UTM
UNIVERSITI TEKNOLOGI MALAYSIA

NETWORK COMMUNICATION
SECR1213

SECTION 06
LECTURER: DR. RAJA ZAHILAH

PROJECT : Network Design for Faculty of Computing Block N28B
TASK 6A

GROUP : 3

Name	Matric No.
MATHABA HASSAN MOHAMED HASSAN	A23CS4044
RAMI YASSEIN ELTAYEB	A23CS0022
ANJUM SIDDIQUA TANVEER SIDDIQUI	A23CS0289

Abstract

This report outlines the networking infrastructure design for the new Block N28B, built for the Faculty of Computing. It provides a comprehensive plan for the layout of the new faculty building, including all facilities and laboratories, with detailed equipment placement that fits the customer's current and future requirements.

The report specifies the cost and quantity of devices required for the labs and networking infrastructure, ensuring alignment with the customer's budget. It also includes references to sources where the listed equipment can be bought.

Additionally, the report details the connections between networking devices, such as switches and routers, alongside the cabling requirements, arranged both vertically and horizontally for optimal efficiency.

Lastly, it addresses the IP addressing scheme and subnetting strategy, presenting the most suitable configuration for every lab in the N28B building

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1.0 Introduction

This project is about designing and setting up the network for a new building for FC called N28B. It includes planning the layout of the building, figuring out what devices are needed and making sure everything comes under the budget and the budget is used efficiently.

This project also does a deeper research and contains the information on various networking devices that were chosen and what type of cables to use and how they will be installed throughout the building and assign IP addresses to all the devices. The goal is to create a network that works well, is easy to manage, and is cost effective.

This plan is based on a few assumptions like having chosen the right equipment for each of the labs, Assigned IP address for each area so that in the face of extension it is more than enough and having enough money to complete the project.

2.0 Project background and an overview of the client's current status and issue:

The Faculty of Computing at UTM Malaysia is undergoing expansion with the construction of a new building, N28B. This facility will house classrooms, labs, and a student lounge, accommodating the growing number of students and faculty members. The new building requires an updated network infrastructure to support both current educational needs and future growth.

The existing network infrastructure is not sufficient to handle the high bandwidth demands of the specialized labs, such as general-purpose labs, a Cisco networking lab, and an embedded systems lab. These labs require fast and reliable connectivity for activities like data-intensive simulations, hardware programming, and network training. Additionally, the current network lacks scalability and security features to support future expansions and ensure smooth operation.

The primary challenge is to design and implement a robust network infrastructure that addresses these issues while staying within budget. The solution must provide reliable connectivity, enhanced security, and scalability to accommodate the growing number of students, faculty, and devices over time.

3.0 Overview of the Group

Group Name :	Pulse LTD
GROUP MEMBERS	
RAMI YASSEIN ELTAYEB	
MATHABA HASSAN MOHAMED HASSAN	
ANJUM SIDDIQUA TANVEER SIDDIQUI	

4.0 Design Layout for the building

4.1 Layout for the Two Floors:

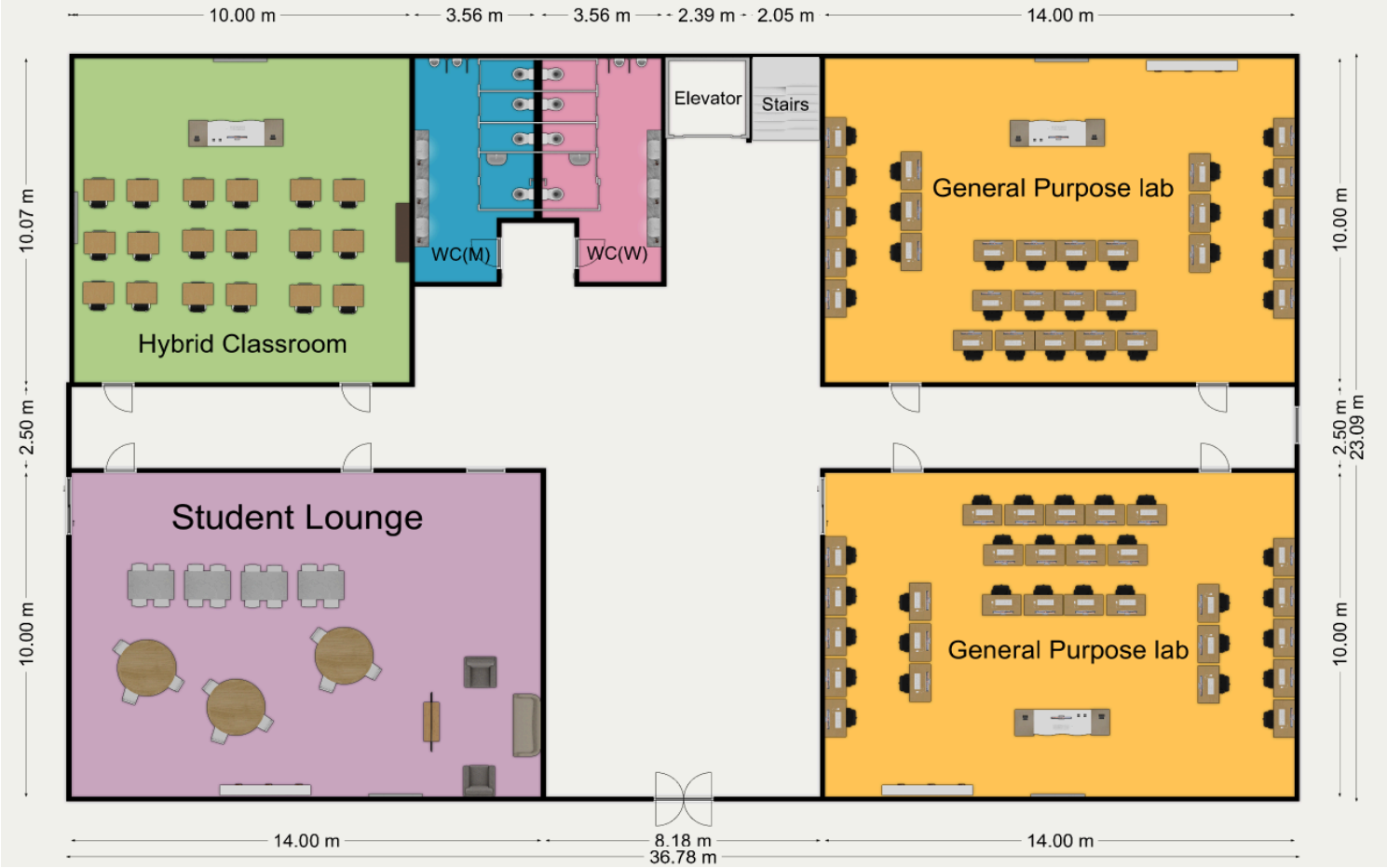


Figure 4.0.1: First Floor Layout

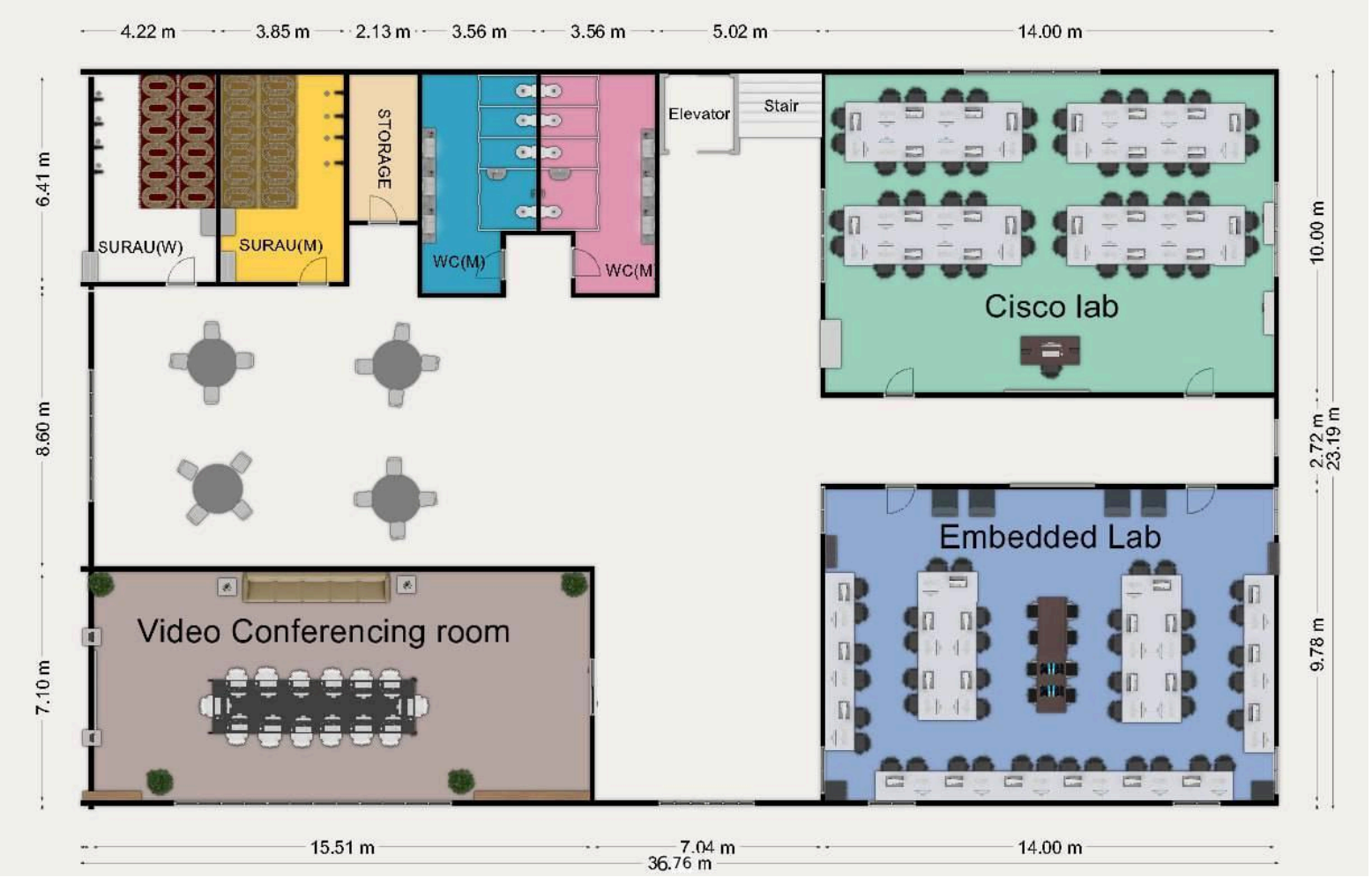


Figure 4.0.2: Second Floor Layout

4.2 Task - 1 Reflection

We learned a lot about different types of softwares that can be used to create floor plans and it took us a lot of time to understand how to use the software that we used to make our floorplan in. We were working a bit late and it took some time to do the scaling and make sure the two storeys are similar in look and measurement. But Alhamdulillah we still submitted on time.

5.0 Preliminary Analysis

After some discussion, we had identified 10 questions regarding the requirements and other information that is necessary to develop a network plan based on the case study.

5.1 Questions

1.How many access points will be required to provide adequate Wi-Fi coverage on each floor?

The placement and number of our access point depends on many factors, including our floor size and expected user density in each area. This plan is based on **Wi-Fi standard 802.11ax**, for its good range and coverage, backward compatibility and enhanced security.

First Floor:

1. General Purpose Labs:

Since we expect our labs to demand higher bandwidth, we will place an access point in the center of each of the computer labs; this ensures good coverage for high data consumption activities during the lab.

2- Hybrid Classroom

We will place an access point in the center of the hybrid classroom, since it is an area that is susceptible to the use of different devices by the students, such as laptops, tablets, or other wireless devices, by placing an access point in the center, we ensure uniform coverage for the whole classroom

3. Student Lounge:

We will place an access point in this area since it is susceptible to high traffic as most students stay in this area during breaks to study or to hangout and relax.

4- Corridor and Common Areas:

We will place an access point in the middle of the common area, to ensure that students and staff maintain good connectivity when roaming between rooms.

Second Floor:

1- Cisco Lab:

We will place an access point in the center of the Cisco lab to maximize the bandwidth since it is susceptible to high data demands like networking simulations and networking training.

2- Embedded Lab:

We will place an access point in the center of the embedded lab to maximize the bandwidth since it is susceptible to high-speed connections for hardware simulations, microcontroller programming and IoT, placing it in the center also ensures a stable connection throughout the lab.

3- Video Conferencing Room:

Since the video conferencing room will require high bandwidth to support smooth video streaming, we will place an access point near the front where the main video streaming activities will likely occur.

4- Corridor and Common Areas:

We will place an access point in the middle of the common area, to ensure that students and staff maintain good connectivity when roaming between rooms.

Total access points: 9

2.Which service provider are we planning to use? Why?

We are planning to choose TIME as our Service provider since it meets our requirements and since TIME would be able to provide a connection that is fast, secure and efficient. The connection is MEF 3.0 certified as this certification ensures high availability, reliability, and robust security. We are considering choosing the dedicated internet as it provides a bandwidth up to 10Gbps suitable for FC's students and faculty staff. Some of its features include a private leased line through the Metro-E network and advanced DWDM mesh for near-perfect uptime

(99.999%). We also considered the climatic condition in Johor is mostly rainy. We need a fiber based connection that is uninterrupted due to any kind of climate disruptions so TIME solves the issue by providing a fiber-based connection. FC does not want to spend money for the next 20 years so getting a fiber based cutting edge technology would assure it can easily adapt to technology upgrades, providing long-term value. TIME also provides a feature of Virtual Router. Since FC already has some existing connection, migrating to a virtual router via Network Functions Virtualization infrastructure (NFVi) can significantly cut costs and simplify network management.

3.What type of cabling are we planning to use?

Since the FC wants cables that will be capable of supporting high-performance to the core backbone , Fiber optic cables would be the best option to consider . Due to their High bandwidth which allows for fast data transmission of large files like research datasets and the immunity to electromagnetic interference which is essential for reliable data transfer especially in the labs with alot of high-power equipment which may lead to corrupted data . Fiber optic cables will also be very suitable because of their resistance to moisture and lighting.

4.What are the specifications of the computer in the class and lab?

The FC wants to step into the latest cutting-edge technology, but is not ready to be paying for long years if it is too expensive . So a cost effective solution has to be made .

Cisco Lab (Networking Lab)

For a Cisco lab focused on networking and cybersecurity, high-performance but specialized machines are essential.

Suggested Specs:

- **Processor:** Intel Core i7 or AMD Ryzen 7 (multi-core for virtualization and network simulation)
- **RAM:** 32 GB to support virtual machines and network simulations (Cisco Packet Tracer, GNS3)

- **Storage:** 512 GB SSD for fast load times, with a 1 TB HDD if additional storage is required
- **Graphics Card:** Integrated graphics that comes with the cpu
- **Networking Hardware:** Each computer should have high-quality NICs (Network Interface Cards), supporting up to 10 Gbps speeds
- **Operating System:** Windows 11 Pro or Ubuntu Linux (dual-boot recommended for flexibility in training)

Embedded Lab (Hardware/Software Integration Lab)

For embedded labs, where students work with microcontrollers, IoT, and real-time systems, the emphasis should be on hardware support and compatibility with embedded tools.

Suggested Specs:

- **Processor:** Intel Core i5 or AMD Ryzen 5 (low power consumption and sufficient for hardware simulations)
- **RAM:** 16 GB (20 GB or higher if handling complex simulations)
- **Storage:** 512 GB SSD to support fast processing
- **Graphics:** Integrated graphics, unless specific simulations require dedicated graphics
- **I/O Ports:** Multiple USB ports (preferably USB 3.0), serial ports, and potentially GPIO headers for hardware interfacing with microcontrollers (Raspberry Pi, Arduino)
- **Operating System:** Windows 11 Pro, with Linux as an option, as many embedded platforms are Linux-based Hybrid Classrooms

Hybrid Classrooms

For hybrid classrooms, where students engage in both in-person and online learning, the focus should be on versatility, multimedia capability, and efficient software support.

Suggested Specs:

- **Processor:** Intel Core i5 or AMD Ryzen 5 for standard usage, Core i7 or Ryzen 7 if handling more multimedia tasks
- **RAM:** 16 GB (enough for presentations, virtual lectures, and occasional programming tasks)

- **Storage:** 512 GB SSD (for faster application performance and quick boot times)
- **Graphics:** Integrated graphics or entry-level dedicated GPU if video editing or graphics design is part of the curriculum
- **Connectivity:** Wi-Fi 6 and Ethernet compatibility, essential for stable online interactions
- **Peripherals:** HD webcam, quality speakers, and microphone for online sessions; touch-enabled monitors may add value for interactive presentations
- **Operating System:** Windows 11 Pro, allowing full access to the Microsoft Office suite and virtual classroom tools .

5.What bandwidth capacity will be provided to each room to support high-demand areas like labs and the video conferencing room?

First Floor:

1. General Purpose Labs:

- **Recommended bandwidth capacity:** 500 Mbps to 1 Gbps per access point.
- **Reasoning:** since each lab will host multiple students working with data-intensive applications such as coding, simulations, or data analysis. We require a high internet connection to ensure efficient performance across all devices.

2. Hybrid Classroom:

- **Recommended bandwidth capacity:** 500 Mbps to 1 Gbps per access point.
- **Reasoning**: we chose this bandwidth since this classroom is a high-demand area, used for in-person and online learning. Real-time collaboration, video streaming, and multimedia use require low latency and high throughput to ensure a smooth learning experience.

3. Student Lounge:

- **Recommended bandwidth capacity:** 500 Mbps per access point.

- **Reasoning:** since it is not as demanding as the labs, the student lounge will have moderate to high traffic from students accessing the internet, streaming, and browsing.

4. Common Areas and Corridor:

- **Recommended bandwidth capacity:** 300 Mbps to 500 Mbps per access point.
- **Reasoning:** since this area is not as bandwidth-intensive as the labs, we chose a bandwidth strong enough to support mobile devices which is what mostly be used in this transitioning area.

Second Floor:

1- Cisco Lab:

- **Recommended bandwidth capacity:** 1 Gbps per access point
- **Reasoning:** high demand area, with multiple users running activities that demands high throughput and low latency.

2- Embedded Lab:

- **Recommended bandwidth capacity:** 1 Gbps per access point.
- **Reasoning:** high demand area, with multiple users running activities that demands high throughput and low latency.

3. Video Conferencing Room:

- **Recommended bandwidth capacity:** 500 Mbps to 1 Gbps per access point.
- **Reasoning:** since the video conferencing requires real-time sharing and video streaming during meetings, it requires a high bandwidth to ensure a smooth experience without delays.

4. Common Areas and Corridor:

- **Recommended bandwidth capacity:** 300 Mbps to 500 Mbps per access point.

- **Reasoning:** since this area is not as bandwidth-intensive as the labs, we chose a bandwidth strong enough to support mobile devices which is what mostly be used in this transitioning area.

6.What kind of firewall should we use and why ?

Given the requirement for robust security against potential network breaches, such as Internet Worms or denial-of-service attacks (as noted in the case study), an NGFW (Next-Generation Firewall) is ideal. NGFWs provide essential features, such as deep packet inspection, intrusion prevention, and application awareness, which are critical for safeguarding FC's network. Additionally, NGFWs offer simplified management, allowing the IT team to efficiently handle security threats while aligning with FC's goal of creating a "secure and easily managed" network.

7.The Layers of Security to be implemented?

For efficient data transmission across labs and the hybrid classroom, Layer 3 managed switches are recommended. These switches will enable internal routing, reducing network latency and optimizing traffic flow, which is critical for the "high-performance to the core backbone" objective stated in the case study. With Layer 3 capabilities, these switches can support future network expansion by managing increased traffic and providing more flexible configurations for VLANs, ensuring scalability for anticipated growth in students and staff.

8.What type of switching to be used , in order to transmit data?

We will use packet switching for data transmission considering a big faculty like FC since packet switching breaks down the data into small chunks of packets and transmits them. It chooses the most efficient route to transmit the data chunks. When compared to circuit switching which decides on a route first then only follows a certain path till the end allowing no room for flexibility.

9.What kind of data policy to be used ?

Implementing a Role-Based Access Control (RBAC) policy would best support FC's need for a secure, manageable system that meets access requirements for diverse user groups. This policy will define access permissions for students, faculty, and support staff, ensuring only relevant resources are available to each group. RBAC aligns with FC's goal of a "reliable, efficient, and

secure" network by limiting access to sensitive data and minimizing potential security vulnerabilities. This approach also supports cost-effectiveness by simplifying user management without the need for extensive custom configurations.

10.How are we planning to reduce Access link utilization?

We also analyzed that FC is a large faculty so the chances of the network getting congested is very high and so we decided to come up with a plan to solve this issue. We are planning to set up a local web cache in our faculty as the cache will store frequently accessed data locally. This will reduce the number of times data is directly fetched from the server ultimately leading to reduced use of access link ensuring it is faster and avoiding any congestion.

11.Does the faculty operate on a cloud-based system or a local server?

The faculty runs on a hybrid system that uses both **c**loud-based services and a local server. The cloud offers scalability and accessibility, which is ideal for non-critical tasks like document storage and email. Whereas, the local server ensures low latency and data control for high-demand activities in labs.

5.2 Feasibility

For the feasibility of the project we would like to consider technical, operational and financial feasibility. Taking into note that FC wants cutting-edge technology but don't want to be paying for the next 20 years

Operational feasibility:

We are expecting a need for regular maintenance of the Internet connection hence we chose TIME as it provides customer support and services included with the plan. We also require a dedicated technician for FC to fix and maintain the lab equipment and fix any minor issues.

Technical feasibility:

The project is technically feasible based on the existing infrastructure within FC. With well-established labs and a pre-existing network setup, the technical requirements align well with the technology already in place. Our choice of equipment and network connection, security and data policy will seamlessly integrate into the existing infrastructure, offering the capacity and

scalability needed for our anticipated growth. We also have 9 access points and a NFVi based network which can be easily upgraded if a need comes in the future.

Financial feasibility:

We were allocated a budget of RM 2.2 million which is more than enough to equip the new building with cutting edge technology and be future ready. We are planning to buy the latest equipment which will last for more than 20 years and also under the budget. We will make good use of the budget and buy equipment with high grade quality ensuring longevity and durability.

5.3 Task 2 - Reflection:

This task helped us enhance our critical thinking and problem-solving skills. We were able to think critically and come up with questions for our preliminary analysis. Then, we used our problem solving and research skills to find answers to those questions.And also we conducted a feasibility study for our project to ensure that it is practical and achievable.

6.0 List of Devices

Type of devices	Usage	Description	Quantity	Price/Unit (RM)	Total (RM)
Cisco Catalyst C9500-40X Layer 3 Switch (C9500-40X-A) 	Used to manage high-volume traffic, interconnect different departments, and ensure reliable communication between servers, workstations, and other network devices.	**Ports:** 40 x 10G/25G SFP+ ports **Layer:** Layer 3 (supports routing and switching) **Features:** High-density 10/25G Ethernet ports for fast data transfer and flexible network configurations.	1	12,021	12,021

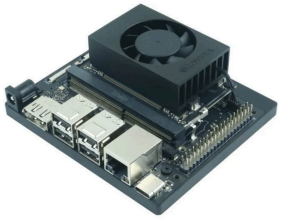
Switch Juniper - EX4100-F Ethernet Switch 	A switch enables connected devices to share information and talk to each other.	**Port Density:** 12, 24, or 48 x 1GbE access ports, with options for PoE+ or non-PoE configurations. **PoE Power:** Up to 740W PoE budget for the EX4100-F-48P model, with 30W per port. **Switching Capacity:** Delivers up to 256 Gbps for high-throughput network environments. **AI-Driven Management:** Integrated with Juniper Mist AI for cloud-based provisioning, monitoring, and performance optimization. **Virtual Chassis Support:** Allows up to 10 EX4100-F switches to be interconnected and managed as a single device for seamless scalability. **Microsegmentation:** Group-based policies (GBP) for granular security and endpoint control, leveraging EVPN-VXLAN.	25	17,000 (48 port)	425,000

Router Cisco - ISR4451-X/K9 	Connect to the internet link (ISP/modem) for network access.	**Aggregate Throughput:** 1 Gbps to 2 Gbps **Total onboard WAN or LAN 10/100/1000 ports:** 4 **RJ-45-based ports:** 4 **Modular slots:** 3 NIM slots, 1 onboard ISC slot **Memory:** up to 16GB DDR2 ECC DRAM and flash memory 8 GB flash memory, expandable to 32 GB **Power Specifications:** 450W maximum power (no PoE) and up to 1450W with PoE boost	1	34,250	34,250
Access Point Juniper - AP45 Access Point 	Used for extending the wireless coverage of an existing network and for increasing the number of users that can connect to it.	**Wi-Fi Bands:** Tri-band (6GHz, 5GHz, 2.4GHz) **Maximum Data Rates:** Up to 4800 Mbps. **Radios:** Dedicated fourth radio for monitoring, security, and analytics. **AI-Driven Optimization:** Automates Wi-Fi 6 features, optimizes RF, and improves performance.	9	6,400	57,600

		IoT Support: TWT and Bluetooth 5.1 for extended IoT device battery life.			
Lysymixs 48 Port RJ45 Patch Panel Cat6 Feed Through, Coupler Network Patch Panel 	Manage and organize network cables.	**LAN Category:** Cat6 **Number of Ports:** 48 **Connector type:** RJ45 **Cable Type:** Ethernet **Shield type:** STP **Rack:** 2 rack, IU, mountable **Connectivity:** 10 Gbps transmission performance	5	325	1,625
Cat6 28AWG Snagless Unshielded (UTP) PVC CM Slim Ethernet Network Patch Cable 	Provide an internet connection, and connect devices to a local network.	**Data Rate Support:** Up to 1G/10G-T **Standard Bandwidth:** Up to 550 MHz **PoE Compatibility:** Supports PoE, PoE+, and PoE++ (IEEE 802.3af/at/bt) **Wire Scheme:** Wired T568B **Cable Jacket:** Snagless Narrow Boot Design **Connectors:** RJ45 Modular Plugs with 50µ" Gold-plated contacts **Conductor Type:** Pure	122	18	2,196

		bare copper, stranded			
30M OM3 LC to LC Fiber Patch Cable, 10Gb Multimode Jumper Duplex LC-LC UPC 50/125um 	For connecting the two floors, the cisco lab server and for uplink connections between switches and routers to ensure it is not a bottleneck.	**Fiber type:** Multimode **Diameter:** 50/125µm **Optical Source:** VSCEL **Connector Type:** Lc/Upc to Lc/Upc **Bandwidth:** 2000MHz*km	8	83	664
Video conferencing bar Owl labs - Owl bar 	Used for enhancing the video conferencing experience with smart switching and framing. Better audio and video.	**Camera**: 4K Ultra HD, 30 MP, automatic framing, and intelligent switching. **Audio**: 18 ft pickup, 4 beamforming microphones, high-fidelity speaker, expandable mic support. **Compatibility**: Works with Zoom, Teams, Meet, Slack, and other video conferencing platforms. **Connectivity**: USB 3.0 (Type-C & Type-A), wireless pairing with Meeting Owl devices.	1	13,000	13,000

TV for Video Conferencing HUAWEI - IdeaHub S2 Interactive Display, 86" 	Used for projection and also for video conferencing. Compatible with video conferencing bar.	**Join Meetings Easily:** We can easily bring our meetings from our personal devices to the Huawei IdeaHub S2 with just a simple transfer. **Effortless Screen Sharing:** Sharing our screen is effortless—one step using Wi-Fi 6, and there's no need to be on the same network. **Collaborate Seamlessly:** We can collaborate seamlessly with features like multi-window views and an enriched office ecosystem. **Crystal-Clear Video:** The professional 4K video camera ensures our video is sharp and lifelike, thanks to advanced AI technology. **Immersive Audio Experience:** With AI-powered audio, we can hear and be heard clearly, even from 12	1	40,000	40,000

		meters away, with no background noise.			
HP ProOne 440 G9 Complete work station 	Used as complete workstation for general purpose labs and work station video conference and hybrid classes.	**All-in-One PC** **Processor:** 14th generation Intel® Core™ i5 **Memory:** 16 GB **DDR5-4800 MHz RAM** **Storage**: 512 GB SSD **Display:** 23.8" FHD screen **Graphics:** Intel® UHD Graphics 770 **Peripherals:** Integrated 5 MP IR camera and HP Wired Keyboard/Mouse Combo	122	4,575	558,150
NVIDIA Jetson Xavier NX Developer Kit Embedded development platform 	Can be used in the embedded lab. Perfect for projects in AI, computer vision, and robotics.	**GPU:** NVIDIA AmpereTM architecture with 1024 x NVIDIA CUDA Cores 32 x Tensor Cores **CPU:** 6-core Arm Cortex-A78AE v8.2 64-bit CPU 1.5 MB L2 + 4 MB L3 **Memory:** 8GB, 128-bit,	30	2,550	76,500

		LPDDR5, 68GB/s **Storage:** External through microSD slot ExternaNVMe SSD through M.2 Key-M			
PowerEdge R760 Rack Server 	Can be used in cisco lab to handle heavy simulation and it is very reliable.	Dual Intel Xeon Platinum 4th Gen processors. Up to 6 TB of DDR5 RAM. PCIe Gen 5 support for NVMe storage.	1	95,508	95,508
StarTech.com RK1232WALHM 12U Wall-Mount Server Rack Cabinet 	Used for organizing and housing network equipment.	**Rack Height**: 12U **Depth**: 32 inches **Mounting Type**: Wall-mountable **Enclosure Type**: Hinged **Material**: Black metal with mesh panels for ventilation **Ventilation**: Mesh panels allow for effective cooling and airflow to prevent overheating **Security**: Lockable doors to secure equipment **Features**: Ideal for	7	3,532	24,724

		organizing and mounting network devices in environments where floor space is limited			
RS PRO 12 Port Single Mode Duplex Fibre Optic Patch Panel With 12 Ports Populated, 1U 	Organizes and manages fiber connections in network labs, providing efficient cable routing and supporting high-speed data transmission for network devices.	**Ports**: 12 ports **Fibre Type**: Single Mode Duplex **Rack Size**: 1U **IP Rating**: IP20 **Cable Entry**: 2 x 20mm, 2 x 25mm cable entry holes	6	348	2,088
Tripp Lite SR42UB SmartRack Rack Enclosure Server Cabinet - 42U, 19" Width, 3000 lbs Load Capacity 	Used to securely organize and store network equipment like servers and switches, ensuring proper ventilation and efficient use of space.	**Rack Height**: 42U **Width**: 19 inches **Load Capacity**: 3000 lbs **Security**: Lockable doors for enhanced security **Mounting**: Designed for standard 19-inch rack-mounted equipment **Cooling**: Mesh design promotes airflow to prevent overheating **Features**: Includes front and rear doors, adjustable rails, and a high load capacity, making it suitable for use in	1	6,901	6,901

		large-scale network setups and data centers.			
Total					1,282,227

6.1 Maintenance Cost for the Next 5 Years:

Description	Per year	For the next 5 years
Annual Maintenance Cost		
-hardware replacement	150,000	750,000
firmware updates	10,000	50,0000
general upkeep.	5,000	25,000
Software Subscription costs		
Network Management and Monitoring Tools	8,000	40,000
Cisco Packet Tracer for the Cisco Network Lab.	2,000	10,000
IoT simulators for the Embedded Lab.	2,000	10,000
General educational software for general-purpose labs.	5,000	25,000

Total for maintenance and software subscription for the next 5 years		910,000
Total costs		2,192,227

6.2 Analysis

Analysis of required devices

We have 30 workstations for the two general labs, cisco and embedded labs, and 19 workstations for the hybrid classroom as well as another workstation in the video conferencing room, making them a total of 140 workstations. Additionally, we will need one powerful Cisco server dedicated to the Cisco lab, along with 15 access switches for each 2 workstations in the cisco lab, and we have Embedded lab development kit devices for specialized development tasks. To ensure network connectivity, Each workstation connects to a cat6 patch panel in the server rack set up in each room, which connects to the access switch and then to a fiber optic patch panel, which then connects everything to the core switch and then to the router. For high-speed and reliable connections, we included OM3 fiber optic cables. To connect the networks across the two floors, the access switches as well as the server to the switch, which ensures seamless communication. This setup prioritizes efficiency, scalability, and reliability to meet the needs of the labs.

Are you surprised by the prices?

Yes, even though we did a lot of research beforehand, we were startled by the prices of some of the devices, while we expected others to cost more; However were not very surprised by the price of each device as much as we were surprised by how much it all added up in the end for only a LAN setup, we never expected that a two storey LAN network would cost up to 1 million Malaysian Ringgit.

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

Of course cost was always a factor, since we started working on this project. Since we have a fixed budget of 2.2 Million Malaysian Ringgit, which is quite good and comfortable to work with, we wanted to use the best devices we could find that fits our network needs, while also fitting our budget, since things can add up later on if we are not very careful with it.

What are the major differences between the same devices from different brands?

The biggest difference we noticed between some of the same devices from different brands was the price and the reputation of that brand or how popular it is between buyers. Mostly, we could find two similar devices from different brands but what differed was only some other minor differences, for example, Cisco 4451-X and Juniper J6350 Router, while they shared most of the functionalities, the Cisco router had an integrated security feature, while Juniper's security was integrable, they also differed in scalability, and we noticed that Cisco covered most of our needs for the network while Juniper was able to scaled to fit our needs, overall, both brands were good, and we chose the one that could cover all of our needs easily while also fitting our budget.

6.3 Task 3 - reflection:

Task 3 further enchanted our research skills and decision making skills because we had to look at different brands of networking devices while keeping in mind that the technology should suffice for the next 20 years to come by. This made our decision making skills sharper as we had to choose the best from the huge sea of different networking devices.

7.0 Work Area

7.1 Network Topology

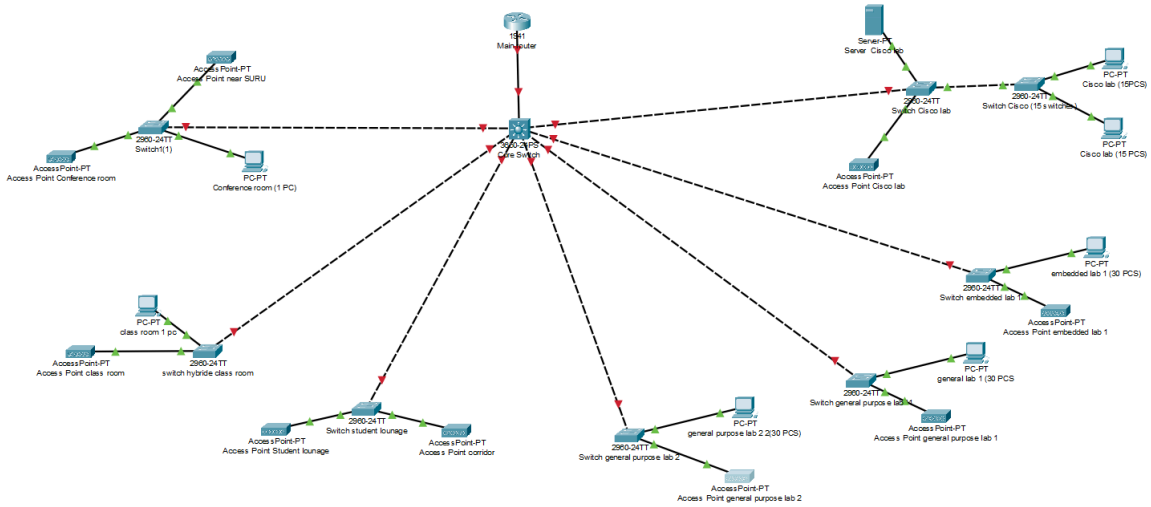


Figure 7.1.1 - Overall Network Topology

Figure 7.1.1 illustrates the network topology for the faculty lab building, showcasing the various network areas and their interconnections. The core of the network is managed by a **Main Router** , which provides centralized control and serves as the gateway to external networks. From the main router, connectivity is distributed through the **Core Switch** , which acts as the backbone for the entire network, facilitating communication across different areas.

Several network segments are depicted, including specific **labs, classrooms, and common areas** such as the student lounge, hybrid classroom, general-purpose labs, embedded labs, and the Cisco lab. Each of these areas connects to a **dedicated switch**, which in turn connects to access points (APs) and devices like PCs and servers.

The network incorporates **access points** strategically placed in each area to ensure wireless connectivity, while the switches provide wired connections for critical devices. Overall, the topology demonstrates a well-structured and hierarchical design that ensures efficient data flow and robust connectivity across all zones.

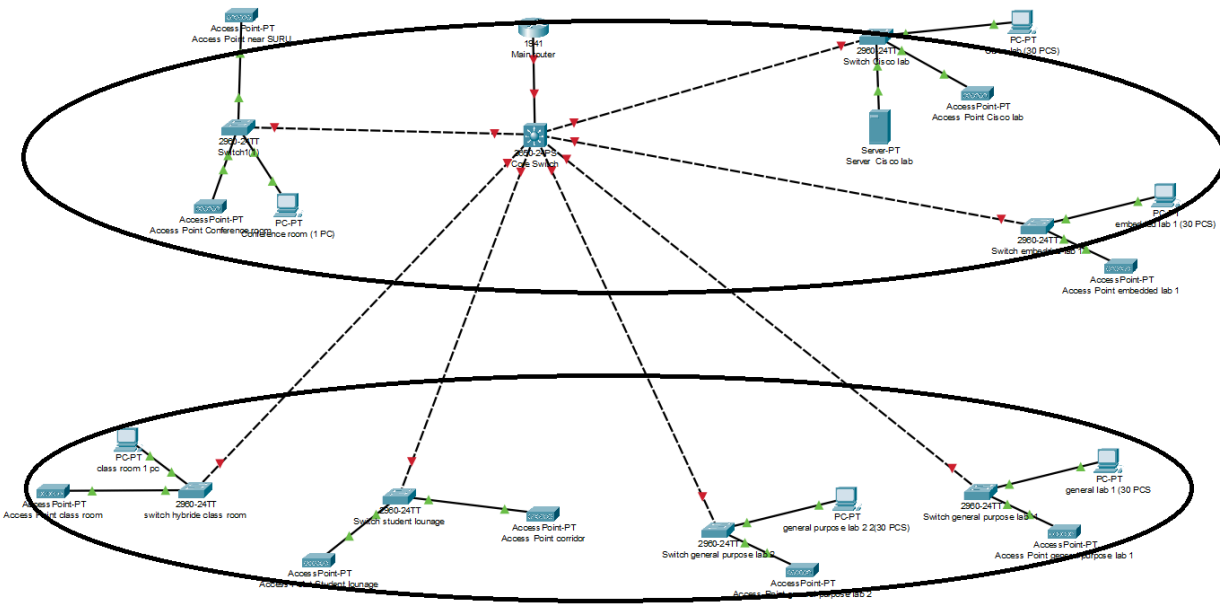


Figure 7.1.2 - Floors Separation

Figure 7.1.2 provides a detailed view of the network topology, showcasing the network devices and configurations distributed across the two floors.

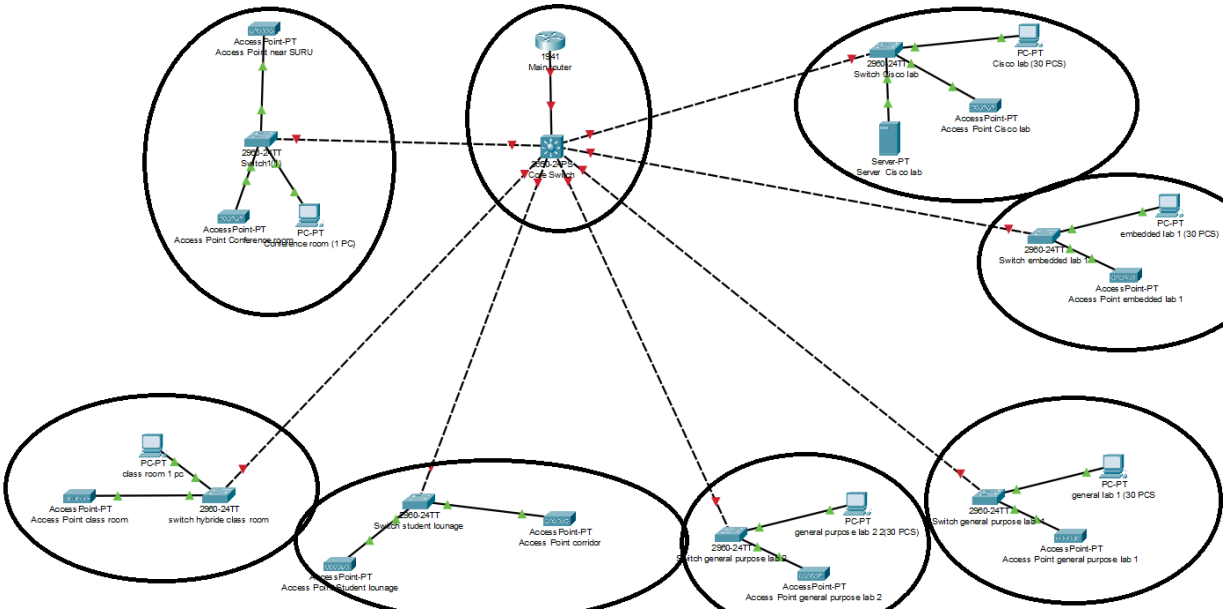


Figure 7.1.3 - Rooms Separation

Figure 7.1.3 provides a focused view of the network segmentation, where each **logical area** represents a room in the building or area.

7.2 Identification of Each Work Area

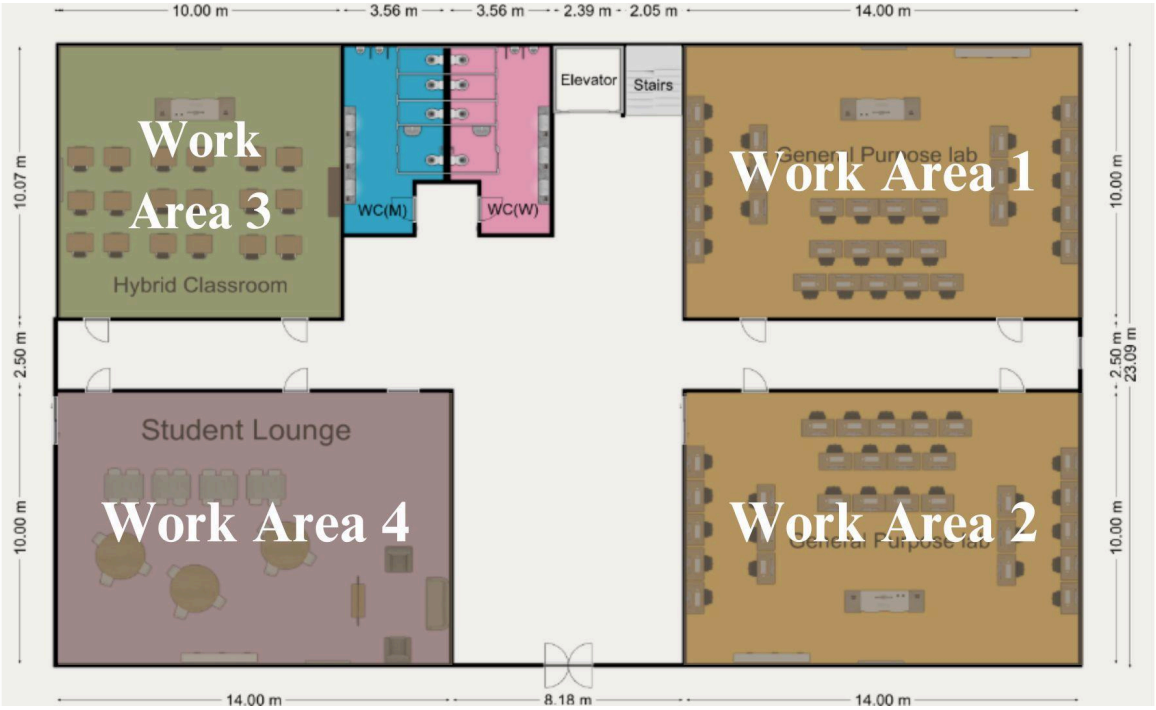


Figure 7.2.1 - Work Areas for Floor 1

Figure 7.2.2 - Work Areas for Floor 2

1. **Storage area**:
    - The **Main Router** and the **Core Switch** are centrally located, acting as the backbone of the entire network, distributing connectivity to all areas.
2. **Cisco Lab**:
    - Connected through a dedicated switch , the Cisco lab hosts **30 PCs** and a **server**. An **access point** ensures wireless access within the lab.
3. **Embedded Lab:**
    - This segment includes a **switch**, an **access point**, and **30 PCs**, providing wired and wireless connectivity.
4. **Conference Room**:
    - Equipped with a **single PC** and an **access point** for small-scale wireless connectivity, connected via a dedicated **switch**.
5. **Hybrid Classroom**:
    - Contains a **switch**, an **access point**, and a **PC** to support both wired and wireless users.
6. **Student Lounge and Corridor**:
    - This area has an **access point** and a **switch** providing coverage for open spaces like the student lounge and corridor.
7. **General Purpose Labs 1 & 2**:
    - Each lab is equipped with **30 PCs**, a **dedicated switch**, and **access points** for seamless wired and wireless connectivity.

8.0 Floor plan

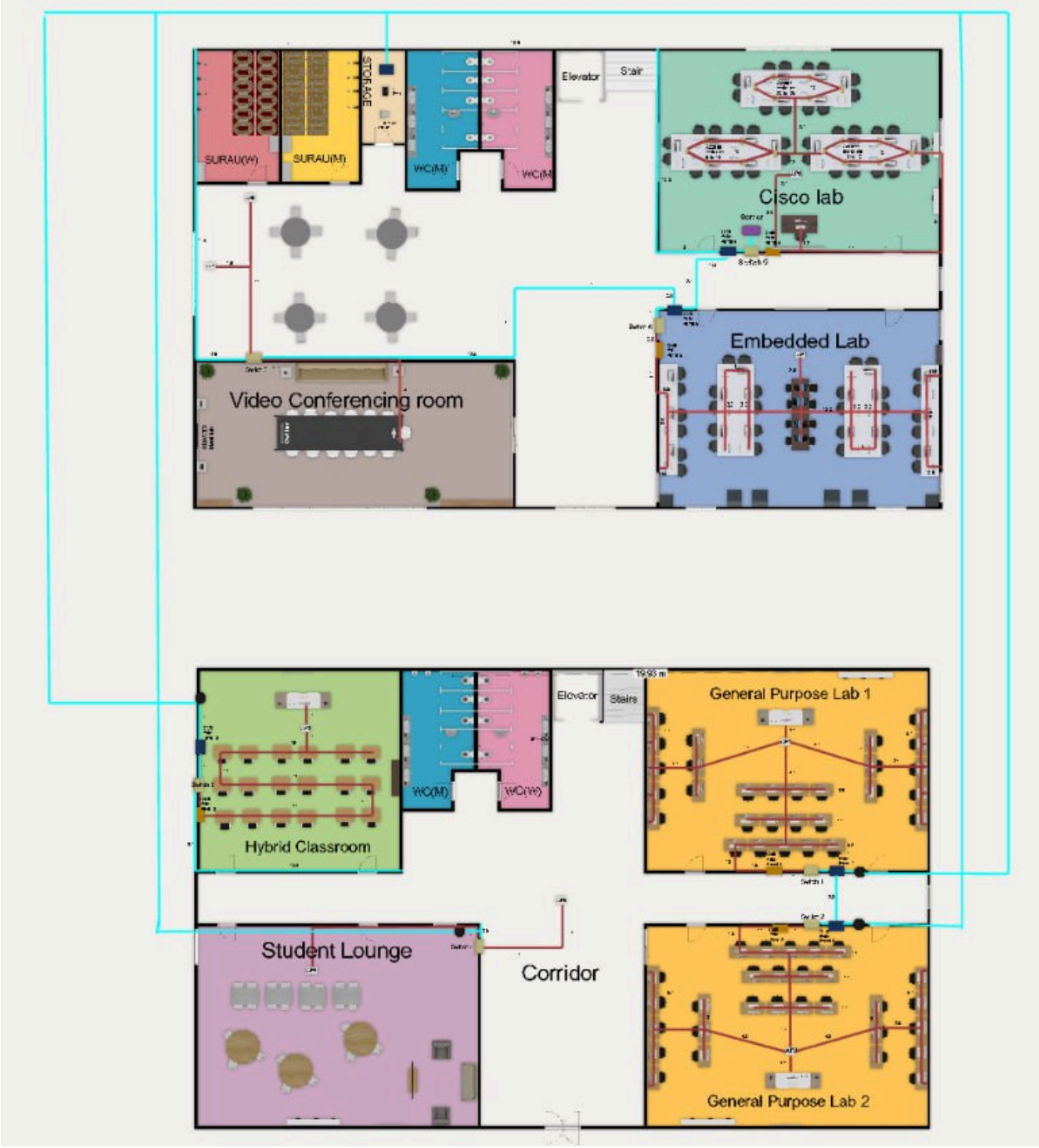
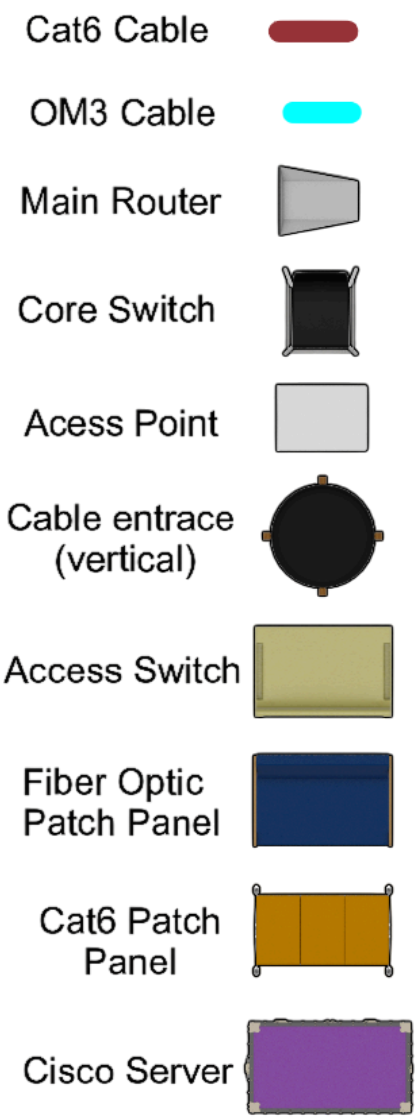


Figure 8.0.1: Two Floor Connections using OM3

We have 4 uplinks in floor 1 that connects vertically to our main router in the storage room, **figure 8.0.1** is for demonstration purposes for the number of uplinks from this floor, actual measurement of the the cable length is calculated below in **9.1.1**

8.1 Key for Floor Plan



8.2 Floor One:

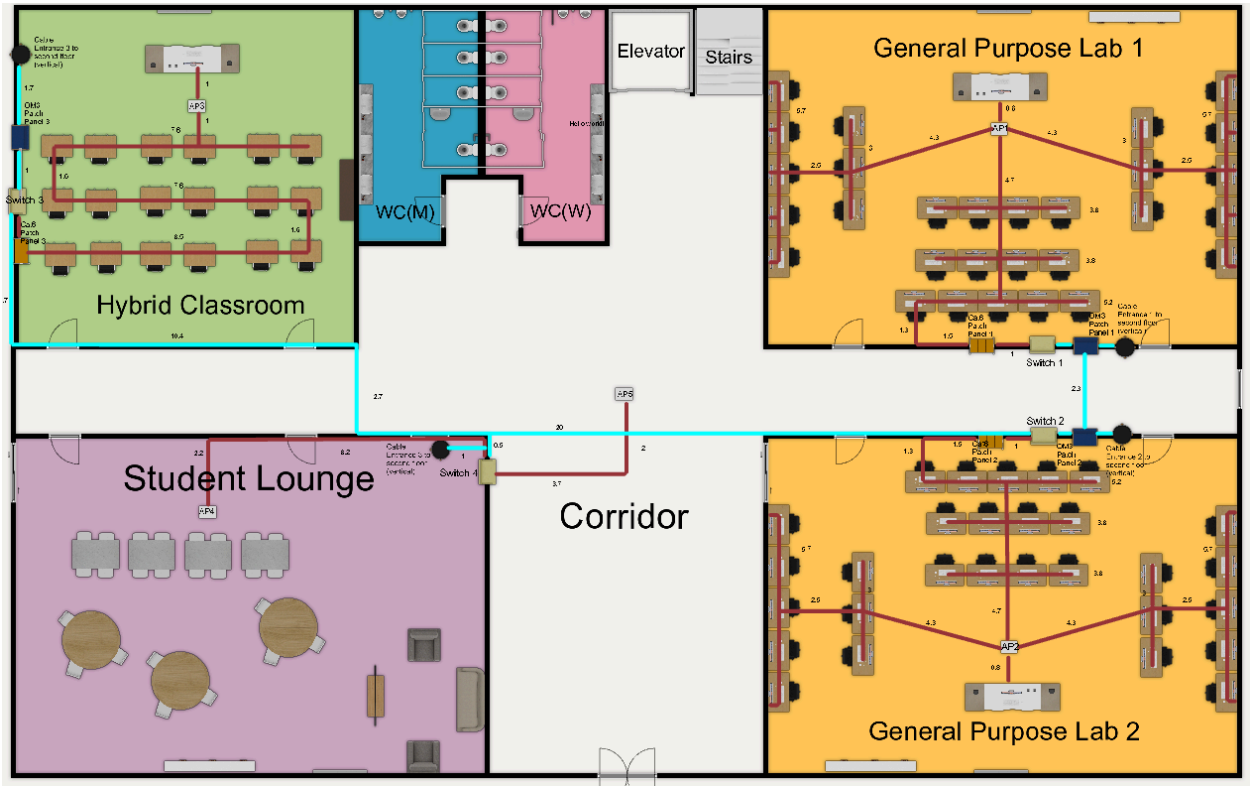
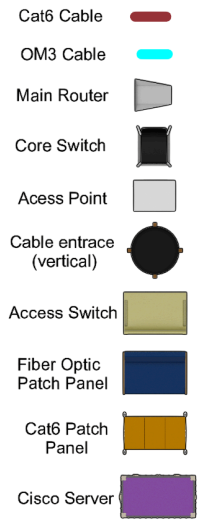


Figure 8.2: Floor One Network Setup

Key:



8.3 Floor Two:

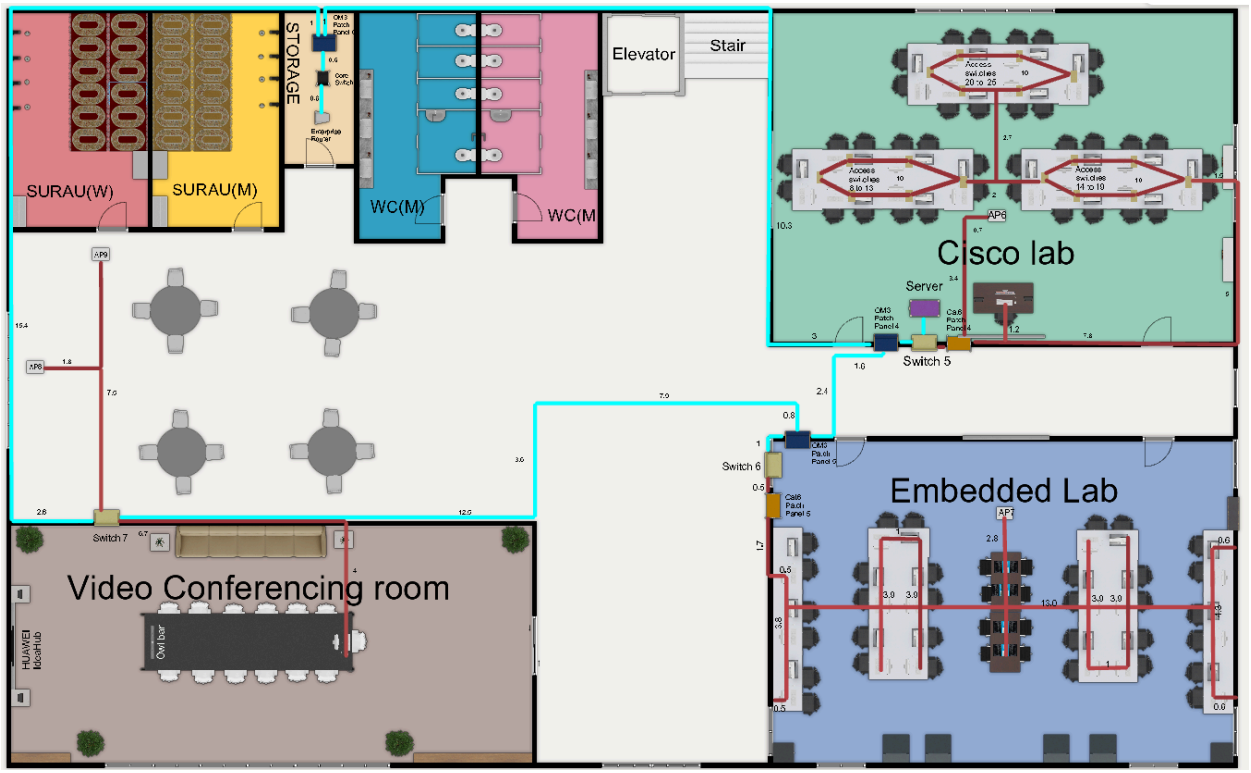
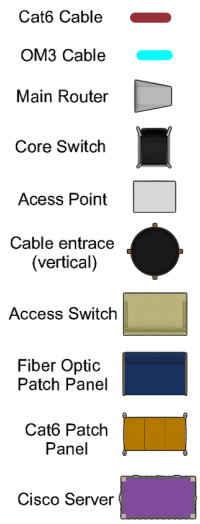


Figure 8.3: Floor 2 Network Setup

Key:



8.4 General Purpose Lab 1

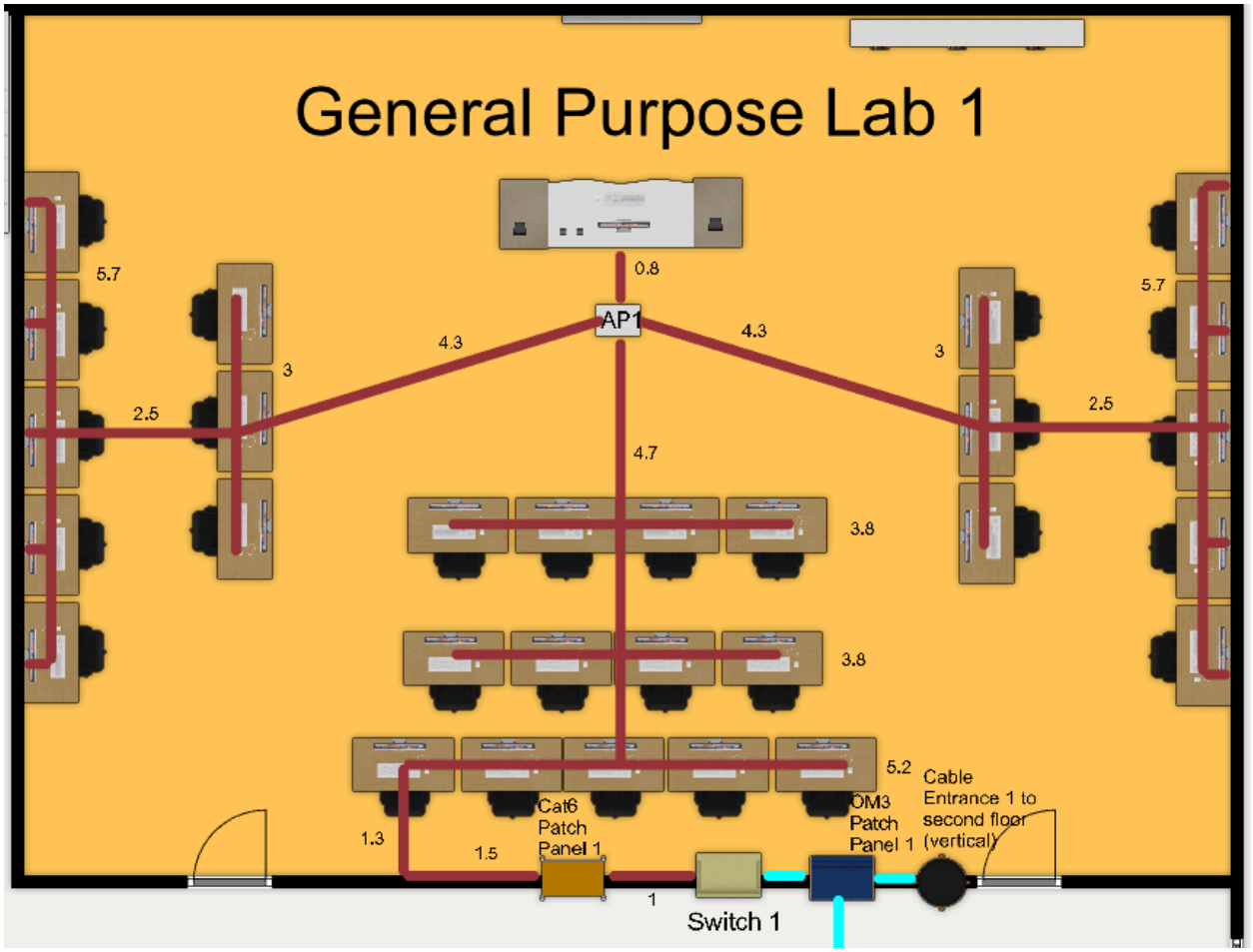
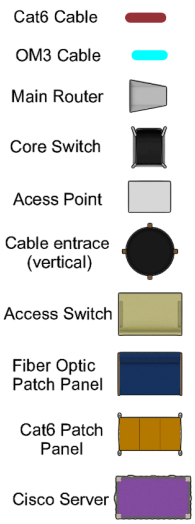


Figure 8.4: General Purpose Lab 1 Network Setup

Key:



8.5 General Purpose Lab 2

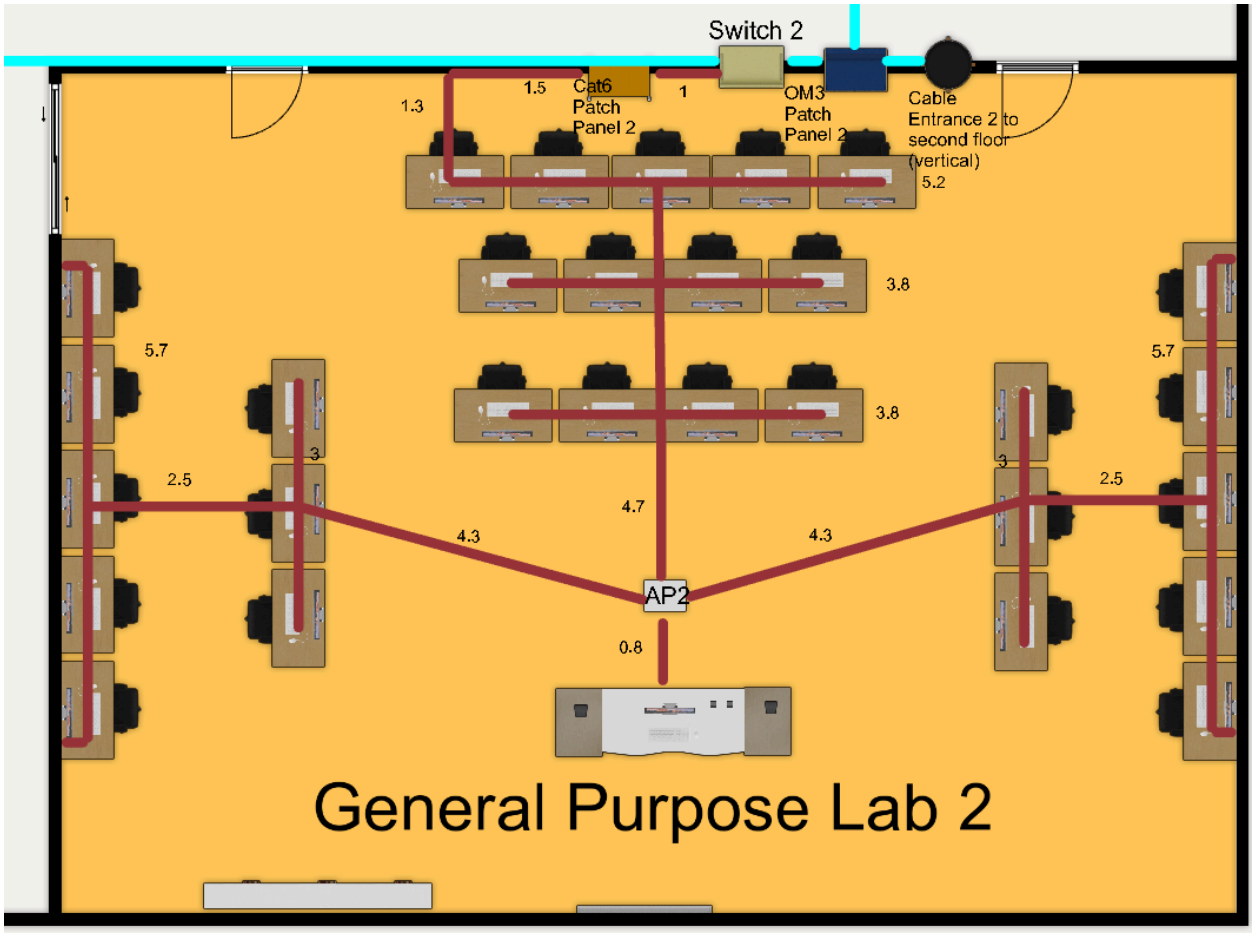
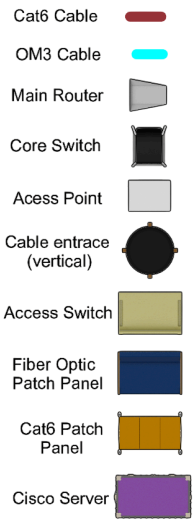


Figure 8.5: General Purpose Lab 2 Network Setup

Key:



8.6 Hybrid Classroom

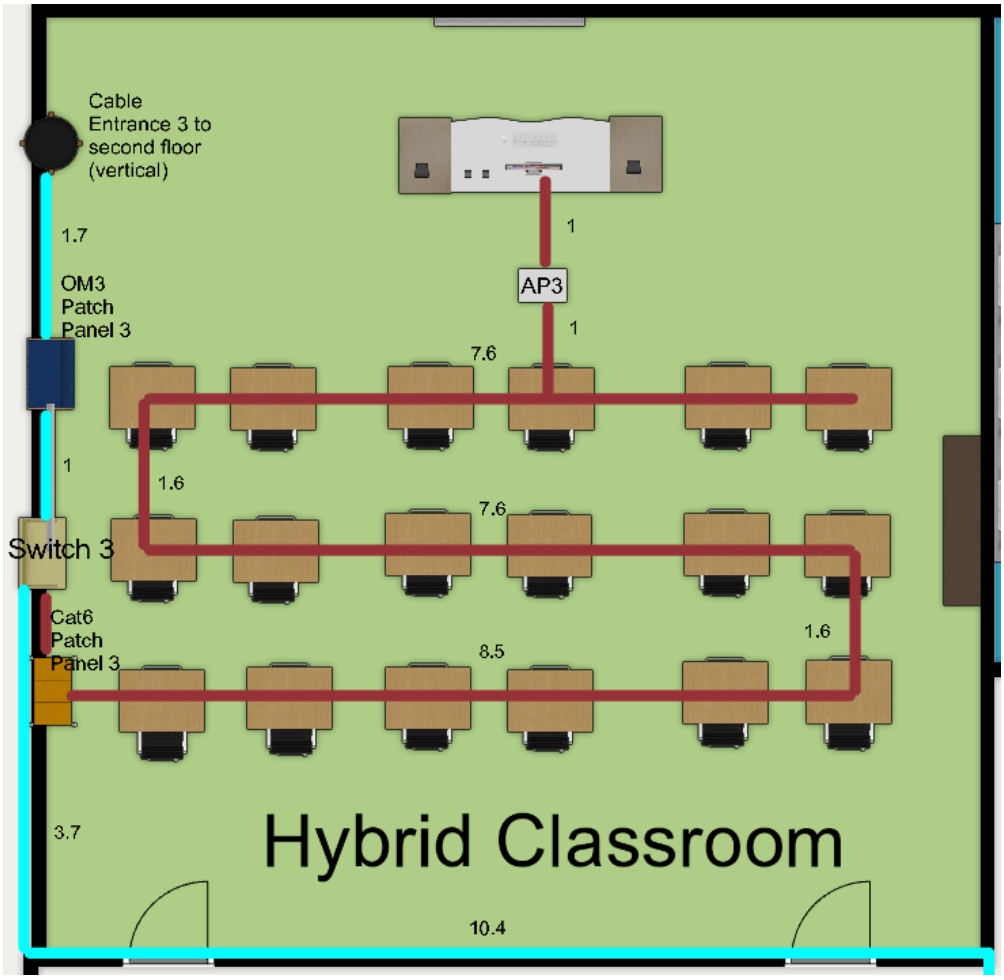
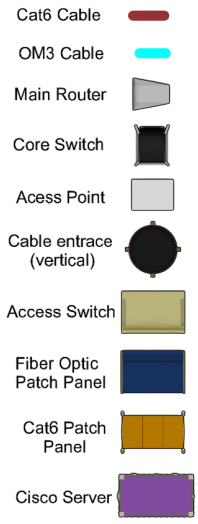


Figure 8.6: Hybrid Classroom Network Setup

Key:



8.7 Student Lounge

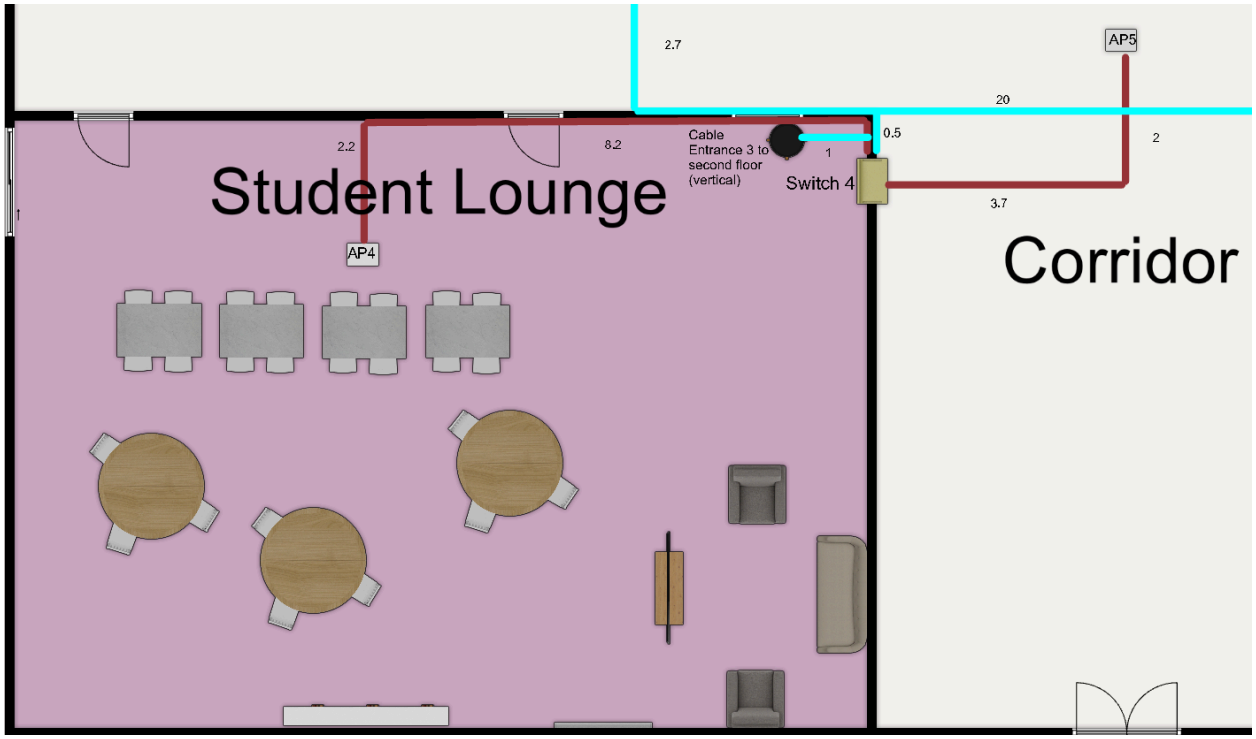
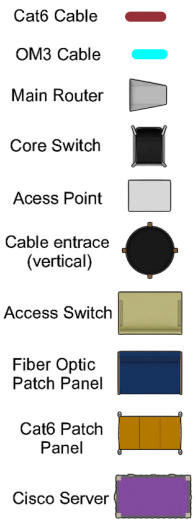


Figure 8.7: Student Lounge Network Setup

Key:



8.8 Cisco Lab

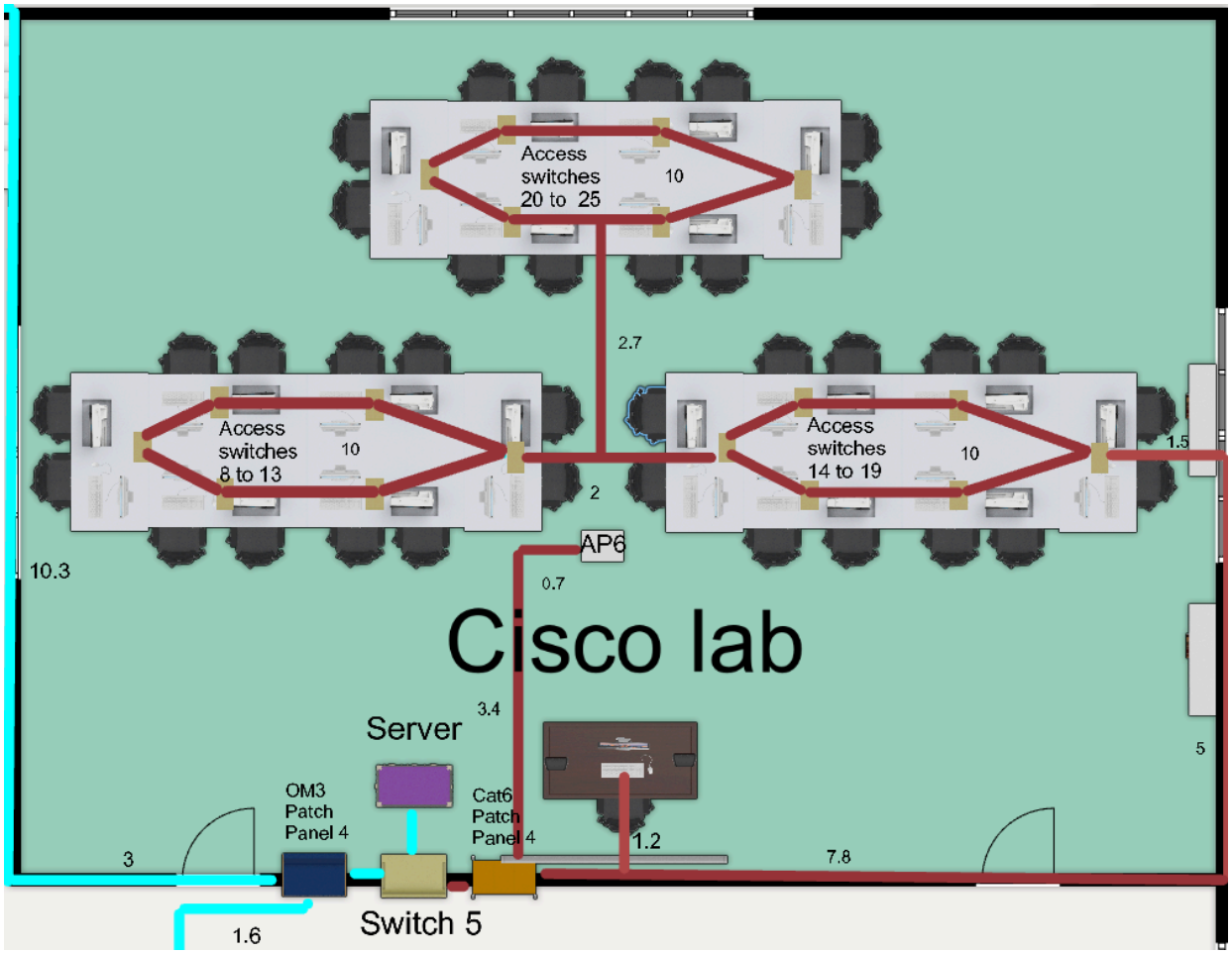
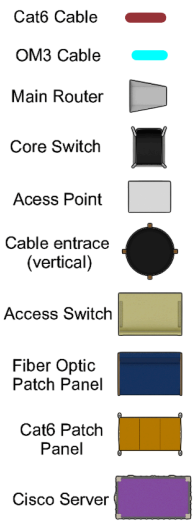


Figure 8.8: Cisco Lab Network Setup

Key:



8.9 Embedded Lab

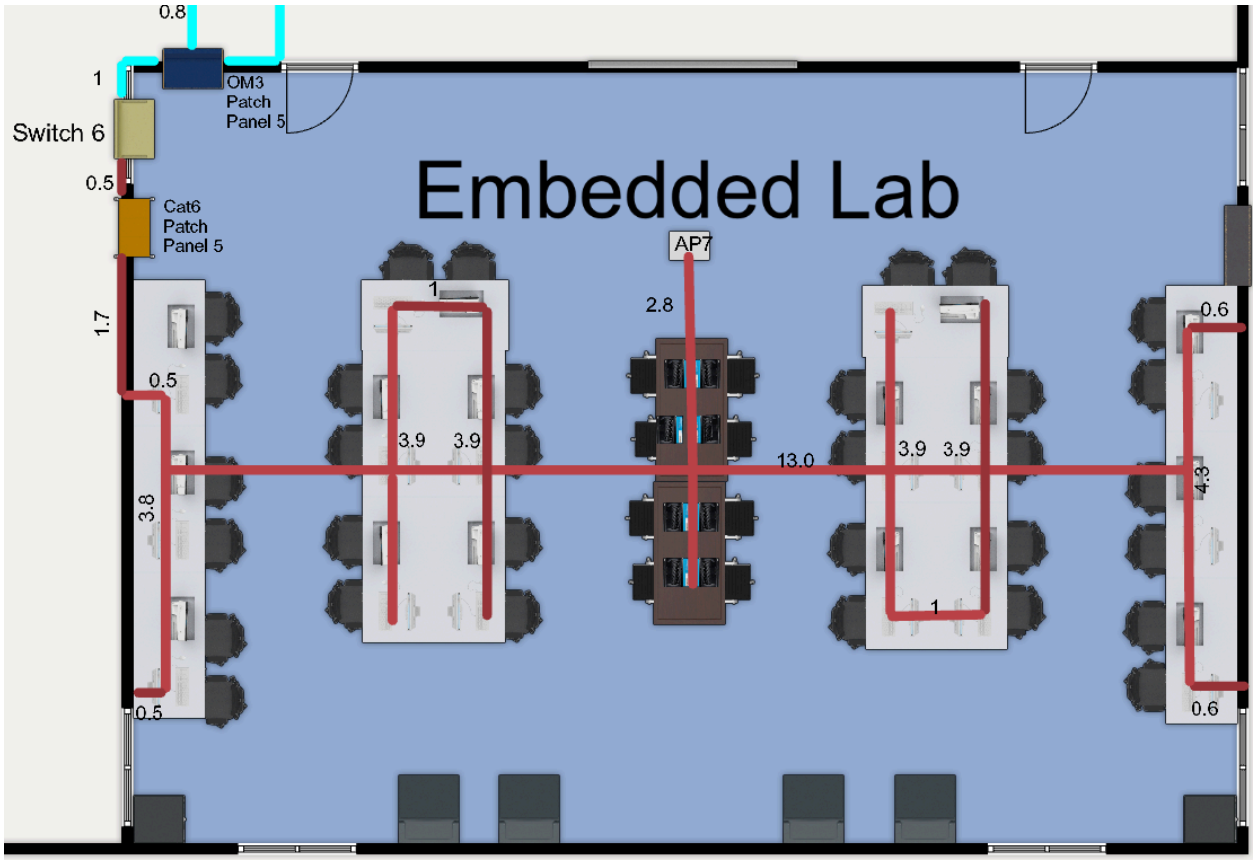
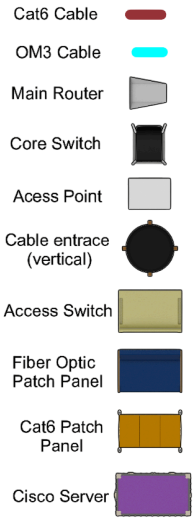


Figure 8.9: Embedded Lab Network Setup

Key:



8.10 Video Conferencing room

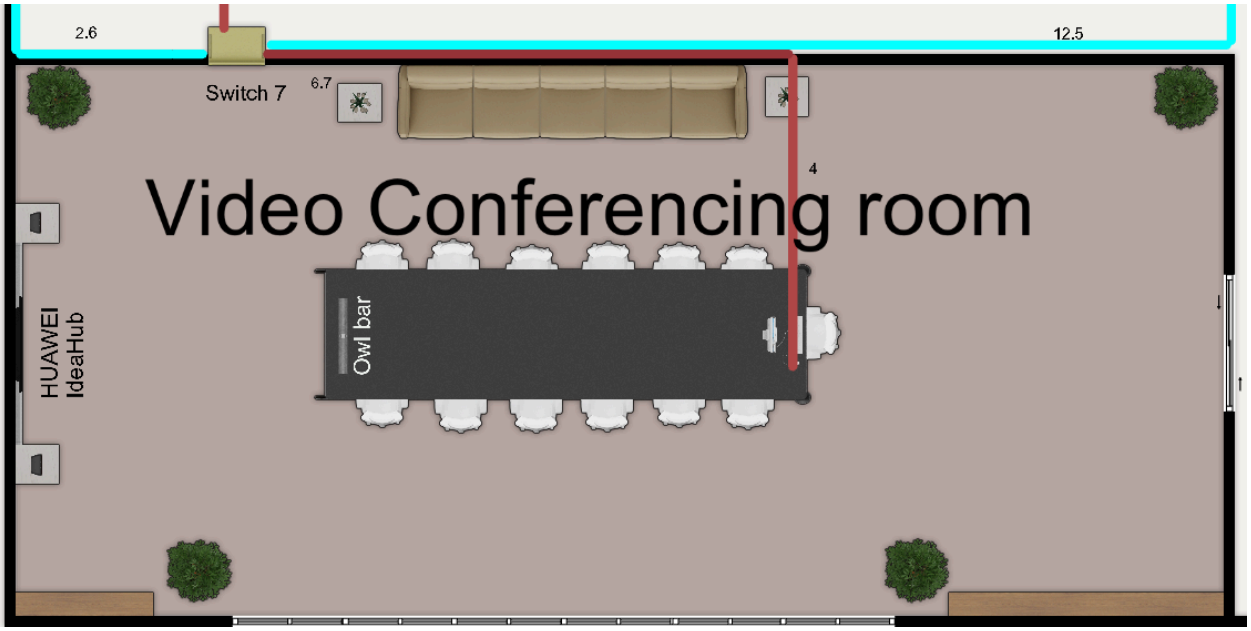
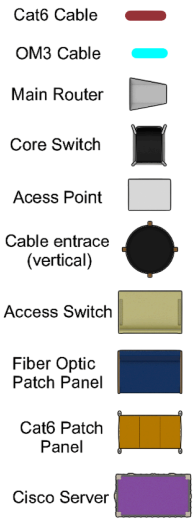


Figure 8.10: Video Conferencing Room Network Setup

Key:



8.11 Corridor

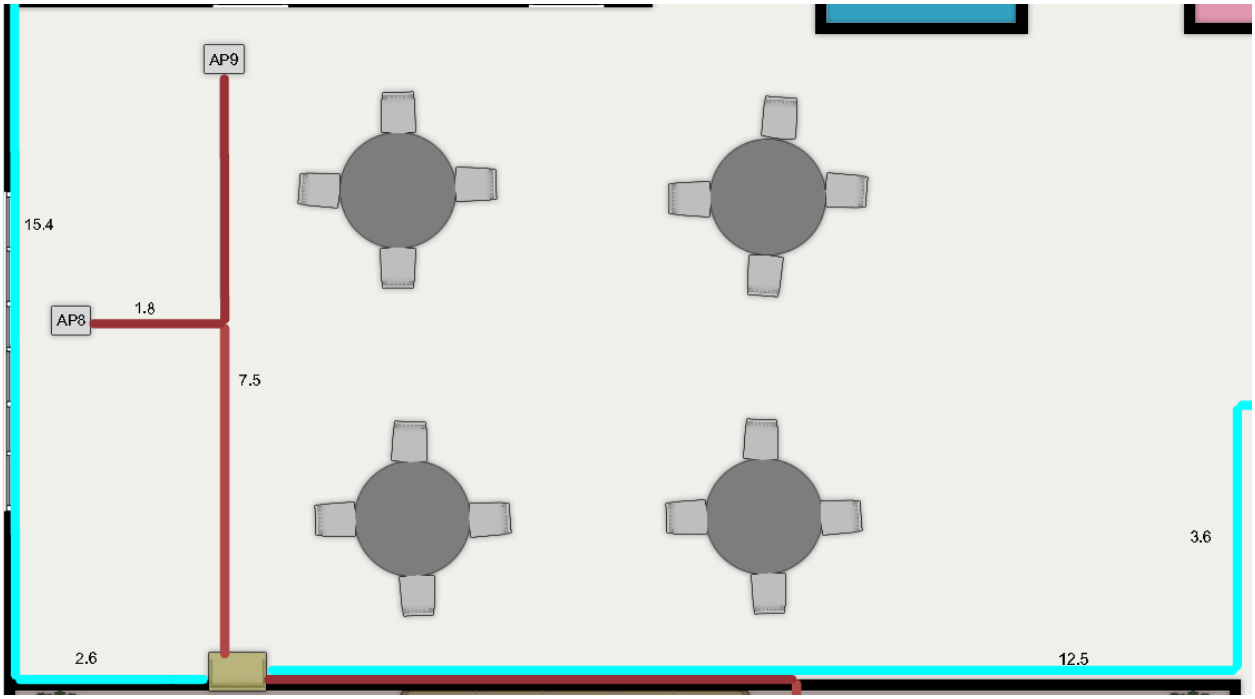
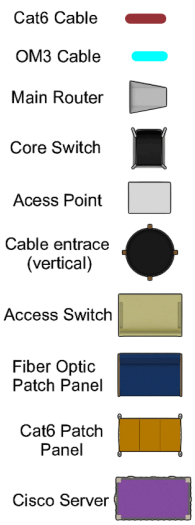


Figure 8.11: Network Setup Near Surau

Key:



8.12 Storage Room

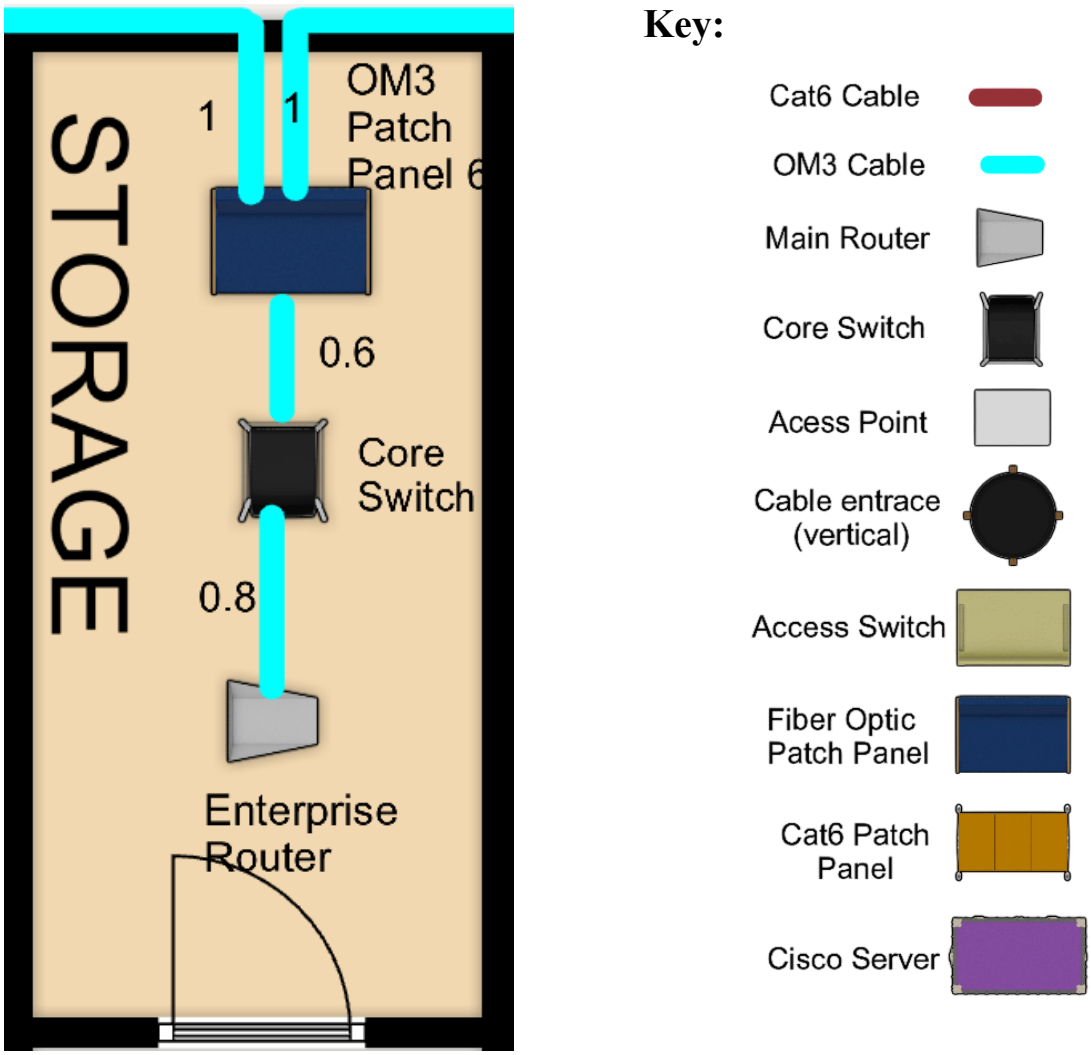


Figure 8.12: Storage Room Network Setup

9.0 Connections, Patch Cords and Switch Ports

9.1 Cable lengths and Types

Description	Cable Type	Cable Length
1st Floor		
General Purpose Lab 1	Cat6 28AWG	48m
	OM3 Fiber Optics	1m
General Purpose Lab 2	Cat6 28AWG	48 m
	OM3 Fiber Optics	1m
Hybrid Classroom	Cat6 28AWG	27.8m
	OM3 Fiber Optics	2.7m
Student Lounge	Cat6 28AWG	10.4m
	OM3 FiberOptics	1m
Connection to access point corridor	Cat6 28AWG	5.7m
Total Cable Length Floor 1- Cat6 AWG		140m
Total Cable Length Floor 1 - OM3 Fiber Optics		5.7m
2nd Floor		
Cisco Lab	Cat6 28AWG	54.3m
	OM3 Fiber Optics	1m
Embedded Lab	Cat6 28AWG	45.9m
	OM3 Fiber Optics	1m
Video Conferencing Room	Cat6 28AWG	10.7m
Access Points near surau	Cat6 28AWG	9.3m
Storage Room	OM3 Fiber Optics	3.4m
Total Cable Length Floor 2 - Cat6 AWG		120.2

Total Cable Length Floor 2 - OM3 Fiber Optics		5.4m
Connection between Access Switches, Core switch & Main Router		
Connection between access switches (horizontal) Floor 1	OM3 Fiber Optics	39.6m
Connection between access switches (horizontal) Floor 2	OM3 Fiber Optics	28.8m
Connection to Main Router (vertical) Floor 1	OM3 Fiber Optics	102.7
Connection to Main router (horizontal) Floor 2	OM3 Fiber Optics	56.2m
Total Length		227.3m
TOTAL CABLE LENGTH FOR THE TWO FLOORS	Cat6 28AWG	260.2m
	OM3 Fiber Optics	238.4m

Table 9.1.1: Cable Lengths and Types

9.1.1 Vertical Cabling Measurements:

Since our wall height is 2.8m, we will account for the ceiling height and approximate 3 meters for the wall length, we will add this height to the connections from the position of our cable entrances to the OM3 Fiber Optic Patch Panel in the storage room, the calculation are then as follows:

General Labs 1 & 2:

(3 + 12.7 + 20) * 2 = 71.4m

Hybrid Classroom:

3 + 12.5 = 15.5m

Student Lounge:

3 + 12.8 = 15.8m

Adding them all together our **total vertical connections between the two floors using OM3 Fiber Optic cable is** 71.4 + 15.5 + 15.8 = 102.7m

9.2 Patch Cords and Switch Ports

Patch Cords:

Cat6 Patch Panel:

We have 30 workstations in each of the General purpose labs, and the cisco and embedded labs, 19 for the hybrid classroom, each of those workstations in the corresponding room connect to Cat6 Patch Panel, therefore, our patch cords for cat6 patch panel is:

30 + 30 + 30 + 30 + 19 = 139 patch cords for Cat6 Patch Panel

Fiber Optic Patch Panel:

We have 6 fiber optic patch panels for the two general purpose labs, hybrid classroom, cisco and embedded labs and the storage room. Each of these rooms have one uplink only that all connect to the storage room's patch panel, each uplink needs 2 LC connectors, which means each room needs 2 LC connectors for its fiber optic link, all of which connect to the fiber optic patch panel in the storage room, which means the storage room's patch panel will need to accommodate those links, therefore it will need 5 * 2 = 10 LC connectors.

Total LC connectors = 10 + 2 * 5 = 20 LC connectors.

This makes the total Patch Ports: 139 + 20 = 159 patch cord

Access Switch Ports:

Cat6 Connections:

The access switches connect to the cat6 patch panel which means we also have 139 switch ports for the rooms that has cat6 patch panel, as well as the 9 access points connections and the video conference connection, as well as the switch connections between each 2 workstations in the cisco lab which are 30, which makes the total switch ports regarding cat6 cables:

139 + 9 + 1 +30 = 179

Fiber Optic Connections:

The access switch also connects to the fiber optic patch panel, it needs 1 SFP port for any 2 LC connectors from the patch panel, which means 1 SFP ports for each uplink, we have all of the rooms uplink to the storage room, which are equal to 7 SFP ports, as well as the access switches connections which are 5 and lastly the server connection. We also have 5 SFP ports for the 5 uplinks from the rooms, which makes the total number of SFP ports:

7 + 5 + 1 + 5 = 18 SFP ports

Therefore the total number of switch ports is: 179 + 18 = 197 port

Description	Total Ports
Patch Cords	197
Switch Ports	167

9.3 Task 4 - Reflection

In Task 4, we conducted extensive research to design a physical network setup that ensures an efficient and robust infrastructure. Our focus was on determining optimal device placement and ensuring seamless connectivity within and between floors. We began by analyzing existing network topologies and evaluating different types of network cables and devices. This research helped us understand the refinement of physical layouts and connectivity requirements.

Using tools like packet tracers, we simulated our network design to validate its functionality and efficiency. This step was crucial in identifying potential issues and refining our approach. Throughout this process, we gained a deeper understanding of the role and functionality of various network components, such as routers, switches, and access points, and how they contribute to an interconnected system. We also learned to calculate cable lengths precisely, ensuring minimal wastage while accommodating all connectivity needs.

Ultimately, Task 4 provided us with a comprehensive understanding of physical network design and its importance in creating a reliable network infrastructure

10.0 IP Addressing Scheme

10.1 IP Subnetting

Our assigned network address is 192.18.0.0/8, we will be dividing it to accommodate all of our devices in the two floors.

From this Address we infer the,
Network portion: 8 bits
Host portion: 32 - 8 = 24 bits

To create **8 subnets**, we need to borrow 3 bits from the host portion (since $2^3 = 8$) which means we have /11 subnet mask which translates into 255.224.0.0

Therefore each subnet will have $2^{32 - 11} = 2^{21} = 2{,}097{,}152$ devices which is still a lot for our network.

To optimize this we will use a mix of subnet masks to assign IP addresses for different areas since we have to take in consideration that not every area needs the same amount of IP addresses. While assigning IP addresses we also have to keep in mind to allocate enough for other personal devices that could be used by staff, students and visitors and also give room for future expansion.

Area	Subnet Mask	Address Range	Network Address	Broadcast Address	IP Range	Usable IPs
General Purpose Lab 1	/24	192.18.0.0 - 192.18.0.255	192.18.0.0	192.18.0.255	192.18.0.1 - 192.18.0.254	254
General Purpose Lab 2	/24	192.18.1.0 - 192.18.1.255	192.18.1.0	192.18.1.255	192.18.1.1 - 192.18.1.254	254
Hybrid Classroom	/24	192.18.2.0 - 192.18.2.255	192.18.2.0	192.18.2.255	192.18.2.1 - 192.18.2.254	254

Student Lounge	/24	192.18.3.0 - 192.18.3.255	192.18.3.0	192.18.3.255	192.18.3.1 - 192.18.3.254	254
Video Conferenc e Room	/26	192.18.4.0 - 192.18.4.63	192.18.4.0	192.18.4.63	192.18.4.1 - 192.18.4.62	62
Embedded Lab	/24	192.18.5.0 - 192.18.5.255	192.18.5.0	192.18.5.255	192.18.5.1 - 192.18.5.254	254
Cisco Lab	/24	192.18.6.0 - 192.18.6.255	192.18.6.0	192.18.6.255	192.18.6.1 - 192.18.6.254	254
Storage	/26	192.18.7.0 - 192.18.7.63	192.18.7.0	192.18.7.63	192.18.7.1 - 192.18.7.62	62

Explanation:

General Purpose Labs, Hybrid Classroom, Student Lounge, Embedded Lab, and Cisco Lab has Subnet mask /24 allows for 254 usable IPs, which is sufficient for the devices in these areas. Video Conference Room and Storage has Subnet mask /26 allows for 62 usable IPs, which is appropriate for these smaller areas as they are less crowded and not frequently used.

10.2 Areas in the building

No.	1st Floor
1	General Purpose Lab 1
2	General Purpose Lab 2
3	Hybrid Classroom
4	Student Lounge
	2nd Floor
5	Cisco Lab

6	Embedded Lab
7	Video Conferencing Room
8	Storage

10.3 Range of IP addresses allocated for devices based on the area

1. **General Purpose Lab 1**

Device	**IP Address**
Access Point 1	192.18.0.1
PC (30)	192.18.0.2 - 192.18.0.31

2. **General Purpose Lab 2**

Device	**IP Address**
Access Point 2	192.18.1.1
PC (30)	192.18.1.2 - 192.18.1.31

3. **Hybrid Classroom**

Device	**IP Address**
Access Point 3	192.18.2.1
PC (19)	192.18.2.1 - 192.18.2.20

4. **Student Lounge**

Device	**IP Address**
Access Point 4	192.18.3.1
Access Point 5	192.18.3.2

5. **Video Conferencing room + corridor**

Device	**IP Address**
Access Point 8	1192.18.4.1
Access Point 9	1192.18.4.2
PC (1)	1192.18.4.3

6. **Embedded Lab**

Device	**IP Address**
Access Point 7	192.18.5.1
PC (30)	192.18.5.2 - 192.18.5.31

7. **Cisco Lab**

Device	**IP Address**
Access Point 6	192.18.6.1
Cisco Server	192.18.6.2 - 192.18.6.7
PCs (30)	192.18.6.8 - 192.18.6.37

10.4 Task 5 - Reflection

In Task 5, we applied our knowledge of IP addressing and subnetting to develop an efficient and scalable IP scheme for the network. This task required us to utilize the assigned network address (192.18.0.0/8) and segment it effectively to accommodate various areas within the building. We prioritized minimizing IP address wastage while ensuring sufficient allocation for each segment.

The process involved calculating the required subnets and determining the appropriate subnet mask to divide the network logically. This included assigning unique IP address ranges to areas like labs, classrooms, and conference rooms. We also incorporated considerations for future scalability, ensuring the network could accommodate additional devices or users without requiring significant reconfiguration.

This task solidified our understanding of subnetting and its practical applications. It highlighted the importance of efficient IP address management in ensuring seamless communication across all devices. By successfully implementing the IP scheme, we demonstrated the ability to apply theoretical knowledge to solve real-world networking challenges.

11. Conclusion

In this project, we successfully planned and designed a robust network infrastructure for the new FC N28B building, addressing every aspect of the network's requirements. The project provided a comprehensive learning experience across various tasks, each contributing to the final outcome.

In **Task 1**, we focused on creating detailed floor plans for the building's two storeys, which required mastering design software and ensuring precision in measurements. This task enhanced our skills in visualizing and documenting physical layouts essential for network planning.

Task 2 involved conducting a thorough preliminary analysis, including identifying requirements and formulating key questions related to the network design. This step honed our critical thinking and problem-solving abilities, enabling us to align our design with the client’s needs while ensuring feasibility in technical, operational, and financial aspects.

In **Task 3**, we explored different brands and specifications of networking devices, comparing their features, costs, and scalability. This process sharpened our decision-making skills as we selected cutting-edge technology that balanced long-term reliability with budgetary constraints.

Through **Task 4**, we focused on the physical network setup, determining optimal device placements, cable management, and connections between floors. This task deepened our understanding of network components, their roles, and the importance of efficient physical layouts.

Task 5 centered on creating an IP addressing scheme and subnetting to ensure logical and efficient resource allocation across the building. This task solidified our expertise in practical IP management and highlighted the significance of scalability and efficient addressing for seamless device communication.

Overall, this project equipped us with valuable insights into network design, balancing theoretical knowledge with real-world application. By ensuring scalability, reliability, and efficiency, we designed a network infrastructure that meets current demands and can adapt to future growth, all while staying within budget. This experience has been instrumental in developing both our technical skills and our ability to address complex networking challenge

11.1 Team responsibilities

Our team had three awesome members, each of us bringing something special to the table for our network design project. Here's a quick breakdown of what each of us did

Mathaba Hassan Mohamed Hassan

Mathaba was in charge of designing Floor 2 and making sure everything was set up to be scalable and functional. She handled the technical parts like figuring out the bandwidth and where to place the access points. She also did a lot of research on routers, patch panels, cables, and server racks, making sure everything would work together. Mathaba was also the one who planned out the patch panel setup and did the final review to make sure everything fit together perfectly.

Anjum Siddiqua Tanveer Siddiqui

Anjum worked on the building layout, sketching out the rough design and making sure the rooms were placed in the best way for the network. She also did a lot of research on important network stuff like security, ISP considerations, and devices like switches, access points, and video conferencing equipment. Anjum also helped with subnetting and IP addressing, making sure our network had a clear and organized addressing scheme.

Rami Yassein Eltayeb

Rami suggested using Floorplanner to design the initial layout and worked on Floor 1's design. He also made a list of important questions for Task 2 and picked the most important ones. Rami did research on network devices like computers for the labs and Cisco servers, making sure everything was within budget. He also helped design the network topology and IP addressing for his areas and put together the final report, making sure everything was clear and professional.

It was a great team effort and everyone contributed in their own way to make sure the project was a success.

11.2 References

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11.3 Appendix

11.3.1 Financial budget

Purchased Devices and Costs

Type of Device	Quantity	Price/Unit (RM)	Total (RM)
Cisco Catalyst C9500-40X Layer 3 Switch (C9500-40X-A)	1	12,021	12,021
Juniper EX4100-F Ethernet Switch	25	17,000	425,000
Cisco ISR4451-X/K9 Router	1	34,250	34,250
Juniper AP45 Access Point	9	6,400	57,600
Lysymixs 48 Port RJ45 Patch Panel Cat6	5	325	1,625
Cat6 28AWG Snagless Unshielded Ethernet Network Patch Cable	122	18	2,196

30M OM3 LC to LC Fiber Patch Cable	8	83	664
Owl Labs Video Conferencing Bar	1	13,000	13,000
Huawei IdeaHub S2 Interactive Display (86")	1	40,000	40,000
HP ProOne 440 G9 All-in-One PC	122	4,575	558,150
NVIDIA Jetson Xavier NX Developer Kit	30	2,550	76,500
PowerEdge R760 Rack Server	1	95,508	95,508
StarTech 12U Wall-Mount Server Rack Cabinet	7	3,532	24,724
RS PRO 12 Port Single Mode Duplex Fibre Optic Patch Panel	6	348	2,088
Tripp Lite SR42UB SmartRack Rack Enclosure Server Cabinet	1	6,901	6,901

Total Amount Spent on Devices: 1,282,227 RM (Purchased)

Our total budget is 2.2 Million Ringgit Malaysia (RM) and we spent 1,282,227 RM on purchasing devices for the new N28B building and we are planning to allocate around 910,000 RM for the maintenance and software subscription for the next 5 years. Summing up everything the total cost is 2,192,227 RM including the devices and maintenance cost and we

still have about 1,92,227 RM left and it can be used for any unseen mishaps that might occur during the development of this building.

11.3.2 Meeting Minutes

Meeting minutes Task 1

DATE/TIME :		11th October 7:30 pm MYT	
LOCATION		Virtual in Google meet	
AGENDA		TASK 1	
Meeting MC		ANJUM SIDDIQUA TANVEER SIDDIQUI	
ATTENDANCE			
NAME	**TIME**		**REASON FOR ABSENCE**
Rami	7:37		
Anjum	7:30		
Mathaba	7:37		
MINUTES			
NO	**ITEM DISCUSSED**	**IDEAS/SUGGESTIONS AND PERSON GIVING IT**	**PERSON IN CHARGE & DATE**
1	Software tool to use for drawing	Rami Suggested to use Figma , canva , floor planner or smartdraw.io . ended up choosing floorplanner	Rami (11/10)

2	Rough Ideas for the floor plan	-Anjum suggested that the building should have the 2 general labs next to each other for future better network connection along with student lounge being in the first storey and the hybrid class , she also sketch an idea of how the design should look like	Anjum(11/10)
3	dividing work	- Mathaba suggested how the work should be divided . one person do the sketching and the other designing one storey each - Ended up settling with Anjum sketching a prototype , rami and mathaba designing each floor	Mathaba(11/10)

Meeting minutes Task 2:

DATE/TIME	26th October 10:20 pm MYT
LOCATION	Virtual in Google meet
AGENDA	TASK 2

Meeting MC		MATHABA HASSAN MOHAMED HASSAN	
ATTENDANCE			
NAME	**TIME**		**REASON FOR ABSENCE**
Rami	10:20		
Anjum	10:22		
Mathaba	10:23		
MINUTES			
NO	**ITEM DISCUSSED**	**IDEAS/SUGGESTIONS AND PERSON GIVING IT**	**PERSON IN CHARGE & DATE**
1	The type of questions required for the preliminary analysis and feasibility.	Rami discussed the type of questions to be used for the interview and filtered out irrelevant topics. Rami suggested we get a rough idea about the network devices to be included before doing the feasibility.	Ram(26/10)
2	Rough ideas for suitable questions and their answers	- Anjum and Mathaba gave ideas for some topics to be considered when generating the questions. - Anjum suggested we focus on the security part of things, while Mathaba suggested we	Anjum(26/10) Mathaba(26/10)

		focus on the connectivity and bandwidth to be used. - Overall both were important, so we decided to include both.	
3	Dividing work	- Rami suggested how the work should be divided. - Ended up settling with Anjum and Mathaba generating suitable questions and then dividing the questions between all members to research and discuss suitable answers, the feasibility done by Anjum and compiling done by Rami.	Rami(26/10)

Meeting Minutes Task 3:

DATE/TIME	16th November 9:30 pm MYT
LOCATION	Virtual in Google meet
AGENDA	TASK 3
Meeting MC	MATHABA HASSAN MOHAMED HASSAN
ATTENDANCE	

NAME	**TIME**		**REASON FOR ABSENCE**
Rami	9:30		
Anjum	9:34		
Mathaba	9:32		
MINUTES			
NO	**ITEM DISCUSSED**	**IDEAS/SUGGESTIONS AND PERSON GIVING IT**	**PERSON IN CHARGE & DATE**
1	The objective of task 3 and the devices required to be included	Mathaba explained the objective of task 3 and ended up concluding that the research will include all the networking devices required for our network, with additional devices in case our budget allows it.	Mathaba(16/11)
2	Budget discussion and example networks	Anjum discussed some example networks she researched and discussed the approximate expected budget for the devices.	Anjum(16/11)
3	Task division and teamwork strategy	Rami suggested that we start researching the fundamental devices for a network first like routers, switches and cables, divide them between us and implement add-as-we go strategy, by adding any necessary devices	Rami(16/11)

		we need along the way and dividing the work between us as we go, and decided to all write the reflection after discussing and seeing each devices price and quantity, ended up with: - Rami researching the Computer hardware for the labs, embedded lab kit and cisco lab server. - Anjum researching the switch for the lab, access points, and video conferencing bar. - Mathaba researching the router, cables and patch panel. - Reflection: discussed and done by the whole team	

Meeting Minutes Task 4

DATE/TIME	15th December 2:00 pm MYT
LOCATION	Virtual in Google meet
AGENDA	TASK 4
Meeting MC	Rami Yassein Eltayeb
ATTENDANCE	

NAME	TIME		REASON FOR ABSENCE
Rami	1:50		
Anjum	2:14		
Mathaba	2:00		
MINUTES			
NO	**ITEM DISCUSSED**	**IDEAS/SUGGESTIONS AND PERSON GIVING IT**	**PERSON IN CHARGE & DATE**
1	The requirements that need to be implemented in task 4	Rami : expressed different ideas on the layout of the report and how to get the requirements that is needed for task 4 , like the wire lengths and number of access points etc	Rami(15/12)
2	Discussion about the location of different devices	Gave a detailed plan regarding where to put each device and how to connect the cable . and suggested the software used to show this	Mathaba(15/12)
3	Task division and teamwork strategy	Mathaba suggested that we use our old design for floor plan and add the cable lengths and devices sketch on top of it , Rami suggested on how to divide the work: - Rami draw the work area and show topology - Mathaba design	Anjum(15/12)

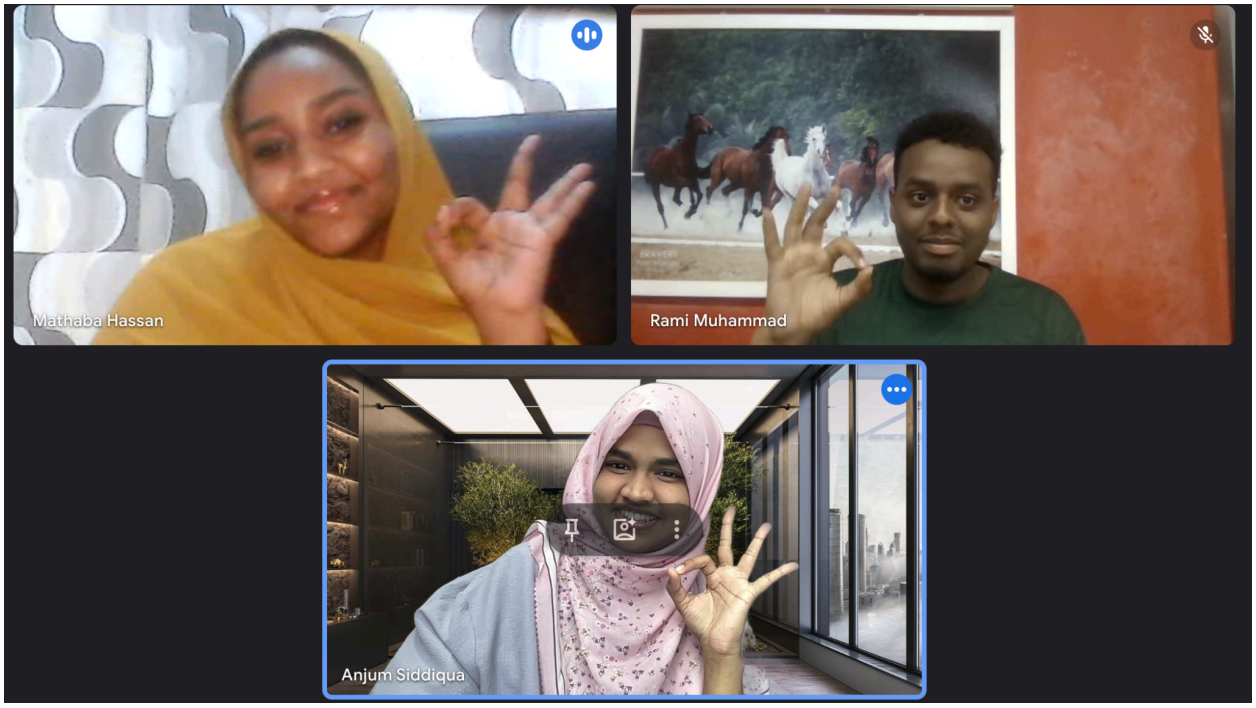
		and show the cabling and devices in floor 1 - Anjum design and show the cabling and devices in floor 2	

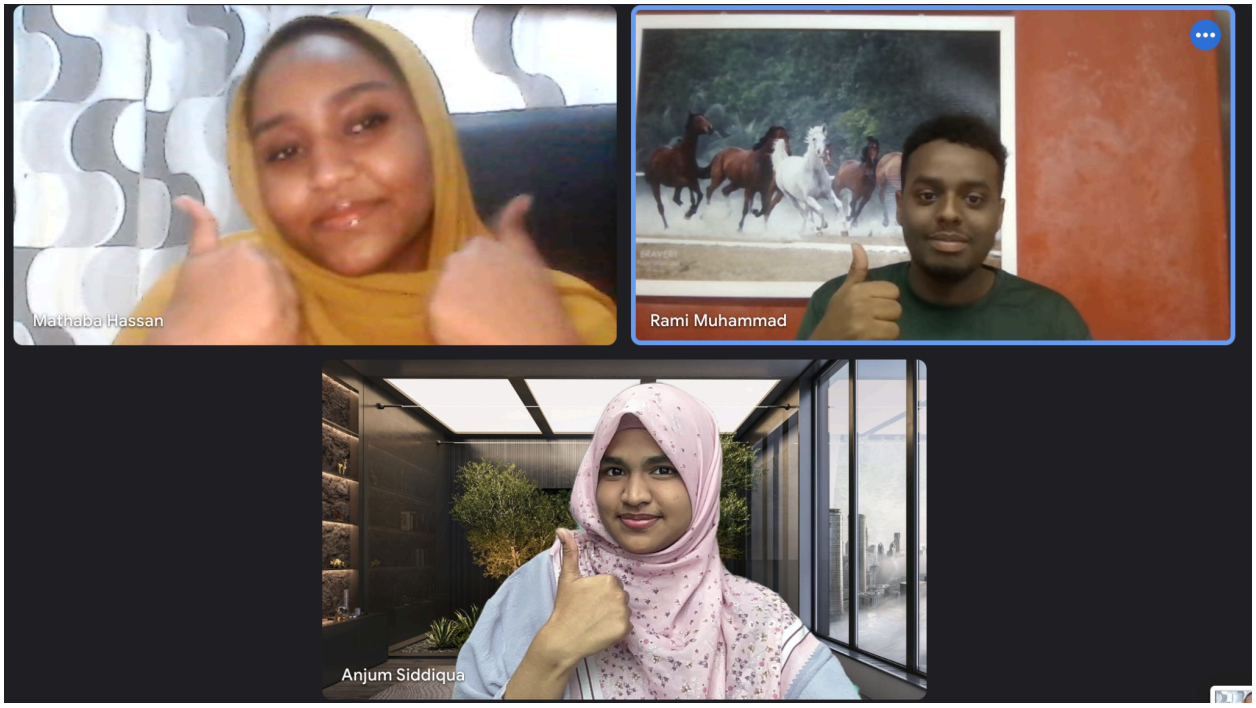
Meeting minutes Task 5

DATE/TIME	20th December 11:30 pm MYT		
LOCATION	Virtual in Google meet		
AGENDA	TASK 5		
Meeting MC	ANJUM SIDDIQUA TANVEER SIDDIQUI		
ATTENDANCE			
NAME	**TIME**		**REASON FOR ABSENCE**
Rami	11:32		
Anjum	11:30		
Mathaba	11:35		
MINUTES			
NO	**ITEM DISCUSSED**	**IDEAS/SUGGESTIONS AND PERSON GIVING IT**	**PERSON IN CHARGE & DATE**
1	The objective of task 5	Anjum explained the objective of task 5 and the deliverables that should be	Anjum (20/12)

		included in the report	
2	Subnet division	Then the discussion continued about the subnet division. Anjum suggested that the subnet to be divided into 8. Mathaba agreed and explained that since we have 8 different areas it is logical to divide like that. Rami continued that since our Network address is /8 . we borrow 3 bits from the 24 bit host portion	Mathaba (20/12)
3	Task division	Mathaba suggested that we divide the work according to work areas. Anjum further added that we also show the main calculation before proceeding with IP Addressing for each area. Rami wrote down the areas to be focused and also added each and every deliverable in a detailed manner in the report. - Anjum : General purpose lab 1 & 2 , Hybrid classroom - Rami : Embedded lab , video conferencing room , student lounge - Mathaba : Cisco lab, Corridor, storages	Rami (20/12)

11.3.3 Team Photo





11.3.4 Sketch for layout