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SECR1213 NETWORK COMMUNICATIONS - SECTION 01

PROJECT TASK 6: DOCUMENTATION AND REFLECTION

NETWORK DESIGN FOR FACULTY OF COMPUTING BLOCK N28B

by DATA VOYAGERS

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Abstract

This Group Report represents the final stage of our project for the Faculty of Computing (FC), where we worked to design and implement a network infrastructure tailored to meet the institution’s current needs and future growth. Over the course of Tasks 1 to 5, we developed a comprehensive plan for a two-story building, featuring specialized labs, a video conferencing room, a hybrid classroom and a student lounge. Our primary goal was to design a space that not only met the size and functionality requirements, but also encouraged collaboration and supported modern learning technologies.

Throughout the project, we conducted a detailed preliminary analysis, generating and answering key questions to assess the project’s feasibility. This included considerations for scalability, security, and cost-effectiveness. We carefully selected LAN devices based on performance and budget constraints, designed an efficient cabling and device layout for the building, and developed a strategic IP addressing scheme to ensure seamless connectivity.

Beyond the technical aspects, the report reflects on our journey, including what worked well, the challenges we encountered, and areas for improvement. Appendices include detailed meeting minutes, plans, and financial breakdowns, resulting in a transparent and well-documented process. Finally, this report demonstrates our commitment to providing a network solution that is consistent with FC's goals of efficiency, scalability, and future readiness.

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1.0 Introduction

As we approach the end of our project journey, it is critical to revisit the fundamental goals, scope, and objectives that have guided us in shaping the Faculty of Computing's (FC) future. Our main objective has been to proactively support the anticipated 15% increase in both student and academic staff over the next four years. This resulted in the large task of designing a cutting-edge two-story building that would house four specialized labs, a video conferencing room, a hybrid classroom and a student lounge. This scope goes beyond architectural considerations to include detailed specifications for each lab, ensuring that they meet the technological demands of education's 4th Industrial Revolution.

Our primary goal has been to build an efficient and future-ready network that is consistent with FC's vision for a comprehensive infrastructure. This entailed thorough planning and execution, as well as the integration of new technologies into the labs and network to ensure ease of management, scalability, and peak performance. Reflecting on our journey, we've tackled a variety of goals, ranging from establishing ideal learning environments to future-proofing the infrastructure with scalable and strong wireless connectivity. This project is more than just a design; it demonstrates our commitment to creating an innovative educational environment that addresses FC's current requirements while also preparing it for future challenges and possibilities.

2.0 Project background and an overview

The Faculty of Computing (FC) is at a pivotal moment, with an expected 15% growth in students and staff over the next four years. To accommodate this expansion, FC is constructing a new two-story building that will include 2 general-purpose labs, 1 Cisco Network Lab, 1 Embedded Lab, a hybrid classroom, a student lounge with WiFi accessand a video conferencing room. Each lab and the student lounge are 14m x 10m, providing sufficient space for collaborative work and learning. The new facilities aim to integrate cutting-edge technology to meet the educational demands of the 4th Industrial Revolution, including high-speed internet, IoT connectivity, and advanced video conferencing capabilities.

Despite the opportunities, this project also presents challenges, particularly in establishing a reliable, efficient, and secure network infrastructure. The Dean envisions a system that is scalable, cost-effective, and capable of supporting diverse academic and administrative activities. Priorities include seamless network management, advanced security measures, and provisions for future growth, such as modular designs and wireless enhancements.

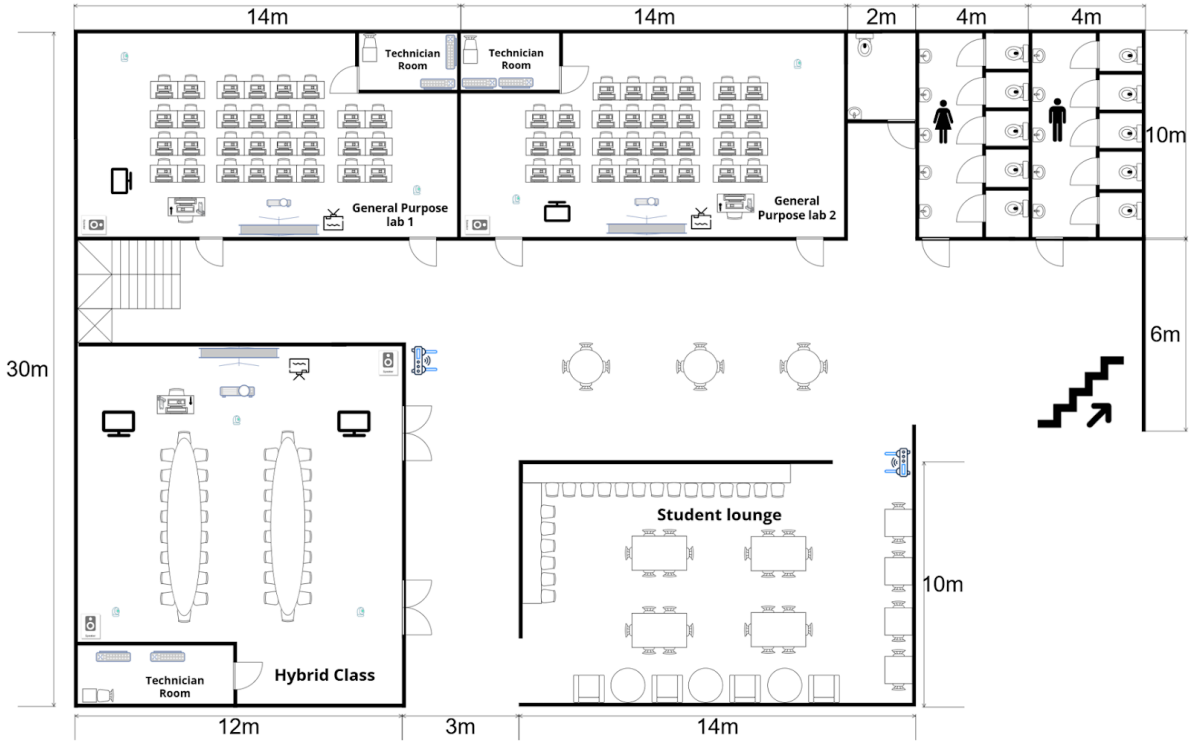
Our group's task has been to address these challenges through innovative solutions, aligning with FC's vision of creating a forward-thinking and adaptable educational environment. The design not only meets the current requirements but also ensures scalability and reliability, laying a solid foundation for FC's future technological needs.

3.0 A compiled solution of Task 1-5

3.1 Task 1 - Project Setup

Suggested floor plan

Ground floor



Indicator

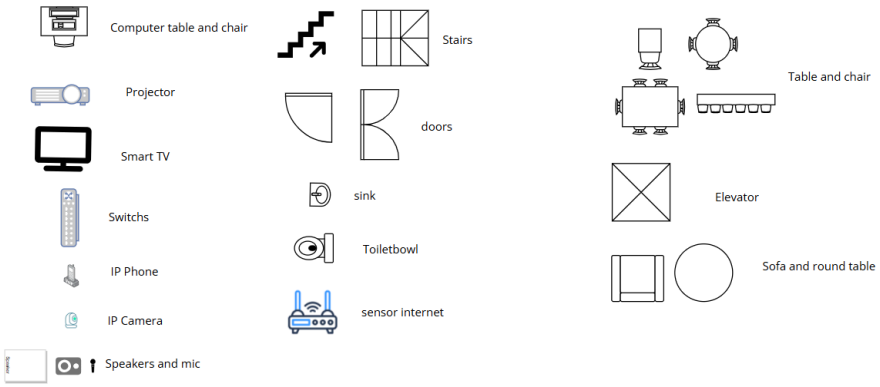
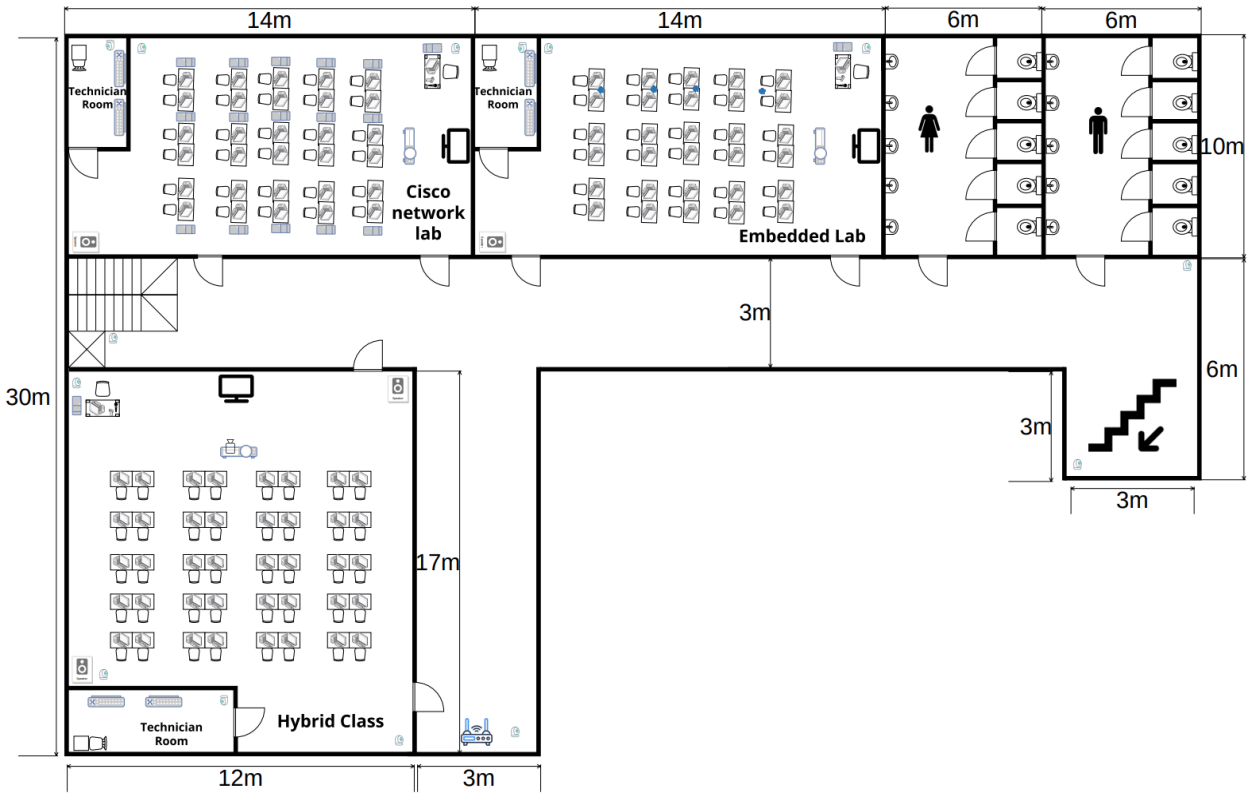


Figure 1.1 Ground floor plan

The ground floor of this building is designed to balance both academic and social needs, featuring two general purpose labs, a video conferencing room, a student lounge and toilet facilities. Both the general labs and the video conferencing room are well-equipped with IP cameras and IP phones, allowing for enhanced monitoring and efficient communication. Besides, each of these labs and rooms includes a technician room to enable immediate troubleshooting of any technical issues. The student lounge is conveniently situated near the main entrance and equipped with Internet access points, making this floor an ideal hub for academic and practical activities. The toilet facilities are located near the general labs, with male accessible toilets on the left and female accessible toilets on the right and also the OKU toilet. A seating area with tables and chairs at the front of the labs provides a place for relaxation and the internet access point is also provided at this area. There is also an elevator and the stairs at the back end of the corridor. There is another stair, along with the main entrance at the front to ensure accessibility.

First floor



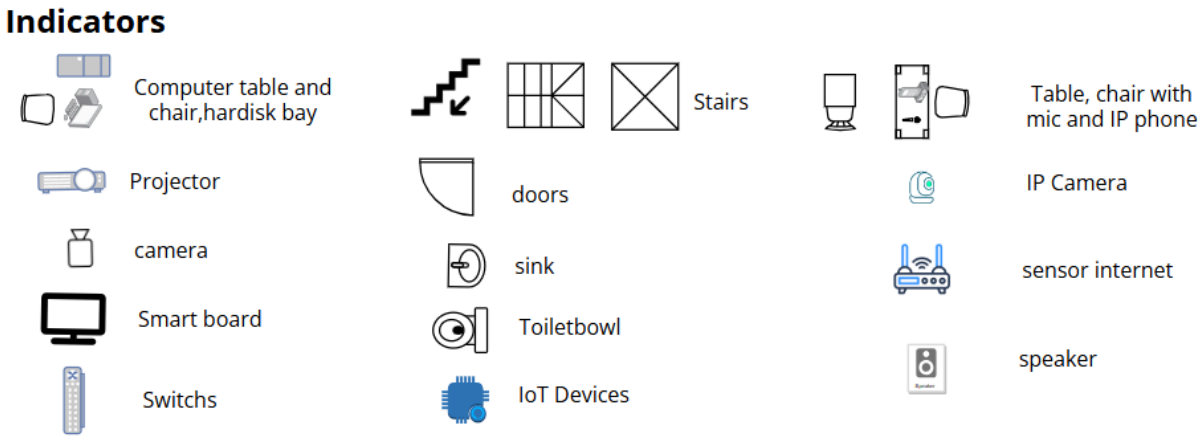


Figure 1.2 First floor plan

The first floor of this building is designed to support specialized technical learning, featuring a Cisco Network lab, an Embedded lab, a hybrid classroom and toilet facilities. Each lab and the hybrid classroom is equipped with IP cameras and IP phones, enhancing communication and security within the learning environment. Technician rooms are also available in each of these areas, providing on-demand technical support for equipment setup and troubleshooting. This floor also includes separate male and female toilets as well as accessible facilities at the back end of the building. Internet access points are located at the corridor's front end, allowing convenient connectivity for students and staff. Accessibility is ensured with an elevator at the back end and stairs at the front end, creating a well-rounded and accommodating environment for various university activities.

Reflection of Task 1

The project began with Task 1, which focused on setting up the project framework. As a group, we finalized our group name, "Data Voyagers," and created a detailed floor plan for the two-story building. The ground floor was designated for general-purpose labs, a video conferencing room, and a student lounge, while the first floor housed the Cisco Network Lab, Embedded Lab, and hybrid classroom. Key decisions included the placement of technician rooms for immediate troubleshooting and ensuring accessibility through elevators and strategically located internet access points.

3.2 Task 2 - Preliminary analysis

3.2.1 Question list and answer

1. What are the estimated user counts and future growth projections?
   Answer from interviewee: As described in the case study description.

   Answer from research: The faculty currently expects to have 1,800 students and 100 academic and 40 staff members, with an expected 15% increase in four years. This growth will require a scalable network that can handle increased connections and data traffic.

2. What is the required internet speed and bandwidth capacity?
   Answer from interviewee: The fastest current internet can provide. To ensure it is up to date.

   Answer from research: A high-speed connection capable of supporting concurrent usage by up to 60 devices per lab is recommended. This ensures a minimum of 1 Gbps for each lab, particularly the Cisco Network Lab, and shared WiFi access points in the lounge for supporting high-density usage of lecturers and students of Faculty Computing.

3. What network security measures are necessary?
   Answer from interviewee: Both at the physical level(anti theft) and firewalls to prevent port and network scanning.

   Answer from research: Security measures should include firewalls, intrusion detection/prevention systems (IDS/IPS), and encrypted access points to prevent breaches, especially this building is given the network's educational and research focus, which may contain sensitive data.

4. What redundancy and backup measures are required to ensure reliability?
   Answer from interviewee: Depending on the function. Critical applications such as hybrid classroom and video conferencing needs to be as reliable as possible.

   Answer from research: Redundant switches and routers, along with dual power supplies and backup Internet Service Providers (ISP), should be considered to prevent downtime, especially for high-demand spaces like the hybrid classroom and Cisco lab.

5. What level of scalability is needed to support future network expansions?
   Answer from interviewee: Can easily add a number of workstations without too much additional cost.

   Answer from research: A scalable network with modular switches that allow additional ports and wireless access points is needed. VLANs (Virtual LANs) could be considered to be implemented to manage traffic and support future expansions without redesigning the entire network.

6. What are the primary use cases of the network in each area (e.g., labs, lounge, hybrid classroom)?
   Answer from interviewee: As stated in the description.

   Answer from research: Labs require high-speed internet for research and teaching. The Cisco Lab needs dedicated network resources for configuration and practical training, while the Embedded Lab requires connectivity for IoT experiments. The hybrid classroom will need video conferencing capabilities, and the lounge requires reliable WiFi for social and light academic use.

7. Should the network support cloud integration, and if so, to what extent?
   Answer from interviewee: Up to the consultant to suggest it.

   Answer from research: Cloud integration can offer scalability, remote access, and simplified maintenance. For a faculty network, the cloud could be used for applications such as data storage, learning management systems, and virtual classrooms. It gives beneficials like reducing cost, improving accessibility and bolster data security. The decision to integrate should weigh factors like security, budget, and user access requirements.

8. What network monitoring and management tools are recommended?
   Answer from interviewee: Up to the consultant to propose it.

   Answer from research: Effective monitoring tools are critical for detecting performance issues early and tracking network health. Tools like SolarWinds, NetFlow, and Nagios provide real-time performance analytics and automated alerts, which can help in managing and troubleshooting networks.

9. How should Bring Your Own Device (BYOD) policies be implemented?
   Answer from interviewee: It's for locations where workstations are not available. Video conferencing and student lounge. Otherwise no restrictions.

   Answer from research: BYOD policies should include network access limits and security protocols, such as endpoint verification. Devices connected to the network should be limited to students/lecturers networks to reduce potential security risks.

10. How will funding impact device and service choices?
    Answer from interviewee: This is for the consultant to answer.

    Answer from research: Budget constraints may require prioritizing high-performance devices in high-use areas, such as the labs and classrooms. Opting for modular and scalable equipment also allows for gradual upgrades as additional funds become available.

11. What is the estimated budget for network devices, cabling, and installation?
    Answer from interviewee: Up to consultant to answer.

    Answer from research: Based on our group getting a 2M budget, cost-effective yet robust devices (e.g., Cisco for switches and routers) should be chosen. And approximately 50-60% of the budget could go towards devices, 20-30% for cabling, and the remainder for installation and maintenance.

3.2.2 Feasibility of the project

1. Technical feasibility

- Network infrastructure: the project requires implementing high-speed internet, LAN and WiFi for various rooms, including the specialized labs such as cisco network lab and IoT lab, a video conferencing room and a hybrid classroom. This is technically feasible with modern networking equipment for example Huawei or Cisco.
- Scalability: The network needs to be scalable to support the anticipated growth. By using modular network equipment and structured cabling, the infrastructure can accommodate future expansions.
- Security and performance: To ensure the security and resilience against cyber threats is achievable by selecting appropriate firewall and network security devices. By implementing quality network devices can also ensure high performance, meeting the requirements of Fourth Industrial Revolution (4IR) standards.

2. Financial feasibility

- Budget constraints: The project budget is assigned by the instructor which is RM 2M. With a well-planned approach, it is feasible to source cost-effective yet high-quality networking devices. However, if the project requires a budget increase for high-end devices, the team can submit a justification report for approval.
- Device selection: By carefully comparing the different brands and selecting devices that meet the requirements without exceeding the budget, the project can remain financially viable. For example, using mid-tier routers or access points that still provide robust performance may be a cost-effective choice.

3. Operational feasibility

- Implementation team skills: With the team collaboration and guidance from the instructor, students can manage the project's design, device selection and setup. Any required skill gaps such as network configuration knowledge can be addressed through group learning or consulting resources provided by the instructor.
- Maintenance and management: The network design should focus on being user-friendly and manageable for faculty of computing staff. Using centralized management solutions, like Cisco's Meraki dashboard could simplify network maintenance and reduce operational strain.
- Timeline: By given clear deadlines, the project is feasible within the academic timeline, provided the group adheres to a well-structured project schedule.

Reflection of task 2

In Task 2, we conducted a preliminary analysis to understand the project's feasibility. This involved addressing 10 essential questions about user needs, scalability, security, and cost-effectiveness. The feasibility study revealed that the project was technically achievable using modern devices like Cisco routers and Fortinet firewalls, financially manageable within the RM 2 million budget, and operationally supported by our team's expertise and structured timeline.

3.3 Task 3 - Choosing the appropriate LAN devices

3.3.1 LAN devices

3.3.1.1 Router

Feature	Cisco ISR 4331	TP-Link Archer AX6000
Performance	100Mbps and upgradeable to 300 Mbps	Up to 6Gbps combined throughput (WiFi 6)
Modularity	Highly modular (support WAN/LAN modules)	Fixed design, no modular options
Security	Enterprise-grade: Firewalls VPN, IPS	Consumer-grade: WPA3, antivirus, parental controls
Management	Cisco DNA Center or CLI	TP-Link Tether App
Scalability	Designed for large-scale networks	Limited to small networks
PoE Support	Yes	No
Price (RM)	4491.11	1029.00
Pros	- Enterprise-grade performance with modularity for scalability - Advanced security features (VPN, firewall, threat detection) - Reliable for handling complex enterprise networks - Supports WAN optimization and SD-WAN - Long-term support and enterprise-level service contracts	- Affordable, consumer-friendly pricing - High-speed Wi-Fi 6 (up to 6 Gbps) for excellent wireless performance - Easy to set up and manage with a mobile app - Compact, sleek design for home or small office use
Cons	- Expensive, with high upfront costs - Requires technical expertise to configure and manage - No built-in wireless capability - Bulky, rack-mount design - Licensing costs for additional features	- Limited to fixed hardware, no expandability - Basic security features compared to enterprise-grade routers - Not suitable for large-scale enterprise networks - No advanced routing capabilities for complex configurations

Resources	 Cisco 4000 Family ISR Data Sheet	 https://www.tp-link.com/my/home-networking/wifi-router/archer-ax6000/

For routers we choose Cisco ISR 4331 instead of TP-Link Archer AX6000 because we need enterprise-grade performance, security, and scalability. Besides, Cisco can fulfill complex requirements or serve critical infrastructure. Next, we have a skilled IT team to configure and maintain the system.

3.3.1.2 Firewall

Feature	Fortinet FortiGate 60F	Cisco Firepower 1010
Firewall throughput	10Gbps	1.9Gbps
Threat protection throughput	700Mbps	650Mbps
Unified Threat Management UTM)	Yes	Partial (requires additional licensing)
Ease of management	Intuitive UI, FortiManager, FortiCloud	Requires expertise: FMC or CLI
Integration with existing network	Strong with SD-WAN and UTM focus	Seamless integration with Cisco products
Scalability	Excellent, can grow with campus needs	Scales well but higher costs for upgrades
Price (RM)	4500.00	2086.79
Pros	- High performance with hardware-accelerated security features via SoC4 chip - Comprehensive threat protection (IPS, AV, web filtering) - Built-in SD-WAN for hybrid network environments - Simple subscription model for security updates	- Strong integration with Cisco networking infrastructure and tools - Advanced Threat Defense features (Malware Protection, URL Filtering, etc.) - Flexibility with support for multiple VPN types and advanced routing
Cons	- Limited to Fortinet ecosystem; integration with third-party solutions can be challenging - User interface may require learning for beginners - May not support as complex configurations as Cisco Firepower	- Higher cost compared to similar SMB firewalls - Can be overkill for small, simple networks - Licensing model can be complex and expensive - Setup and management may require specialized Cisco knowledge

References	 [FortiGate FortiWiFi 60F Series Data Sheet]	 [Cisco Firepower 1010 NGFW Appliance]

For firewalls, we choose Fortinet FortiGate 60F instead of Cisco Firepower 1010 because Fortinet offers high performance at a more affordable price. Fortinet has user-friendly solutions for SMBs or enterprises without compromising on security. Fortinet also offers integrated UTM features and SD-WAN in a single device.

3.3.1.3 Wireless Access Point

Feature	Ubiquiti UniFi 6 Pro	Cisco Catalyst 9105AXI
Wi-Fi Standard	Wi-Fi 6 (802.11ax)	Wi-Fi 6 (802.11ax)
Max Throughput	Up to 4.8 Gbps	Up to 5.38 Gbps
Frequency Bands	Dual-band (2.4 GHz and 5 GHz)	Tri-band (2.4 GHz, 5 GHz, and additional 5 GHz)
PoE Support	PoE and PoE+	PoE+
Security	WPA3, VLAN support, and guest isolation	WPA3, advanced identity-based networking, and encryption
Scalability	Easy to scale for medium networks	Enterprise-grade scalability for larger environments
Price	1024.00	1900.08
Pros	- Affordable, excellent value for small to medium-sized networks - Wi-Fi 6 support for higher speeds and better performance in dense environments - Easy to set up and manage with UniFi Controller or UniFi Cloud Key	- Enterprise-grade performance with Wi-Fi 6 capabilities - Advanced security features (Secure Boot, Trustworthy Solutions, rogue AP detection) - Multi-gigabit Ethernet support for higher-speed connections
Cons	- Limited advanced enterprise features compared to Cisco - Lacks built-in advanced security features - No multi-gigabit Ethernet port for higher throughput in future-proofing	- Expensive, suitable for enterprise budgets - Requires Cisco expertise for configuration and management - Overkill for small to medium-sized networks without enterprise-level requirements
Reference	 Ubiquiti UniFi 6 Pro	 Cisco catalyst 9105AX

For wireless access point, we choose Ubiquiti Unifi 6 Pro because it also suitable for labs, classrooms, and open study spaces where moderate client density (20–50 devices per AP) is expected.

3.3.1.4 Switches (48 ports)

Feature	Cisco Catalyst 2960-X (48-Port)	Ubiquiti UniFi Switch Pro 48 (48-Port)
Ports	48 Gigabit Ethernet (GE) + 4 SFP uplinks (Gigabit)	48 Gigabit Ethernet (GE) + 2 10G SFP+ uplinks
PoE Support	PoE+ (up to 740W)	PoE+ (up to 400W)
Layer 3 Capabilities	Basic Layer 3 (Static routing)	Layer 3 support via advanced software with UniFi Controller
Switching Capacity	216 Gbps (Non-blocking)	70 Gbps (Non-blocking)
Performance	High-performance with industry-leading switching capacity	Solid performance for small to medium-sized environments
Price	700.00	2700.00
Pros	- Advanced security features (802.1x, MACsec, TrustSec support) - Supports Energy Efficient Ethernet (EEE) for lower power consumption - Robust support for Layer 2 features with some Layer 3 (static routing)	- Supports Layer 3 capabilities for inter-VLAN routing and static routing - Offers both fiber (SFP+) and copper connectivity options - Sleek, modern design and compatibility with the UniFi ecosystem
Cons	- Complex setup and management may require Cisco expertise - Lacks modern features like centralized cloud management - Limited to Cisco's proprietary ecosystem for optimal use	- Less robust warranty and support compared to Cisco - Not as feature-rich for Layer 3 and advanced routing needs - Limited advanced enterprise features compared to Cisco
Reference	 Cisco Catalyst 2960-X	 Ubiquiti Networks UniFi Switch PRO 48

For 48 ports switches, we choose Cisco Catalyst 2960-X instead of Ubiquiti UniFi Switch Pro 48 because it is affordable and offers scalability for a faculty setup. The high PoE (740W) is sufficient for powering devices like access points or IP cameras. It can integrate well into

enterprise networks as our requirement about the network is mission-critical since it requires cutting-edge technology, or integrates heavily into a Cisco ecosystem.

3.3.1.5 Switches (24 ports)

Feature	Cisco Catalyst 2960-L (24-Port)	Ubiquiti UniFi Switch 24 (24-Port)
Ports	24 Gigabit Ethernet (GE) ports + 4 Gigabit SFP uplinks	24 Gigabit Ethernet (GE) ports + 2 Gigabit SFP uplinks
PoE Support	PoE+ (up to 370W)	PoE+ (up to 400W)
Layer 3 Capabilities	Layer 2 switching (Basic Layer 3 for static routing)	Layer 2 switching (Layer 3 features via UniFi Controller)
Switching Capacity	56 Gbps (Non-blocking)	52 Gbps (Non-blocking)
Price	700.00	1776.30
Pros	- Advanced security features (802.1x, MAC filtering, etc.) - Energy-efficient design (EEE) to reduce power consumption - Built for long-term stability in enterprise environments	- Centralized cloud management through UniFi Controller - User-friendly interface suitable for SMBs and home office setups - Modern design with options for SFP uplinks
Cons	- Lacks advanced Layer 3 capabilities (primarily Layer 2 focused) - Proprietary ecosystem with limited third-party integrations - Setup and management require Cisco expertise	- Relies heavily on UniFi ecosystem for seamless integration - Less suited for highly secure or enterprise-critical deployments - Less robust support compared to Cisco
Reference	 Cisco Catalyst 2960-L Series Switches Data Sheet - Cisco	 Switch 24 PoE (250W) - Ubiquiti Store United States

For 24 ports switches, we choose Cisco Catalyst 2960-L instead of Ubiquiti UniFi Switch 24 because they offer great value for money, strong security, and are suitable for larger-scale deployments like classrooms, labs, and administrative offices. These factors, combined with their affordability and long-term reliability, make them a perfect fit for our needs.

3.3.1.6 Patch Panel (48 ports)

Features	Tripp Lite N252-048-1U (48 ports)	TRENDnet TC-P48C6 (48 ports)
Ports	48 RJ45 Cat5e/6 ports	48 RJ45 Cat6 ports
Cable Compatibility	Compatible with Cat5e and Cat6 cables	Compatible with Cat6 cables, but works with lower categories too
Material	Heavy-duty steel	Steel
Price	1191.70	311.30
Pros	- Ideal for network setups requiring reliable performance and organization - Designed for easy cable management and organization with labeling options	- Simple installation and well-labeled ports for easier cable organization - Compact design, fits easily into 19-inch racks
Cons	- Lacks some advanced features like modularity or higher-density designs - May not be as durable or flexible as premium brands like Leviton for demanding environments	- Limited advanced features for future-proofing or scalability - Some users report cable management can be slightly more difficult compared to others
Reference	 Tripp Lite Patch Panel 48 port	 48-port Cat6 Unshielded Patch Panel - TRENDnet TC-P48C6

For 48 ports patch panel, we choose Tripp Lite N252-048-1U instead of TRENDnet TC-P48C6 because of its high-density design, enterprise-grade durability, and integrated cable management, ideal for large-scale deployments.

3.3.1.7 Patch Panel (24 ports)

Features	Tripp Lite N252-024 (24-Port)	Legrand 24-Port Cat6 Patch Panel (24 ports)
Ports	24 Cat6 RJ45 ports	24 Cat6 RJ45 ports
Cable Compatibility	Compatible with Cat5e and Cat6 cables	Compatible with Cat5e, Cat6, and lower category cables
Material	Heavy-duty metal construction	Metal construction
Price	241.20	800.55
Pros	- Sturdy construction with a reasonable level of durability - Affordable and good value for small to medium-sized network installations	- Excellent build quality with robust materials, ensuring durability and longevity - Comes with solid cable management options, reducing clutter and improving organization
Cons	- Limited advanced features such as enhanced cable management tools or modularity - May not be suitable for high-density or high-performance enterprise environments	- Installation might require more time due to better cable management features - May not offer additional ports or expandability options for larger, more complex networks
Reference	 Tripp Lite 24-Port 1U Rackmount Cat6 110 Patch Panel 568B, RJ45 Ethernet(N252-024)	 Cat 6 24-Port Rack Mount Patch Panel

For 24 ports patch panel, we choose Tripp Lite N252-024 instead of Legrand 24-Port Cat6 Patch Panel because it is suitable for basic deployments with moderate cable management. It is ideal for small to medium-sized network setups

3.3.1.8 Server

Feature	Cisco UCS C480 M5	Lenovo ThinkSystem SR630
Processor	Up to 4 Intel Xeon Scalable processors	Up to 2 Intel Xeon Scalable processors
Memory	Up to 6 TB DDR4 memory, 24 DIMM slots	Up to 1.5 TB DDR4 memory, 16 DIMM slots
Storage Options	Up to 12x 3.5” or 2.5” drives with flexible configurations	Up to 10x 2.5” or 12x 3.5” drives
Expansion Slots	8 PCIe 3.0 slots	6 PCIe 3.0 slots
Power Supply	2x 1600W or 2x 2000W redundant power supplies	2x 550W, 750W or 1100W redundant power supplies
Price	39441.75	15859.00
Pros	- Integrated management with Cisco Intersight, enabling cloud-based monitoring and management - Excellent for mission-critical applications and large data centers - Supports a wide range of storage options (local, SAN, etc.)	- Excellent value for performance, scalability, and price, suitable for a wide range of workloads - Simplified management with Lenovo XClarity for easy deployment and monitoring
Cons	- Limited flexibility in terms of supporting other ecosystems outside of Cisco's proprietary tech - More complex to deploy and manage without prior experience with Cisco UCS	- Fewer advanced integration features compared to Cisco, particularly for larger environments - May require additional purchases for advanced management and monitoring options
Reference	 Cisco UCS C480 M5 High-Performance Rack Server	 Lenovo ThinkSystem SR630

For server, we choose Cisco UCS C480M5 instead of Lenovo ThinkSystem SR630 because Cisco UCS C480M5 is a more powerful and scalable server. It boasts a higher maximum CPU capacity, enabling it to handle more demanding workloads, and a higher maximum memory

capacity, which can help to improve performance for memory-intensive applications. It also offers more storage options, providing the flexibility to store more data and choose the most suitable storage type.

3.3.1.9 Connector

Feature	Dintek Cat 6 Unshielded RJ45 Connector	AMP Tyco RJ45 CAT6 8P8C Unshielded Modular Plug Network Lan Connector
Ease of Installation	Straightforward; basic design for standard crimping.	Includes user-friendly features like guides and alignment tools for easier installation.
Performance	Meets Cat 6 standards; suitable for up to 10 Gbps over short distances.	Meets or exceeds Cat 6 standards; offers better long-term reliability and consistency.
Build quality	Good for typical installations but less robust in high-stress environments.	Superior build quality; designed for mission-critical and high-performance applications.
Application	Small to medium-scale networks; cost-sensitive projects.	Enterprise networks, data centers, or environments requiring high durability and precision.
Price (RM)	3.00	24.90 (100pcs)
Pros	- Affordable and widely available for various networking projects - Easy to use with standard crimping tools - Available in bulk, making it cost-effective for larger installations	- High-quality build and reliability, ideal for professional and enterprise-level installations - Designed for easy crimping with robust connectors to ensure secure connections - Offers consistent and dependable performance for network infrastructure
Cons	- May not be as durable or reliable in high-performance or critical network environments - May not provide the best performance in high-density or interference-heavy	- Not as widely available as more common RJ45 connectors - Limited options compared to other brands offering similar products at lower prices

	environments	
Reference	 Dintek Cat.6 Unshielded RJ45 Modular Plug, 1501 88027 | Asashi Technology Sdn Bhd (332541-T) | Malaysia IT Online Store	 AMP Tyco RJ45 CAT6 8P8C Modular Plug Network Lan Connector (100 PCS)

For LAN connectors, we choose the AMP Tyco RJ45 CAT6 8P8C Modular Plug Network LAN Connector instead of the Dintek Cat 6 Unshielded RJ45 Connector because AMP Tyco offers superior build quality and long-term reliability. Its user-friendly features, such as guides and alignment tools, make installation more precise and efficient. Additionally, AMP Tyco exceeds Cat 6 standards, ensuring consistent performance and making it suitable for high-performance applications like enterprise networks and data centers. The 100-piece bundle also provides cost-effectiveness for large-scale implementations.

3.3.1.10 Cable

Feature	trueCable 6ECMRBLU_1Kbx	Cat 6 Ethernet Cable 305m with 23 AWG and 4 twisted pairs
Bandwidth	Up to 550 MHz, ensuring enhanced data transmission.	Up to 550 MHz, similar high-frequency support.
Speed	Supports 10 Gbps up to 165 feet (50m); drops after	Supports 10 Gbps over short distances.
Material	Solid bare copper, more durable but costlier.	Copper-Clad Aluminum (CCA), cost-effective.
Jacket Type	CMR (Riser-rated), ideal for fire safety in vertical installations.	Standard, not specialized for fire-resistance.
Ease of Use	Pull-box packaging, similar ease of handling.	Standard pull-box packaging for installation.
PoE Support	Supports PoE++ (up to 100W), better for advanced setups	Compatible with PoE and PoE+ devices.
Applications	Ideal for professional and enterprise environments.	Suitable for general-purpose networks.
Price (RM)	783.50	296.50
Pros	- High-quality construction, ideal for professional and commercial use - Solid build with extra protection against noise and interference - UL-listed and RoHS compliant, ensuring safety and reliability	- Affordable, providing good value for large installations and high-performance networks - Available in bulk (305 meters) for extensive installations - 23 AWG wires offer better signal transmission over longer distances than thinner cables
Cons	- Bulk options may not be as	- May not provide the same

	versatile for all networking environments - Can be more difficult to work with compared to lower-gauge cables due to stiffness	longevity and robustness for industrial or mission-critical applications - Less optimized for environments with heavy electromagnetic interference (EMI)
Reference	 true cable	 CAT 6 Ethernet Cable 305m

The Cat 6 Ethernet Cable 305m is a better choice for its affordability and sufficient performance, offering 550 MHz bandwidth and 10 Gbps speed. It supports PoE devices and is ideal for small to medium networks. While trueCABLE provides a fire-resistant jacket and solid copper, these features add unnecessary cost for general setups, making the Cat 6 Ethernet Cable 305m more practical.

3.3.2 Expected cost

No.	Device	Quantity	Price per unit (RM)	Total Unit Price (RM)
1.	Cisco ISR 4331 routers	1	4491.11	4491.11
2.	Fortinet FortiGate 60 F firewalls	1	4500.00	4500.00
3.	Ubiquiti Unifi 6 Pro wireless access point	4	1024.00	4096.00
4.	Cisco Catalyst 2960-X for 48 ports switches	2	700.00	1400.00
5.	Cisco Catalyst 2960-L for 24 ports switches	1	700.00	700.00
6.	Tripp Lite N252-048-1U for 48 ports patch panel	2	1191.70	2383.4
7.	Tripp Lite N252-024 for 24 ports patch panel	2	241.20	482.40
8.	Cisco UCS C480M5 server	5	39441.75	197208.75
9.	AMP Tyco RJ45 CAT6 8P8C Unshielded Modular Plug Network Lan Connector(100pcs)	9	24.90	224.10
10.	Cat 6 Ethernet Cable 305m with 23 AWG and 4 twisted pairs	9	296.50	2668.50
			Total cost (RM)	218154.26

3.3.3 Reflection

1. **Are you surprised by the prices? How were you surprised?**
   Answer: Yes, the prices of networking devices can be quite surprising. As we don't know that the devices can be quite expensive before we do research for this project, especially when exploring enterprise-grade equipment like Cisco routers and switches. The high cost of these devices often reflects their advanced features, reliability, and brand reputation. Another surprising aspect is the variance in pricing between brands and models. While premium brands like Cisco offer cutting-edge technology and top-tier support, budget-friendly options still meet the needs of less demanding environments at a fraction of the cost. The realization that these prices also account for factors like build quality, long-term durability, and enhanced security features can help make sense of the numbers, even though they still seem steep at first glance.

2. **Have you ever considered cost as a factor for choosing networking devices?**
   Answer: For us, cost is always an important factor when selecting networking devices, but it's not the only one. As our group's budget is RM 2 millions, hence balancing the budget with the specific needs of the network is critical. For instance, while it's tempting to go for cheaper devices to save costs, it's important to think about the long-term implications, such as durability, scalability, and maintenance expenses. Total Cost of Ownership (TCO) is a key consideration—cheaper devices may save money upfront, but premium devices with better warranties and support often prove more economical in the long run. In an academic setup, prioritizing cost-effective devices for general areas while investing in high-performance ones for specialized labs can strike the right balance. For example, using TP-Link or Ubiquiti for less demanding environments and reserving Cisco for high-tech labs allows us to manage costs effectively while still ensuring quality.

3. **What are the major differences between the same devices from different brands? For example, Cisco and Huawei Routers.**
   Answer:
   Router: Cisco vs Tp-Link
   For target audience, Cisco is designed for enterprise-level networks, businesses, and critical infrastructure while Tp-Link is primarily aimed at home users, small businesses, and budget-conscious buyers.
   For performance, Cisco has high performance as it is built for high-throughput and low-latency operations in demanding environments meanwhile Tp-Link has good performance as it is adequate for home and small office environments but may struggle under heavy loads..
   For security, Cisco provides enterprise-grade security features such as intrusion prevention, advanced firewalls, and zero-trust architecture while Tp-Link provides basic security features such as WPA3, firewalls, and basic VPNs for consumer and small business use.
   For price, Cisco tends to be more expensive to reflect its focus on enterprise and critical systems meanwhile Tp-Link is more affordable as it focuses on delivering value for money for home and small business users.

Switch: Cisco vs Huawei

The popular series of Cisco switches are the enterprise switches, Catalyst series and Nexus switches. Cisco Catalyst switches are designed for core layers in campus networks, while the Nexus is mainly for data centers. Whereas, for Huawei switches, the popular one is the campus switches.

For target audience, Cisco is geared toward enterprises, data centers, service providers, and mission-critical networks meanwhile Huawei aims to serve enterprises, SMBs, and telecom operators with cost-effective solutions.

For performance, both Cisco and Huawei brands provide high-performance switches. Cisco uses IOS for stability and advanced management, while Huawei employs VRP which offers flexibility and traffic optimization.

For cost, Cisco switches are more expensive which reflects their premium features and reliability. Whereas, Huawei provides cost-effective solutions, appealing to budget-conscious users.

Patch panel: Tripp Lite vs TRENDnet

For target audience, Tripp Lite is designed for enterprise-grade and data center environments while TRENDnet is aimed at small to medium-sized businesses (SMBs) and budget-conscious users.

For its features, Tripp Lite offers high-density patch panels, supporting large-scale networks meanwhile TRENDnet provides standard patch panels, often for Cat5e and Cat6 cables and focused on basic features like numbered ports and simple design.

For shielding and performance, TRENDnet emphasizes shielding for environments with potential EMI, whereas Tripp Lite patch panels are mre general-purpose, catering to standard networking needs.

For PoE compatibility, Tripp Lite frequently includes PoE features which may not be standard in all TRENDnet models.

For build and design, TRENDnet often uses metal shielding for added durability and stability, while Tripp Lite focuses on flexible setups with easy cable management.

For price, Tripp Lite offers a higher price point, reflecting its professional-grade quality and features, while TRENDnet is more affordable and budget-friendly.

Server : Cisco UCS C480M5 High-Performance Rack Server VS Lenovo ThinkSystem SR630

The Cisco UCS C480M5 High-Performance Rack Server is a 4U rackmount system powered by dual 2nd-generation Intel Xeon Scalable processors meanwhile Lenovo ThinkSystem SR630 is a 2U rackmount server designed with up to 2nd Gen Intel Xeon Scalable processors, supporting configurations with up to 28 cores.

For memory capacity, Cisco UCS C480M5 supports up to 24 DDR4 DIMM slots, allowing a maximum memory capacity of 384GB meanwhile Lenovo ThinkSystem SR630 provides up to 12 DDR4 DIMM slots, enabling a maximum memory capacity of 192GB.

For storage, Cisco UCS C480M5 accommodates up to 32 2.5-inch hot-swappable SAS/SATA HDDs or SSDs, and it includes dual 10GBASE-T Intel x550 network adapters meanwhile Lenovo ThinkSystem SR630 allows up to 16 2.5-inch hot-swappable SAS/SATA HDDs or SSDs, and its networking capabilities include dual 10GbE SFP+ ports.
For its additional feature, Cisco UCS C480M5 also supports up to 12 NVMe SSDs and features an integrated management controller (iMC) meanwhile Lenovo ThinkSystem SR630 supports up to 6 NVMe SSDs and offers management through the BMC with IPMItool.

Reflection of Task 3

Task 3 focused on the selection of appropriate LAN devices to support the network infrastructure. We chose Cisco ISR 4331 routers for their enterprise-grade performance, Fortinet FortiGate 60F firewalls for robust security, Ubiquiti UniFi 6 Pro wireless access points for cost-effective WiFi coverage, and Cisco Catalyst 2960-X switches for scalability and energy efficiency. The selection process prioritized balancing high performance with budget constraints, especially in critical areas such as labs and classrooms.

3.4 Task 4 - Making the connections-LAN and WAN

3.4.1 Work areas on the floor plan

Ground floor

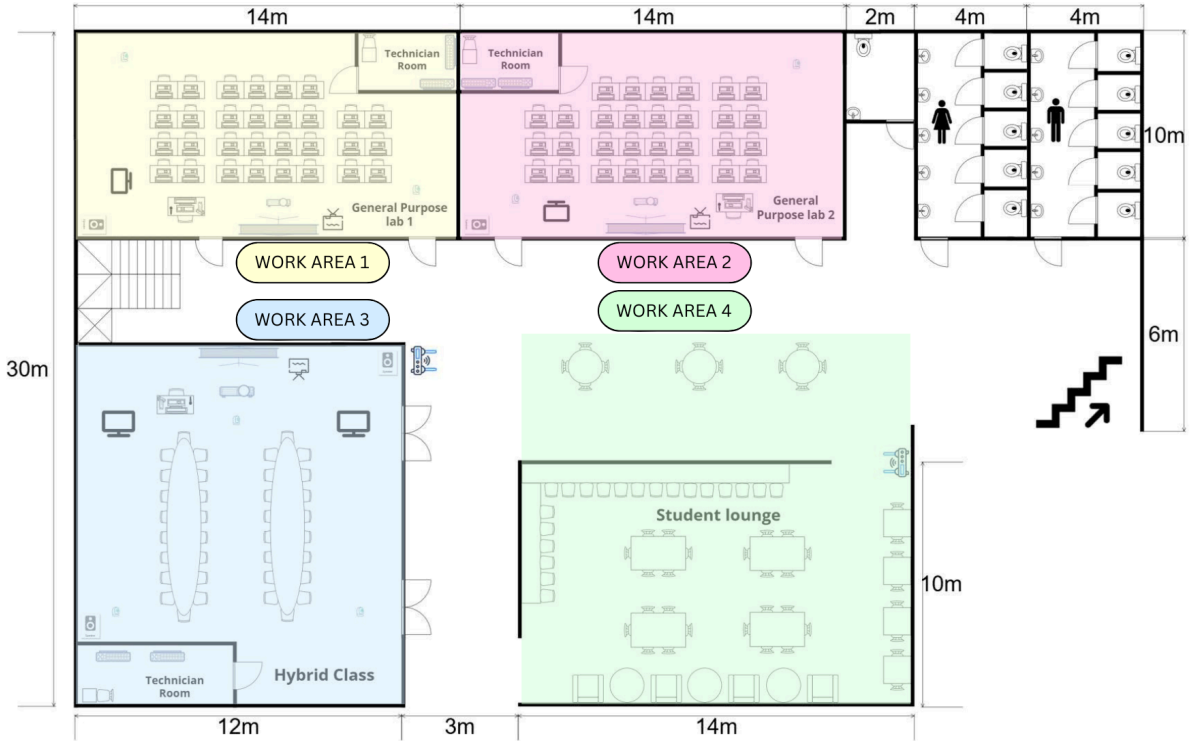


Figure 2.1 Work area of ground floor

The ground floor plan of the new Faculty of Computing building comprises four distinct work areas, each serving a specific purpose: General Purpose Lab 1, General Purpose Lab 2, a video conferencing room, and a student lounge. Both General Purpose Labs are equipped with 30 workstations, each connected to a centralized switch to ensure efficient network connectivity. The video conferencing room is designed to facilitate collaborative meetings, providing a professional and connected environment for virtual discussions and presentations. Additionally, the student lounge provides a comfortable space for students to relax or collaborate on projects, featuring comprehensive internet access to support casual browsing or academic discussions while waiting for their next class.

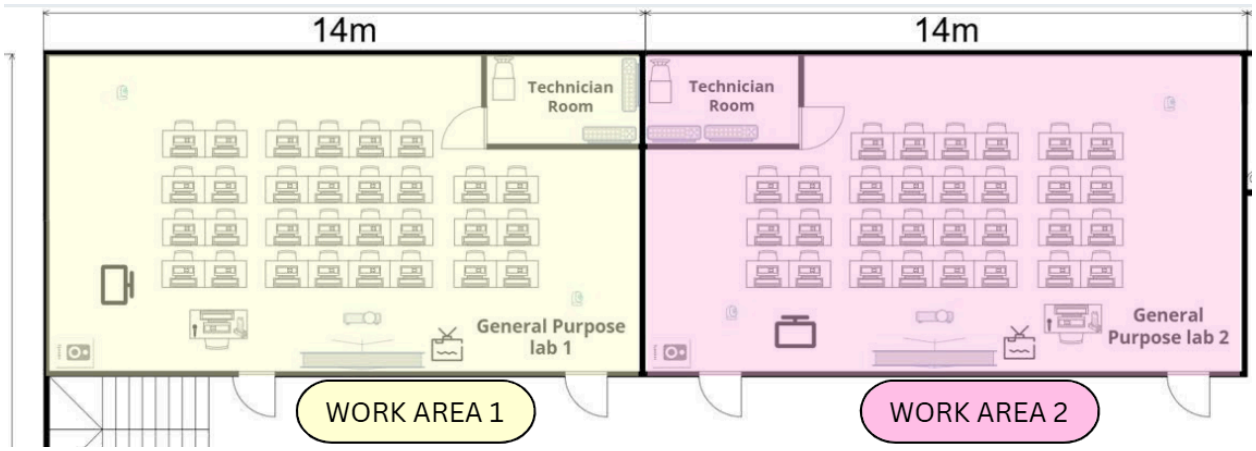


Figure 2.2 Work Area 1 and 2 - General Purpose Lab 1 and 2

Work Areas 1 and 2 which are known as General Purpose Lab 1 and General Purpose Lab 2, are designed to accommodate up to 30 students each, with 30 dedicated workstations per lab. Each facility is equipped with 31 PCs to support a variety of learning activities. All devices are interconnected via a centralized switch and patch panel using Cat6 cables, ensuring smooth and reliable data transfer. Additionally, each lab features a Ubiquiti UniFi 6 Pro wireless access point, enabling wireless-capable devices to seamlessly connect to the network and enhancing the flexibility and functionality of the learning environment.

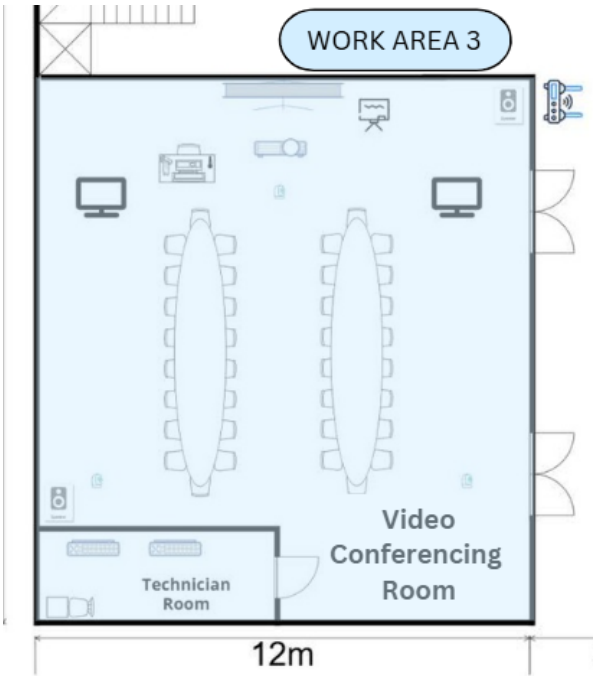


Figure 2.3 Work Area 3 - Video Conferencing Room

A video conferencing room is designed as a dedicated space to facilitate collaborative meetings and interactive discussions. To enhance presentation capabilities, a projector has been installed for sharing and displaying presentations, documents, and demonstrations on a large screen, ensuring maximum visibility for all participants. For seamless connectivity, the room is equipped with the Ubiquiti Unifi 6 Pro wireless access point (WAP), providing a reliable and high-speed wireless connection. Additionally, the TrippLite N252-048-1U 48-port patch panel is utilized to manage and organize network connections, supporting efficient communication within the video conferencing environment.

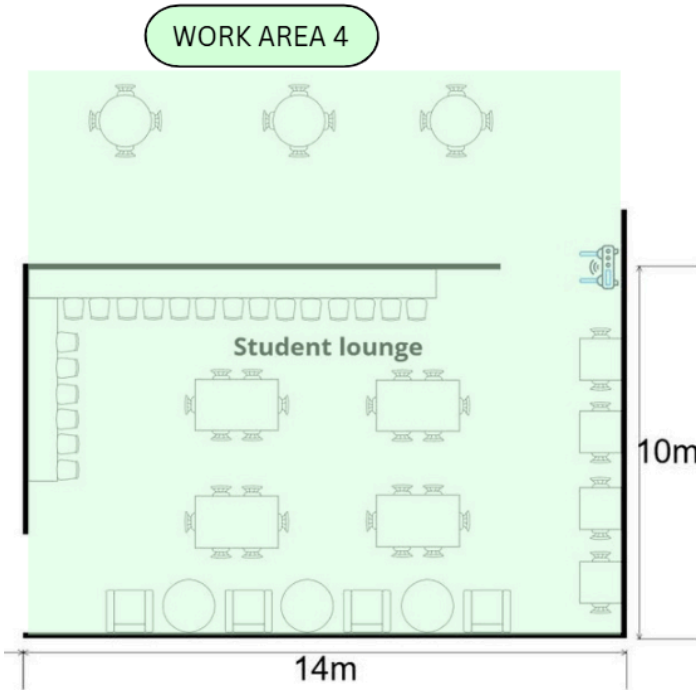


Figure 2.4 Work Area 4 - Student Lounge

The student lounge is designed as a comfortable space for students, lecturers, and staff to relax or collaborate in a casual setting. To ensure seamless connectivity, a Ubiquiti UniFi 6 Pro wireless access point (WAP) has been installed, providing strong and reliable Wi-Fi coverage for laptops and mobile devices. This WAP enhances data transfer rates, especially in high-density environments, making it an ideal choice for supporting multiple users simultaneously while maintaining optimal performance.

First floor

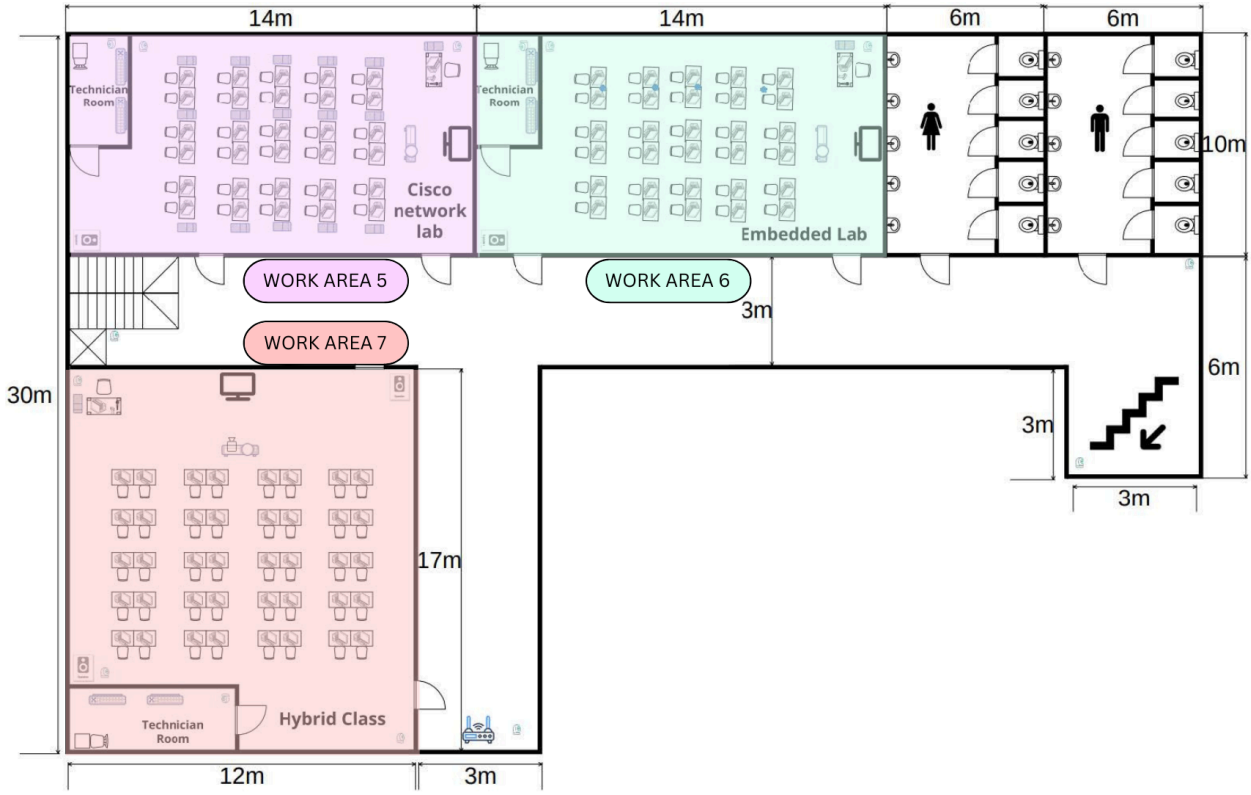


Figure 2.5 Work Area of First Floor

The second floor of the new Faculty of Computing building features three key work areas: a hybrid classroom, a Cisco Network Lab, and an Embedded Lab. The Cisco Network Lab and Embedded Lab are each equipped with 30 workstations and dedicated servers to support their specialized functions, such as networking education and IoT-related projects. The hybrid classroom is designed to support modern teaching methods, combining physical and virtual learning environments. It is equipped with advanced multimedia tools and wireless access to facilitate interactive sessions, enabling students and faculty to seamlessly integrate digital resources into their learning experiences.

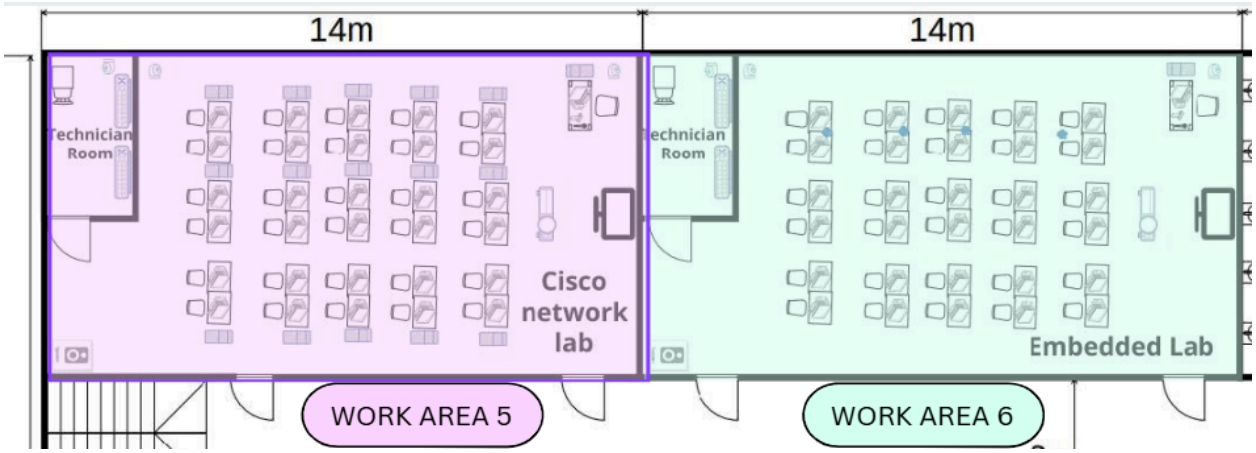


Figure 2.6 Work Area 5 & 6 - Cisco Network Lab and Embedded Lab

The Cisco Network Lab is a specialized workspace designed to support hands-on networking education and training. Equipped with 31 dedicated workstations, the lab includes state-of-the-art networking devices such as routers, switches, and access points to simulate real-world network configurations and troubleshooting scenarios. The integration of the Cisco UCSC 480 M5 server enhances the lab by providing powerful computing resources for data storage, lab activities, and simulations, ensuring smooth and efficient operations. To further optimize connectivity, the room is outfitted with the Ubiquiti UniFi 6 Pro wireless access point (WAP), which ensures a reliable, high-speed wireless network, supporting seamless collaboration and resource access for all participants. This lab fosters practical learning and equips students with the technical skills necessary for managing and deploying modern network infrastructures.

The Embedded Lab focuses on cutting-edge technologies related to IoT, sensors, and embedded systems. Like the Cisco Lab, it features 31 workstations, each configured to support hands-on experimentation and development. The lab is equipped with advanced devices, including microcontrollers, development boards, and peripheral tools, enabling students to design, build, and test innovative projects. A dedicated server ensures smooth data processing and management, while high-speed internet connectivity supports seamless collaboration and resource access.

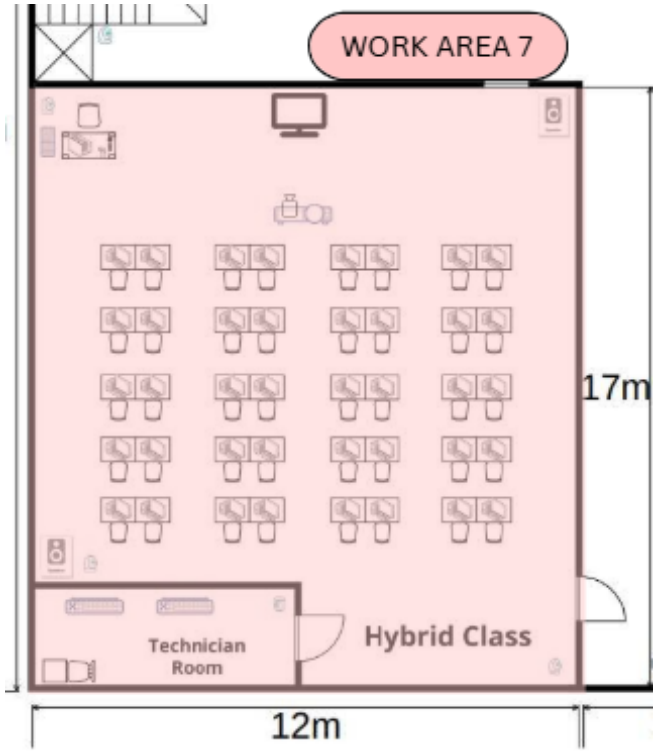


Figure 2.7 Work Area 7 - Hybrid Classroom

The Hybrid Classroom is designed to enhance the teaching and learning experience by seamlessly integrating both physical and virtual learning environments. This versatile space can accommodate up to 36 students, making it ideal for interactive lectures, group discussions, and collaborative activities. Equipped with a centralized switch, a patch panel, and a wireless access point (WAP), the classroom ensures efficient network connectivity for all devices. The inclusion of advanced peripherals, such as multimedia tools and wireless capabilities, enables smooth integration of digital resources, fostering active participation and engagement for both in-person and remote learners.

3.4.2 Network diagram

3.4.2.1 Ground Floor

General Purpose Lab 1

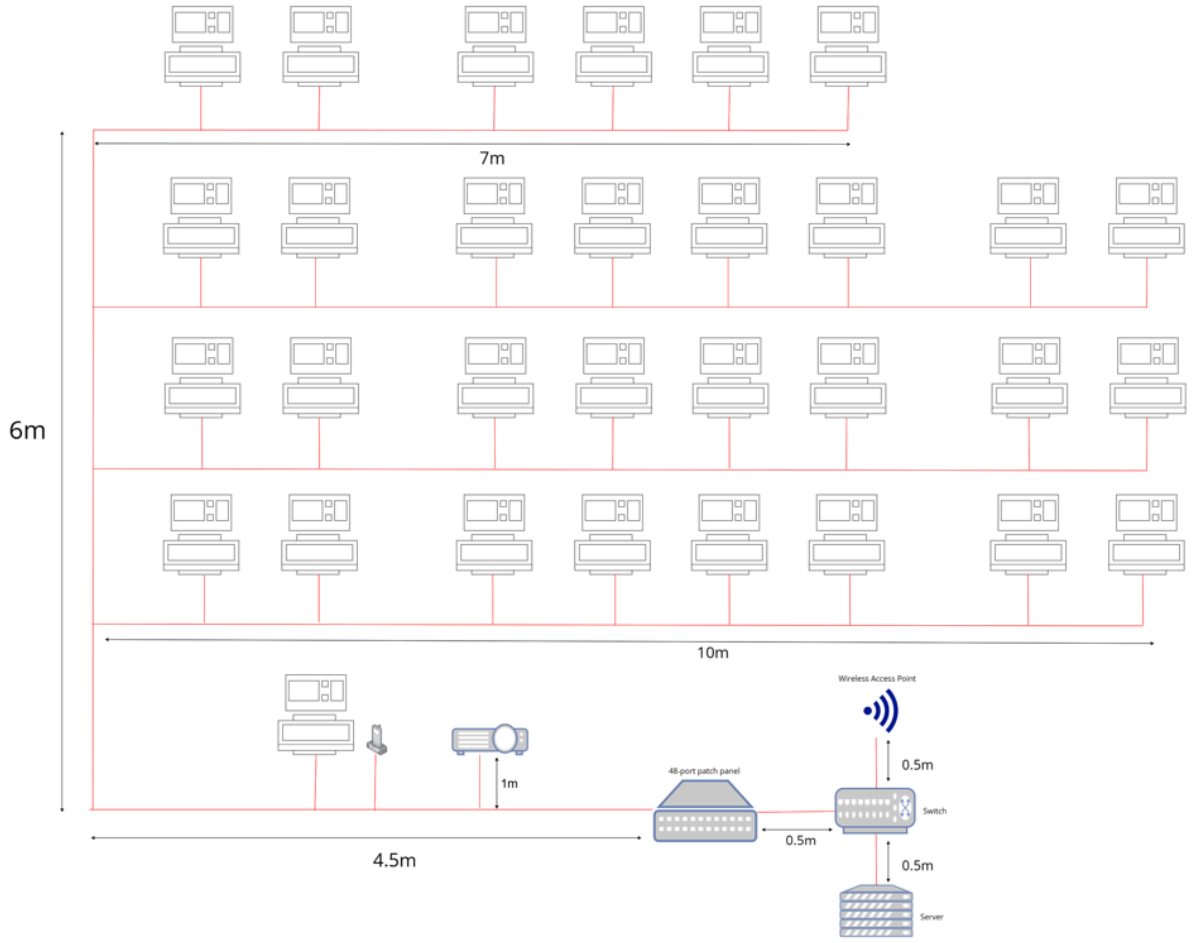


Figure 2.8 Network diagram for General Purpose Lab 1

General Purpose Lab 2

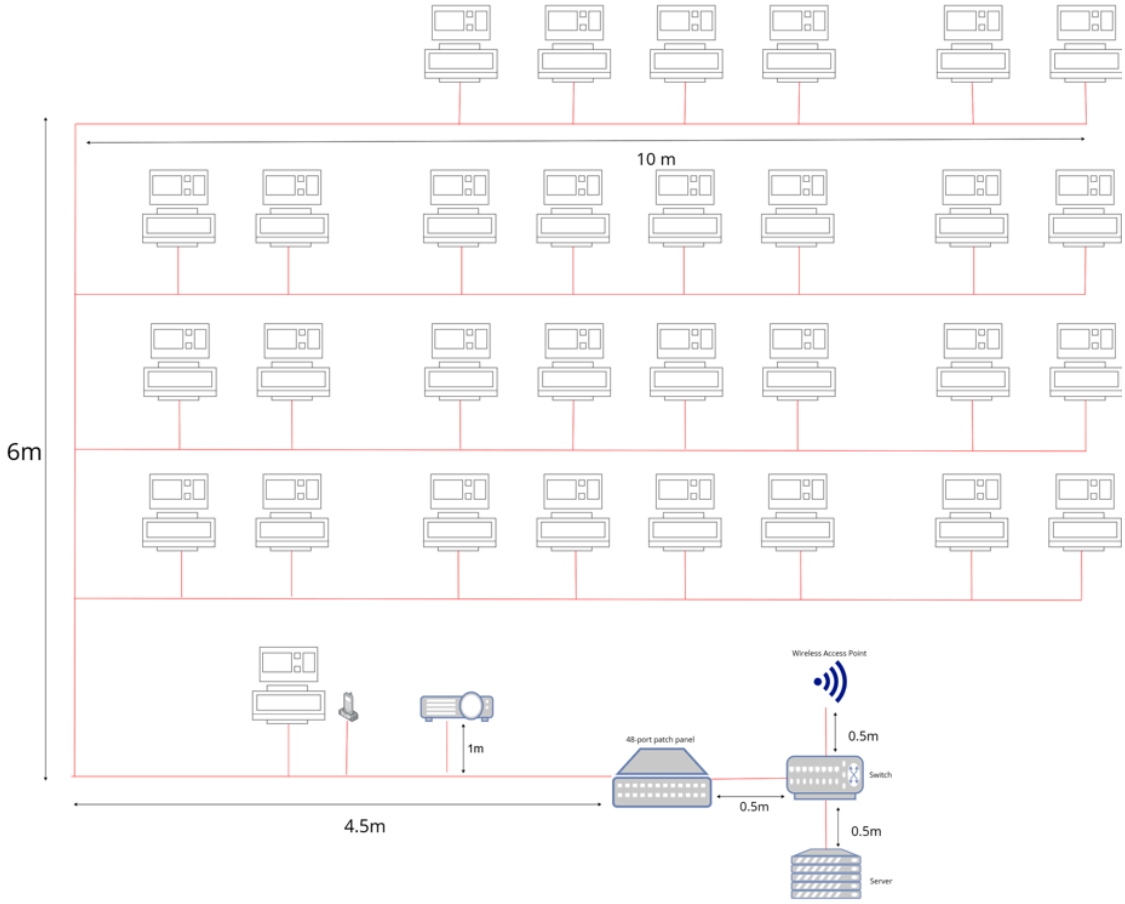


Figure 2.9 Network diagram for General Purpose Lab 2

The above figures show the distribution and connection of networks in general purpose lab 1 and general purpose lab 2. Both of these general purpose labs have similar distribution and connection networks. All 31 PCs are connected to the server and Wireless Access Point (WAP) through the 48-port patch panel and 48-port switch by cat 6 cable which the total length is approximately 93 meters, and is represented by the red line in the figures above. The server is the central repository of resources, such as applications, databases, and file storage, accessible by all PCs in the labs. It ensures data centralization and provides computing power for shared tasks. Patch panel serves as the centralized wiring hub, where all the Cat 6 cables from the PCs, server, switch and WAP are terminated. It provides an organized way to manage cable connections. The patch panel is linked to a 48-port switch, which ensures efficient data distribution and connectivity among all devices. The switch facilitates communication between PCs, the server, and the wireless access point. The Wireless Access Point enables wireless connectivity for devices equipped with Wi-Fi capabilities, such as laptops, tablets, and smartphones that are used by both students and lecturers.

Video Conferencing Room

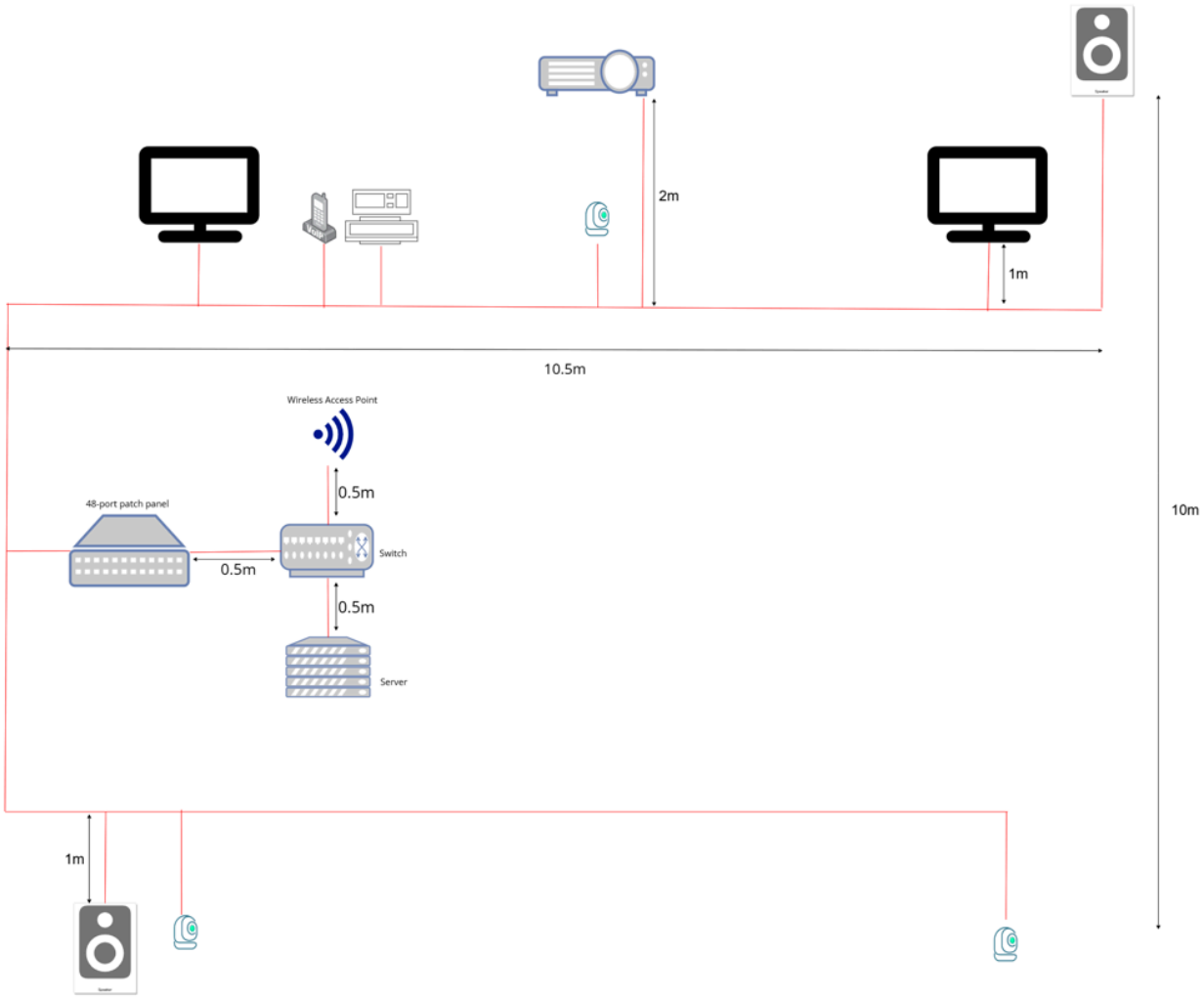


Figure 2.10 Network diagram for Video Conferencing Room

All of the devices such as projector, television, IP camera, speaker and PC in video conferencing rooms are connected to Wireless Access Point through 48-port Patch Panel and 48-port Switch by cat 6 cable which is represented by the red line in the figures above. The patch panel ensures organized cable management, making it easier to identify and maintain individual connections. The switch can efficiently distribute data between the devices and the wireless access point, ensuring smooth communication and operation. For the Wireless Access Point, it allows wireless devices to connect to the wired network without the need for physical cables. However, it still needs to be connected to the switch using cable to utilize the Wi-Fi technology. Cat 6 cable used because it is capable of supporting Gigabit Ethernet, ensuring minimal signal degradation even over long distances.

Student Lounge

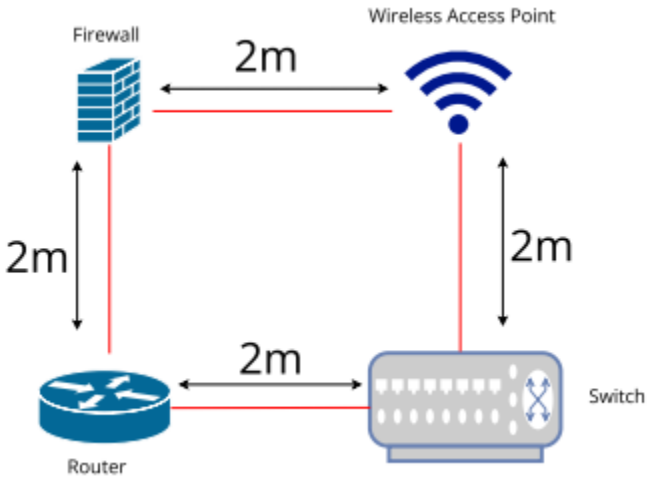


Figure 2.11 Network diagram for Student Lounge

In the Student Lounge area, we have Wireless Access Point, Router, Firewall and Switch because most people will bring their own devices and prefer the convenience of wireless connections. This setup prioritizes flexibility and convenience, allowing users to move freely while maintaining reliable network access. Router and firewall is placed in the student lounge because it is the most centralised area of the building. The router is near the wireless access point for easy connection to the internet. Firewall is placed directly between the router and the switch to ensure that all inbound and outbound traffic passes through the firewall for inspection before reaching internal devices or the external network. The wireless access point and switch function similarly to those in other areas, ensuring consistent performance. This simple yet efficient setup aligns with the lounge's purpose, minimizing the need for wired connections and focusing on user preferences for wireless access.

3.4.2.2 Second Floor

Cisco Network Lab

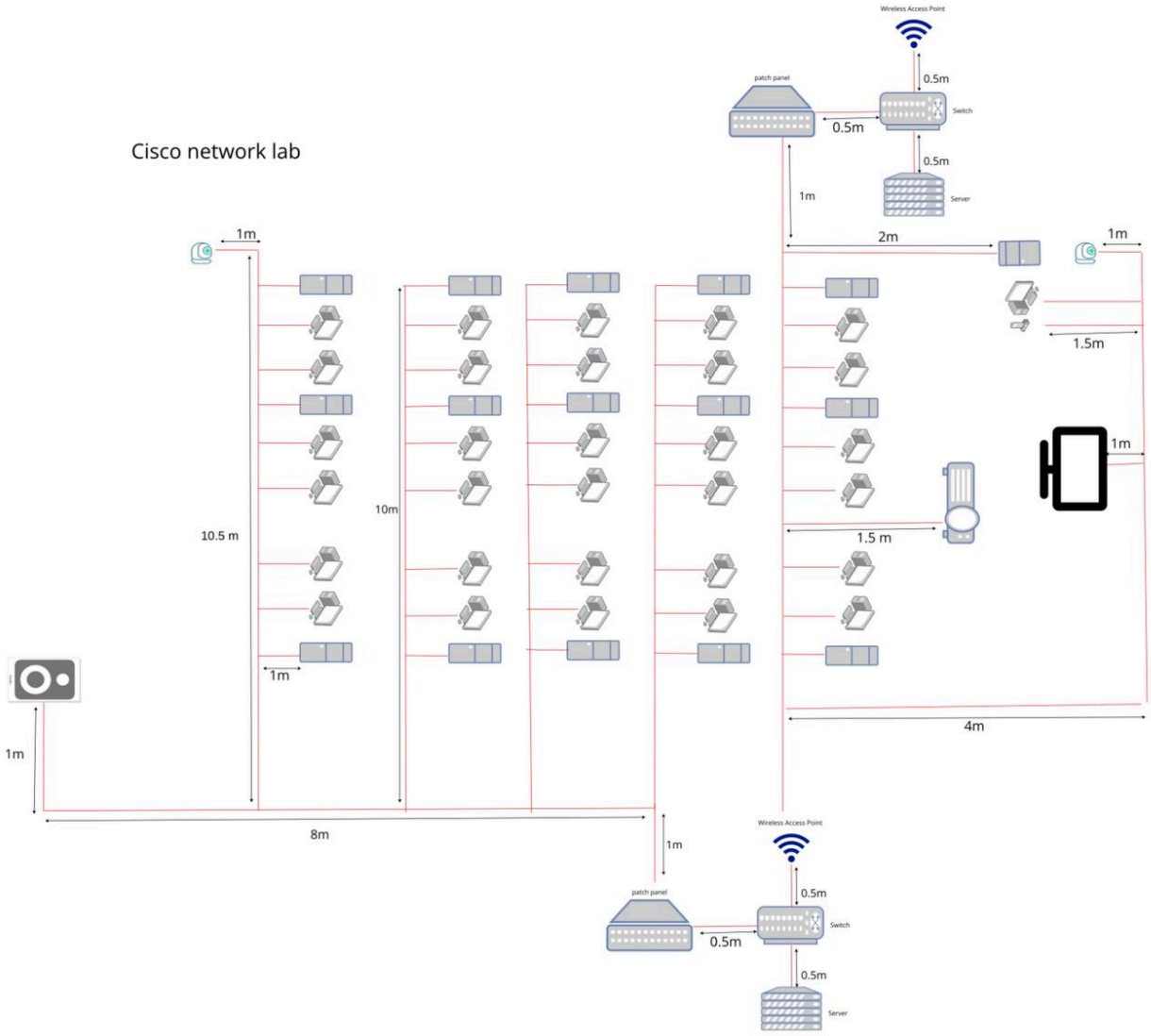


Figure 2.12 Network diagram for Cisco Network Lab

In the Cisco network lab, all the devices interconnected through a structured network setup that includes a switch, patch panel, server, and Wireless Access Point (WAP). Each workstation and hard disk bay is connected via Cat 6 cables through the patch panel and switch, ensuring high-speed, reliable communication. The server acts as the backbone, hosting applications, simulations, and shared resources, while the WAP provides wireless connectivity for mobile devices. Patch panel organizes the cabling infrastructure, making it easier to manage connections to the switch. The 24-ports switch serves as the central hub for wired connections, linking all devices in the lab to ensure efficient data transfer and minimal latency for all connected devices.

Embedded Lab

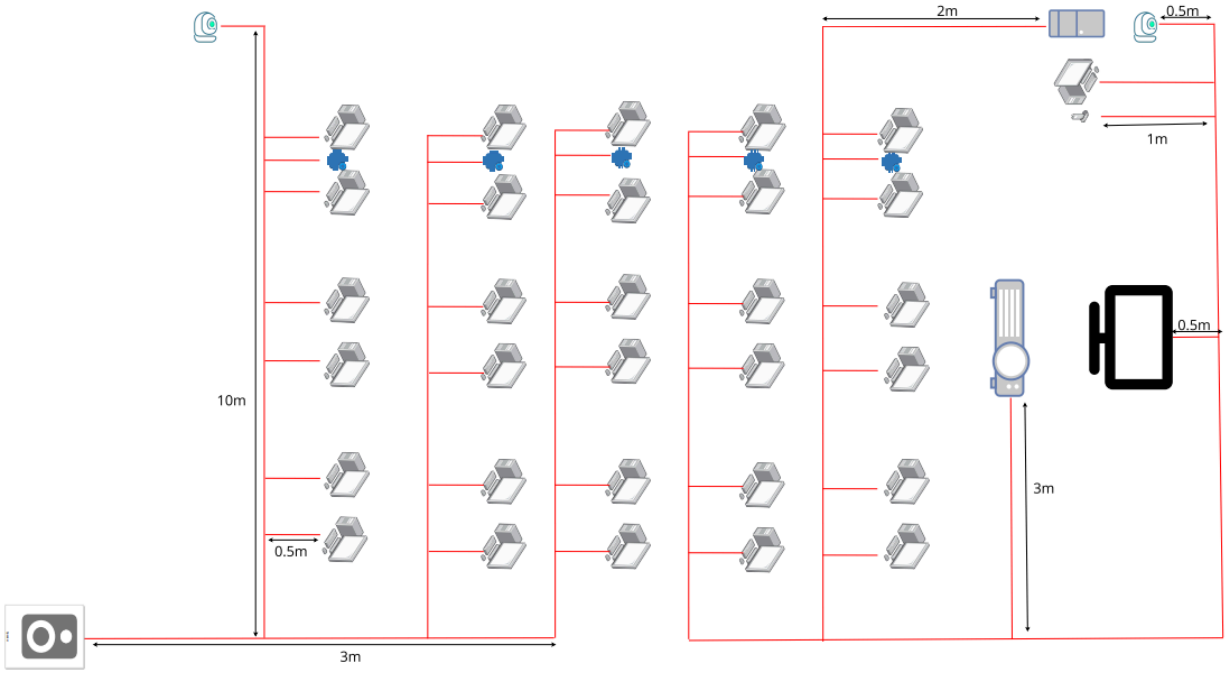


Figure 2.13 Network diagram for Embedded Lab

The embedded lab network setup, similar to the Cisco network lab, adds an IoT device to enable hands-on experimentation with embedded systems. Cat 6 cables connect workstations, the IoT device, the projector, television, IP cameras, speakers, and other devices to the patch panel and switch, ensuring high-speed, reliable connections. The server is connected to the switch for centralized data management and resource sharing. Same as other labs, switches connect all the devices in the lab, ensuring fast data transmission and efficient network traffic management. Patch panel centralizes all cabling connections, making it easy to manage and troubleshoot the network. Server provides a centralized point for storing code, configurations, and experimental data for embedded and IoT systems.

Hybrid Classroom

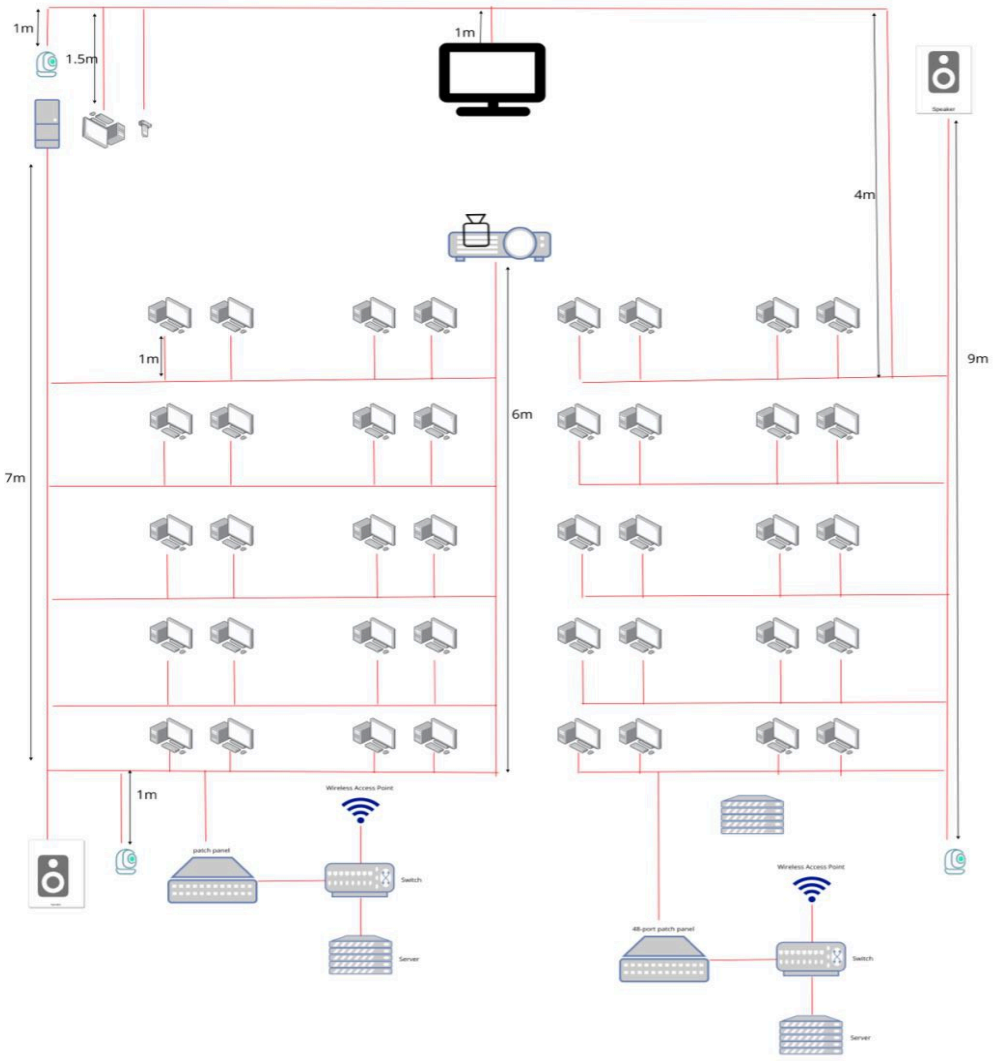


Figure 2.14 Network diagram for Hybrid Classroom

All of the devices in the hybrid classroom are connected to the patch panel and switch via cat 6 cable indicated by the red line in the figure above. The server is connected to the switch, providing centralized storage, content management, and real-time data sharing. The Wireless Access Point (WAP) is connected to the switch, providing wireless network access for mobile devices and remote students. The IP cameras and speakers are integrated into the network to facilitate communication and real-time streaming of classroom activities to remote learners. This network setup enables smooth integration of both in-person and remote learning, supporting real-time interaction between students and instructors.

3.4.3 Cable and connections

3.4.3.1 Floor Plan

This section outlines the network connectivity strategy for the entire building, designed to ensure efficient data flow and reliable connections to designated areas. Our building utilizes Cat 6 Ethernet cables, chosen for their high bandwidth capabilities and suitability for educational purposes. The copper construction of these cables supports the demands of a dynamic educational environment, providing dependable and high-speed data transfer throughout the building.

3.4.3.2 Ground Floor

The figure illustrates the connectivity of the ground floor's rooms and labs through the switches in the area. This setup involves linking switches in General Purpose Lab 1, General Purpose Lab 2, video conference room using Cat 6 Ethernet cables. The cables are neatly routed along the walls, ensuring comprehensive network access by connecting to switches in each room. A horizontal cable pathway is provided across the center of the building to enable quick and efficient connections to switches in other rooms, simplifying the cable management process.

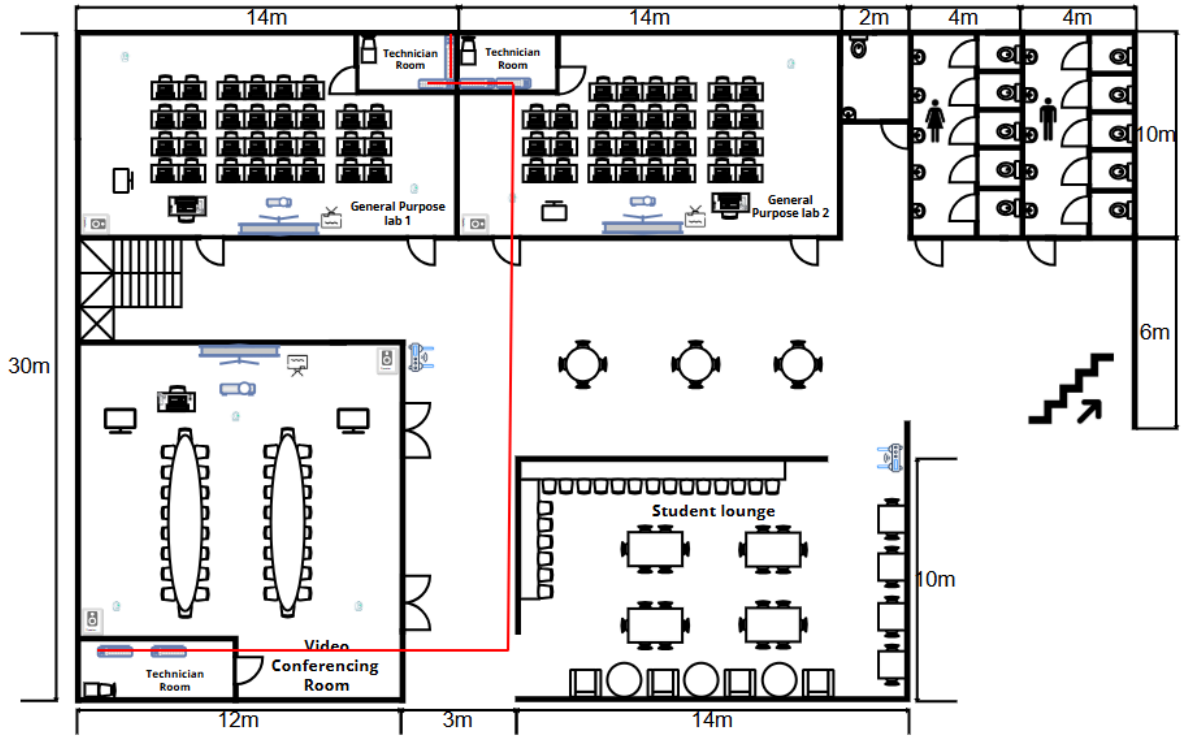


Figure 2.15 Connection diagram for Ground Floor

3.4.3.3 First Floor

For the first floor, the rooms and the labs are connected to each other through every switch in the area. We use the CAT 6 cable type to implement the connection between switches in 4 work areas on the second floor (Hybrid class, embedded lab and Cisco network lab). The cabling is installed hidden in the ceiling and easily attaches to switches in each space. In order to simplify the connections to switches in other rooms, we offer a horizontal cable path across the center of the building, which streamlines the cable management procedure.

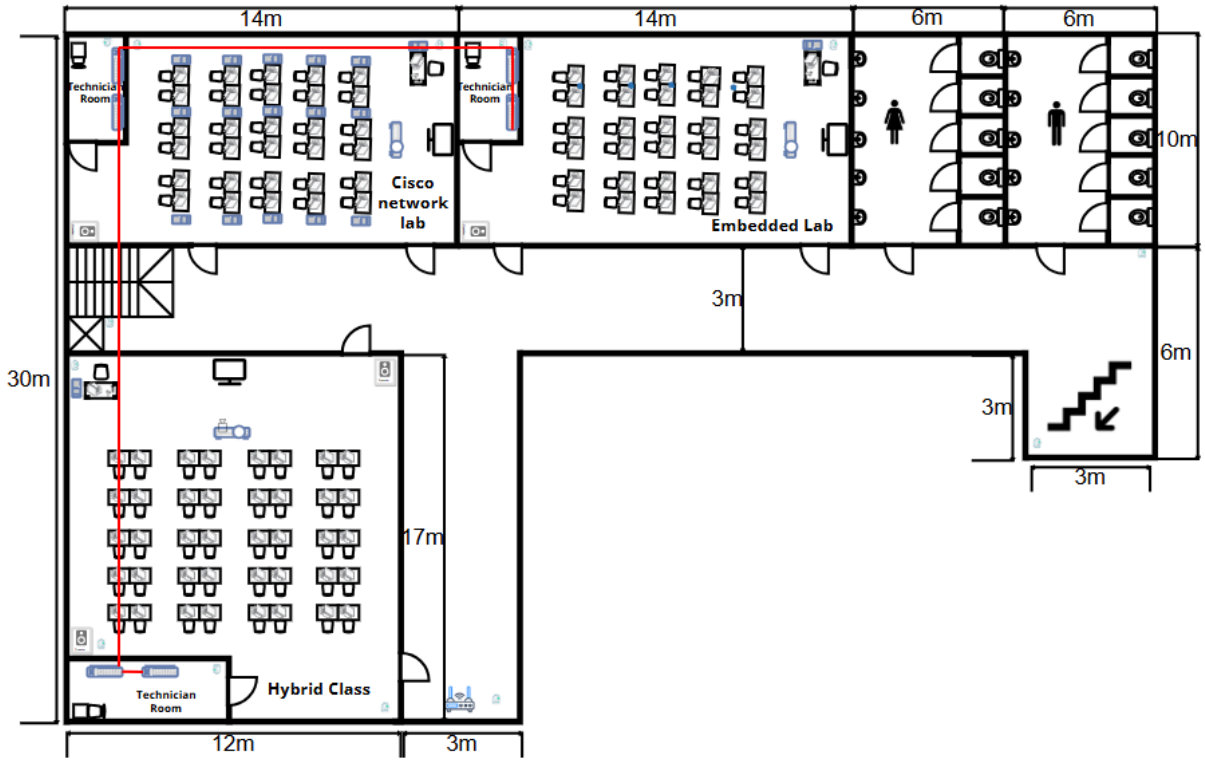


Figure 2.16 Connection diagram for First Floor

3.4.3.4 Cable Lengths

Description	Cable Type	Length(m)
First Floor		
General Purpose Lab 1	CAT 6 cable	93
General Purpose Lab 2	CAT 6 cable	93
Video Conferencing room	CAT 6 cable	40
Student lounge	CAT 6 cable	30
First floor	CAT 6 cable	20
The total length of the First Floor (m)		276
Second Floor		
Cisco Network lab	CAT 6 cable	70
Embedded lab	CAT 6 cable	75
Hybrid Class	CAT 6 cable	60
Second floor	CAT 6 cable	20
The total length of the Second Floor (m)		225
Total length of all cable used		501

Device	Quantity	Total ports
Switch	12	192

The total cable length is about 501 meters for all the floor plans. The number of ports for used switches is 192 ports. A patch cord, or occasionally termed patch cable, is a copper cable that has an RJ45 connector on both ends. It can link up the router, switch, or hub to computers, printers, and other peripheral devices. For this network connection, we use a 210-meter patch cord. Switch ports are Layer-2-only interfaces related to a physical port. A switch port can be an access port, a trunk port, or a tunnel port. In this network, the number of switches used is 12, and each of them has 24 ports.

3.4.4 Identifying the cable length and type

In the design and planning of the network infrastructure for both the first and second floors of the building, our group has strategically chosen CAT6 twisted cable to ensure efficient and reliable connectivity with the total length of 501 meters of CAT6 cable. This decision aligns with the specific needs of different rooms and the advantages offered by CAT6 cable. CAT6 is selected for both horizontal and vertical cabling, connecting computers to various devices within rooms such as the Student Lounge, General Purpose Labs, Hybrid Classroom, Cisco Lab, Video Conferencing room and Embedded Lab.

The inclusion of 12 switches with a total of 192 ports plays a crucial role in facilitating efficient data flow and connectivity within the network infrastructure of the building. These switches are strategically placed throughout the building to distribute connectivity effectively. Each switch serves as a central point to connect multiple devices within its vicinity, such as computers, servers, and other networked equipment. In rooms such as the Cisco Lab, Embedded Lab, General Purpose Labs, Hybrid Classroom, Video Conferencing Room, and Student Lounge, individual switches provide connectivity for devices within the specific room. This design ensures devices in each room can communicate efficiently.

CAT6 twisted cables connect devices within a room to their respective switches, forming the horizontal cabling network. Each switch, therefore, manages the local connectivity within its designated area. Additionally, CAT6 supports high-speed data transmission of up to 10Gbps, facilitating seamless connectivity for data-intensive tasks, reducing both time and cost associated with cabling, and enhancing overall efficiency. With a bandwidth of up to 500MHz, CAT6 ensures a robust and responsive network infrastructure. The thicker copper wire in CAT6 also allows for efficient heat dissipation, making it highly suitable for the LAN system within the building.

This network design demonstrates how CAT6 cables and well-distributed switches contribute to a reliable and efficient network infrastructure. It highlights how the careful selection and implementation of cable types optimize both performance and durability in the network system for the building.

Reflection of Task 4

In Task 4, we developed a comprehensive plan for LAN and WAN connections. This included identifying work areas, selecting suitable cabling such as twisted-pair and fiber optic cables, and calculating cable lengths to ensure efficiency and compliance with the building's dimensions. The outcome was a scalable and organized cabling plan designed to accommodate future expansions.

3.5 Task 5 - IP addressing scheme

3.5.1 Network Address

Group/Section	Network Address
1	192.16.0.0/8
2	192.17.0.0/8
3	192.18.0.0/8
4	192.19.0.0/8
5	192.20.0.0/8
6	192.21.0.0/8
7	192.22.0.0/8
8	192.23.0.0/8
9	192.24.0.0/8
10	192.25.0.0/8

An IP address is like a tag for the hosts on the internet. The network address is a part of this tag that shows which group the hosts belong to. On the other hand, the broadcast address is a way to talk to everyone in that group at once. Subnet masks help break down the tag into parts, making it easier to organize and manage different groups on the internet. These things are fundamental to setting up networks.

The IP address for our group given by the faculty representative is 192.19.0.0/8 . In this task we would do the subnetting and IP address assignation to ensure that all hosts in the faculty would have their own unique IP address. The following is our report about this task.

3.5.2 Subnetting

3.5.2.1 Subnet Mask

A subnet mask is a 32-bit number used in networking to separate an IP address into its network and host components. It helps to determine which part of the IP address identifies the network and which part identifies individual devices within that network. Written in the same format as IP address, the subnet mask uses a sequence of 1s to denote the network portion and 0s to denote the host portion. Subnet masks are essential for organizing the networks, optimizing IP address allocation and enhancing the security by segmenting traffic. They enable efficient communication within and between subnets by defining the scope of the network and the devices it can include. Our group is given a network address with an "/8" notation representing the subnet mask. A "/8" network means the first 8 bits of the IP address define the network portion and leave the remaining 24 bits for hosts.

IP address: 192.19.0.0/8
Subnet mask: 255.0.0.0

IP address (Decimal)	192.	19.	0.	0
IP address (Binary)	1100 0000.	0001 0011.	0000 0000.	0000 0000
Subnet Mask (Decimal)	255.	0.	0.	0
Subnet Mask (Binary)	1111 1111.	0000 0000.	0000 0000.	0000 0000

The binary of the IP address 192.19.0.0 is 1100 0000.0001 0011.0000 0000.0000 0000. The CIDR notation 192.19.0.0/8 represents a network where the first 8 bits (the first octet) of the IP address are reserved for the network portion, leaving the remaining 24 bits for host addresses. This corresponds to a subnet mask of 255.0.0.0, meaning that all IP addresses within the range share the same first octet of 192 while the other three octets can vary. The network includes IP addresses ranging from 192.0.0.1 to 192.255.255.254 which provides a total of 16,777,214 usable addresses with 2 reserved for the network address and broadcast address. This makes it a very large network which is suitable for organizations requiring millions of IP addresses.

3.5.2.2 Subnet Address

A subnet address is a unique identifier for a specific subnet within a network. It is calculated by performing a bitwise AND operation between an IP address and a subnet mask. There are $2^{24} = 16,777,216$ possible hosts which can range from 192.19.0.1 to 192.19.255.254. The network IP address is 192.19.0.0 which is the first IP address used to identify the network itself and cannot be assigned to individual hosts. The broadcast address is 192.19.255.255 which is the last IP address. It also cannot be assigned to individual hosts as it is reserved for the broadcasting information to all hosts within the subnet.

Calculation of subnet address:

IP Address (Binary)	1100 0000.	0000 0000.	0000 0000.	0000 0000
Subnet Mask (Binary)	AND 1111 1111.	0000 0000.	0000 0000.	0000 0000
Subnet Address (Binary)	1100 0000.	0000 0000.	0000 0000.	0000 0000
Subnet Address (Decimal)	192.	0.	0.	0

From the above calculation, we apply the AND operation to calculate the subnet address by converting both IP address and subnet mask into binary. The result of the AND operation is 192.0.0.0 in decimal is the subnet address.

IP Address 192.19.0.0/8

IP Address	Network Portion	Host Portion
192.19.0.0/8	**1100 0000.**	0001 0011. 0000 0000. 0000 0000
	8 bits	24 bits

The 7 work areas in the Faculty of Computing are General Purpose Lab 1, General Purpose Lab 2, Video Conferencing Room, Student Lounge, Cisco Network Lab, Embedded Lab and Hybrid Classroom. Since there are at least 7 work areas, the network needs to have 8 major subnets. Hence, 192.19.0.0/8 will be divided into 8 subnets which is 2^3. Now, the IP address is 192.19.0.0/11. The number of bits borrowed from the host portion is 3 bits. The network portion becomes 11 bits and the host portion becomes 12 bits.

Subnet	Work Area	Subnet Address (Decimal)	Subnet Address (Binary)
0	General Purpose Lab 1	192.0.0.0/11	1100 0000.000**0 0000.0000 0000.0000 0000**
1	General Purpose Lab 2	192.32.0.0/11	1100 0000.001**0 0000.0000 0000.0000 0000**
2	Video Conferencing Room	192.64.0.0/11	1100 0000.010**0 0000.0000 0000.0000 0000**
3	Student Lounge	192.96.0.0/11	1100 0000.011**0 0000.0000 0000.0000 0000**
4	Cisco Network Lab (Switch 1)	192.128.0.0/11	1100 0000.100**0 0000.0000 0000.0000 0000**
5	Cisco Network Lab (Switch 2)	192.16.0.0/11	1100 0000.101**0 0000.0000 0000.0000 0000**
6	Embedded Lab	192.192.0.0/11	1100 0000.110**0 0000.0000 0000.0000 0000**
7	Hybrid Classroom	192.224.0.0/11	1100 0000.111**0 0000.0000 0000.0000 0000**

3.5.3 IP Assignation

3.5.3.1 Network and Broadcast Address for each Subnet

The ranges for the 8 subnets are as follows:

Subnet	Work Area	Network Address	Broadcast Address	Range of Usable Address
0	General Purpose Lab 1	192.0.0.0	192.31.255.255	192.0.0.1 - 192.31.255.254
		1100 0000.0001 0011. 0000 0000.0000 0000	1100 0000.0001 0011. 1111 1111.1111 1111	1100 0000.0000 0000. 0000 0000.0000 0001- 1100 0000.0001 0011. 1111 1111.1111 1110
1	General Purpose Lab 2	192.32.0.0	192.63.255.255	192.32.0.1 - 192.63.255.254
		1100 0000.0010 0000. 0000 0000.0000 0000	1100 0000.0011 1111. 1111 1111.1111 1111	1100 0000.0010 0000. 0000 0000.0000 0001- 1100 0000.0011 1111. 1111 1111.1111 1110
2	Cisco Network Lab (Switch 1)	192.64.0.0	192.95.255.255	192.64.0.1 - 192.95.255.254
		1100 0000.0100 0000. 0000 0000.0000 0000	1100 0000.0101 1111. 1111 1111.1111 1111	1100 0000.0100 0000. 0000 0000.0000 0001- 1100 0000.0101 1111. 1111 1111.1111 1110
3	Cisco Network Lab (Switch 2)	192.96.0.0	192.127.255.255	192.96.0.1 - 192.127.255.254
		1100 0000.0110 0000. 0000 0000.0000 0000	1100 0000.0111 1111. 1111 1111.1111 1111	1100 0000.0110 0000. 0000 0000.0000 0001- 1100 0000.0111 1111. 1111 1111.1111 1110
4	Embedded Lab	192.128.0.0	192.159.255.255	192.128.0.1 - 192.159.255.254
		1100 0000.1000 0000. 0000 0000.0000 0000	1100 0000.1001 1111. 1111 1111.1111 1111	1100 0000.1000 0000. 0000 0000.0000 0001- 1100 0000.1001 1111.

				1111 1111.1111 1110
5	Hybrid Classroom	192.160.0.0	192.191.255.255	192.160.0.1 - 192.191.255.254
		1100 0000.1010 0000. 0000 0000.0000 0000	1100 0000.1011 1111. 1111 1111.1111 1111	1100 0000.1010 0000. 0000 0000.0000 0001- 1100 0000.1011 1111. 1111 1111.1111 1110
6	Video conferencing Room	192.192.0.0	192.223.255.255	192.192.0.1 - 192.223.255.254
		1100 0000.1100 0000. 0000 0000.0000 0000	1100 0000.1101 1111. 1111 1111.1111 1111	1100 0000.1100 0000. 0000 0000.0000 0001- 1100 0000.1101 1111. 1111 1111.1111 1110
7	Student Lounge	192.224.0.0	192.255.255.255	192.224.0.1 - 192.255.255.254
		1100 0000.1110 0000.0000 0000.0000 0000	1100 0000. 1111 1111.1111 1111. 1111 1111	1100 0000.1110 0000. 0000 0000.0000 0001- 1100 0000. 1111 1111. 1111 1111. 1111 1111. 1111 1110

3.5.3.2 IP assignation for each work area

The table below shows detail information about the remaining work area in relation to its IP Addresses :

Work Area	Hosts	Range IP Address
General Purpose Lab 1	30 student workstations	192.0.0.1–192.0.0.30
	1 lecturer workstation	192.0.0.31
	IP phone	192.0.0.32
	Projector	192.0.0.33
	Patch panel	192.0.0.34
	Switch	192.0.0.35
	Server	192.0.0.36
	Wireless Access Point	192.0.0.37
General Purpose Lab 2	30 student workstations	192.32.0.1–192.32.0.30
	1 lecturer workstation	192.32.0.31
	IP phone	192.32.0.32
	Projector	192.32.0.33
	Patch panel	192.32.0.34
	Switch	192.32.0.35
	Server	192.32.0.36
	Wireless Access Point	192.32.0.37
Cisco Network Lab (Switch 1)	24 student workstations	192.64.0.1-192.64.0.24
	Speaker	192.64.0.25
	IP camera	192.64.0.26
	Switch	192.64.0.27
	Server	192.64.0.28
	Wireless Access Point	192.64.0.29

	Patch panel	192.64.0.30
Cisco Network Lab (Switch 2)	6 student workstations	192.96.0.1-192.96.0.6
	1 lecturer workstation	192.96.0.7
	Projector	192.96.0.8
	16 hard disk bay	192.96.0.9-192.96.0.24
	IP camera	192.96.0.25
	IP phone	192.96.0.26
	Smart TV	192.96.0.27
	Switch	192.96.0.28
	Server	192.96.0.29
	Wireless Access Point	192.96.0.30
	Patch Panel	192.96.0.31
Embedded Lab	30 student workstations	192.128.0.1–192.128.0.30
	1 lecturer workstation	192.128.0.31
	2 IP camera	192.128.0.32–192.128.0.33
	IP phone	192.128.0.34
	Projector	192.128.0.35
	Smart TV	192.128.0.36
	Patch panel	192.128.0.37
	Switch	192.128.0.38
	Server	192.128.0.39
	Wireless Access Point	192.128.0.40
Hybrid Classroom	30 student workstations	192.160.0.1–192.160.0.30
	1 lecturer workstation	192.160.0.31
	Projector	192.160.0.32

	2 IP camera	192.160.0.33–192.160.0.34
	IP phone	192.160.0.35
	Smart TV	192.160.0.36
	Patch panel	192.160.0.37
	Switch	192.160.0.38
	Server	192.160.0.39
	Wireless access point	192.160.0.40
Video Conferencing Room	I lecturer workstation	192.192.0.1
	Projector	192.192.0.2
	2 Smart TV	192.192.0.3-192.192.0.4
	IP Phone	192.192.0.5
	3 IP Camera	192.192.0.6-192.192.0.8
	Speakers	192.192.0.9
	Patch panel	192.192.0.10
	Switch	192.192.0.11
	Server	192.192.0.12
	Wireless access point	192.192.0.13
Student lounge	Wireless Access Point 1	192.224.0.1
	Firewall	192.224.0.2
	Switch	192.224.0.3
	Router	192.224.0.4

Reflection of Task 5

Finally, Task 5 involved creating an IP addressing scheme tailored to the building's needs. Subnetting was applied based on room functions to ensure unique IP addresses for each host. Reserved IP ranges were allocated to account for future scalability. The result was an efficient and well-structured IP addressing plan that facilitates seamless connectivity across all areas of the building.

4.0 Conclusion

In conclusion, our project reflects a forward-thinking approach to educational infrastructure, designed to address both the immediate and future needs of the Faculty of Computing. By integrating advanced technologies and creating a scalable network, we have laid a solid foundation for the institution's growth and adaptation to the demands of the 4th Industrial Revolution.

Our meticulous planning and collaborative efforts ensured the design of a two-story building equipped with specialized labs, a video conferencing room, and a student lounge, all interconnected with a robust and secure network infrastructure. This project embodies our commitment to innovation and excellence, creating an environment that fosters learning, collaboration, and technological advancement.

Our team has successfully designed a scalable, secure, and efficient network that meets the Faculty of Computing's needs now and in the future. We put a lot of thought into choosing the right devices, balancing performance, security, and cost-effectiveness. By using Cisco ISR routers, Fortinet firewalls, and Cisco Catalyst switches, we ensured fast, reliable, and secure connections across the building. Setting up a structured IP addressing scheme and VLAN segmentation helped us organize the network efficiently, manage traffic better, and strengthen security. We also prioritized strong WiFi coverage with Ubiquiti UniFi 6 Pro access points, making sure students and staff have a seamless wireless experience in labs, classrooms, and shared spaces. This project not only demonstrated our technical proficiency in network planning but also reinforced our ability to troubleshoot and solve real-world networking challenges effectively.

As we complete this milestone, we are confident that our work will not only support the Faculty of Computing's current goals but also inspire future developments. The building and network infrastructure stand as a testament to our dedication and vision for a resilient, adaptable, and efficient academic environment.

5.0 Team Members and responsibilities

Group name : DataVoyagers **Section :** 01			
Group members :			
No.	Member Photo	Member Details	Responsibility
1.		Name : Chin Pei Wen Matric no : A23CS0065	Task 1: Designing the floor plan for ground floor Task 2: Conduct interview session with lecturer and determine the project's feasibility Task 3: Research, compare and decide the different network devices Task 4: Draw the network diagrams for work areas Task 5: Subnetting and IP assignation
2.		Name : Koo Xuan Matric no : A23CS0300	Task 1 : Designing the floor plan for first floor Task 2 : Formulated feasibility questions and conducted research on network scalability, security, and cost-effectiveness Task 3 : Device Selection and Budgeting Task 4 : Identifying work areas on the floor plan and determining the optimal placement of devices and connections. Task 5 : Subnetting plan discussion and contribution
3.		Name : Ling Yu Qian Matric no : A23CS0301	Task 1 : Designing the floor plan for first floor Task 2 : Research and discussion with the answer Task 3 : compare device to select device with budget planning Task 4 : Network arrangement for Cable and connections Task 5 : Engaging in discussions and contributing to the subnetting plan.

4.		Name : Tan Zhao Hong Matric no : A23CS0188	Task 1: Write description for the floor plan Task 2: Do research and provide answer for some questions Task 3: Do comparison and choose the suitable network devices Task 4: Draw the cabling diagrams Task 5: IP assignation for all work areas

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7.0 Appendices

7.1 Financial Budget

Details	Quantity	Amount(RM)
Income		
Budget given		2,000,000.00
Expenses		
Cisco ISR 4331 routers	1	4491.11
Fortinet FortiGate 60 F firewalls	1	4500.00
Ubiquiti Unifi 6 Pro wireless access point	4	4096.00
Cisco Catalyst 2960-X for 48 ports switches	2	1400.00
Cisco Catalyst 2960-L for 24 ports switches	1	700.00
Tripp Lite N252-048-1U for 48 ports patch panel	2	2383.40
Tripp Lite N252-024 for 24 ports patch panel	2	482.40
Cisco UCS C480M5 server	5	197208.75
AMP Tyco RJ45 CAT6 8P8C Unshielded Modular Plug Network Lan Connector(100pcs)	9	224.10
Cat 6 Ethernet Cable 305m with 23 AWG and 4 twisted pairs	9	2668.50
Total Expenses		218154.26
BALANCE		1,781,845.74

7.2 Meeting Minutes

7.2.1 Meeting minutes of Task 1

Meeting Minutes #1

DATE/TIME	15 Oct 2024 7:30 pm	
LOCATION	Physical	
AGENDA	1. Discuss the question on Task 1	
	2. Way to arrange the floor plan	
	3. Tools for designing the floor plan	
	4. Task distribution for each person	
MEETING MC	CHIN PEI WEN	
ATTENDANCE		
NAME	**TIME**	**REASON FOR ABSENCE**
CHIN PEI WEN	1930	-
KOO XUAN	1930	-
LING YU QIAN	1930	-
TAN ZHAO HONG	1930	-

Minutes			
No.	**Item Discussed**	**Details**	**Person-In-Charge**
1	Find name	Slide showed the question and rubric given on Task 1	All members
		Suggested our group name as “Data Voyager”	
2	Software to use	After discussion, we decided to use SmartDraw	All members
3	Floor plan	We draw the initial draft of the floor plan design on the paper.	All members
		We discussed potential layouts and shapes for each floor of the building.	

		A suggestion was made to connect rooms requiring internet, which was agreed upon by all members as a cost-saving measure.	
		Suggested connecting the rooms that require the internet together.	
		All members agreed to the suggested plan to reduce the cost.	All members
		Suggested adding toilets at both floors and suggested adding accessible toilets.	
		Suggested adding an office and meeting room as well as putting all 4 labs on the ground floor as an office and meeting room, usually on the first floor.	
		Suggested adding a lift and making the area more spacious to facilitate accessible people.	
		Mentioned the size of each lab and student lounge that has been given.	
		Suggested a hybrid classroom that has the same size with each lab and student lounge.	
		Suggested the size of toilets.	
4	Next meeting	17 Oct 2024 - Floor plan (ground floor & first floor) - Floor plan (Cisco Network Lab & Embedded Lab) - Floor plan (Video Conferencing Room & Hybrid Classroom) - Floor plan (2 General Purpose Lab) - Floor plan (Student Lounge)	All members
5	Meeting ended	2230	All members

Meeting Minutes #2

DATE/TIME	17 Oct 2024 9:30 am		
LOCATION	Physical		
AGENDA	Task 1 (Project Final Checking Before Submission)		
MEETING MC	KOO XUAN		
ATTENDANCE			
NAME	**TIME**	**REASON OF ABSENCE**	
CHIN PEI WEN	0930	-	
KOO XUAN	0930	-	
LING YU QIAN	0930	-	
TAN ZHAO HONG	0930	-	
Minutes			
NO.	**ITEM DISCUSSED**	**IDEAS / SUGGESTIONS AND PERSON GIVING IT**	**PERSON IN CHARGE & DATE**
1.	Brief sharing session about each part		All Members
2.	Update Floor Plan Design	Provides final version of floor plan design before submission.	All members
		Design and edit each room and floor.	
		Unified size of appliances.	
		Combination of each lab and room on the ground and first floor.	
		Beautify the final floor plan design for the first floor and second floor.	
3.	Meeting ended	1300	-

Meeting Minutes #3

DATE/TIME	25 Oct 2024 9:30 am
LOCATION	Physical
AGENDA	Task 1 (Correction)
MEETING MC	LING YU QIAN

ATTENDANCE

NAME	TIME	REASON OF ABSENCE
CHIN PEI WEN	0930	-
KOO XUAN	0930	-
LING YU QIAN	0930	-
TAN ZHAO HONG	0930	-

Minutes

NO.	ITEM DISCUSSED	IDEAS / SUGGESTIONS AND PERSON GIVING IT	PERSON IN CHARGE & DATE
1.	Summarize correction for each part based on the comment given		All Members
2.	Modify floor plan design	Edit measuring fonts for each room and floor.	All members
		Add IP phone and IP cameras	
		Add other suitable devices such as smartboard, mic and speaker	
		Make sure the label looks clear and readable	
		Combination of each lab and room on the ground and first floor.	

		Beautify the final floor plan design for the first floor and second floor.	
3.	Meeting ended	1300	-

7.2.2 Meeting minutes of Task 2

Meeting Minutes #4

DATE/TIME	30 Oct 2024 5:00 pm		
LOCATION	Physical		
AGENDA	1. Discuss the question on Task 2		
	2. Task distribution for each person		
MEETING MC	TAN ZHAO HONG		
ATTENDANCE			
NAME	**TIME**	**REASON FOR ABSENCE**	
CHIN PEI WEN	1700	-	
KOO XUAN	1700	-	
LING YU QIAN	1700	-	
TAN ZHAO HONG	1700	-	
Minutes			
No.	**Item Discussed**	**Details**	**Person-In-Charge**
1	Understand the task requirement	Slide showed the question and rubric given on Task 2	All members
2	Suggestion for questions.	All members discussed the possible questions that can be used in task 2.Each member suggested 12 question that can be used in task two	All members
3	Filter and select the most related question	We select the top 12 most related questions that can be used in task 2 through Discussion and all members agreed with their	All members

		suggestions.	
		Select the top 10 most related questions that can be used in task 2 through discussion.	
		had to do research to find a solution for all selected questions.	
		arrange the references used by all members.	
		All members agreed to the suggested plan to reduce the cost.	All members
		All members review the questions and the answer carefully	
		Suggested drop the question which is not related to the syllabus	
		12 questions are finalized	
4	Discuss on the feasibility assessment	- explained the feasibility assessment to all members - Complete feasibility assessment	All members
5	Meeting ended	2230	All members

Meeting Minutes #5

DATE/TIME	18 Nov 2024 1:00 pm
LOCATION	Physical
AGENDA	Correction - Task 2
MEETING MC	CHIN PEI WEN

ATTENDANCE

NAME	TIME	REASON FOR ABSENCE
CHIN PEI WEN	1300	-
KOO XUAN	1300	-
LING YU QIAN	1300	-
TAN ZHAO HONG	1300	-

Minutes

No.	Item Discussed	Details	Person-In-Charge
1	Identify mistakes for each part	We refer to the comments that were given by the lecturer.	All members
2	Suggestion to correct the mistake.	All members discussed to add more references and citation	All members
5	Meeting ended	1430	All members

7.2.3 Meeting minutes of Task 3

Meeting Minutes #6

DATE/TIME	2 Dec 2024 10:00 am		
LOCATION	Physical		
AGENDA	1. Discuss the question on Task 3		
	2. Task distribution for each person		
	3. Research on network devices for the academic institution		
MEETING MC	KOO XUAN		
ATTENDANCE			
NAME		**TIME**	**REASON FOR ABSENCE**
CHIN PEI WEN		1000	-
KOO XUAN		1000	-
LING YU QIAN		1000	-
TAN ZHAO HONG		1000	-
Minutes			
No.	**Item Discussed**	**Details**	**Person-In-Charge**
1	Understand the task requirement	Slide showed the question and rubric given on Task 3	All members

2	Research on network devices for the academic institution	All members discussed the importance of selecting appropriate network devices for the academic institution.	All members
		Members shared their research findings on routers, switches, wireless devices, and patch panels from various brands like Cisco, Huawei, and Asus.	
3	Selection of LAN Devices Based on Requirements and Budget	We state out the specifications and features to identify devices for our project.	All members
		Finding the prices of the devices we selected	
		We choose and select the most suitable devices for the project.	
		All members agreed to the suggested devices based on our budget.	
		Arrange the references used by all members.	
4	Device Comparison Between Different Brands	Members discussed the major differences between different brands of devices which focused on their performance, scalability, and price.	All members
5	Meeting ended	1230	All members

Meeting Minutes #7

DATE/TIME	16 Dec 2024 1:00 pm
LOCATION	Physical
AGENDA	Correction - Task 3
MEETING MC	LING YU QIAN

ATTENDANCE

NAME	TIME	REASON FOR ABSENCE
CHIN PEI WEN	1300	-
KOO XUAN	1300	-
LING YU QIAN	1300	-
TAN ZHAO HONG	1300	-

Minutes

No.	Item Discussed	Details	Person-In-Charge
1	Identify mistakes for each part	We refer to the comments that were given by the lecturer.	All members
2	Suggestion to correct the mistake.	All members discussed to add more references and citation	All members
5	Meeting ended	1430	All members

7.2.4 Meeting minutes of Task 4

Meeting Minutes #8

DATE/TIME	20 Dec 2024 10:00 am		
LOCATION	Physical		
AGENDA	1. Discuss the question on Task 4		
	2. Task distribution for each person		
	3. Draw network diagram for each work areas		
MEETING MC	TAN ZHAO HONG		
ATTENDANCE			
NAME	**TIME**	**REASON FOR ABSENCE**	
CHIN PEI WEN	1000	-	
KOO XUAN	1000	-	
LING YU QIAN	1000	-	
TAN ZHAO HONG	1000	-	
Minutes			
No.	**Item Discussed**	**Details**	**Person-In-Charge**
1	Understand the task requirement and task distribution	Slide showed the question and rubric given on Task 4	All members
2	Identify the work areas on floor plan	Members shared their ideas about how many work areas should be identified for each floor.	All members

3	Draw the PC and network devices arrangement	We discussed how to draw a network diagram for each work area.	All members
		We discussed the connection of all the devices in each work area.	
		We decide the cable length for all the device connections.	
4	Calculate the cable length in the identified work areas	Members calculate the total cable length of each work area for each floor based on the network diagram.	All members
5	Meeting ended	1330	All members

7.2.5 Meeting minutes of Task 5

Meeting Minutes #9

DATE/TIME	13 Jan 2025 5:00pm
LOCATION	Physical
AGENDA	1. Discuss the question on Task 5
	2. Calculate subnet address for each work areas
	3. Assign IP address for each devices
MEETING MC	CHIN PEI WEN

ATTENDANCE		
NAME	**TIME**	**REASON FOR ABSENCE**
CHIN PEI WEN	1700	-
KOO XUAN	1700	-
LING YU QIAN	1700	-
TAN ZHAO HONG	1700	-

Minutes			
No.	**Item Discussed**	**Details**	**Person-In-Charge**
1	Understand the task requirement and task distribution	Slide showed the question and rubric given on Task 5	All members
2	Subnetting	Members shared their ideas about the subnet for each work area.	All members

3	Subnet Address calculation	We discussed how to calculate the subnet address for each work area.	All members
4	IP Assignation	Members calculate the network and broadcast address for each work area	All members
5	Meeting ended	1930	All members

7.3 Pictures

Figure 3.1 Picture after we done Task 2

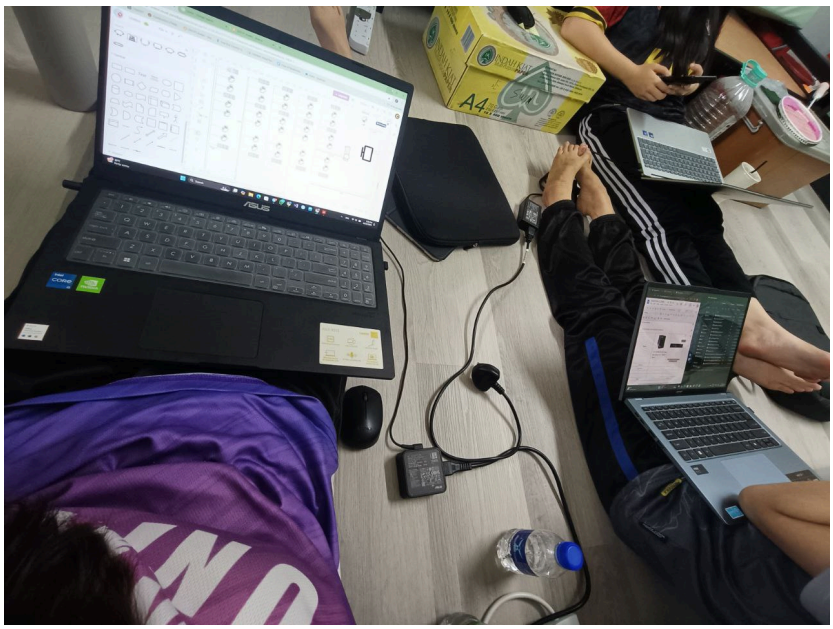

Figure 3.2 Picture when we are doing Task 4

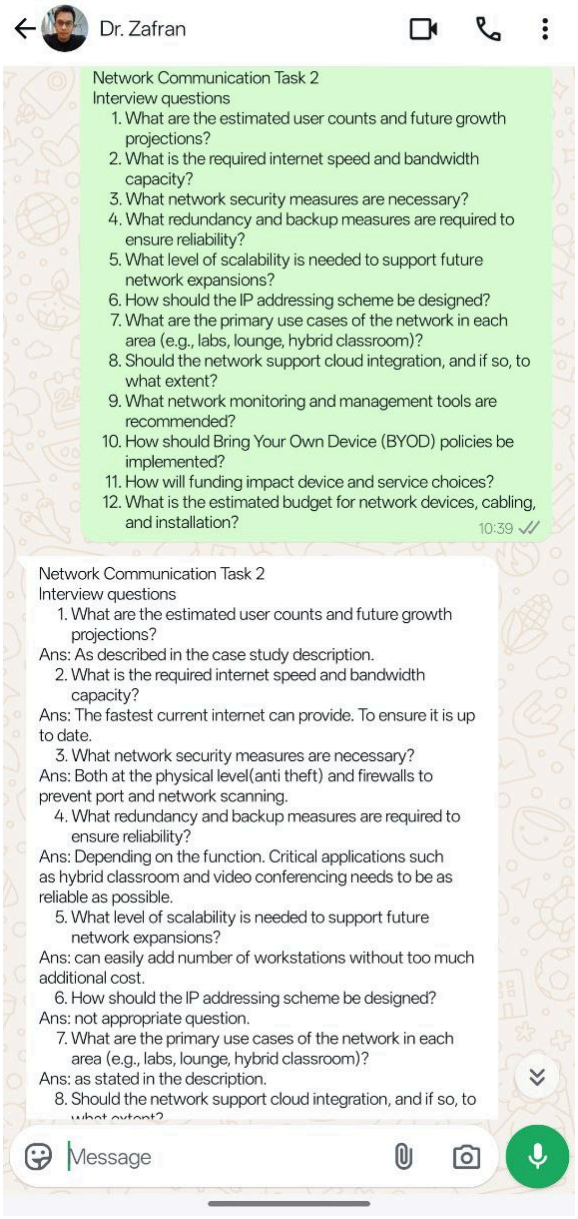

Figure 3.3 Online interview session of Task 2 with Dr Zafran