



UTM

UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF COMPUTING

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BACHELOR OF COMPUTER SCIENCE (BIOINFORMATICS)

SECR1213 NETWORK COMMUNICATIONS - SECTION 01

PROJECT TASK 4

MAKING THE CONNECTIONS - LAN and WAN

GROUP NAME: DATA VOYAGERS

GROUP MEMBERS	MATRIC NO
CHIN PEI WEN	A23CS0065
KOO XUAN	A23CS0300
LING YU QIAN	A23CS0301
TAN ZHAO HONG	A23CS0188

**LECTURER'S NAME : DR MUHAMMAD ZAFRAN BIN MUHAMMAD ZALY
SHAH**

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1.0 Work areas on the floor plan

1.1 First Floor

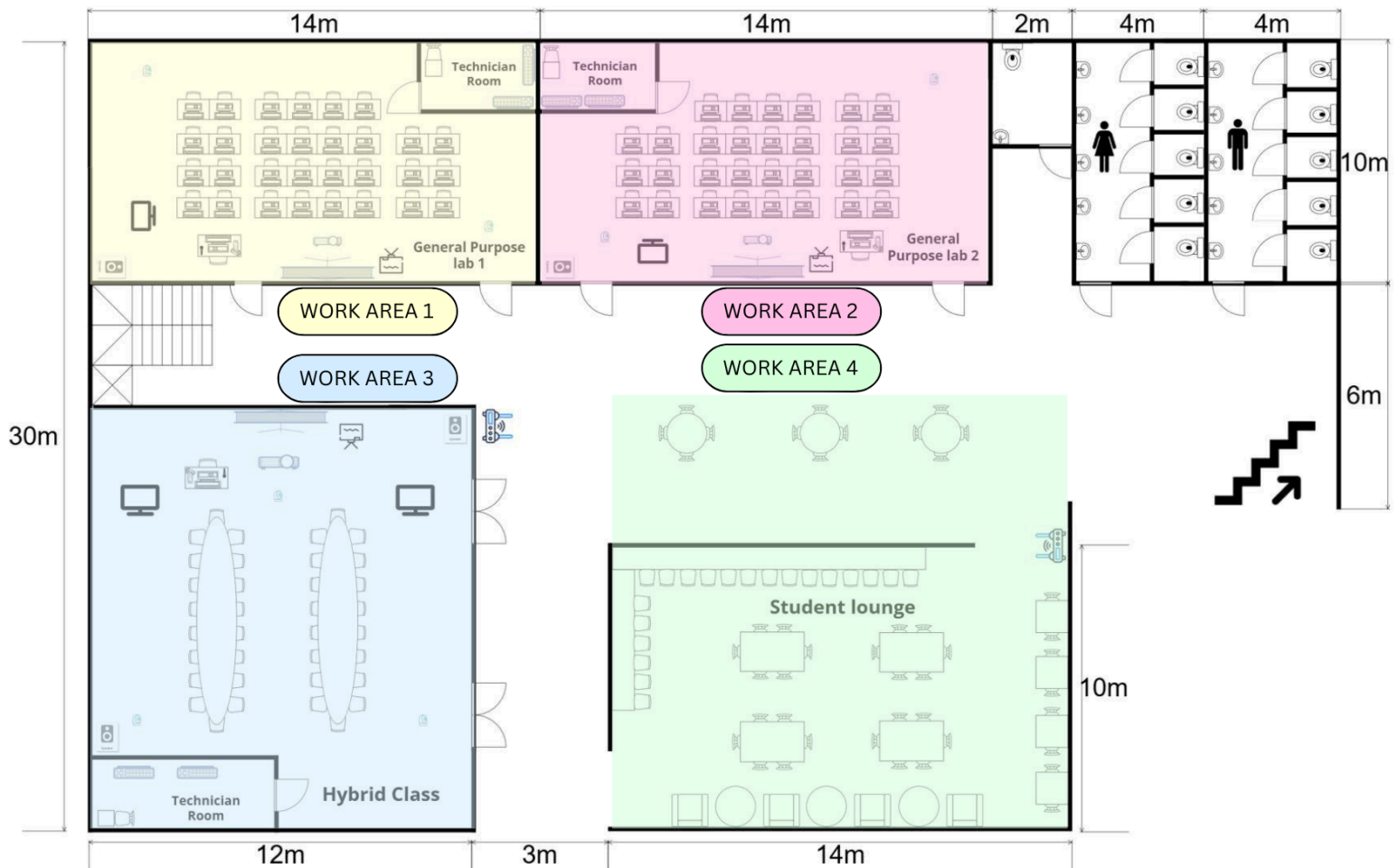


Figure 1.1 Work Area Ground Floor

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.

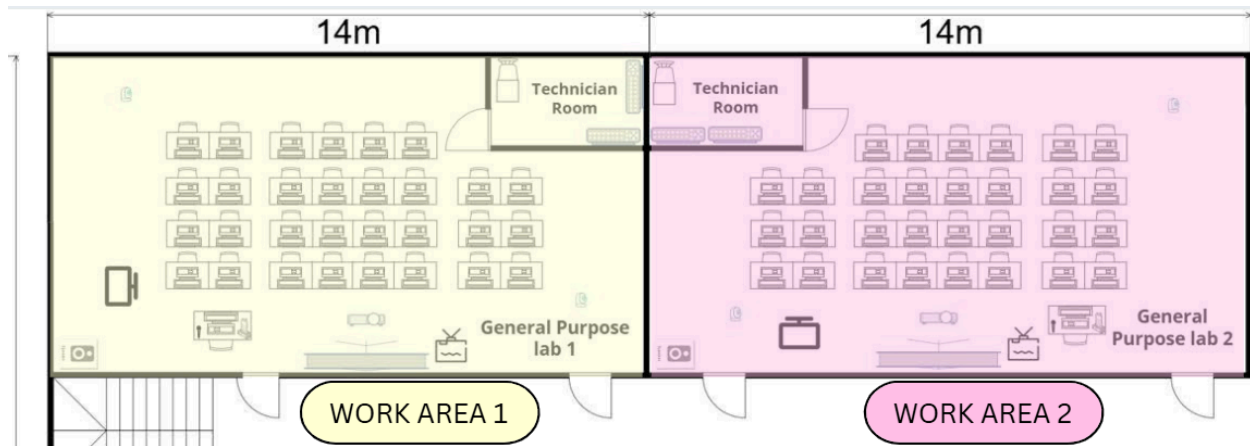
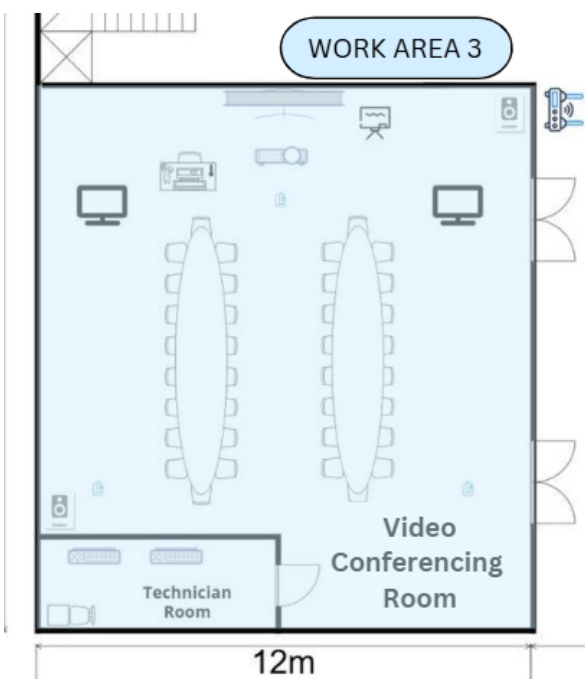


Figure 1.1.1 Work Area General Purpose Lab 1 and 2

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.



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 1.1.2 Work Area 3 - Video Conferencing Room

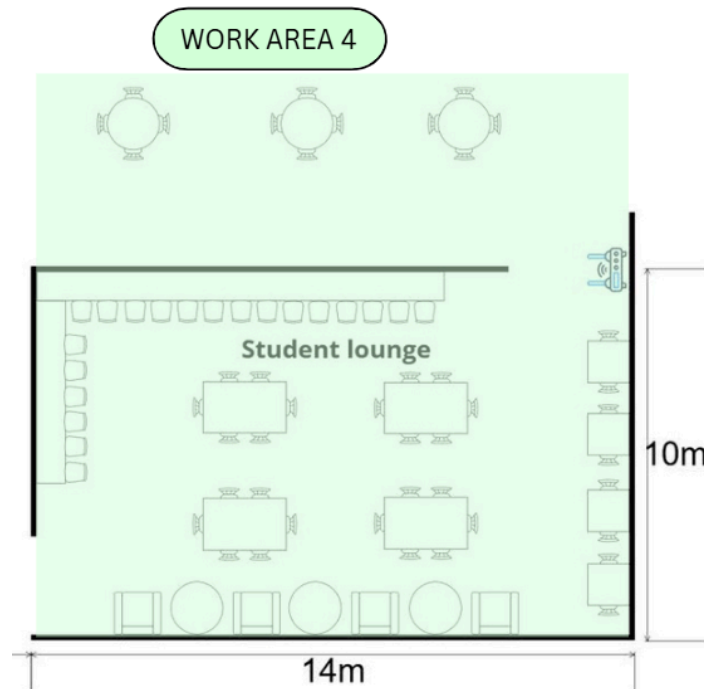


Figure 1.1.3 Work Area 4 - Student Lounge

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.

1.2 Second Floor

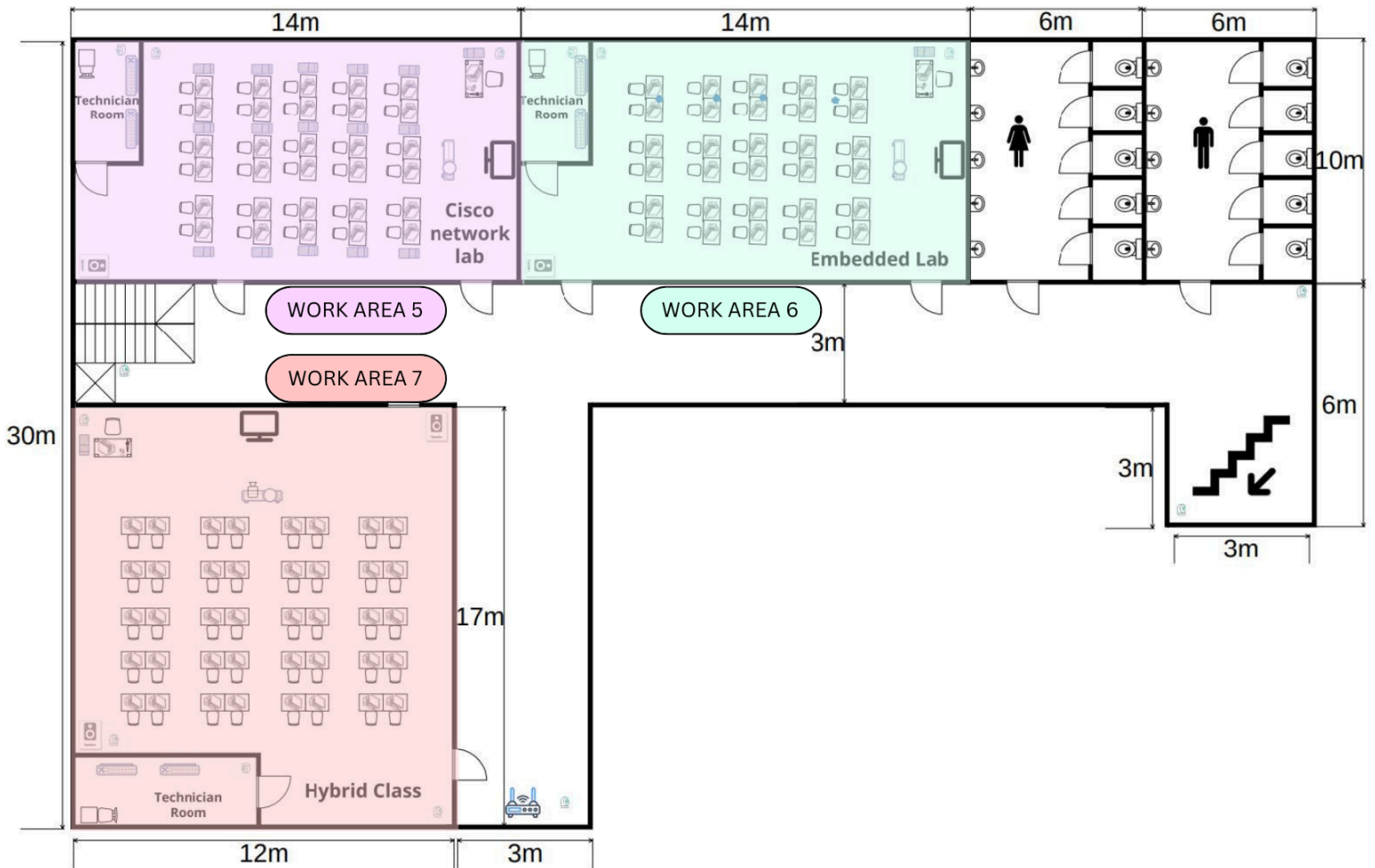


Figure 1.2 Work Area First Floor

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.

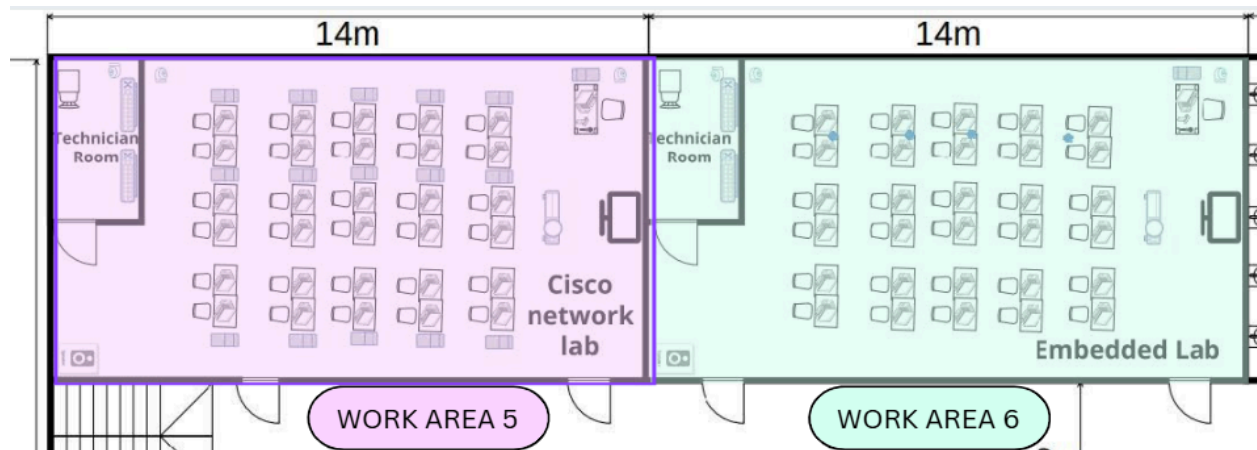


Figure 1.2.1 Work Area 5 & 6 - Cisco Network Lab and Embedded Lab

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.

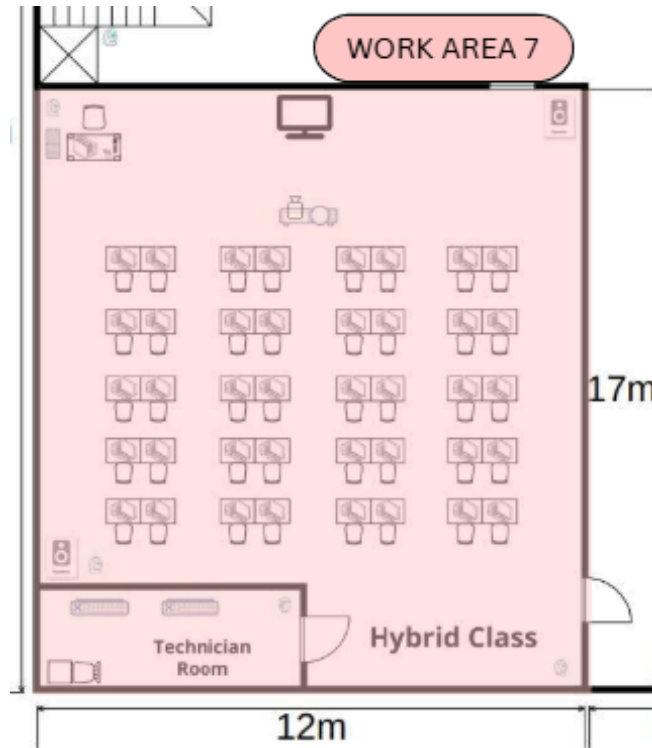


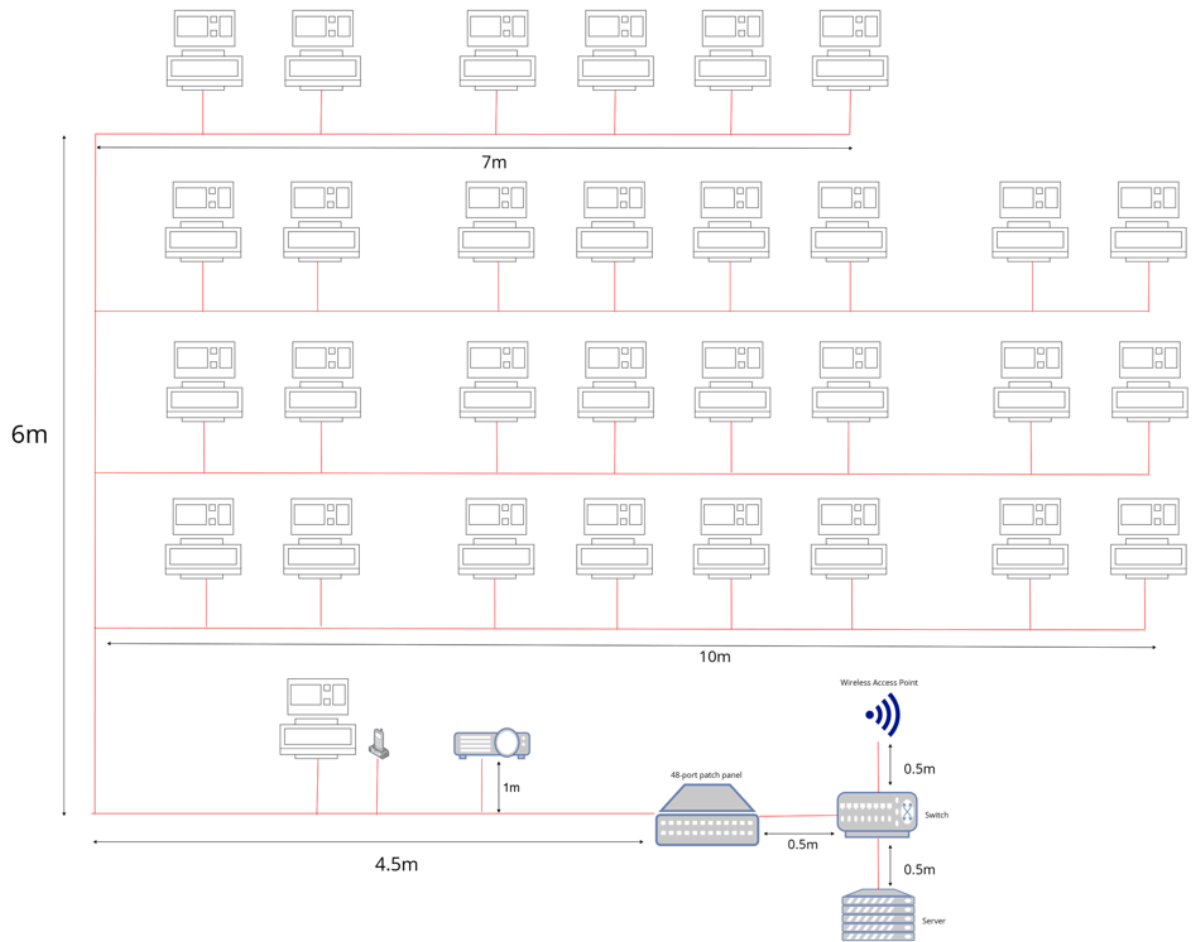
Figure 1.2.2 Work Area 7 - Hybrid Classroom

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.

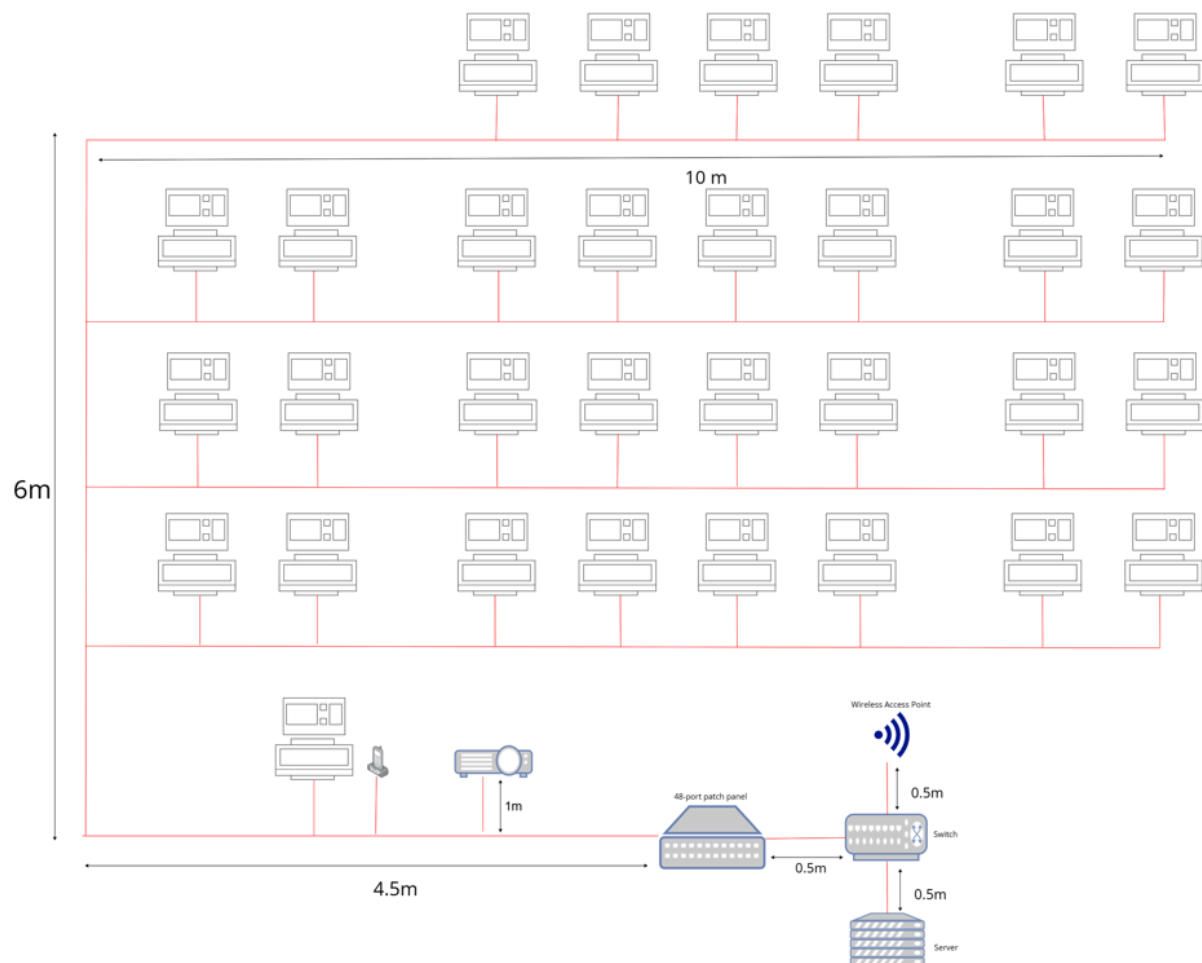
2.0 Network Diagram

2.1 First Floor

General Purpose Lab 1

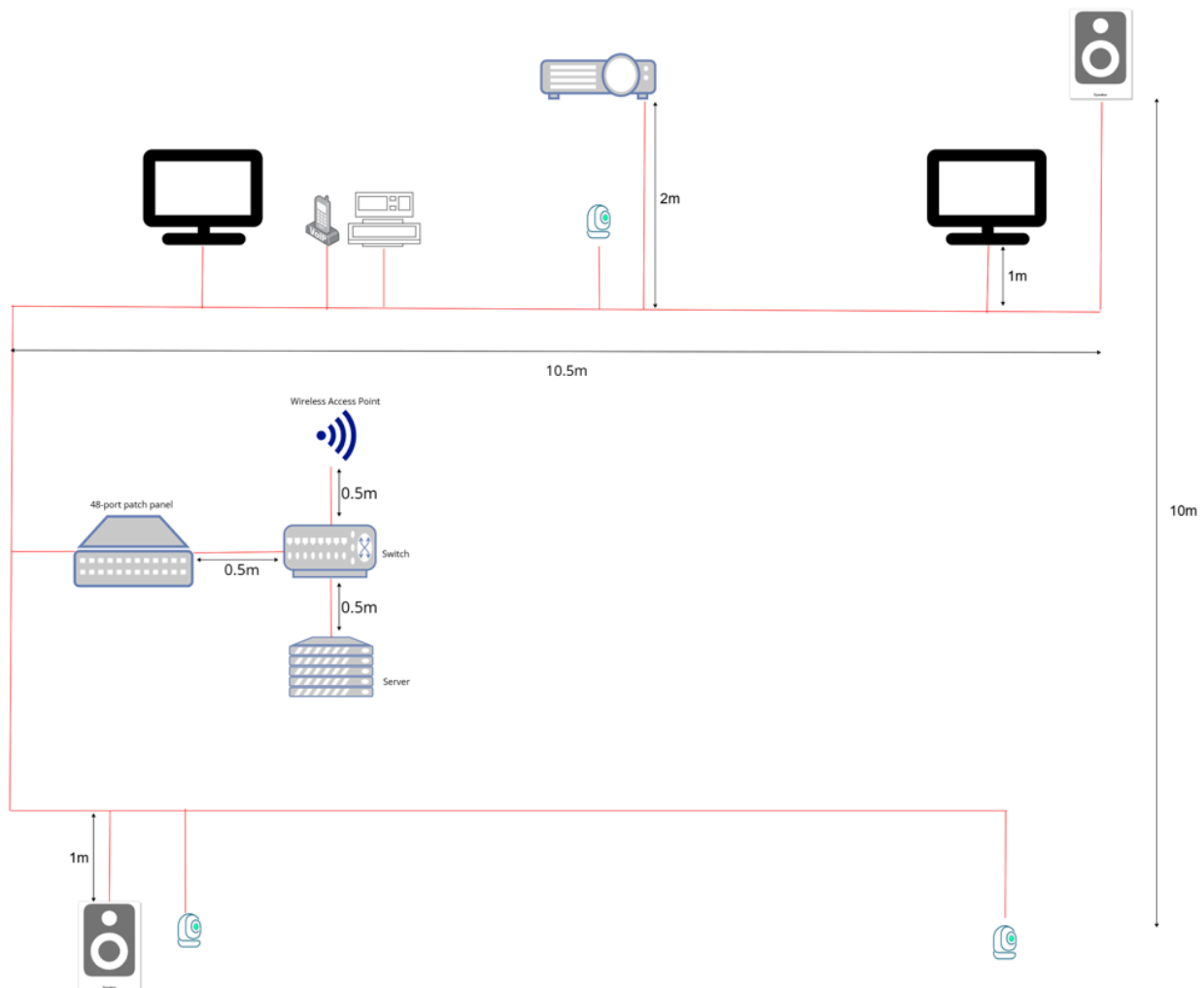


General Purpose Lab 2



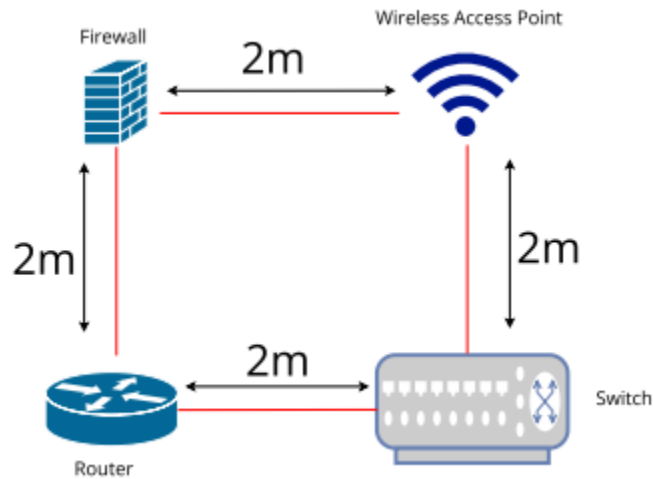
The above figures show the distribution and connection of networks in general purpose lab 1 and general purpose lab 2. Both of these general purpose labs have similar distribution and connection networks. All 31 PCs are connected to the server and Wireless Access Point (WAP) through the 48-port patch 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



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.

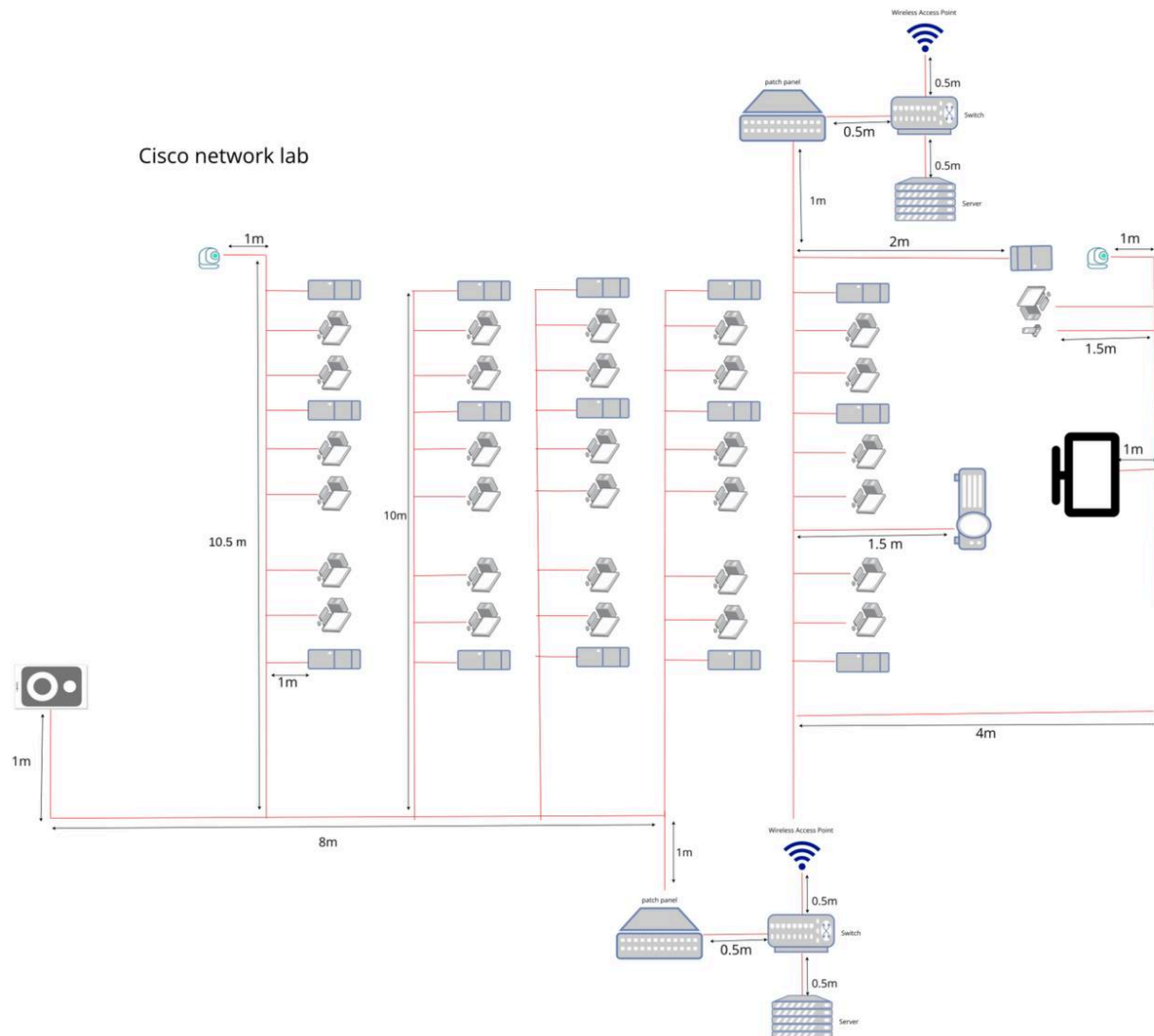
Student Lounge



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.

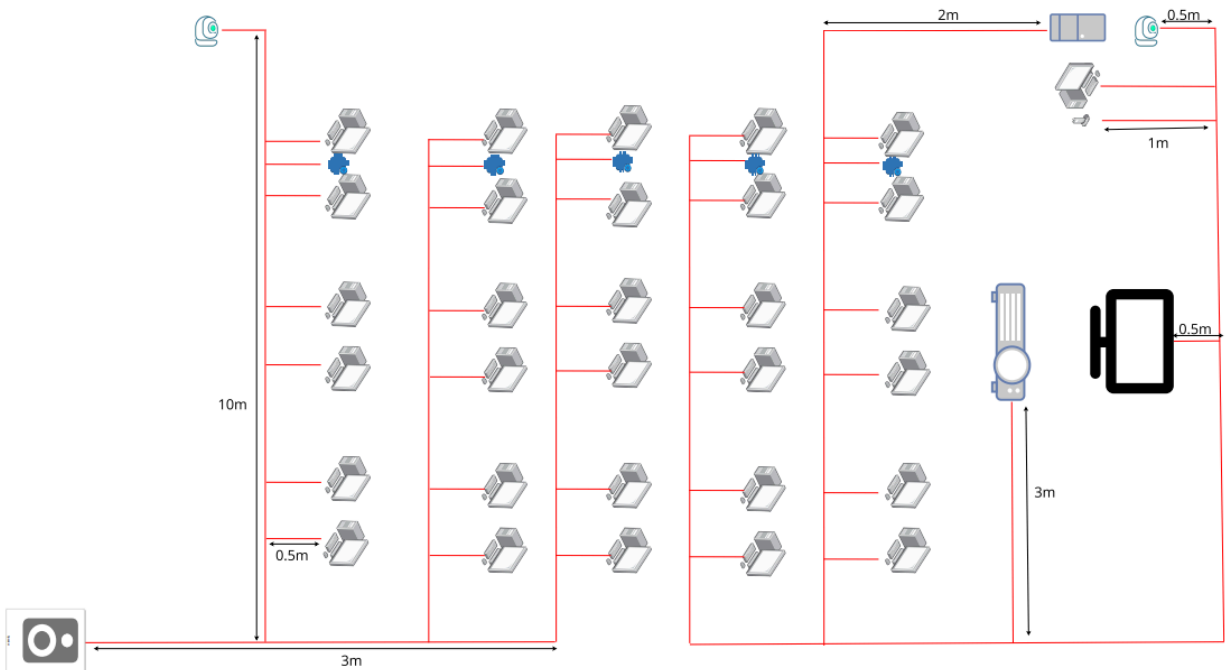
2.2 Second Floor

Cisco Network Lab



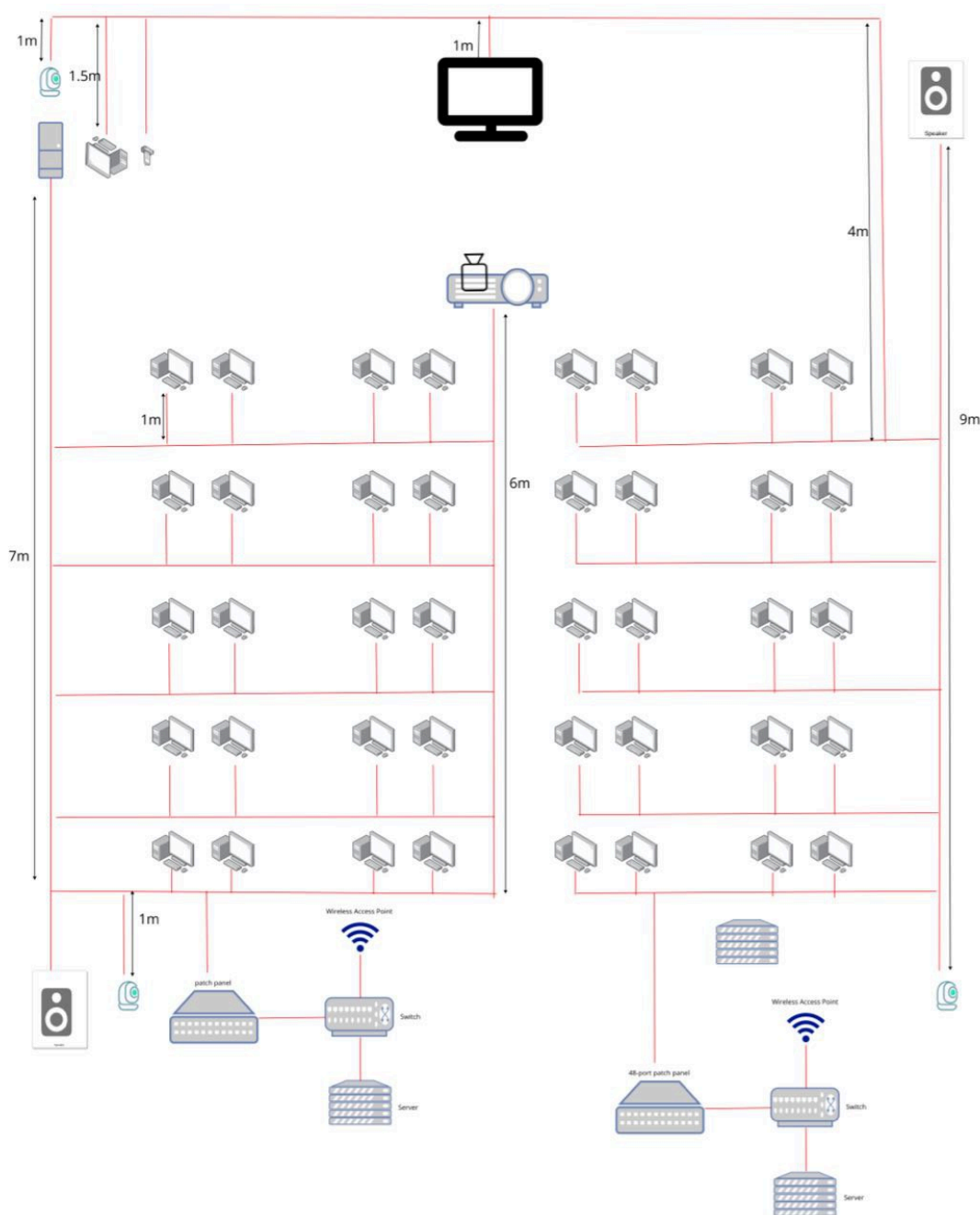
In the Cisco network lab, all the devices interconnected through a structured network setup that includes a switch, patch panel, server, and Wireless Access Point (WAP). Each workstation and hard disk bay is connected via Cat 6 cables through the patch panel and switch, ensuring high-speed, reliable 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



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



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.

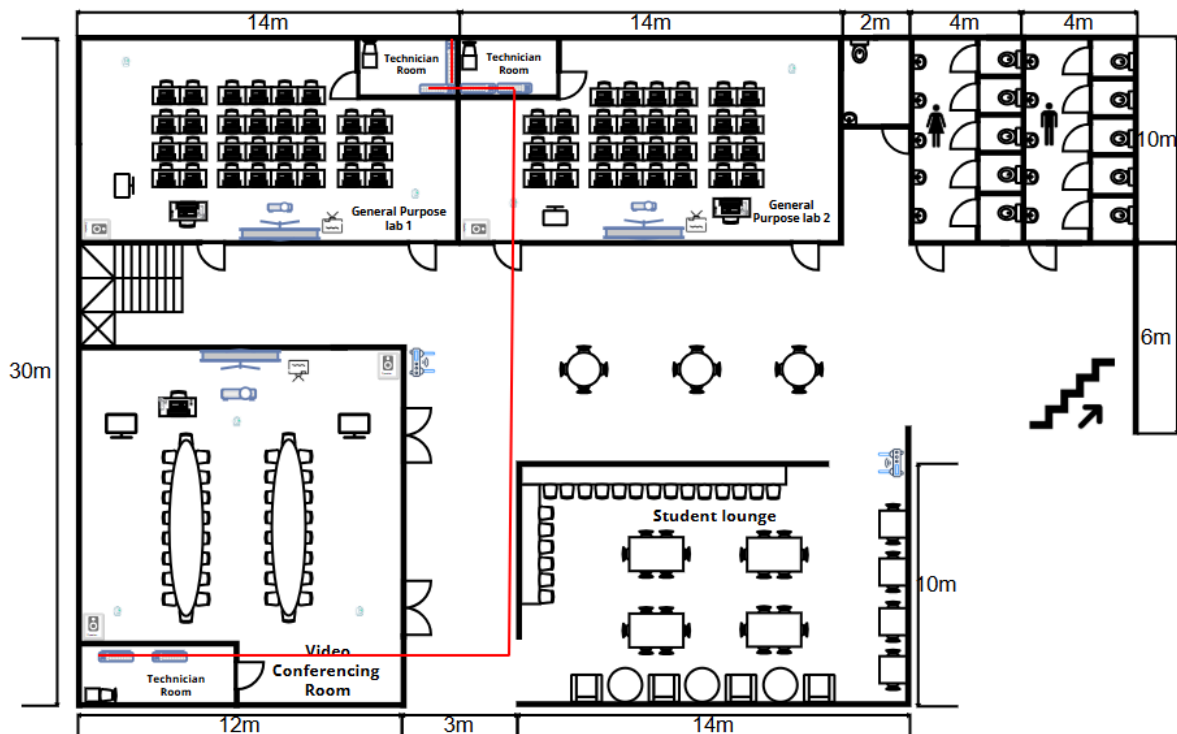
3.0 Cable and connections

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.

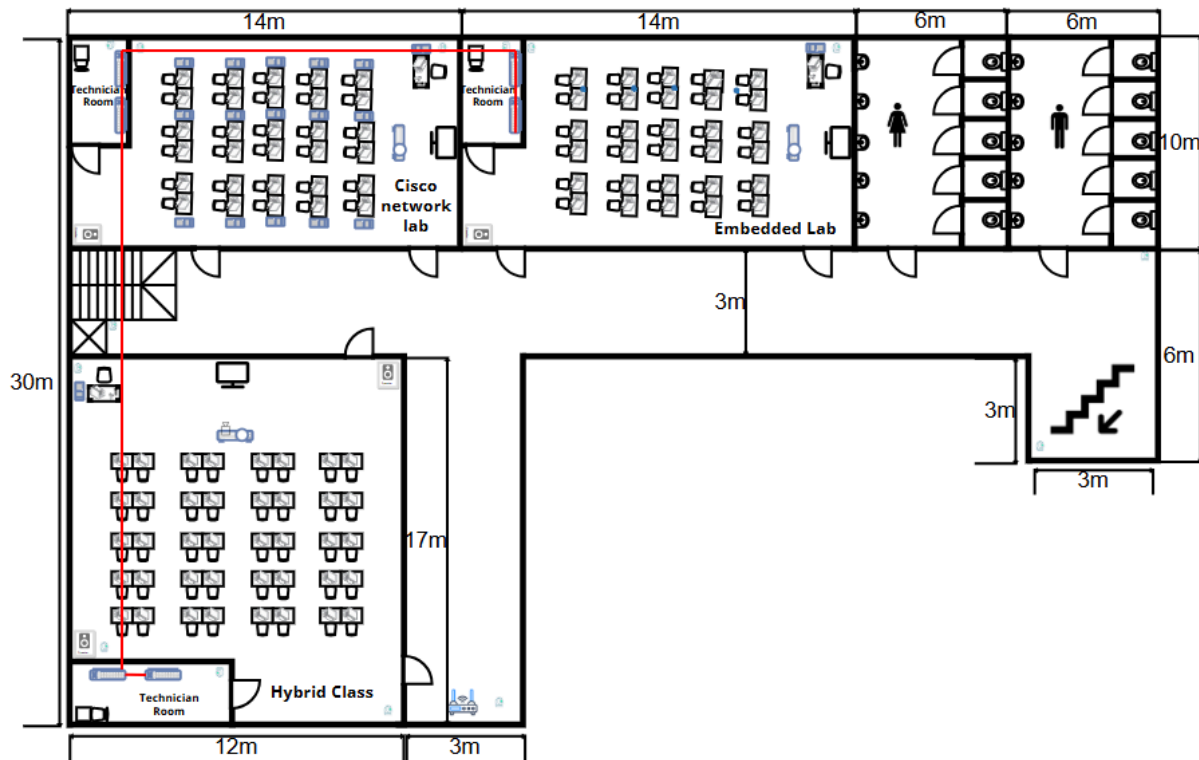
3.1.1 First Floor

The figure illustrates the connectivity of the first 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.



3.1.2 Second Floor

For the second 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.



3.1.3 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.

3.2 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.

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