SECR1213 NETWORK COMMUNICATION

20242025 – SEMESTER 1

GROUP PROJECT

NETWORK DESIGN FOR FACULTY OF COMPUTING

BLOCK N28B

GROUP A&C

NAME	MATRIC ID
Kahlan Sultan Mohammed	A23MJ4021
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Bu Guoshun	A23MJ4019
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Report Abstract

This report explains how our team, Group A&C, designed and built a network system for the new two-story building of the Faculty of Computing. The goal of this project was to create a system that is efficient, secure, and ready for future growth. We worked on six main tasks to complete this project, including designing floor plans, checking the project's feasibility, choosing devices, planning connections, assigning IP addresses, and reflecting on the work.

In Task 1, we made a clear floor plan using a scaled layout. Task 2 involved analyzing what was needed for the project and checking if it could work within the RM 1.3 million budget. For Task 3, we researched and selected network devices that offered good performance while staying cost-effective. Task 4 focused on planning the cables and physical connections to make sure all areas were connected efficiently. In Task 5, we assigned IP addresses to different areas to ensure smooth communication across the network.

Finally, we reviewed our progress, identified challenges, and reflected on what we learned. This project taught us the importance of teamwork, careful planning, and balancing costs with performance. We also made recommendations for future projects, like using better templates for design and exploring cloud-based solutions to save money. This report shows how we worked as a team to create a reliable and scalable network system for the Faculty of Computing.

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Introduction

This project focuses on designing and implementing a network infrastructure for the Faculty of Computing's new two-story building. The aim is to create a scalable, efficient, and secure system that meets the immediate needs of students and staff while accommodating future growth. The scope of the project includes planning the layout, selecting appropriate network devices, assigning IP addresses, and ensuring connectivity across all functional areas.

Objectives of the project:

1. Provide reliable high-speed internet access for all users.
2. Design a system that supports the Faculty's growing demand for technology-driven education and research.
3. Maintain cost-efficiency within the allocated budget of RM 1.3 million.
4. Ensure the network infrastructure is secure and easy to manage.

Assumptions for this project:

1. The provided budget is only for network equipment procurement, cabling, and related purposes, excluding any furniture or interior decoration costs and is sufficient.
2. The selected network devices and solutions are compatible and meet the performance expectations.

Project Background and

Overview of the Client's Current Status and Issues

The Faculty of Computing is home to a dynamic community of 1,800 students and 140 staff members. With a projected growth rate of 15% over the next four years, the Faculty aims to stay ahead by building a new facility tailored to its evolving needs. This two-story building will house specialized labs, a video conferencing room, a hybrid classroom, and other support areas to foster innovation and collaboration.

Currently, the Faculty faces challenges with its outdated network infrastructure, which struggles to meet growing demands for bandwidth, security, and scalability. The existing system is insufficient to support the cutting-edge technologies and high-speed connectivity essential for modern education and research.

This project is a solution to these challenges. By designing a robust and scalable network infrastructure, the Faculty will ensure uninterrupted connectivity, better security, and the flexibility to accommodate future expansions. The design focuses on optimizing resource allocation within a RM 1.3 million budget while aligning with the Faculty's vision of embracing technology to enhance learning and research. Through careful planning and collaboration, this project aims to create an environment that supports both current operations and long-term growth.

SECR1213 NETWORK COMMUNICATION

20242025 – SEMESTER 1

PHASE 1

Floor Plan Design

FACULTY OF MJIIT

GROUP A&C

NAME	MATRIC ID
Kahlan Sultan Mohammed	A23MJ4021
Liu Ruoyang	A23MJ4022
Buguoshun	A23MJ4019
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Brief introduction on our floor planning activity:

Our team was tasked with creating a comprehensive floor plan for a two-story multipurpose structure that would support the Faculty of Computing's (FC) future expansion as part of the Network Communication module (SECR1213). FC anticipates a 15% increase in both students and personnel over the next four years, with a present population of 1800 students, 100 academic staff, and 40 support staff. In order to accommodate this expansion, a cutting-edge, functional building that is affordable, future-proof, and capable of supporting both academic and technical endeavors must be constructed.

The new building will house four key labs, including:

- **2 General-Purpose Labs**: These labs, each with 30 workstations, will serve a variety of academic needs.
- **Cisco Network Lab**: A specialized lab designed to provide hands-on networking education using the latest Cisco equipment.
- **Embedded Lab**: Dedicated to IoT, sensors, and digital systems, this lab will facilitate research and learning in line with the advancements of the 4th Industrial Revolution (4IR).

Additional features include:

- **A Video Conferencing Room**: Equipped for virtual meetings and collaborative projects.
- **Hybrid Classroom**: Designed for flexible and efficient teaching and learning experiences.
- **Student Lounge**: A comfortable space for students to relax and work, with high-speed wireless connectivity.

Floor Details:

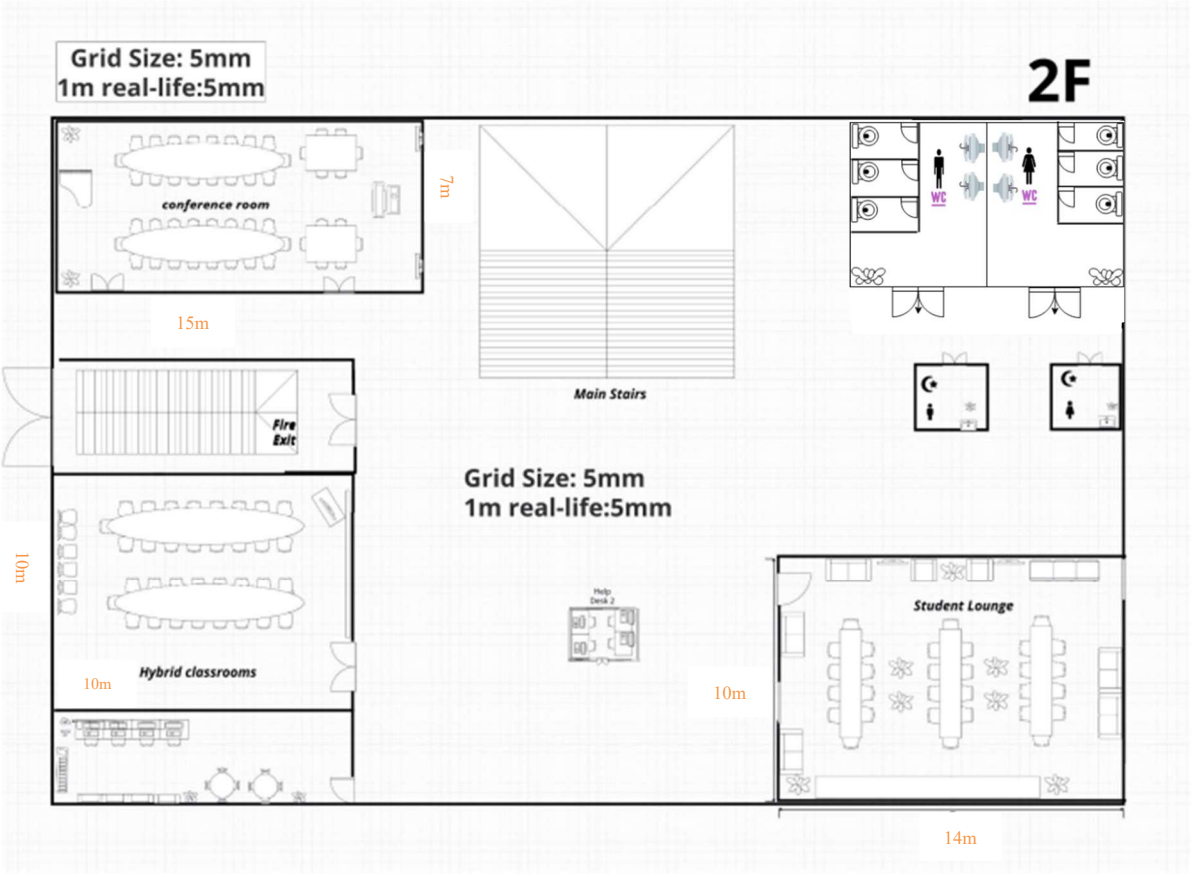
We improved the readability

First Floor Layout

- The first floor of the building is designed with a focus on laboratory spaces, technical support, and basic facilities for both students and staff.
- The key features include:
- **2 General Purpose Labs** (14m x 10m each): These labs are equipped with 30 workstations each, providing flexible spaces for a wide range of computing courses.
- **Cisco Lab** (14m x 10m): A dedicated lab for networking, equipped with Cisco devices to facilitate hands-on learning and practical network setup.
- **IoT Lab** (14m x 10m): Designed to support learning in IoT, digital sensors, and related technologies, this lab fosters innovation in line with 4IR trends.
- **Service Center**: A support area for technical assistance and maintenance of equipment.
- **Help Desk**: Strategically located near the entrance for student and staff assistance.

- **Fire Exit**: Positioned for quick access to ensure safety and evacuation in case of emergencies.
- **2 Surau** (Prayer Rooms): Separate rooms for men and women, ensuring religious inclusivity.
- **2 Washrooms**: One for men and one for women, providing necessary facilities on the floor.
- **Main Stairs**: Centrally located to provide easy access to the second floor.

Second Floor Layout



We reviewed the placement of the washrooms and relocated them to align on the same side of the building, adhering to efficient piping.

verified the dimensions of the hybrid classroom against the grid size

- The second floor is more focused on collaborative spaces, teaching, and student relaxation areas. The key features include:
- **Video Conferencing Room**: A fully equipped space for virtual meetings, presentations, and remote collaborations.
- **Hybrid Classroom**: This classroom is designed with flexible seating and high-performance equipment for both traditional and online teaching formats.

- **Student Lounge**: A comfortable area for students to relax, study, and collaborate, while connected to the network via high-speed Wi-Fi.
- **Help Desk**: Similar to the first floor, this is an information and assistance center for students and staff.
- **Fire Exit**: Strategically located for safety and evacuation purposes.
- **2 Surau (Prayer Rooms)**: Separate prayer spaces for men and women.
- **2 Washrooms**: One for men and one for women, ensuring convenience for everyone on this floor.
- **Main Stairs**: Providing access to the first floor and connecting both levels for ease of movement.

Meeting Minutes

DATE/TIME	13/10/2024 10:00a.m. --- 12:00a.m.
LOCATION	Webex online meeting
AGENDA	Discuss about task1
MEETING MC	Liu Ruoyang

ATTENDENCE

NAME	TIME	REASON OF ABSENCE
Kahlan Sultan Mohammed	10:00am—12:00am	N/A
Liu Ruoyang	10:00am—12:00am	
Buguoshun	10:00am—12:00am	
Abdulrahman Siad	10:00am—12:00am	

MINUTES

NO.	ITEM DISCUSSED	IDEAS/SUGGESTIONS AND PERSON GIVING IT	PERSON IN CHARGE AND DATE
1	Group name	A&C by Kahlan since we are Arab and Chinese.	Kahlan(13/10)
2	Software to be used	Visual Paradigm found by Liu since it has many pre-made icons available.	Liu Ruoyang(13/10)
3	Floor design	Liu and Kahlan take charge of designing first floor. Abdul and Bu take charge of second floor.	Everyone(13/10)
4	Next meeting	Whenever the preparation of task 2 begins.	Everyone(13/10)
5	Meeting ended	12:00	Everyone(13/10)

Projected Marks

Task1

ITEM	MARKS
Group name and members	2/2
Suggested floor plan	
Fit description - 2 general purpose lab, 1 Cisco Network lab and 1 IOT lab, 1 video conferencing rooms, 1 student lounge	2/2
A total 30 workstations and other equipment planned for each lab	2/2
Scale: with scale	1/1
Clear and readable. Has appropriate labels	2/2
Creativity	1/1
Total	10/10

SECR1213 NETWORK COMMUNICATION

20242025 – SEMESTER 2

PHASE 2

Question Answering and Feasibility Test

FACULTY OF MJIIT

Group: A&C

NAME	MATRIC ID
Kahlan Sultan Mohammed	A23MJ4021
Liu Ruoyang	A23MJ4022
Buguoshun	A23MJ4019
Abdulrahman Siad	A23MJ3061

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Part 1 Q&A

1. **What is the minimum network performance requirement, such as bandwidth, latency, and packet loss tolerance, for each lab?**

   For a lab accommodating 30 users, a minimum bandwidth of **7 Mbps per user** is recommended. This equates to a total bandwidth requirement of **210 Mbps** (7 Mbps x 30 users) to ensure smooth operation, especially if multiple devices are accessed simultaneously. [1]

   For optimal network performance in labs, the minimum requirements generally include a latency of under 20 ms for real-time applications and a packet loss tolerance of less than 1%. These thresholds ensure efficient data transmission and user experience, especially in environments requiring real-time communication and collaboration. [2]

2. **What are the equipment requirements for the video conferencing room, including HD cameras, sound systems, and other necessary tools?**

   For an effective video conferencing room equipment requires HD cameras since it is essential to have high quality image; in this case, it’s normally PTZ that is Pan-Tilt-Zoom, sound system which has high-quality speakers and microphone which cancels echo. Others are big displays or projectors for common display, Control System- a touch panel to control audio video and display sharing plus the light controls for video optimization. (For our conference room we've included a piano for creative breaks and beautiful flowers to enhance the ambiance. This comprehensive setup will elevate the meetings and collaborations to new heights.) [3]

3. **What is the equipment needs for the hybrid classroom, such as interactive whiteboards, remote conferencing tools, and wireless projection systems?**

   If you are to teach a class that is partly face to face and partly online you will need good audio visuals such as, Cams of high definition with P/T/Z features to

capture the entire classroom, Microphones that are installed at the ceiling to capture sound. For dynamic interaction, there has to be the presence of an online whiteboard or at least a screen sharing tool that can facilitate interaction of all the learners who are attending the face-to-face meeting from those who are receiving the interaction asynchronously. Further, there are needs for wireless projection system and good/reliable internet quality to facilitate the flow of real time data.[4]

4. **What specific equipment, like routers, switches, or firewalls, is required for the Cisco lab?**
   A Cisco lab requires fundamental hardware which include routers such as the Cisco 1941 & 2901, switches, especially from the Catalyst series like 2960 or 3560 and firewalls from the Cisco ASA series. This configuration allows practical and active involvement in real network setup and configuration with basic routing and security consistency with the CCNA standards. [5]

5. **What is the equipment needs for the IoT lab, including quantities of microcontrollers, sensors, and embedded boards, and any brand preferences?**

   For an IoT lab, the necessary devices consist of approximately 30 microcontrollers (Arduino or Raspberry Pi), different sensors as thermal, movement as well as light ones, and embedded boards (for example STM32 or ESP8266 for wireless functionalities). These devices allow the students to work on realistic IoT projects and can be purchased from familiar non-counterfeit brands.[6]

6. **How will the 15% projected increase in students and staff over four years impact network capacity requirements?**
   Based on the effective growth in the number of students and staff members up to 15% for four years; the load on the networks presents the main challenge for the Faculty of Computing. Surging from 1,800 students to about 2,070 as well as a corresponding increase in staff; there is increased demand for bandwidth, hardware, and connectivity. This growth creates the need for efficient and effective network solutions at a large level, and undefined higher bandwidth to support multiple users at the same time and undefined security measures to combat different threats.[7]

7. **Is there a long-term plan for network expansion, such as adding new labs or functional areas?**

When designing the new building you need to put into account if the faculty decides to add new labs for AI and other labs, but they don't have definite plans to do so in the near future is just that as stated int the project brief they want to have some scalability. The faculty representative said.

8. **Is there a need for backup power (e.g., UPS) or redundant network lines to ensure stability during outages?**

Yes, backup power supplies are essential for labs in case a disaster occurs or any emergencies prevent power to reach the lab. We can use suppliers such as: UPSs (uninterruptible power supplies), engine generators, and batteries.

UPSs: UPSs are generally placed between the systems and the power supply, and contain a system of batteries, chargers, switches, and inverters to maintain charge while conveying power to systems.
Batteries: Batteries are typically set up in parallel to the load and source to allow for float charging and to seamlessly power the system when necessary

Backup power supplies should be kept in secure facilities, maintained and monitored to prevent any degradation in performance. [8]

9. **What network security equipment is required, like firewalls, IDS, or IPS, to ensure security?**

To ensure the security of your network, a combination of hardware and software solutions is essential. Here are some of the key network security equipment we should consider:

- **Firewalls**
  Firewalls are one of the most fundamental network security appliances.

- **Intrusion Detection Systems (IDS)**
  Network-based intrusion protection systems proactively monitor all the traffic going through your network.

- **VPN Gateways**

With the rise of remote work, every company needs to ensure that their internal network resources are accessible securely from anywhere. [9]

10. **Are there specific requirements for network traffic monitoring to prevent misuse and enhance efficiency?**

Effective network traffic monitoring is crucial for preventing misuse, enhancing efficiency, and ensuring overall network security. Here are some key requirements:

1) **Choose a data source of best fit:**
   To start exploring the depths of your network, you must gain brief visibility of the data
   .
2) **Discover main applications running on your network:**
   discovering how users are accessing your network will allow you to track usage back to the user's origin.

3) **Apply network monitor tools:**
   there are multiple network monitoring tools you'll want to consider utilizing to have total control of your network's traffic and security such as:

- Wireshark
- SolarWinds Network Performance Monitor
- Data Dog

By addressing these requirements and implementing effective network traffic monitoring solutions, organizations can significantly improve network security, performance, and overall efficiency. [10]

11. **Our budget is RM1.3 million; when the budget is insufficient, which aspects should be prioritized?**

The main aspects that should be prioritized are technology and devices that will be used in the laboratory. Here are the main devices: [11]

Hardware:

- **Routers and Switches**
- **Firewalls**
- **Servers**
- **Cables and Accessories**

Software:

- **Cisco Packet Tracer, GNS3, or EVE-NG**
- **VMware or VirtualBox**
- **Network Monitoring Tools**

12. Is it possible to reduce equipment burden through outsourcing services like cloud services?

Yes, outsourcing through cloud services can greatly reduce budget and equipment burdens. Cloud models like:

•Software-as-a-Service (SaaS)

enables users to access and utilize cloud-based applications via the internet. In this setup, the cloud service provider manages the hosting, delivery, and maintenance of the software, resulting in cost savings.

•Infrastructure-as-a-Service (IaaS)

This offers essential cloud computing services—like computing power, networking, and data storage—over the internet as needed. With these virtual services, users do not have to purchase, store, or maintain physical data servers and other equipment on-site.

•Platform-as-a-Service (PaaS)

This provides users with a comprehensive cloud platform that includes hardware, software, and infrastructure, enabling them to develop, run, and manage applications without the need for costly, bulky, and inflexible on-site facilities.

This flexibility helps companies manage costs effectively while accessing scalable infrastructure. [12]

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[1] Fortinet. (n.d.).(Modified Tue, 30, july) *How much bandwidth is needed to run a lab?* Fortinet Helpdesk. Retrieved October 30, 2024, from https://helpdesk.training.fortinet.com/support/solutions/articles/73000617318-how-much-bandwidth-is-needed-to-run-a-lab

[2] ManageEngine. (n.d.). *Network performance monitoring (NPM) software & tools - OpManager*. Retrieved October 30, 2024, from https://www.manageengine.com/network-monitoring

[3] Virtual Meeting World. (March,26,2024). (Updated May 31,2024) *Video conferencing room setup requirements checklist*. Retrieved October 30, 2024, from https://virtualmeetingworld.com/equipment/video-conferencing-requirements/

[4] Kalyzee. (2024). *Hybrid classroom equipment: 7 tips for making the right choice*. Kalyzee. Retrieved October 30, 2024, from https://www.kalyzee.com/en/resources/technical/hybrid-classroom-equipment/

[5] NetworkLessons. (n.d.). *Recommended lab equipment for Cisco CCNA*. Retrieved October 30, 2024, from https://networklessons.com/cisco/ccna-routing-switching-icnd1-100-105/recommended-lab-equipment-for-cisco-ccna

[6] Sunjeev Newpaney. (n.d). *IoT*. Scribd. Retrieved October 30, 2024, from https://www.scribd.com/document/425879841/Iot

[7] Kairouz, P., McMahan, H. B., Alizadeh, M., Arnold, S., Baldesi, L., ... & Zhao, S. (2019). *A Survey on Federated Learning: The Journey from Centralized on-device Machine Learning to Privacy-Preserving Distributed Intelligence*. IEEE Xplore. https://doi.org/10.1109/COMST.2019.2942298

[8] ScienceDirect. (n.d.). *Backup power supply*. In *Engineering Topics*. Retrieved October 30, 2024, from https://www.sciencedirect.com/topics/engineering/backup-power-supply

[9] RestorePoint. (n.d.). *What are network security devices?* RestorePoint. Retrieved October 30, 2024, from https://www.restorepoint.com/topics/what-are-network-security-devices

[10] Varonis. (2024, January 10).(Updated June 23,2023) *How to monitor network traffic.* Varonis. Retrieved October 30, 2024, from https://www.varonis.com/blog/how-to-monitor-network-traffic

[11] Network Journey. (2024, August 02). *Build your own network lab: A step-by-step guide.* Network Journey. Retrieved October 30, 2024, from https://networkjourney.com/build-your-own-network-lab-a-step-by-step-guide/

[12] Orient Software. (2023). *Cloud outsourcing: An in-depth look at its benefits and challenges*. Orient Software. Retrieved October 30, 2024, from http://www.orientsoftware.com/blog/cloud-outsourcing/

Part 2 Project feasibility

Efficient network systems, advanced equipment and complete laboratories are crucial to ensuring a high-quality learning experience for future users. Project feasibility covers budget, technology, management, scalability and future growth. Therefore, we hope that through the prepared materials, these laboratories will create a comfortable learning and working environment for students and faculty.

Budget feasibility:

The budget is FEASIBLE if the total project budget is expected to be less than RM1.3 million. However, if all expenses approach or exceed the budget limit, adjustments will need to be made for additional equipment and backup equipment. With proper planning and selection, a budget of RM1.3 million is feasible

Hardware requirements analysis

1. **Routers and Switches:** Depending on the lab and network size, multiple routers and switches may be required, with an estimated cost of **MYR 100,000 to MYR 300,000.**
2. Firewall: Choose high-performance firewall equipment, which costs approximately **MYR 50,000 to MYR 150,000.** Server is **between MYR 150,000 and 300,000**.
Cables and **accessories at MYR 50,000 to MYR 100,000.**
Software requirements analysis：
1.Network monitoring tools and virtualization software (such as Wireshark, SolarWinds, DataDog, etc.), estimated cost is **MYR 50,000 to MYR 150,000.**
2.Additional equipment requirements is about **MYR 100,000 to MYR 200,000**. Hybrid Classroom Equipment is **MYR 100,000 to MYR 200,000**.
Emergency and redundant equipment is **MYR 50,000 to MYR 100,000** to ensure the stability of the laboratory in the event of a power outage.
Based on the above budget, the total cost may range from MYR 750,000 to MYR 1,500,000. If the amount exceeds MYR 1,300,000, the investment in emergency and redundant equipment can be reduced, or the remaining experimental equipment can be reasonably purchased.

Technical feasibility forecast:

Current technology can meet the basic requirements of 4IR in terms of network performance and equipment support, and the technical feasibility is high.

1. Network performance requirements: The laboratory requires a bandwidth of 210 Mbps and a latency of less than 20 milliseconds to support real-time applications and high-concurrency user scenarios. Modern network technology can meet these needs.
2. IoT lab support: The IoT lab requires about 30 microcontrollers, various sensors, and embedded circuit boards for real-time data collection and processing. Current technology can effectively support a variety of IoT applications and meet the interconnection needs of smart devices in 4IR.

Management feasibility:

The system is relatively simple to manage and has reasonable maintenance costs. By rationally selecting management tools and equipment, the complexity and cost of management and maintenance can be effectively reduced and the efficient operation of the system can be ensured.
1. Management convenience: Modern network systems usually support centralized management platforms, allowing administrators to monitor and manage all devices through a single interface, thereby simplifying the management process and reducing complexity.
2. Reasonable maintenance costs: Although initial equipment purchases (such as routers, switches, firewalls, etc.) require larger investments, the durability and low failure rates of modern equipment can often reduce long-term maintenance costs. In addition, many equipment manufacturers provide technical support and maintenance services, and reasonable maintenance contracts can further reduce risks and unexpected expenses.

Scalability and future growth:

This design has good scalability and can effectively cope with the increase in users, diversification of equipment types and the introduction of new technologies, ensuring the sustainable development and efficient operation of the system.
1. Design scalability: The current design uses a modular architecture to make it easy to add or replace routers, switches, and access points as needed. This design makes the system scalable and able to quickly adapt to changing needs. The equipment and technology selected meet the latest industry standards and are compatible with new equipment, reducing barriers to future upgrades.
2. Adapt to future network demand growth: The design takes into account future bandwidth demand growth, supports high bandwidth and low latency performance, and can meet the future needs of multiple users and high data traffic. As the number of IoT and smart devices increases, network design supports more connections and data transmission, ensuring stability and efficiency in device-dense environments.

Meeting Minutes

DATE/TIME	26/10/2024 10:00a.m.----12:00a.m.
LOCATION	Webex online meeting
AGENDA	Discuss about task2
MEETING MC	Bu Guoshun

ATTENDENCE		
NAME	**TIME**	**REASON OF ABSENCE**
Kahlan Sultan Mohammed	10:00am—12:00am	N/A
Liu Ruoyang	10:00am—12:00am	
Buguoshun	10:00am—12:00am	
Abdulrahman Siad	10:00am—12:00am	

MINUTES			
NO.	**ITEM DISCUSSED**	**IDEAS/SUGGESTIONS AND PERSON GIVING IT**	**PERSON IN CHARGE AND DATE**
1	Questions design	Liu will take charge of this part	Liu Ruoyang(26/10)
2	Question answering	Kahlan and Abdul will answer the questions through research and interview	Kahlan Sultan Mohammed (27/10) Abdulrahman Siad (28/10)
3	Feasibility test	Bu will test the feasibility of the project through considering our budget, which is RM 1.3M	Bu Guoshun(29/10)
4	Next meeting	Whenever the preparation of task 3 begins.	Everyone(27/10)
5	Meeting ended	12:00	Everyone(27/10)

Projected Marks

Task2

ITEM	MARKS
10 questions	
Questions are appropriate to project and beneficial to better understanding	2/2
Questions are answered correctly and appropriately	2/2
Questions are researched through FC representative and reputable sources.	1/1
Answers are correctly referenced (with reference and citation)	2/2
Feasibility	
Feasibility answer	1/1
Feasibility reasoning is logical and appropriate	2/2
Total	10/10

SECR1213 NETWORK COMMUNICATION

20242025 – SEMESTER 1

PHASE 3

CHOOSING THE APPROPRIATE LAN DEVICES

FACULTY OF MJIIT

GROUP A&C

NAME	MATRIC ID
Kahlan Sultan Mohammed	A23MJ4021
Liu Ruoyang	A23MJ4022
Buguoshun	A23MJ4019
Abdulrahman Siad	A23MJ3061

Overview of Budget:

Our allocated budget for the entire project is RM 1.3 million. So, we have an allocation of RM 1,300,000 for the network devices and end user devices we are going to list out in this part of the project.

This project aims to design and set up a comprehensive network infrastructure for our institution. The focus is on creating functional spaces like labs, a conference room, and service areas, each equipped to meet its unique purpose.

The labs will support diverse needs such as hands-on Cisco training, IoT development, and general computing.

Additionally, we plan to ensure seamless connectivity and usability across all areas through the careful selection of network devices and end-user equipment. This setup is designed to balance performance and scalability, laying a solid foundation for both current and future needs.

Rewrote overview to make it easier to read

The budget will no longer be allocated for furniture and renovation purposes; it will be used exclusively for network equipment procurement.

LAN Devices List (with price calculation)

Unify the calculation of equipment commonly needed in each area to avoid a cluttered appearance.

Ensured connectivity for each area

1. General Devices and Accessories

Network devices including routers, switches, patch panels, wireless access points and cables for each area needs.

Accessories such as monitors, keyboards and mouses for general use.

Regarding computer configurations, each laboratory is equipped with 35 student computers and 1 teacher's workstation, totaling 36 computers per lab. Additionally, there are 3 workstations, one in each room on the second floor, and one in the service center. In total, 36 × 4 + 4 = 148 computers are required. Prices of Monitors and Accessories are calculated here. The model of computers and prices are then calculated separately in each area.

For network equipment configurations, each laboratory requires 1 router, 1 patch panel, 1 switch, and 1 wireless access point. The service center, hybrid classroom, conference room, and students' lounge on the second floor each require 1 router and 1 wireless access point. In total, 8 routers, 4 switches, 4 patch panels, and 8 wireless access points are needed. Additionally, the server room will house 5 servers.

To fulfill the connectivity requirements, we need 4 fibre optic cables, 4 Cat6 Ethernet cables, and additional cables totaling approximately 1500 meters. The total cost is approximately RM 6500.

Ensured the devices are all for enterprise/education use

Equipment	Model	Description	Unit Price (RM)	Qty	Total Price (RM)
Router	Huawei NetEngine AR6100	Designed for the cloud era, this enterprise-grade router offers up to three times the industry's forwarding performance and supports 5G ultra-broadband uplink. It integrates SD-WAN, cloud management, VPN, MPLS, security, and voice functions, making it ideal for educational institutions and enterprises requiring high-performance and versatile networking solutions.	5000	8	40000

Switch	TP-Link TL-SG1048	This unmanaged switch offers 48 Gigabit Ethernet ports, providing a reliable and cost-effective solution for expanding your network. It's designed for easy integration into standard 19-inch racks and supports plug-and-play functionality.	1099	4	4396
Accessories	Dell KM636 Wireless Keyboard and Mouse Combo	A compact wireless set featuring a full-sized keyboard with chiclet keys and a comfortable optical mouse. Designed to reduce desk clutter and provide a seamless user experience.	150	148	22200
Monitor	Dell P2419H	A 23.8-inch Full HD IPS display with ultra-thin bezels, offering sharp visuals and accurate colors. It features blue light reduction, flicker-free technology, and an adjustable stand for ergonomic comfort.	800	148	118400
Patch Panel	CommScope AMP CAT 6 Patch Panel 2U-48 Ports	This high-performance patch panel exceeds ANSI/TIA-568-C.2 Category 6 hardware transmission performance. It features dual-type IDC termination, accepts 22-26 AWG stranded or solid wire, and supports both T568A and T568B wiring.	375	4	1500
Wireless Access Point	TP-Link EAP670 AX5400	A high-speed dual-band access point offering up to 5400 Mbps, ideal for high-density environments with seamless roaming and Omada Mesh support.	1299	8	10392
Server	HP ProLiant DL380 Gen10	Offers scalability with Intel Xeon Scalable processors, up to 3TB RAM, and enhanced security features. Suitable for diverse workloads in educational settings.	12000	5	60000
Cables	Cables	For connectivity requirements.			6500

Table 1: General device selections and costs

Subtotal for General devices and accessories: RM 263,388

Clearly distinguish between the equipment needed for network connections and the equipment required for Cisco technical training.

2. Cisco Lab

Purpose: To facilitate hands-on training for CCNA and advanced networking courses.

Equipment	Model	Description	Unit Price (RM)	Qty	Total Price (RM)
Cisco Device for Training Purpose	Cisco ASA 5506-X	A next-generation firewall designed to provide network protection and monitoring. It includes advanced intrusion prevention and malware defense features, ideal for securing lab environments	10000	1	10000
Computers	Dell OptiPle x 7080	High-performance desktop PCs equipped with Intel i7 processors, 16GB RAM, and 512GB SSD storage, ensuring smooth performance for complex networking tasks	4000	36	144000
Cisco Device for Training Purpose	Cisco ISR 4321 Router	A versatile router ideal for Cisco lab training, enabling hands-on experience with advanced routing and security configurations.	3509	2	7018
Cisco Device for Training Purpose	Cisco Catalyst 2960 Series Switch	An essential switch for Cisco lab environments, providing practical exposure to VLANs, STP, and network management.	950	2	1900

Cisco Device for Training Purpose	Cisco ASA Firewall	A critical component for Cisco lab training, offering real-world experience in implementing network security measures and VPN configurations.	1500	2	3000

Subtotal for Cisco Lab: RM 165,918

Table 2: Cisco device selections and costs

Recalculated costs for each area

3. IoT Lab

Purpose: For IoT device development, embedded programming, and data collection projects.

Equipment	Model	Description	Unit Price (RM)	Qty	Total Price (RM)
Microcontroll er	Raspberr y Pi 4 Model B	A versatile microcontroller with 4GB RAM and a quad-core Cortex-A72 CPU, capable of running IoT applications and integrating with various sensors	300	36	10800
Embedded Board	STM32 Nucleo-F446R E	A development board featuring STM32F446RE MCU, ideal for real-time data processing and IoT prototyping	100	20	2000
Sensors	Various	Assorted sensors including light, temperature, and motion sensors for comprehensive IoT project development and environmental monitoring	50	36	1800

Computers	HP ProDesk 400 G6	Mid-range desktop PCs equipped with Intel i5 processors, 8GB RAM, and 256GB SSD, suitable for IoT development and data analysis	3000	36	108000

Table 3: IoT device selections and costs

Subtotal for IoT Lab: RM 122,600

4. General Purpose Labs (2 Labs)

Purpose: For basic computing courses and general use.

Equipment	Model	Description	Unit Price (RM)	Qty	Total Price (RM)
Computers	Lenovo ThinkCentre M720	Desktop PCs with Intel i5 processors, 8GB RAM, and 256GB SSD storage, optimized for general computing tasks and educational use	2500	72	180000
Printer	HP LaserJet Pro M404dn	A monochrome laser printer with duplex printing capabilities, providing efficient document printing for lab users	1200	2	2400

Subtotal for General Purpose Labs: RM 182,400

Table 4: General lab device selections and costs

5. Conference Room

Purpose: For video conferencing and meetings.

Equipment	Model	Description	Unit Price (RM)	Qty	Total Price (RM)
PTZ Camera	Logitech PTZ Pro 2	An HD 1080p PTZ camera with 10x optical zoom, designed for capturing high-quality video during meetings	5000	1	5000
Audio System	Bose Professional	An integrated audio system featuring high- quality speakers and microphones for clear and immersive sound in conference settings	8000	1	8000
Display	Samsung 75" 4K UHD	A large-format display with 4K resolution, ideal for presenting visual content during meetings	10000	1	10000
Control Panel	Crestron TSW-1060	A 10.1" touch screen control panel for managing audio, video, and lighting systems in the conference room	6000	1	6000
Computer	Lenovo ThinkCentre M720	Desktop PCs with Intel i5 processors, 8GB RAM, and 256GB SSD storage, optimized for general computing tasks and educational use	2500	1	2500

Subtotal for Conference Room: RM 31,500 Table 5: Device Selections for conference room and costs

6. Hybrid Classroom

Purpose: For blended learning (online and offline).

Equipment	Model	Description	Unit Price (RM)	Qty	Total Price (RM)
PTZ Camera	AVer CAM540	A 4K PTZ camera with 16x zoom, providing wide-angle coverage and high-resolution video for hybrid teaching setups	6000	1	6000
Ceiling Microphone	Shure MXA910	An advanced ceiling array microphone for capturing clear audio across the classroom	12000	2	24000
Interactive Whiteboard	SMART Board 7000R	A 75" interactive display with iQ technology, enhancing engagement in hybrid learning environments	15000	1	15000
Wireless Projection System	Barco ClickShare CX-20	A wireless presentation system that allows seamless screen sharing in real-time	5000	1	5000
Computer	Lenovo ThinkCentre M720	Desktop PCs with Intel i5 processors, 8GB RAM, and 256GB SSD storage, optimized for general computing tasks and educational use	2500	1	2500

Subtotal for Hybrid Classroom: RM 52,500

Table 6: Device Selections for hybrid classroom and costs

7. Student Lounge

Purpose: For student relaxation and casual use.

Equipment	Model	Description	Unit Price (RM)	Qty	Total Price (RM)

Computers	Acer Aspire TC	Basic desktop PCs with Intel i3 processors, 4GB RAM, and 1TB HDD, providing reliable performance for casual use	2000	2	4000

Subtotal for Student Lounge: RM 4,000

Table 7: Device Selections for student lounge and costs

8. Service Area

Purpose: For administrative and support functions.

Equipment	Model	Description	Unit Price (RM)	Qty	Total Price (RM)
Computers	HP Pavilion Desktop	Basic desktop PCs for administrative tasks, featuring Intel i3 processors and 256GB SSDs	2000	2	4000
Printer	HP LaserJet Pro M404dn	A monochrome laser printer with duplex printing capabilities, providing efficient document printing for lab users	1200	2	2400

Subtotal for Service Areas: RM 6,400

Table 8: Device Selections for service center

Summary of Total Costs

Updated total costs

Room/Area	**Subtotal (RM)**
General Devices and Accessories	263,388
Cisco Lab	165,918
IoT Lab	122,600

General Purpose Labs (2 Labs)	182,400
Conference Room	31,500
Hybrid Classroom	52,500
Student Lounge	4,000
Service Area	6,400
Backup Power (UPS)	50,000
Network Monitoring Tools	50,000
Total	**928,706**

Table 9: Total costs calculation

Remaining Budget: RM 371,294

The budget remaining can be allocated for unexpected expenses such as additional equipment.

Reflection Report on Network Equipment and Prices

Edited Reflection Report to fit content changes in previous pages

1. Is the price surprising?

Some network equipment prices are predictable, while others are surprising.

Cisco's high-end devices, such as the ISR 4321 router and Catalyst switches, are expensive, reflecting their advanced features and reliability. Meanwhile, devices like TP-Link EAP670 wireless access points and CommScope AMP CAT6 patch panels are affordable, making them suitable for moderate-performance areas. This price disparity highlights how brand reputation and functionality impact pricing.

The project's RM1.3 million budget allocation carefully balances performance and cost. High-end Cisco devices are prioritized for environments like Cisco labs, where reliability and functionality are critical. In contrast, TP-Link and CommScope devices are chosen for general-purpose spaces like student lounges, offering cost-effectiveness without compromising usability.

2. Reflect on costs of devices

Cost was a primary consideration in this project. The planning reflects a deliberate effort to balance performance with budget constraints:

- IoT Laboratory: Raspberry Pi and STM32 development boards were chosen for their affordability and adaptability, ideal for prototyping and educational tasks.
- General Laboratory: Cisco Catalyst switches and Lenovo PCs ensure performance for essential tasks while avoiding high expenses.
- Service Area: TP-Link EAP670 wireless access points provide cost-effective, high-speed connectivity for student support areas.

These strategic decisions illustrate how the project successfully meets diverse needs while staying within budget.

3. Main differences between different brands of equipment (e.g., Cisco vs Huawei routers)

When comparing brands like Cisco and Huawei, the differences lie in key areas:

- Price: Cisco devices, such as the ISR 4321 router, are generally more expensive due to their advanced features and strong global support system. Huawei offers affordable alternatives, making them attractive for projects with limited budgets.
- Functionality: Cisco excels in enterprise-level performance, including superior WAN aggregation and advanced security features, ideal for large-scale deployments like Cisco labs. Huawei offers competitive functionality but may face compatibility challenges in mixed-brand environments.

- Support and Ecosystem: Cisco provides extensive resources, including CCNA certification programs and a large global user community, which make it a leader in user support. Huawei is rapidly improving in these areas but still has some gaps compared to Cisco.
- Performance: Both brands are reliable, but Cisco’s scalability and capacity to handle complex networks make it the better choice for enterprise-grade applications.

Summary

This project demonstrates a thoughtful approach to balancing "high performance" with "cost efficiency." Cisco devices were chosen for environments requiring advanced capabilities, such as Cisco labs, while affordable solutions like TP-Link and CommScope were used in general-purpose areas. This approach maximizes the available budget while ensuring a scalable and robust network architecture.

Ensure referenced in APA style

References:

1. Network Lessons. (n.d.). *Recommended lab equipment for Cisco CCNA*. Retrieved January 5, 2025, from https://networklessons.com/cisco/ccna-routing-switching-icnd1-100-105/recommended-lab-equipment-for-cisco-ccna
2. Hwang, H., Kang, T., Kim, H., & Park, S. (2018). Predictive load balancing based on machine learning for IoT applications. *2018 International Conference on Information Networking (ICOIN)*. IEEE Xplore. doi:10.1109/ICOIN.2018.8343209

Meeting Minutes

DATE/TIME	27/11/2024 10:00a.m. 12:00a.m.
LOCATION	Google meet
AGENDA	Discuss Lan Devices
MEETING MC	Abdul-Rahman Siad

ATTENDENCE

NAME	TIME	REASON OF ABSENCE
Kahlan Sultan Mohammed	10:00am—12:00am	N/A
Abdulrahman Siad	10:00am—12:00am	
Buguoshun	10:00am—12:00am	
Liu Ruoyang	10:00am—12:00am	

MINUTES

NO.	ITEM DISCUSSED	IDEAS/SUGGESTIONS AND PERSON GIVING IT	PERSON IN CHARGE AND DATE
1	Research about routers, switch racks, printers, monitors, TV and equipment.	Liu suggested appropriate options for various equipment, including routers for video streaming and lab use, switch racks, printers, video conferencing monitors, a TV for the lounge, and necessary equipment for Cisco and IoT labs.	Liu Ruoyang(26/11)
2	Budget allocation for workstations and the specs that go along with it, relative to the IOT, CISCO and general lab	Because of the diversified aim and mission, there should be different distribution of requirements between the labs. To say that it would be pertinent to properly fund that said purpose to the best of their abilities while not neglecting the grand scheme of things as well.	Kahlan Sultan Mohammed (26/11) Abdulrahman Siad (26/11)

3	Router and switches and their implications in order to make an interactive system	Using implications of servers and wireless internet connections and ethernet cables for the connection of router and switches.	Bu Guoshun(26/11)
4	Interactive help desk and environment	Using specific PCs in order to meet the requirements of the customers at the help desk and small additions in the conference room and lounge in order to provide nuance experience.	Everyone(27/11)
5	Meeting ended	Everyone leaving the meeting.	Everyone (27/11)

Projected Marks

Task3

ITEM	MARKS
List of devices	
Is enough research done? *Also need references	2/2
References included ; are appropriate and reputable	1/1
Does LAN devices chosen accomplish needs/requirements of FC?	2/2
Characteristics of LAN Devices chosen is explained/shown clearly	2/2
Report	
Are you surprised by the prices?	1/1
Reflect on costs of devices	1/1
What are the major differences between the same devices from different brands	1/1
Total	10/10

UNIVERSITI TEKNOLOGI MALAYSIA

Malaysia-Japan International Institute of Technology (MJIIT)

SECR1213 NETWORK COMMUNICATION

20242025 – SEMESTER 1

PHASE 4

MAKING THE CONNECTIONS – LAN and WAN

FACULTY OF MJIIT

GROUP A&C

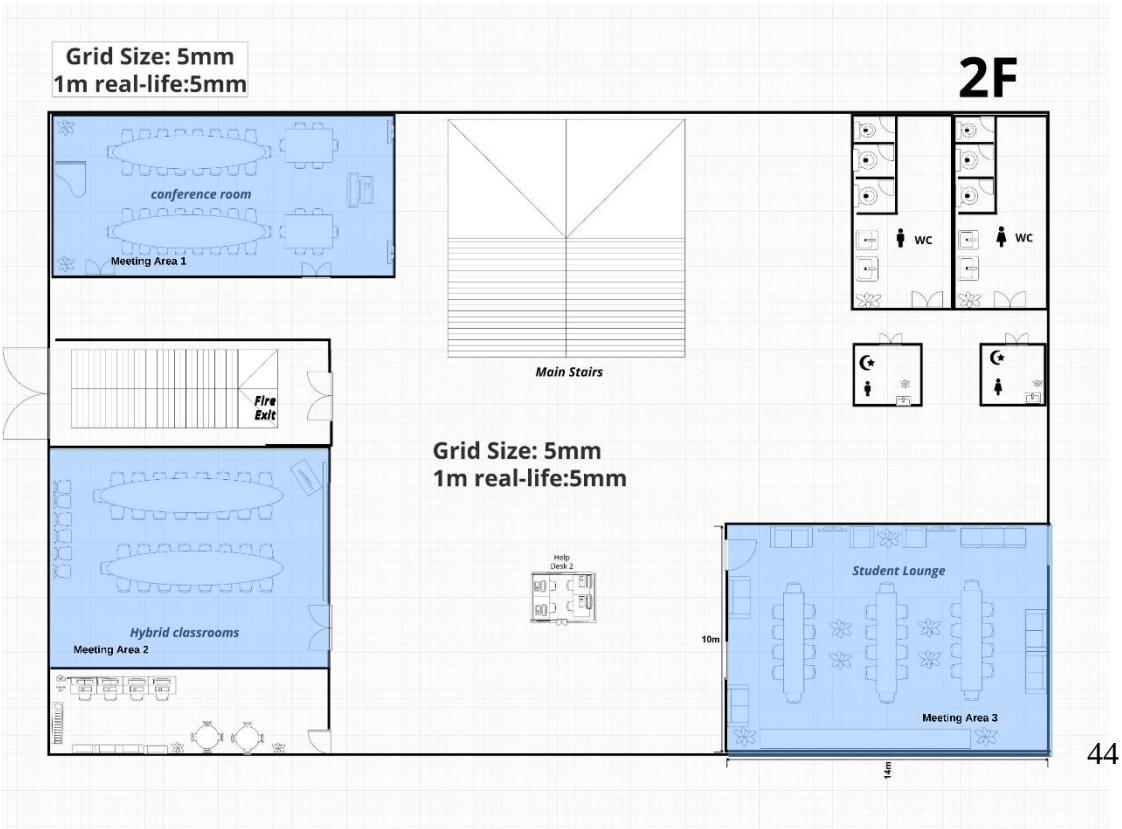
NAME	MATRIC ID
Kahlan Sultan Mohammed	A23MJ4021
Liu Ruoyang	A23MJ4022
Buguoshun	A23MJ4019
Abdulrahman Siad	A23MJ3061

1.Work Areas identification

a. First floor

b. Second floor

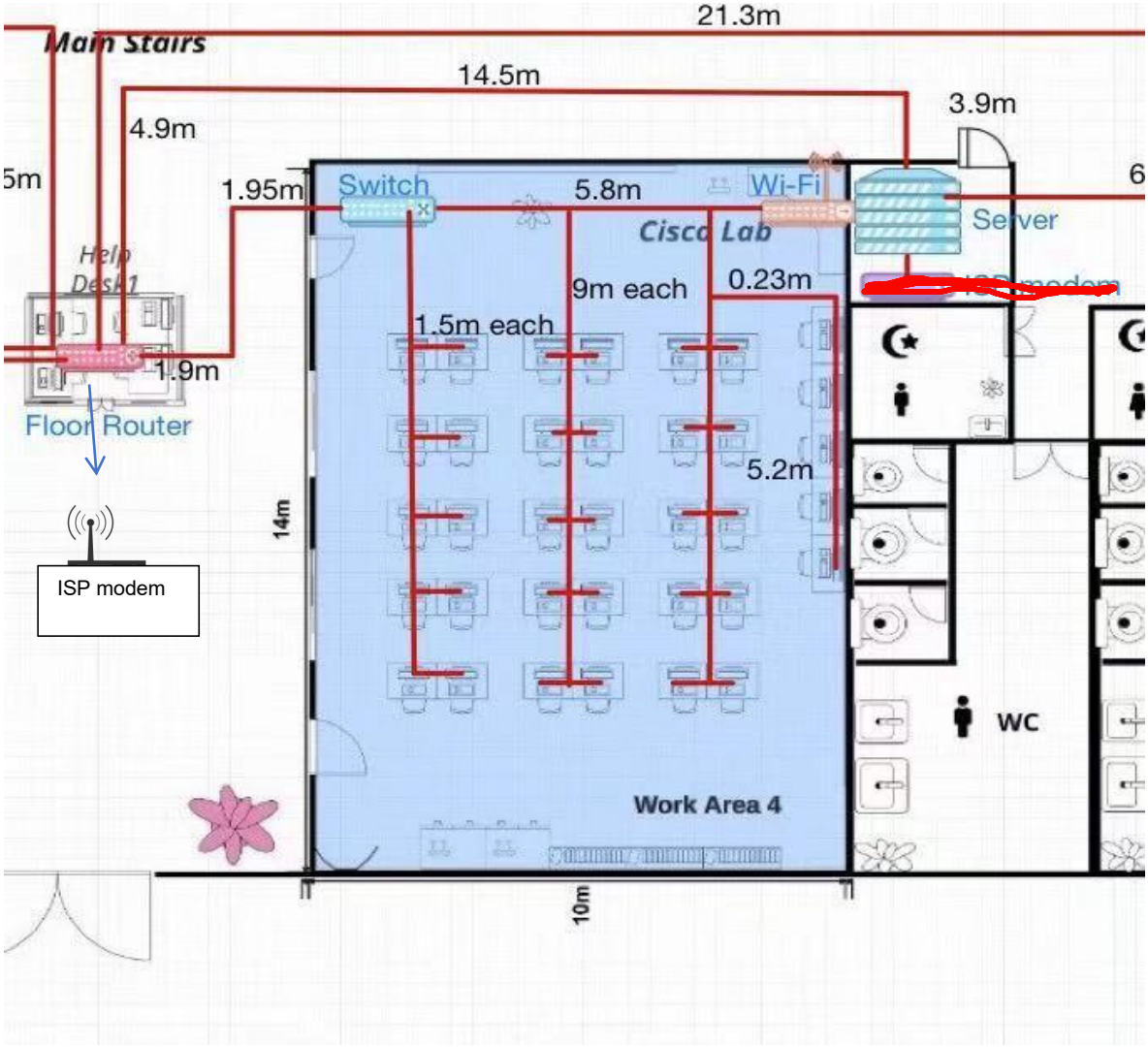
Explanation: We have divided the workspace into different sections. The four laboratories on the first floor share similar characteristics and layouts, so they are collectively referred to as "Work Area" and labeled as Work Area 1-4. The Service Center on the first floor is labeled as Service Area 1. On the second floor, the conference room and hybrid classroom are primarily used for classes and meetings, and are therefore labeled as Meeting Area 1 and 2, respectively. Student Lounge, designated as Meeting Area 3, is primarily used for



students to rest and study. It can also serve as a backup space for holding meetings when other meeting areas are occupied.

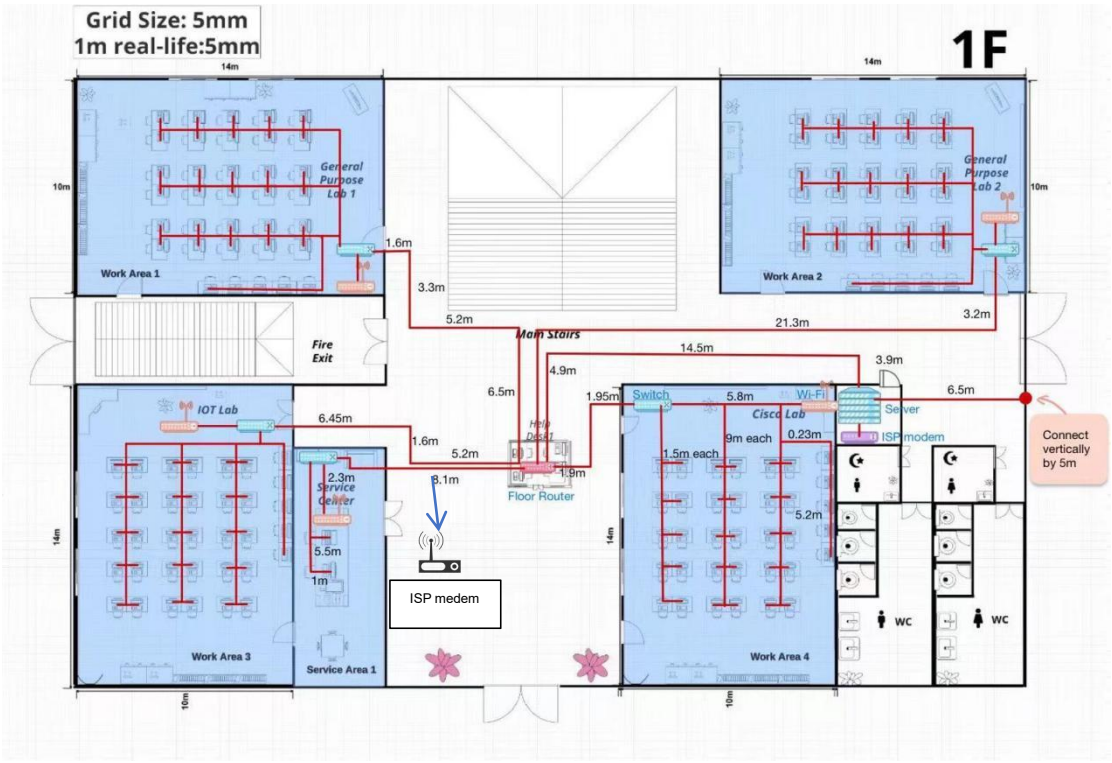
2.Cabling Simulation

We use Work Area 4 as an example of in-lab cabling.



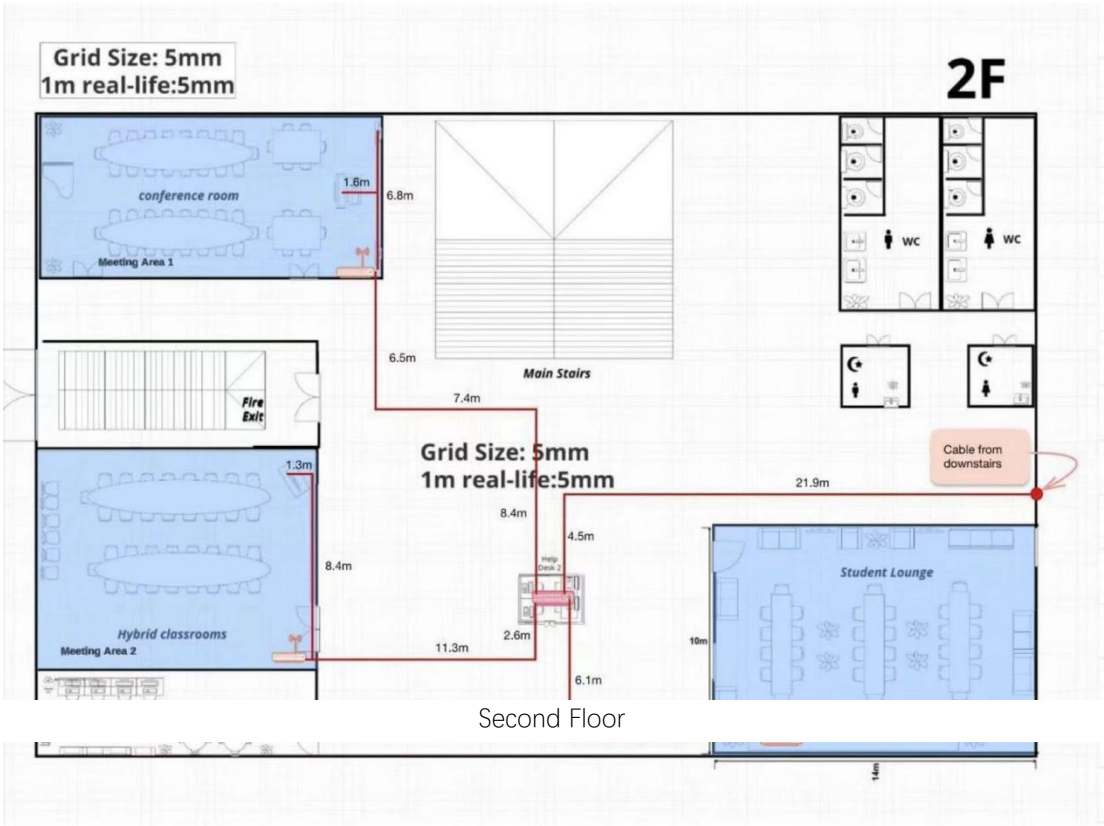
Since the four labs share similar characteristics and equipment, we have provided the labels for each device in Work Area 4 and the estimated cable lengths based on scaled measurements as a reference.

Remove the original ISP, then add a new ISP under the central router on the first floor and connect it to the router.



First Floor

3.**Network Topology:**



Second Floor

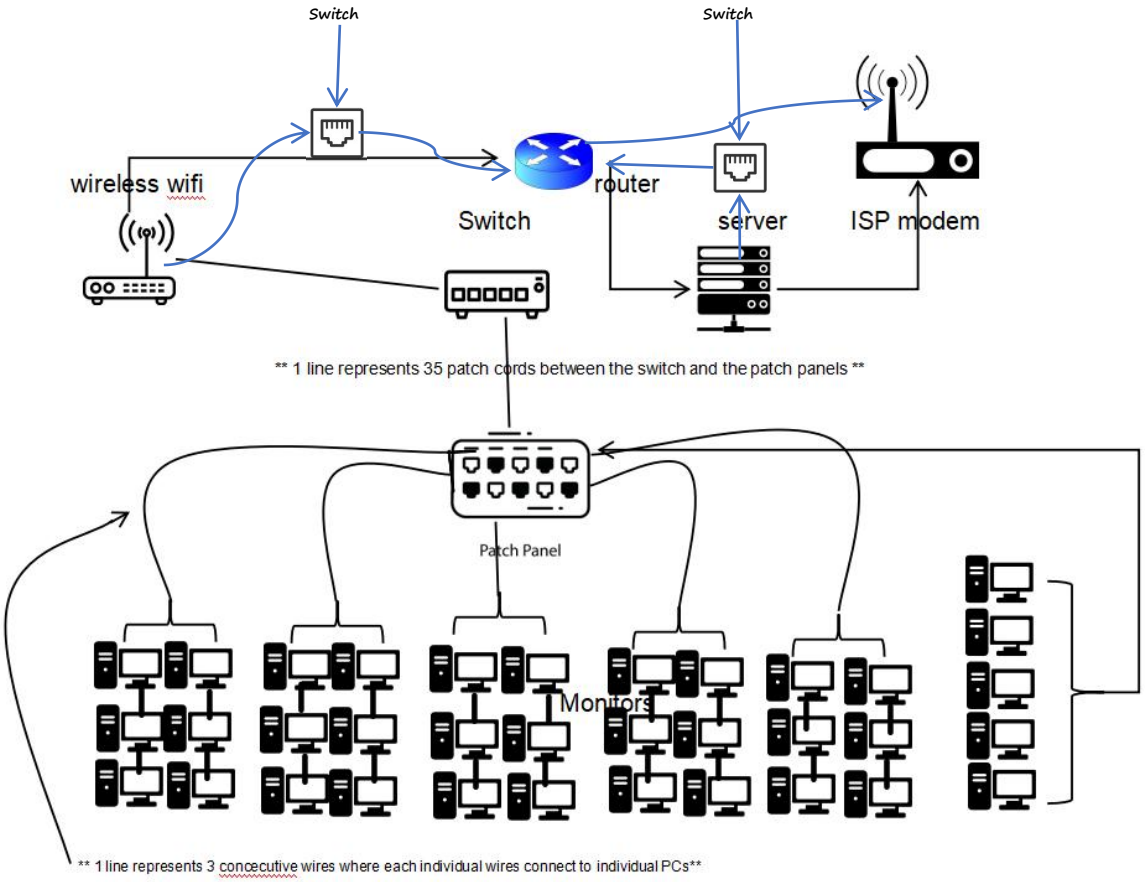
This section entails the details of the network topology design for each workstation and meeting place

a.For each section

The blue arrow is after the change

Wireless AP → Switch → Router → ISP Modem

Server → Switch → Router → ISP Modem



workstation sections (1-4) on the first floor have the same layout, defined by this diagram.

The APs are clearly labeled and a switch is added between the APs and the router.

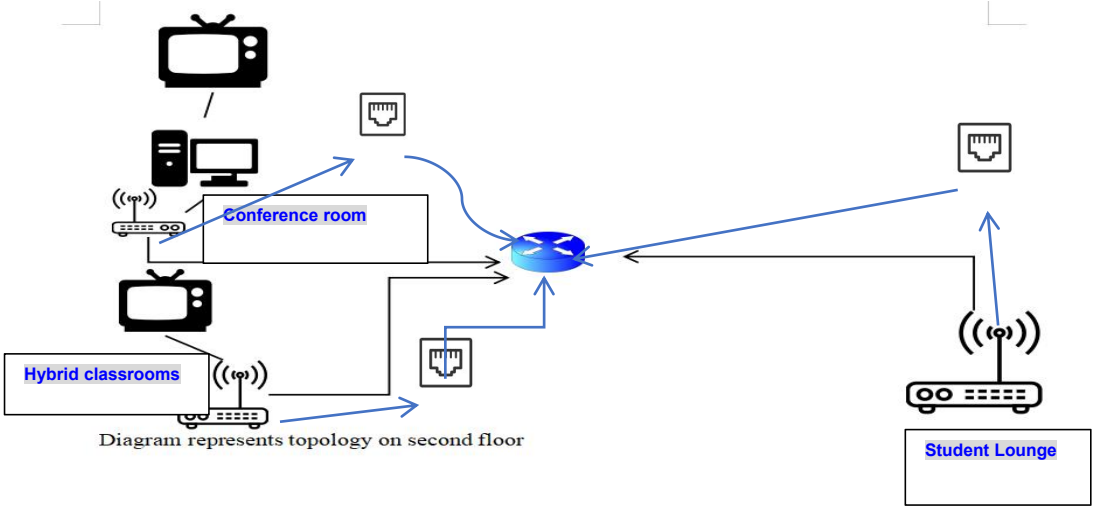


Diagram represents topology on second floor

b.For the whole network

The details are the same as above.

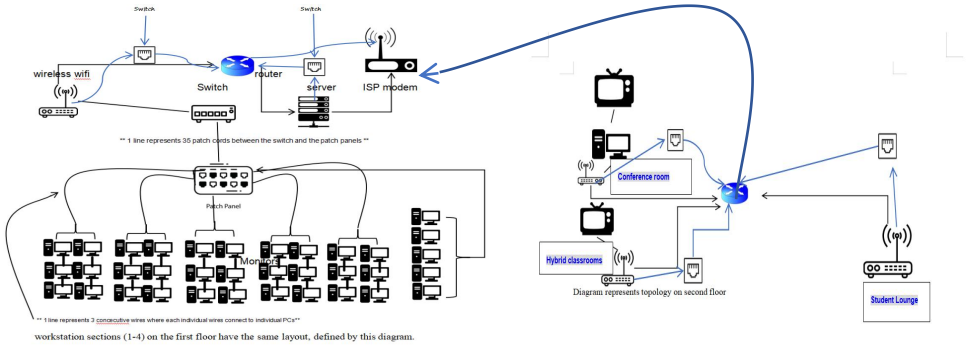
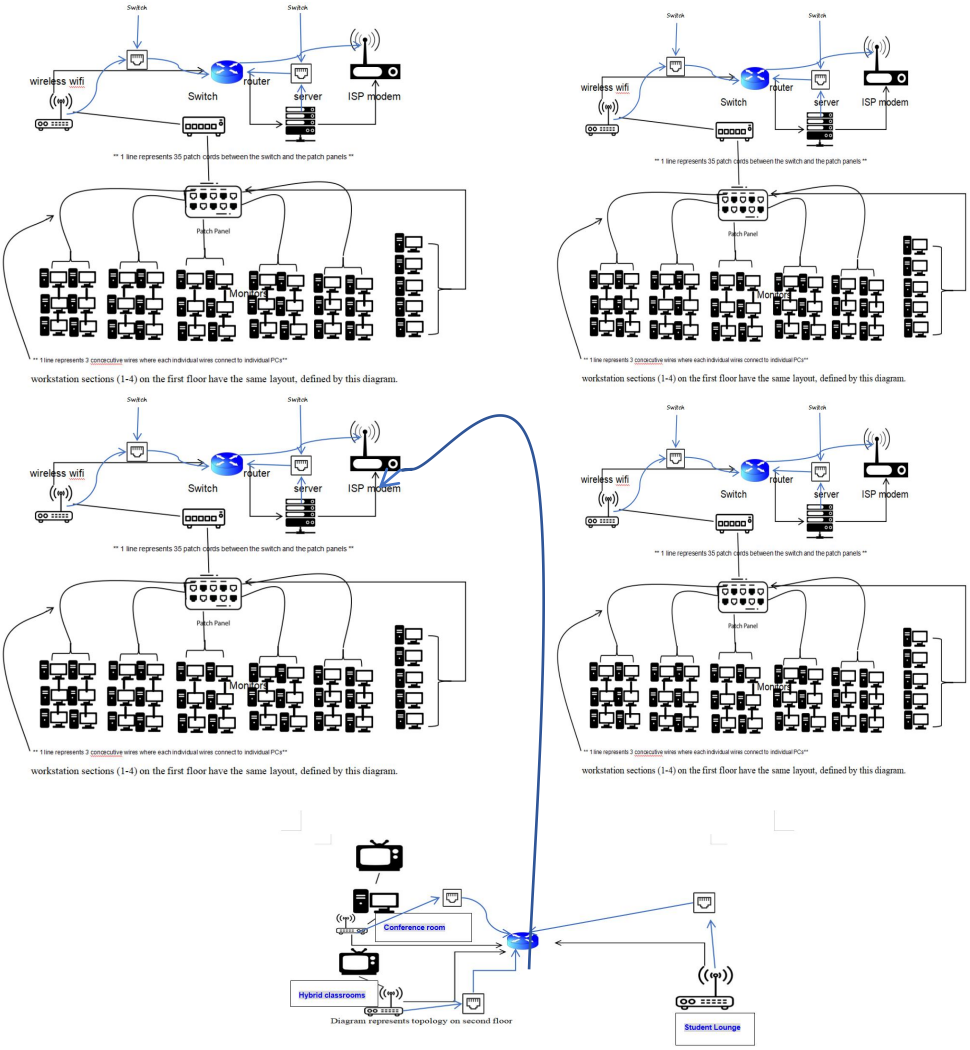


Diagram represents Topology for the whole network, keep in mind the workstations have been merged into one for easier representation.



Full topology diagram for the network, refer to previous diagram for more details.

4.Cabling Specifications

a.Cable Length

① Horizonal:

Floor	Area	Cable length required per unit (m)	Quantity	Total cable length required (m)
1	Work Area 1-4	325	4	1300
1	Service Area 1	23.5	1	23.5
1	Others	98.5	1	98.5
2	Meeting Area 1	15	1	15
2	Meeting Area 2	18	1	18
2	Meeting Area 3	15	1	15
2	Others	63	1	63

② Vertical:

Area	Length(m)
Floor1-Floor2	5

③ Total:

Area	Total(m)
Floor1	1422
Floor2	111
Vertical	5
Total	**1538**

b.Cable Type and Amount

For the cabling within the work areas, specifically between workstations and patch panels, we opted for Cat6 Ethernet copper cables due to their durability and high performance. In the four laboratories (Work Areas 1-4) on the first floor, a total of 140 cables (35x4) will be used to connect the workstations to the patch panels. Similarly, 140 patch cords will connect these patch panels to their respective switches.

To establish connections between all the work areas (Work Areas 1-4 and Service Area 1) to the first-floor router, 4 fibre optic cables are allocated.

For the second floor, Meeting Area 1 and Meeting Area 2 connections involve the following:

4 Cat6 Ethernet cables:

a.2 cables to connect the smart TVs in Meeting Area 1 to its designated router.

b.1 cable to connect the smart TV and Ethernet ports in Meeting Area 2 to its router.

c.1 cable will connect the wireless router to the floor router to provide network connectivity.

The routers for Meeting Area 1-3 and the first-floor router are all connected to the server room using **4** fibre optic cables, linking them to the ISP modem through the server room. This ensures a high-speed backbone for the network infrastructure.

References:

The operation of LAN and WAN hardware and protocols FORM
https://www.open.edu/openlearncreate/mod/oucontent/view.php?id=130530&printable=1

What is a wide area network (WAN

https://www.cloudflare.com/learning/network-layer/what-is-a-wan/
LANs, WANs, and the Internet (1.2)

https://www.ciscopress.com/articles/article.asp?p=2164577&seqNum=5

What Are Wide Area Network (WAN) and Local Area Network (LAN)
https://www.spiceworks.com/tech/networking/articles/wide-area-network-vs-local-area-network-differences-and-similarities/

Meeting Minutes

DATE/TIME	**16th December 2024**
LOCATION	**Webex online meeting**
AGENDA	**Working on Task 4**
MEETING MC	**Abdul-Rahman Siad**

ATTENDENCE

NAME	TIME	REASON OF ABSENCE
Kahlan Sultan Mohammed	11:00 pm	N/A
Abdulrahman Siad	11:40 pm	
Buguoshun	11:00 pm	
Liu Ruoyang	11:40 pm	

MINUTES

NO.	ITEM DISCUSSED	IDEAS/SUGGESTIONS AND PERSON GIVING IT	PERSON IN CHARGE AND DATE
1	Identification of the connections	Everyone participates in identified the connections between the wires, workstations, and equipment.	Everyone (16/12)
2	Wire drawings	Sketching the cables on the floor layout provided by Liu Ruoyang	Liu Ruoyang (16/12)
3	Wire length identification	Determine the wire lengths using the information provided by Kahlan and Abdul-Rahman	Kahlan Sultan (16/12) Abdul-Rahman Siad (16/12)
4	Diagrams of topology	Drawing the topology diagrams; given by Bu Guoshun	Bu Guoshun (17/12)
5	Meeting ended	Everybody departing the meeting	Everyone(17/12)

Projected Marks

ITEM	MARKS
Identify connections and cables	
Connection, patch cord, switchport identified	2/2
Cable length and types identified	2/2
Choices are suitable and appropriate	2/2
Sketch of PC and Network devices arrangement (+cable) clearly shown and labelled	3/3
Scale: is appropriate	1/1
Total	10/10

SECR1213 NETWORK COMMUNICATION

20242025 – SEMESTER 1

PHASE 5

(IP ADDRESSING SCHEME)

FACULTY OF MJIIT

GROUP A&C

NAME	MATRIC ID
Kahlan Sultan Mohammed	A23MJ4021
Liu Ruoyang	A23MJ4022
Bu Guoshun	A23MJ4019
Abdulrahman Siad	A23MJ3061

Here we are providing the answers to some questions

The assigned IP address is 192.16.0.0/8

1. What is the total identified areas in the building? (Total areas = number of labs + rooms + common areas + etc)

Total subnet needed = Total identified areas = 8

2. What is the number of reserved bits from the host for the identified subnets? Additionally, identify the number of extra subnets, if applicable
Number of reserved bits:

number of reserved bits=4

number of extra subnets=2^ {reserved bits} - total subnet=8

3. Given your assigned IP address, clearly show the network and host portions, and the reserved/borrowed bits for your subnets?

Network bits=4+8=12

Host bits = (32-12) =20

4. What is your custom subnet mask?

The original mask is **/8**.

Borrowing 4 bits for subnetting gives: **/8+4**

=/12

1. IP Addressing Scheme

The designated network address **192.16.0.0/8** has been subdivided into smaller subnets to meet the specific needs of various labs and rooms. By reserving 4 bits for subnetting. This setup provides 8 additional subnets beyond the immediate requirement of 8, ensuring the network is scalable and can accommodate future growth.

The customized subnet mask, achieved by borrowing 4 bits from the host portion, is **255.240.0.0 (/12)**. This structure allocates 12 bits for the network and 20 bits for hosts, ensuring sufficient IP addresses for all devices while maintaining efficient resource utilization.

A comprehensive subnetting table has been created to detail the IP assignments for each lab, room, and area. The table specifies the **Network Address**, **Broadcast Address**, and **Usable IP Range** for each subnet, ensuring clarity and efficient resource management.

Correction

Showing the Assignment in binary

1.general purpose lab

Network Address: 192.16.0.0

Binary: 11000000.00010000.00000000.00000000

- Network portion: 11000000.0001 (12 bits for the network as per /12)
- Host portion: 0000.00000000.00000000

Broadcast Address: 192.31.255.255

Binary: 11000000.00011111.11111111.11111111

- Network portion: 11000000.0001
- Host portion: 1111.11111111.11111111

Usable Range: 192.16.0.1 - 192.31.255.254

Binary (start of range):

- 192.16.0.1: 11000000.00010000.00000000.00000001
  Binary (end of range):
- 192.31.255.254: 11000000.00011111.11111111.11111110

2: General Purpose Lab 2

Network Address: 192.32.0.0

Binary: 11000000.00100000.00000000.00000000

- Network portion: 11000000.0010 (12 bits for the network as per /12)
- Host portion: 0000.00000000.00000000

Broadcast Address: 192.47.255.255

Binary: 11000000.00101111.11111111.11111111

- Network portion: 11000000.0010
- Host portion: 1111.11111111.11111111

Usable Range: 192.32.0.1 - 192.47.255.254

Binary (start of range):

- 192.32.0.1: 11000000.00100000.00000000.00000001

  Binary (end of range):
- 192.47.255.254: 11000000.00101111.11111111.11111110

3: IOT Lab

Network Address: 192.48.0.0

Binary: 11000000.00110000.00000000.00000000

- Network portion: 11000000.0011 (12 bits for the network as per /12)
- Host portion: 0000.00000000.00000000

Broadcast Address: 192.63.255.255

Binary: 11000000.00111111.11111111.11111111

- Network portion: 11000000.0011
- Host portion: 1111.11111111.11111111

Usable Range: 192.48.0.1 - 192.63.255.254

Binary (start of range):

- 192.48.0.1: 11000000.00110000.00000000.00000001

  Binary (end of range):
- 192.63.255.254: 11000000.00111111.11111111.11111110

4: Service Center

1. **Network Address: 192.64.0.0**

   Binary: 11000000.01000000.00000000.00000000
   - Network portion: 11000000.0100 (12 bits for the network as per /12)
   - Host portion: 0000.00000000.00000000
2. **Broadcast Address: 192.79.255.255**

   Binary: 11000000.01001111.11111111.11111111
   - Network portion: 11000000.0100
   - Host portion: 1111.11111111.11111111
3. **Usable Range: 192.64.0.1 - 192.79.255.254**

   Binary (start of range):
   - 192.64.0.1: 11000000.01000000.00000000.00000001

     Binary (end of range):
   - 192.79.255.254: 11000000.01001111.11111111.11111110

5: CISCO Lab

1. **Network Address: 192.80.0.0**
   Binary: 11000000.01010000.00000000.00000000
   - Network portion: 11000000.0101 (12 bits for the network as per /12)
   - Host portion: 0000.00000000.00000000
2. **Broadcast Address: 192.95.255.255**
   Binary: 11000000.01011111.11111111.11111111
   - Network portion: 11000000.0101
   - Host portion: 1111.11111111.11111111
3. **Usable Range: 192.80.0.1 - 192.95.255.254**
   Binary (start of range):
   - 192.80.0.1: 11000000.01010000.00000000.00000001
     Binary (end of range):
   - 192.95.255.254: 11000000.01011111.11111111.11111110

6: Conference Room

1. **Network Address: 192.96.0.0**
   Binary: 11000000.01100000.00000000.00000000
   - Network portion: 11000000.0110 (12 bits for the network as per /12)
   - Host portion: 0000.00000000.00000000
2. **Broadcast Address: 192.111.255.255**
   Binary: 11000000.01101111.11111111.11111111
   - Network portion: 11000000.0110
   - Host portion: 1111.11111111.11111111
3. **Usable Range: 192.96.0.1 - 192.111.255.254**
   Binary (start of range):
   - 192.96.0.1: 11000000.01100000.00000000.00000001
     Binary (end of range):
   - 192.111.255.254: 11000000.01101111.11111111.11111110

7: Hybrid Classroom

1. **Network Address: 192.112.0.0**
   Binary: 11000000.01110000.00000000.00000000
   - Network portion: 11000000.0111 (12 bits for the network as per /12)
   - Host portion: 0000.00000000.00000000
2. **Broadcast Address: 192.127.255.255**
   Binary: 11000000.01111111.11111111.11111111
   - Network portion: 11000000.0111
   - Host portion: 1111.11111111.11111111
3. **Usable Range: 192.112.0.1 - 192.127.255.254**
   Binary (start of range):
   - 192.112.0.1: 11000000.01110000.00000000.00000001
     Binary (end of range):
   - 192.127.255.254: 11000000.01111111.11111111.11111110

8: Student Lounge

1. **Network Address: 192.128.0.0**
   Binary: 11000000.10000000.00000000.00000000
   - Network portion: 11000000.1000 (12 bits for the network as per /12)
   - Host portion: 0000.00000000.00000000
2. **Broadcast Address: 192.143.255.255**
   Binary: 11000000.10001111.11111111.11111111
   - Network portion: 11000000.1000
   - Host portion: 1111.11111111.11111111
3. **Usable Range: 192.128.0.1 - 192.143.255.254**
   Binary (start of range):
   - 192.128.0.1: 11000000.10000000.00000000.00000001
     Binary (end of range):
   - 192.143.255.254: 11000000.10001111.11111111.11111110

subnet	Area	Network Address	Broadcast Address	Usable Range
1	General Purpose Lab1	192.16.0.0	192.31.255.255	192.16.0.1 - 192.31.255.254
2	General Purpose Lab2	192.32.0.0	192.47.255.255	192.32.0.1 - 192.47.255.254
3	IOT Lab	192.48.0.0	192.63.255.255	192.48.0.1 - 192.63.255.254
4	Service Center	192.64.0.0	192.79.255.255	192.64.0.1 - 192.79.255.254
5	CISCO Lab	192.80.0.0	192.95.255.255	192.80.0.1 - 192.95.255.254
6	Conference Room	192.96.0.0	192.111.255.255	192.96.0.1 - 192.111.255.254
7	Hybrid Classroom	192.112.0.0	192.127.255.255	192.112.0.1 - 192.127.255.254
8	Student Lounge	192.128.0.0	192.143.255.255	192.128.0.1 - 192.143.255.254

Table 1: IP address allocation for each area

Meeting Minutes

DATE/TIME	28/12/2024 10:00a.m.12:00a.m.
LOCATION	Google meet
AGENDA	Discuss Task 5 (IP ADDRESSING SCHEME)
MEETING MC	Kahlan Sultan Mohammed

ATTENDENCE

NAME	TIME	REASON OF ABSENCE
Kahlan Sultan Mohammed	10:00am—12:00am	N/A
Abdulrahman Siad	10:00am—12:00am	
Bu Guoshun	10:00am—12:00am	
Liu Ruoyang	10:00am—12:00am	

MINUTES

NO.	ITEM DISCUSSED	IDEAS/SUGGESTION S AND PERSON GIVING IT	PERSON IN CHARGE AND DATE
1	Task Disruption	Distribute the task among the team members	Kahlan
2	Discuss and update the answers to questions we were given in class	We chose the best answer possible based on our discussion	Everyone
3	Update the table we create in the class	We discuss what changes must be done to the table According to changes we made in questions	Everyone
4	Making final report	Abdulrahman Siad was asked to make the final report	Abdulrahman Siad
5	Meeting ended	Everyone leaving the meeting.	Everyone (28/12)

Rubrics

TASK 5	
ITEM	**MARKS**
IP Addressing	
Use correct network address for group	1
Workings is provided clearly and labelled	4
IP division is appropriate and logical	1
Complete detail of all IP assignation for all labs and room	4
TOTAL	**10**

Conclusion

This project provided valuable opportunities for learning and growth. Our achievements can be categorized into knowledge and skills development:

Achievements:

- **Knowledge:** We learned how to create detailed floor plans, plan facilities, and allocate areas effectively. We gained insights into evaluating project feasibility, considering factors such as budget limitations, technical requirements, and long-term scalability. Additionally, we understood the intricacies of equipment procurement, such as comparing brands, assessing performance, and managing costs. We also mastered essential aspects of cabling design, including efficient layout planning, and developed an understanding of IP address allocation to ensure seamless network operation.
- **Skills:** The project enhanced our ability to work as a team, improved our subject-matter expertise, and strengthened our problem-solving, organizational, and error-correction skills. These abilities enabled us to apply theoretical knowledge in a practical setting effectively.

Strengths:

1. Applying theoretical knowledge to practical scenarios.
2. Effective task planning and allocation, ensuring smooth workflows.
3. A collaborative environment where team members could identify and correct errors, maintaining high-quality deliverables.

Weaknesses:

1. Inadequate time management for some tasks, leaving little room for revisions.
2. Gaps in understanding certain concepts, which required extra effort to resolve.
3. Incomplete mastery of some technical knowledge, which occasionally slowed progress.

Suggestions for Improvement:

1. Provide optional tutorials on supplementary skills to help students better understand project requirements.
2. Offer standardized templates or examples early in the project to clarify formatting expectations.
3. Align project tasks more closely with course content, creating a stronger synergy between theoretical learning and practical application.

Overall, this project was an enriching experience that prepared us for future challenges, both academically and professionally. The lessons learned and suggestions provided here can contribute to improving similar projects in the future.

Potential Improvements for Client Decision-Making

Task 1: Floor Plan Design

- If the budget allows, expanding the planned space could provide more flexibility for future labs or study areas.
- Additional funding could enable the use of more advanced planning tools, which would make the design process faster and more accurate.

Task 2: Feasibility Analysis

- Increasing the budget could allow for in-depth consultations with industry experts, ensuring that the design aligns with the latest trends and needs.

Task 3: Device Selection

- With a slightly higher budget, upgrading to higher-capacity devices would better support future growth and advanced research needs.
- Adding more devices, such as backup servers or redundant switches, could enhance network reliability and minimize downtime.

Task 4: Cabling and Connectivity

- Using higher-grade cables or increasing the number of access points could improve overall network speed and coverage.
- More funding could allow for a more robust cable management system, reducing maintenance efforts.

Task 5: IP Address Allocation

- A larger budget could support more advanced IP management software, simplifying future expansions and ensuring better network stability.

Team Members and Responsibilities

- **Kahlan Sultan Mohammed:** Project Manager. Responsible for coordinating the entire project, ensuring tasks are completed on time, and maintaining team collaboration.
- **Liu Ruoyang:** Design Specialist. Focused on creating floor layouts and visual designs for the network infrastructure, ensuring functionality and aesthetics.
- **Bu Guoshun:** Technical Analyst. Conducted feasibility studies, analyzed technical requirements, and contributed to the selection of network devices.
- **Abdulrahman Siad:** Report Coordinator. Managed report compilation, budget tracking, and ensured proper documentation of all project phases.

References:

1. Varne, P. N., Priyanka, J., Shetty, S. V., Tejus, A. K., & Gowda, N. C. (2023). Campus network design and implementation using Cisco Packet Tracer. *International Journal of Computer and Information*, 4(1). https://milestoneresearch.in/JOURNALS/index.php/IJCLI/article/view/125
2. Xie, S. (2010). Planning, designing, and building large-scale network at campus. In *Proceedings of the 2010 International Conference on Educational and Information Technology* (Vol. 2, pp. V2-282-V2-285). IEEE. https://ieeexplore.ieee.org/abstract/document/5764182
3. Kumar, A., & Singh, R. (2021). Implementation and testing of proposed campus network. In *Advances in Digital Science* (pp. 567-576). Springer. https://link.springer.com/chapter/10.1007/978-981-16-2406-3_51
4. Ismaeel, A. G., & Yousif, R. Z. (2014). Simulate high traffic and effective cost an academic Kurdistan network based on DWDM using OPNET. *International Journal of Computer Applications*, 98(1), 1-7. https://files.aiscience.org/journal/article/pdf/70080027.pdf
5. Flyvbjerg, B. (2009). Survival of the unfittest: Why the worst infrastructure gets built—and what we can do about it. *Oxford Review of Economic Policy*, 25(3), 344-367. https://koreascience.kr/article/CFKO200728649642448.pdf
6. Network Lessons. (n.d.). *Recommended lab equipment for Cisco CCNA*. Retrieved January 5, 2025, from https://networklessons.com/cisco/ccna-routing-switching-icnd1-100-105/recommended-lab-equipment-for-cisco-ccna
7. Hwang, H., Kang, T., Kim, H., & Park, S. (2018). Predictive load balancing based on machine learning for IoT applications. *2018 International Conference on Information Networking (ICOIN)*. IEEE Xplore. doi:10.1109/ICOIN.2018.8343209

Appendices

All meeting minutes

Task 1

DATE/TIME		13/10/2024 10:00a.m.----12:00a.m.	
LOCATION		Webex online meeting	
AGENDA		Discuss about task1	
MEETING MC		Liu Ruoyang	
ATTENDENCE			
NAME	**TIME**		**REASON OF ABSENCE**
Kahlan Sultan Mohammed	10:00am—12:00am		N/A
Liu Ruoyang	10:00am—12:00am		
Buguoshun	10:00am—12:00am		
Abdulrahman Siad	10:00am—12:00am		
MINUTES			
NO.	**ITEM DISCUSSED**	**IDEAS/SUGGESTIONS AND PERSON GIVING IT**	**PERSON IN CHARGE AND DATE**
1	Group name	A&C by Kahlan since we are Arab and Chinese.	Kahlan(13/10)
2	Software to be used	Visual Paradigm found by Liu since it has many pre-made icons available.	Liu Ruoyang(13/10)
3	Floor design	Liu and Kahlan take charge of designing first floor. Abdul and Bu take charge of second floor.	Everyone(13/10)
4	Next meeting	Whenever the preparation of task 2 begins.	Everyone(13/10)
5	Meeting ended	12:00	Everyone(13/10)

Task 2

DATE/TIME		26/10/2024 10:00a.m.----12:00a.m.	
LOCATION		Webex online meeting	
AGENDA		Discuss about task2	
MEETING MC		Bu Guoshun	
ATTENDENCE			
NAME	**TIME**		**REASON OF ABSENCE**
Kahlan Sultan Mohammed	10:00am—12:00am		N/A
Liu Ruoyang	10:00am—12:00am		
Buguoshun	10:00am—12:00am		
Abdulrahman Siad	10:00am—12:00am		
MINUTES			
NO.	**ITEM DISCUSSED**	**IDEAS/SUGGESTIONS AND PERSON GIVING IT**	**PERSON IN CHARGE AND DATE**
1	Questions design	Liu will take charge of this part	Liu Ruoyang(26/10)
2	Question answering	Kahlan and Abdul will answer the questions through research and interview	Kahlan Sultan Mohammed (27/10) Abdulrahman Siad (28/10)
3	Feasibility test	Bu will test the feasibility of the project through considering our budget, which is RM 1.3M	Bu Guoshun(29/10)
4	Next meeting	Whenever the preparation of task 3 begins.	Everyone(27/10)
5	Meeting ended	12:00	Everyone(27/10)

Task 3

DATE/TIME	27/11/2024 10:00a.m. 12:00a.m.
LOCATION	Google meet
AGENDA	Discuss Lan Devices
MEETING MC	Abdul-Rahman Siad

ATTENDENCE		
NAME	**TIME**	**REASON OF ABSENCE**
Kahlan Sultan Mohammed	10:00am—12:00am	N/A
Abdulrahman Siad	10:00am—12:00am	
Buguoshun	10:00am—12:00am	
Liu Ruoyang	10:00am—12:00am	

MINUTES			
NO.	**ITEM DISCUSSED**	**IDEAS/SUGGESTIONS AND PERSON GIVING IT**	**PERSON IN CHARGE AND DATE**
1	Research about routers, switch racks, printers, monitors, TV and equipment.	Liu suggested appropriate options for various equipment, including routers for video streaming and lab use, switch racks, printers, video conferencing monitors, a TV for the lounge, and necessary equipment for Cisco and IoT labs.	Liu Ruoyang(26/11)
2	Budget allocation for workstations and the specs that	Because of the diversified aim and mission, there should be different distribution of requirements between	Kahlan Sultan Mohammed (26/11)

	go along with it, relative to the IOT, CISCO and general lab	the labs. To say that it would be pertinent to properly fund that said purpose to the best of their abilities while not neglecting the grand scheme of things as well.	Abdulrahman Siad (26/11)
3	Router and switches and their implications in order to make an interactive system	Using implications of servers and wireless internet connections and ethernet cables for the connection of router and switches.	Bu Guoshun(26/11)
4	Interactive help desk and environment	Using specific PCs in order to meet the requirements of the customers at the help desk and small additions in the conference room and lounge in order to provide nuance experience.	Everyone(27/1 1)
5	Meeting ended	Everyone leaving the meeting.	Everyone (27/11)

Task 4

DATE/TIME	16th December 2024
LOCATION	Webex online meeting
AGENDA	Working on Task 4
MEETING MC	Abdul-Rahman Siad

ATTENDENCE

NAME	TIME	REASON OF ABSENCE
Kahlan Sultan Mohammed	11:00 pm	N/A
Abdulrahman Siad	11:40 pm	
Buguoshun	11:00 pm	
Liu Ruoyang	11:40 pm	

MINUTES

NO.	ITEM DISCUSSED	IDEAS/SUGGESTIONS AND PERSON GIVING IT	PERSON IN CHARGE AND DATE
1	Identification of the connections	Everyone participates in identified the connections between the wires, workstations, and equipment.	Everyone (16/12)
2	Wire drawings	Sketching the cables on the floor layout provided by Liu Ruoyang	Liu Ruoyang (16/12)
3	Wire length identification	Determine the wire lengths using the information provided by Kahlan and Abdul-Rahman	Kahlan Sultan (16/12) Abdul-Rahman Siad (16/12)
4	Diagrams of topology	Drawing the topology diagrams; given by Bu Guoshun	Bu Guoshun (17/12)
5	Meeting ended	Everybody departing the meeting	Everyone(17/12)

Task 5

DATE/TIME	28/12/2024 10:00a.m. 12:00a.m.
LOCATION	Webex online meeting
AGENDA	Working on Task 5
MEETING MC	Kahlan Sultan Mohammed

ATTENDENCE

NAME	TIME	REASON OF ABSENCE
Kahlan Sultan Mohammed	10:00 a.m.-12:00 a.m.	N/A
Abdulrahman Siad	10:00 a.m.-12:00 a.m.	
Buguoshun	10:00 a.m.-12:00 a.m.	
Liu Ruoyang	10:00 a.m.-12:00 a.m.	

MINUTES

NO.	ITEM DISCUSSED	IDEAS/SUGGESTIONS AND PERSON GIVING IT	PERSON IN CHARGE AND DATE
1	Task Disruption	Distribute the task among the team members	Kahlan
2	Discuss and update the answers to questions we were given in class	We chose the best answer possible based on our discussion	Everyone
3	Update the table we create in the class	We discuss what changes must be done to the table According to changes we made in questions	Everyone (28/12)
4	Making final report	Abdulrahman Siad was asked to make the final report	Abdulrahman Siad(28/12)
5	Meeting ended	Everyone leaving the meeting.	Everyone (28/12)

Task 6a

DATE/TIME	11/01/2024 10:00a.m.12:00a.m.
LOCATION	Google meet
AGENDA	Discuss Task 6 (IP ADDRESSING SCHEME)
MEETING MC	Kahlan Sultan Mohammed

ATTENDENCE

NAME	TIME	REASON OF ABSENCE
Kahlan Sultan Mohammed	10:00am—12:00am	N/A
Abdulrahman Siad	10:00am—12:00am	
Bu Guoshun	10:00am—12:00am	
Liu Ruoyang	10:00am—12:00am	

MINUTES

NO.	ITEM DISCUSSED	IDEAS/SUGGESTION S AND PERSON GIVING IT	PERSON IN CHARGE AND DATE
1	Task Disruption	Kahlan assigned a task to each member	Kahlan
2	Writing the Introduction and Project background	Everyone drafted and finalized the Introduction and Project background of the task	Everyone
3	Compiling Solution and reflections of Task 1	liu ruoyang oversaw Task 1	liu ruoyang
4	Compiling Solution and reflections of Task 2	Abdulrahman oversaw Task 2	Abdulrahman Siad
5	Compiling Solution and reflections of Task 3	liu ruoyang oversaw Task 3	liu ruoyang
6	Compiling Solution and reflections of Task 4	Bu Guoshun oversaw Task 4	BU Guoshun
7	Compiling Solution and reflections of Task 5	Kahlan oversaw Task 5	Kahlan

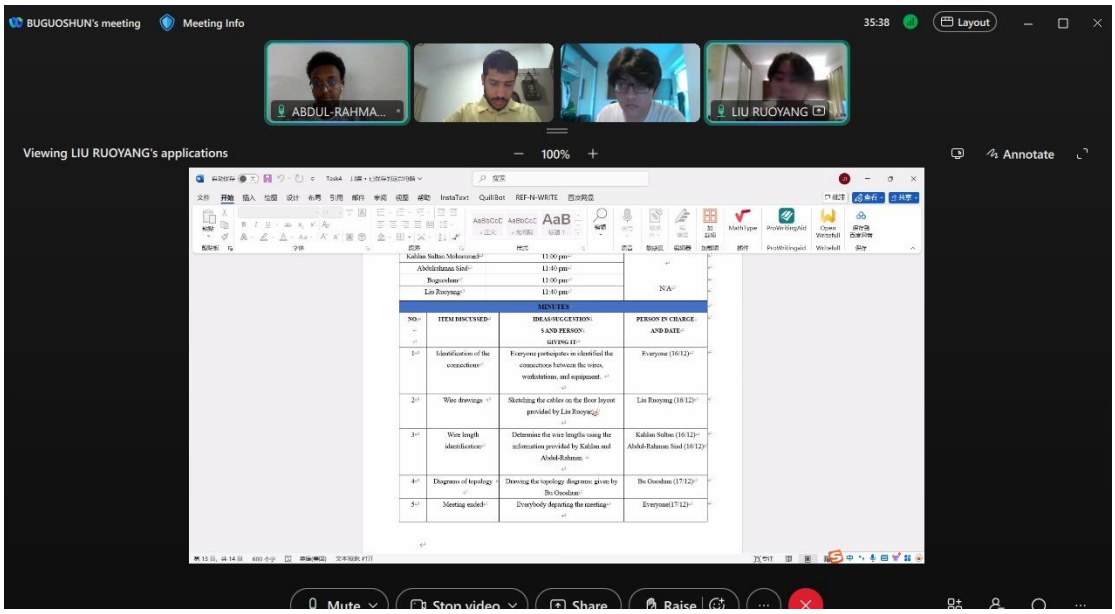
8	Verification and Editing	The compiled solutions of the tasks were switched with the member next to him. Then. They scanned and verified each other's tasks to ensure it was correctly compiled. Good suggestions were edited into the compilation	Everyone
9	Creation of Table of Contents and List of Figures	Kahlan created the Table of Contents and the List of Figures	Kahlan
10	Page numbering	BU Guoshun inserted the page numbering at the end of the project, and added them to the Table of Contents and List of Figures	BU Guoshun
11	Conclusion	Abdulrahman analyzed the entire task, then drafted and wrote the conclusion of the task	Abdulrahman
12	Compilation of References	Kahlan and Abdulrahman compiled all the references documented in the previous tasks	Kahlan and Abdulrahman

Financial Budget

We were allocated a total budget of RM 1.3 million in Task 3. Out of this, we spent RM 928,706 on network equipment and cabling, leaving a balance of RM 371,294. All costs were strictly for the purchase of network-related items, such as devices and cables.

Pictures of our team working on the project

Figure 1: Working on the project



We group members discuss through Webex meeting, working on the project together

People we met to discuss our project

DR. KAIYISAH

Projected Marks

TASK 6A	
ITEM	**MARKS**
6A: GROUP REPORT	
Title page follows requirement	1/1
TOC clearly and correctly done	1/1
List of Figures – available, appropriate and correctly done	1/1
Introduction: done well, help with understanding, did not copy and paste	4/4
Project background clearly and correctly done	4/4
A compiled solution (all task) with reflections	5/5
Conclusion clearly and correctly done	2/2
References clearly and correctly done	2/2
Correctly formatted	1/1
Team meetings	
Team Members and responsibilities	3/3
Team meeting minutes (all meeting minutes MUST be informational and specific).	4/4
Appendices: complete with all the requirements as in Project document	2/2
TOTAL	**30**

The End