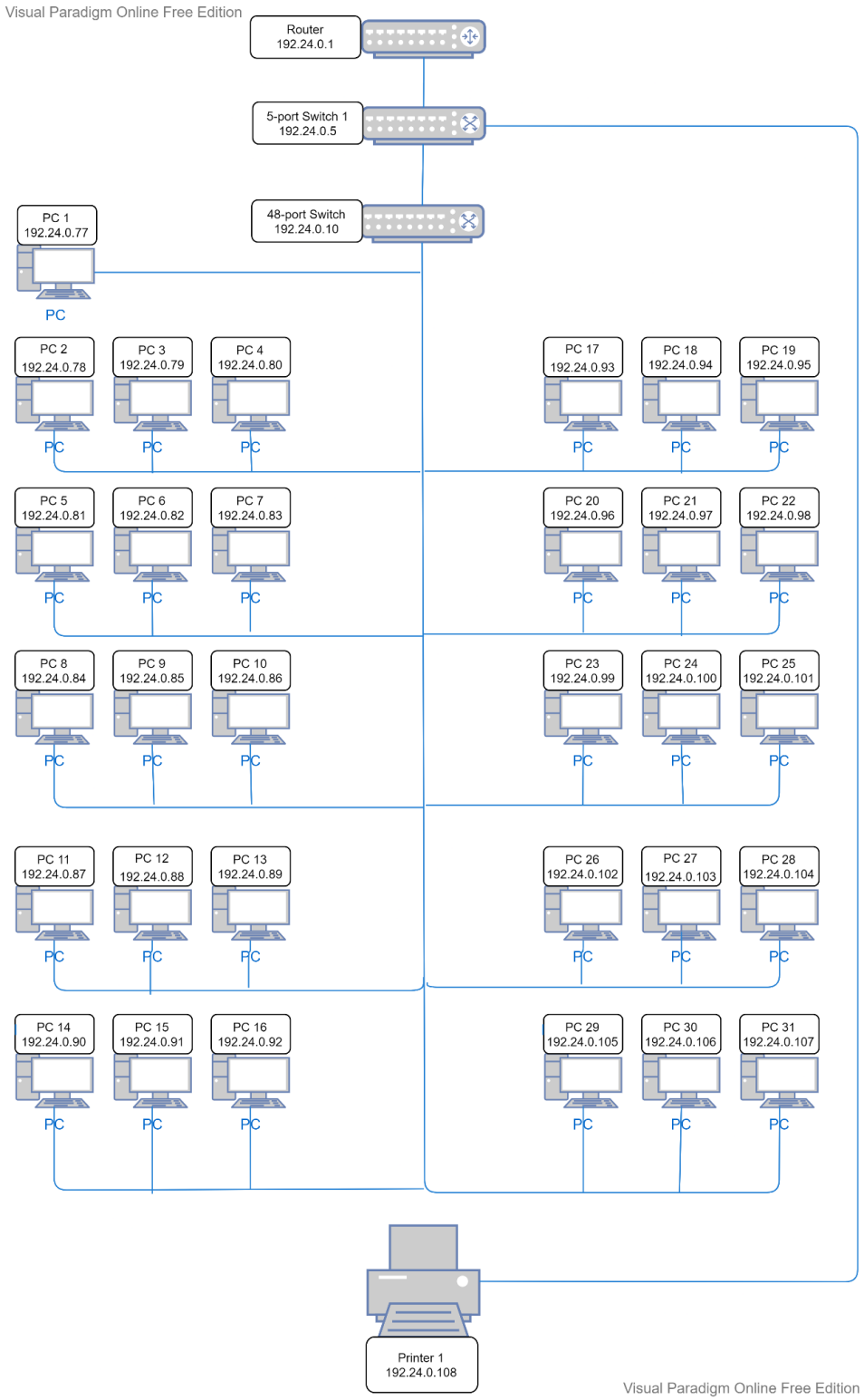


*Figure 14: General Purpose Lab IP Addressing Scheme*

- **Computer Security Lab**

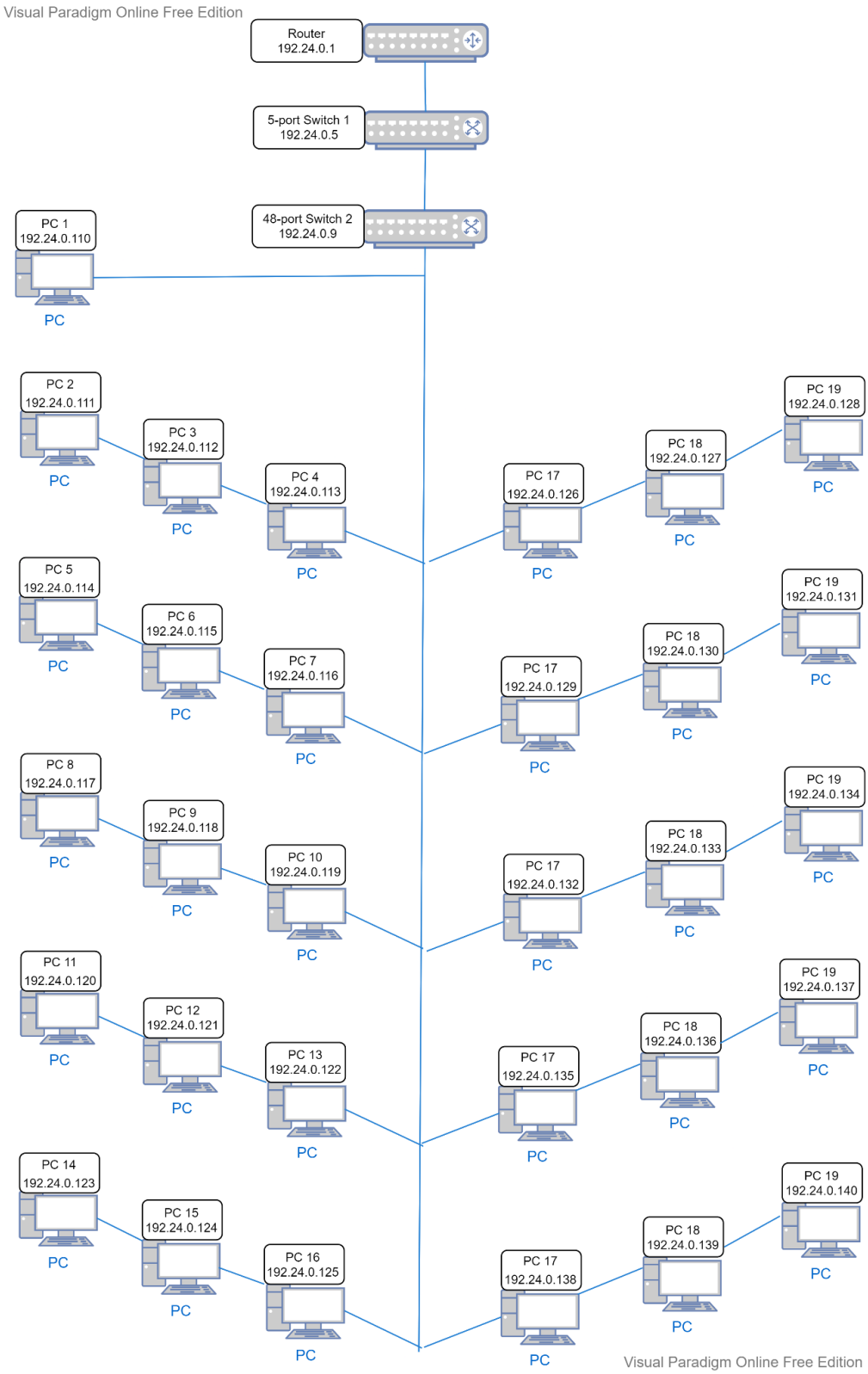


***Figure 15: Computer Security Lab IP Addressing Scheme***

- **Video Conferencing Room 1**

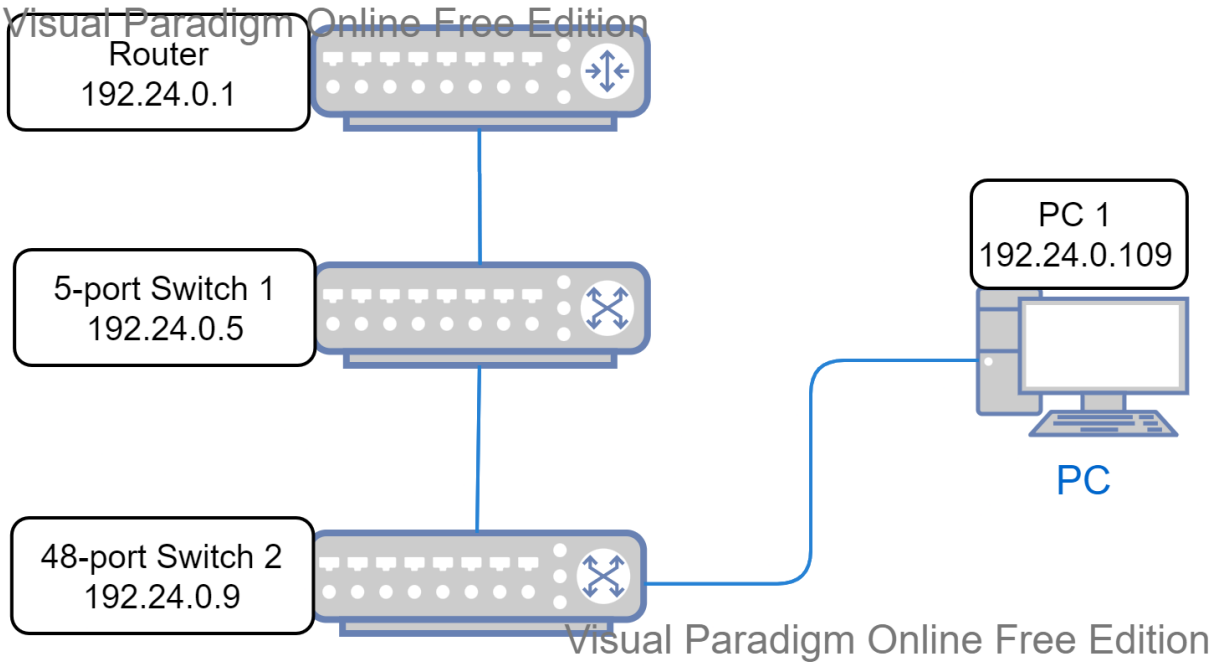


***Figure 16:*** **Video Conferencing Room *1 IP Addressing Scheme***

- **Lounge Area 1**

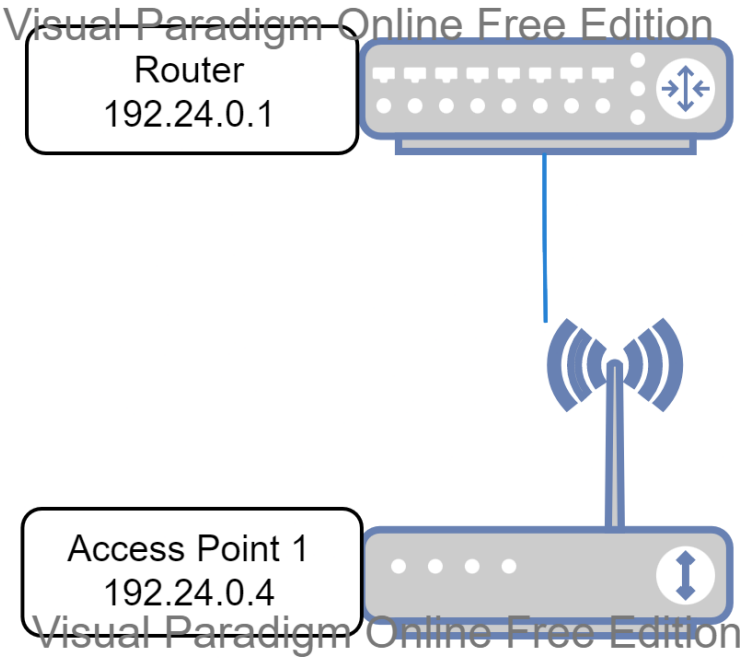


***Figure 17: Lounge Area 1 IP Addressing Scheme***

**Reflection on Task 5:**

We found that IP addressing is crucial in making sure that every host can connect to the network without any conflicts. To avoid any problems that may happen in the future, we did some research on the best way to divide the subnetwork from the network address provided which is 192.24.0.0/8. This task teaches us how to assign an unique IP address to each of the workstations and devices.

## 4.0 CONCLUSION

This project has given us the chance to know more about networking and how it works in a real world setting. From the start of the project, we have done proper planning and brainstorming when designing the whole structure and connections. We also have to consider the changes to be made in the future. Therefore, it is very important for us to do deep research to avoid any mistakes and errors when going through all the tasks. The research done also has helped us a lot in understanding the important elements in networking, such as cabling and measurements, function of each network device and also the task in assigning the IP address. This project also required us to work as a team to achieve the best result from the beginning until the end of this project. However, the only challenge we have to face is the greater distance among our team members because of the pandemic that affects the communication between us to discuss thoroughly, but we manage to overcome it by dividing each task and having a good coordination in completing the project. Overall, this project has given us valuable and practical experience in networking, especially when completing the whole project in a neat process and how it will be implemented in our daily lives.

## 5.0 TEAM MEMBERS AND THEIR RESPONSIBILITIES

| Team Members | Responsibilities |
|---|---|
| Ahmad Nazran bin Yusri | ● Design the IOT Lab and one video conferencing room.<br>● Structure the interview questions.<br>● Involve in researching and comparing the appropriate LAN devices.<br>● Involve in cabling and network devices arrangement.<br>● Identifying the connection, patch cords, switch ports, cable types and length.<br>● IP addressing scheme.<br>● Report: table of content, table of figure, team members and responsibilities, references |

| | |
|---|---|
| Megat Irfan Zackry bin Ismail | ● Design the Network Lab and one video conferencing room.<br>● Structure the interview questions.<br>● Creating the feasibility study.<br>● Involve in researching and comparing the appropriate LAN devices.<br>● Involve in cabling and network devices arrangement.<br>● Identifying the connection, patch cords, switch ports, cable types and length.<br>● Report: introduction, project background |
| Muhammad Hafizzul bin Abdul Manap | ● Design the General Purpose Lab and other additionional rooms.<br>● Structure the interview questions.<br>● Involve in researching and comparing the appropriate LAN devices.<br>● Involve in cabling and network devices arrangement.<br>● Identifying the connection, patch cords, switch ports, cable types and length.<br>● IP addressing scheme.<br>● Report: compiled solution, conclusion |
| Tie Sing Hao | ● Design the Computer Security Lab and other additionional rooms.<br>● Structure the interview questions.<br>● Involve in researching and comparing the appropriate LAN devices.<br>● Identifying the work areas and networking devices with identified connections.<br>● Identifying the connection, patch cords, switch ports, cable types and length..<br>● IP addressing scheme.<br>● Report: report abstract, appendices |

## 6.0 REFERENCES

[1] M. Roomi, “7 Advantages and Disadvantages of LAN: Limitations & Benefits of LAN,” *HitechWhizz*, 17-Jul-2020. [Online]. Available: https://www.hitechwhizz.com/2020/07/7-advantages-and-disadvantages-drawbacks-benefits-of-lan.html. [Accessed: 09-Nov-2021].

[2]“Advantages and Disadvantages of WLAN,” *GeeksforGeeks*, 07-Sep-2021. [Online]. Available: https://www.geeksforgeeks.org/advantages-and-disadvantages-of-wlan/. [Accessed: 09-Nov-2021].

[3] "5 Unique Benefits of Fiber Optic Cable", Belden, 2021. [Online]. Available: https://www.belden.com/blogs/smart-building/5-unique-benefits-of-fiber-optic-cable/. [Accessed: 09- Nov- 2021]

[4] "7 Advantages of Fiber Optic Cables Over Copper Cables", Tripplite, 2021. [Online]. Available: https://blog.tripplite.com/7-advantages-of-fiber-optic-cables-over-copper-cables/. [Accessed: 09- Nov- 2021]

[5] "Computer Science learning for school students", Teach-ict, 2021. [Online]. Available: https://www.teach-ict.com/gcse_new/networks/topologies/miniweb/pg2.htm. [Accessed: 09- Nov- 2021]
[6] "How to Position a Wireless Access Point or Router", Spamlaws, 2021. [Online]. Available: https://www.spamlaws.com/position.html. [Accessed: 09- Nov- 2021]
[7] Written by Steve Symanovich for NortonLifeLock, "What is a VPN?," *Norton*. [Online]. Available: https://us.norton.com/internetsecurity-privacy-what-is-a-vpn.html#:~:text=A virtual private network . [Accessed: 09-Nov-2021].
[8] S. L. T. A. Pamungkas, "Comparison of Three Browser Performances," *Sisforma*, vol. 1, no. 2, p. 9, 2014.
[9] S. Sjouwerman, "Microsoft 365 vs. Office 365: What's the difference?," *Blog*. [Online]. Available: https://blog.knowbe4.com/microsoft-365-vs.-office-365-whats-the-difference. [Accessed: 09-Nov-2021].

## 7.0 APPENDICES

| Meeting Date, Time, Venue | Members Participate | Activity | Tasks for each member |
|---|---|---|---|
| 26/10/2021, 8:00 p.m., Discord | Ahmad Nazran bin Yusri | Discuss Task 1, then look for floor plan designing applications and divide the rooms/labs for each member to design. | Design the IOT Lab and one video conferencing room |
| | Megat Irfan Zackry bin Ismail | | Design the Network Lab and one video conferencing room |
| | Muhammad Hafizzul bin Abdul Manap | | Design the General Purpose Lab and other additionional rooms |
| | Tie Sing Hao | | Design the Computer Security Lab and other additionional rooms |
| 9/11/2021, 9:00 p.m., Discord | Ahmad Nazran bin Yusri | Discuss Task 2, brainstorm in group about all the questions we have, and try to answer them | Structure the interview questions |
| | Megat Irfan Zackry bin Ismail | | Structure the interview questions, creating the feasibility study. |
| | Muhammad | | Structure the interview |

| | | | |
|---|---|---|---|
| | Hafizzul bin Abdul Manap | | questions |
| | Tie Sing Hao | | Structure the interview questions |
| 26/12/2021, 8:30 p.m., Discord | Ahmad Nazran bin Yusri | Discuss Task 3, identify and search for all the network devices required, as well as their quantity and pricing. | Researching and comparing the appropriate LAN devices. |
| | Megat Irfan Zackry bin Ismail | | Researching and comparing the appropriate LAN devices. |
| | Muhammad Hafizzul bin Abdul Manap | | Researching and comparing the appropriate LAN devices. |
| | Tie Sing Hao | | Researching and comparing the appropriate LAN devices. |
| 15/12/2021, 8:00 p.m., Discord | Ahmad Nazran bin Yusri | Discuss Task 4, analyze how the quantities of network devices are interconnected in different work areas, determine cable types and lengths | Involve in cabling and network devices arrangement, identifying the connection, patch cords, switch ports, cable types and length. |
| | Megat Irfan Zackry bin Ismail | | Involve in cabling and network devices arrangement, identifying the connection, patch cords, switch ports, cable types and length. |
| | Muhammad Hafizzul bin Abdul Manap | | Involve in cabling and network devices arrangement, identifying the connection, patch cords, switch ports, cable types and length. |

| | | | |
|---|---|---|---|
| | Tie Sing Hao | | Identifying the work areas and networking devices with identified connections, identifying the connection, patch cords, switch ports, cable types and length.. |
| 27/12/2021, 9:00 p.m., Discord | Ahmad Nazran bin Yusri | Discuss Task 5, investigate the appropriate method for dividing the subnetwork based on the network address assigned to our group. | Design network diagram of Network Lab and video conferencing rooms, IP addressing scheme. |
| | Muhammad Hafizzul bin Abdul Manap | | Design network diagram of General Purpose Lab and lounge areas, IP addressing scheme. |
| | Tie Sing Hao | | Design network diagram of IOT Lab and Computer Security Lab , IP addressing scheme. |
| 20/1/2022, 3:00 p.m., Discord | Ahmad Nazran bin Yusri | Discuss Task 6A, prepare a professional report highlighting our team, our results, future recommendations, and work reflection | Table of content, table of figure, team members and responsibilities, references |
| | Megat Irfan Zackry bin Ismail | | Introduction, project background |
| | Muhammad Hafizzul bin Abdul Manap | | Compiled solution, conclusion |
| | Tie Sing Hao | | Report abstract, appendices |

Pictures of our team working on the project:

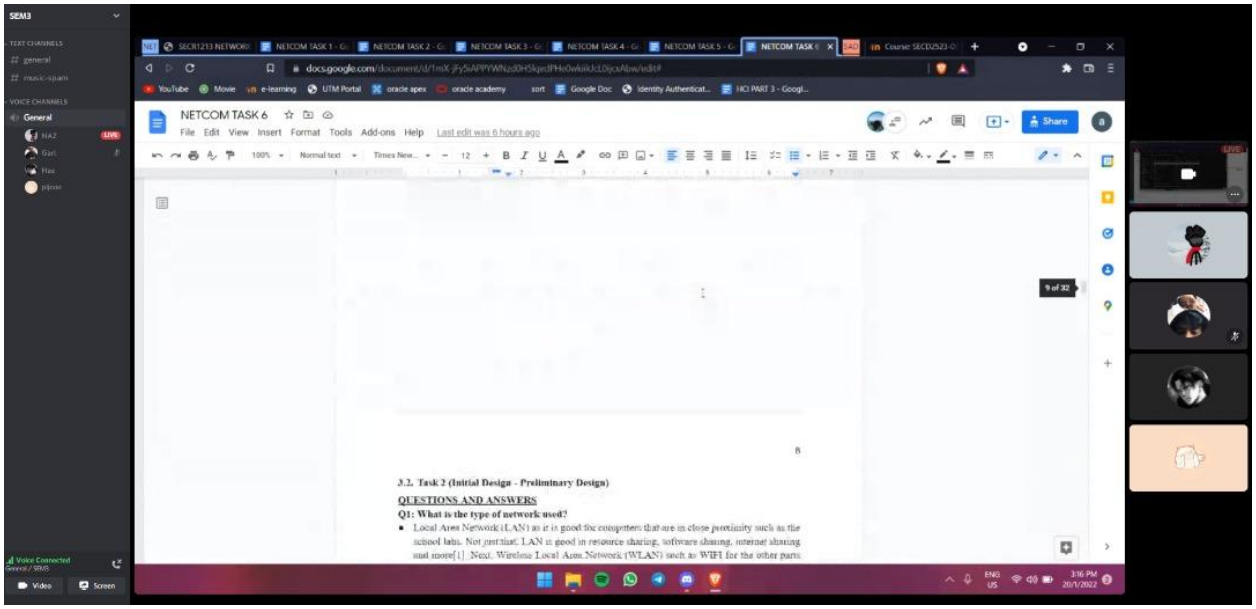


*Figure 18: Group Discussion*


*Figure 19: Group Discussion*