



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF COMPUTING
UTM Johor Bahru

SECR1213-05

NETWORK COMMUNICATIONS

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TASK 4 | SURVIVOR

Lecturer:

MUHAMMAD ZAFRAN BIN MUHAMMAD ZALY SHAH

Group 02 Members:

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BRIEF EXPLANATION OF THE TASK

Task 4 focuses on transitioning our logical design into a physical reality by strategically placing hardware and establishing the cabling infrastructure. This phase addresses real world constraints such as switch placement and workstation layout to ensure a manageable, 4IR-ready network. By planning the layout now, we ensure the network meets performance requirements while supporting future scalability.

We organize the network into four key physical zones, which are the **work area**, **telecommunications room (MDF)**, **backbone (vertical) cabling**, and **horizontal cabling**. This structured approach ensures a professional connection between the 120 workstations, their respective access switches, and the central core backbone. Vertical cabling connects the building's two floors, while horizontal cabling links individual devices to the local network hub.

Finally, we determine precise media requirements by measuring cable runs from the MDF, accounting for vertical wall climbs and corner routing. Selecting Fiber Optics for high-speed backbones and Cat6 for horizontal runs allows us to achieve the necessary 10Gbps speeds for 4IR applications. These accurate measurements are vital to ensuring the project remains within the assigned **RM 0.9 Million** budget.

CONNECTIVITY LOGIC

Overview

For this network design, we have implemented a **Hierarchical Star Topology** utilizing a collapsed core architecture. We organize devices into a logical tree structure consisting of two main layers, which are the **Core Layer** and the **Access Layer**.

The topology is physically distributed across two floors (Ground Floor and Level 1). The design centers around a high-availability Core Switch stack on Level 1, which acts as the central backbone connecting the Internet Gateway (Firewall), local servers, and the Access Switches located in various labs and rooms to ensure efficient traffic management.

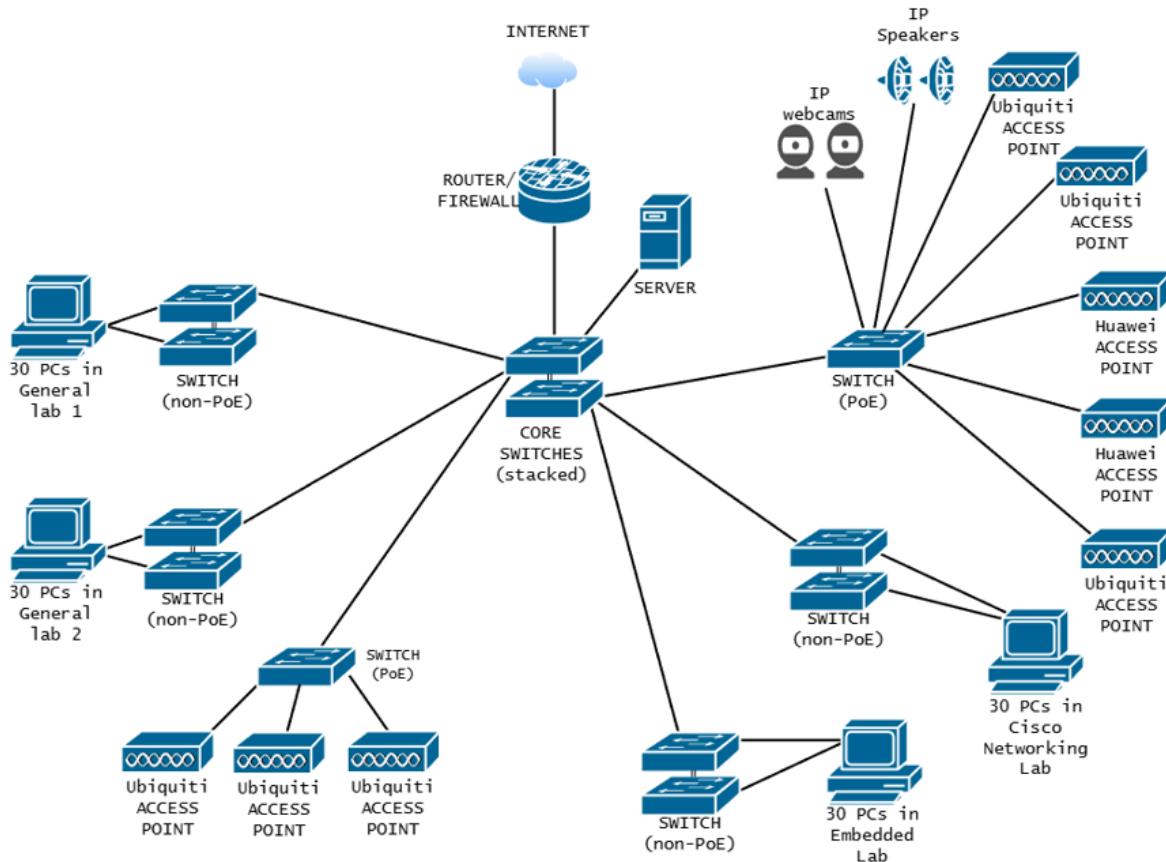


Figure 1.0 N28B Network topology

Connectivity Breakdown

A. Core Layer: Huawei S6730 Traffic Handling

The heart of the network consists of two Huawei S6730-H switches configured in a stack. This Core Layer performs several critical functions:

- **Inter-VLAN Routing:** Instead of sending internal traffic all the way to a router, the Huawei Core switches perform Layer 3 switching. They route traffic locally between different labs at wire speed to minimize latency.
 - **Traffic Aggregation:** All uplinks from the Access Switches (Cisco C9200L) terminate here. The Core aggregates data from the heavy-traffic labs and classrooms on Level 1 efficiently towards the servers or the internet.
 - **Redundancy:** By stacking two units of the core switch, if one physical Core switch fails, the other immediately takes over traffic forwarding to ensure zero downtime for the building.

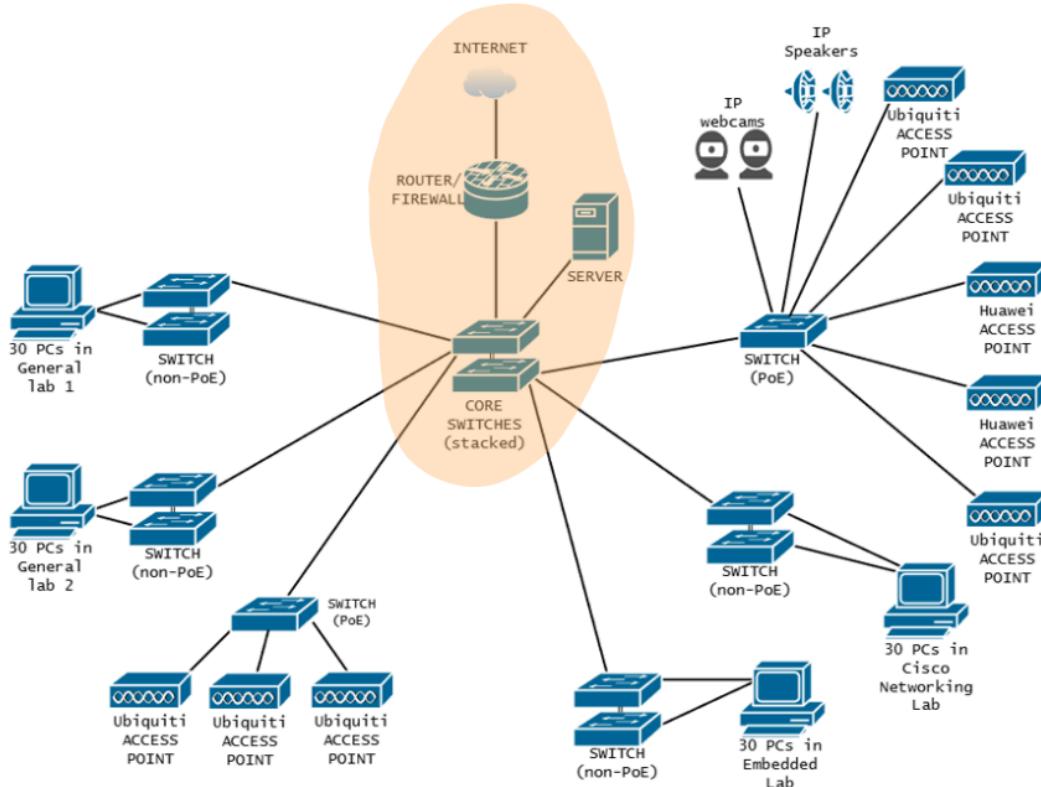


Figure 1.1 Connectivity Breakdown (Core Layer)

B. Access Layer: Cisco C9200L End-User Connection

The Access Layer is built using Cisco Catalyst 9200L switches, which serve as the direct connection point for end devices. We have categorized these connections based on power requirements:

- **Data Connectivity (Non-PoE):** Standard workstations, such as the 30 PCs in the General Labs and the Network Lab, connect to the Non-PoE switch stacks. These switches provide Gigabit Ethernet connectivity for high-speed data transfer during lab exercises.
- **Power over Ethernet (PoE):** Wireless Access Points (Ubiquiti/Huawei) and IP Phones connect exclusively to the designated PoE Switches on each floor. This ensures these devices receive both data and electrical power through a single Ethernet cable, eliminating the need for separate power adapters in the ceiling or on desks.

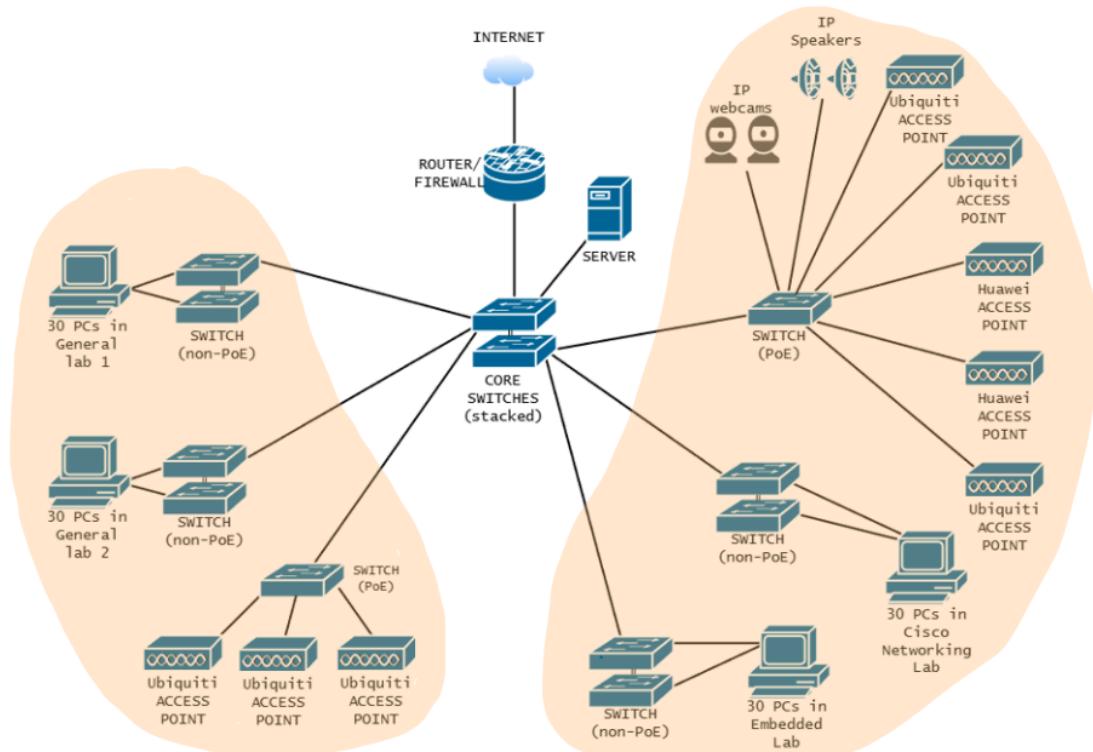


Figure 1.2 Connectivity Breakdown (Access Layer)

C. Security Perimeter: Fortinet Firewall Connection

The network entrance is guarded by a FortiGate 80F Next-Generation Firewall (NGFW).

- **The Gateway Link:** The Firewall connects directly to the Huawei Core Switch via a secure uplink. It is the only path in and out of the network to the ISP (Internet).
- **Security Enforcement:** Before any traffic from the labs reaches the internet (or vice versa), it must pass through the FortiGate. The firewall performs Network Address Translation (NAT) and Deep Packet Inspection (DPI) to block malicious external threats and prevent students from accessing restricted external sites.

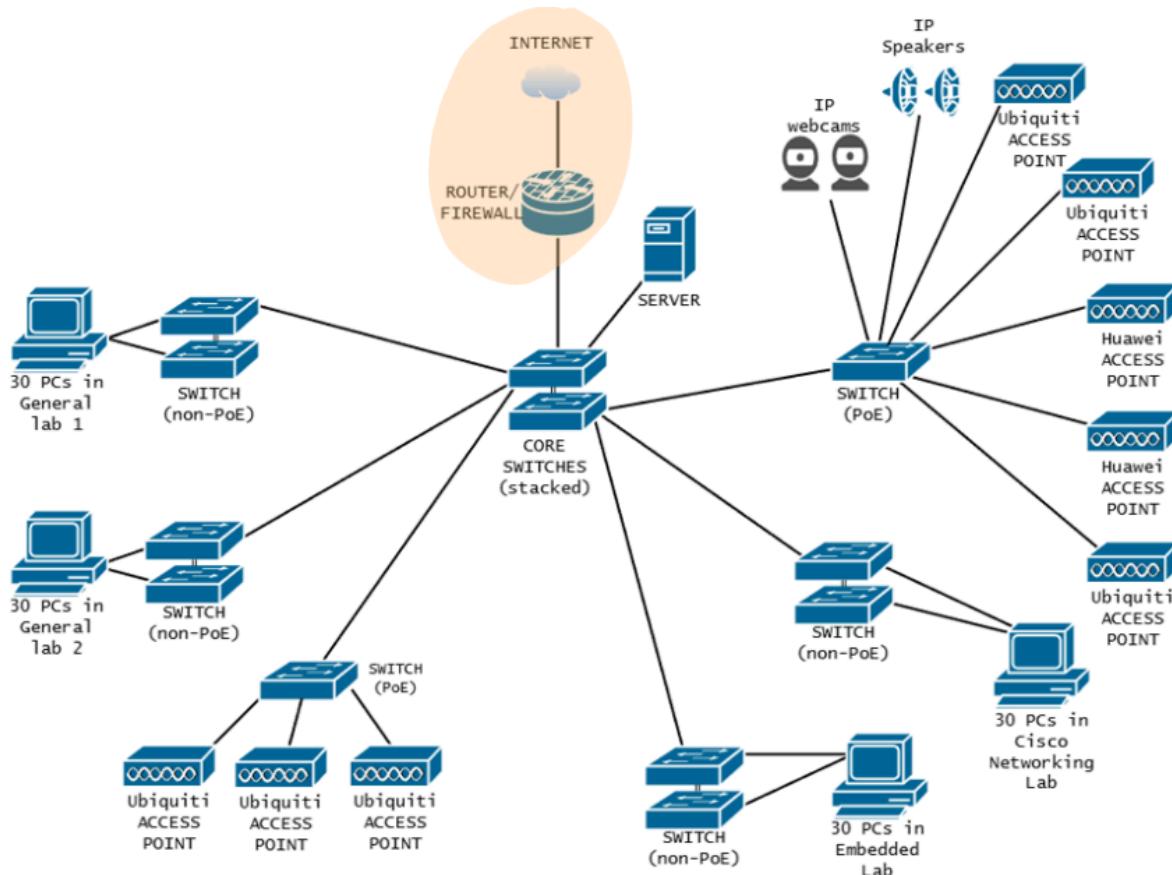


Figure 1.3 Connectivity Breakdown (Security Perimeter)

D. Physical Placement

The physical infrastructure is organized into two primary zones: the Ground Floor and Level 1, interconnected by a vertical fiber backbone running through the building's secure riser. The network design centers around the Main Distribution Facility (MDF) located in the Level 1 Cisco Networking Lab , which houses the high-availability Core Switch stack and the Fortinet security gateway.

On the Ground Floor, we utilize a distributed approach where Access Switches are placed inside the labs themselves (General Purpose Labs 1 & 2) rather than in a separate utility room. This layout allows for shorter Cat6 cable runs to the 120 workstations , ensuring all connections remain well within standard Ethernet distance limitations while connecting back to the Level 1 core via high-speed vertical fiber optics.

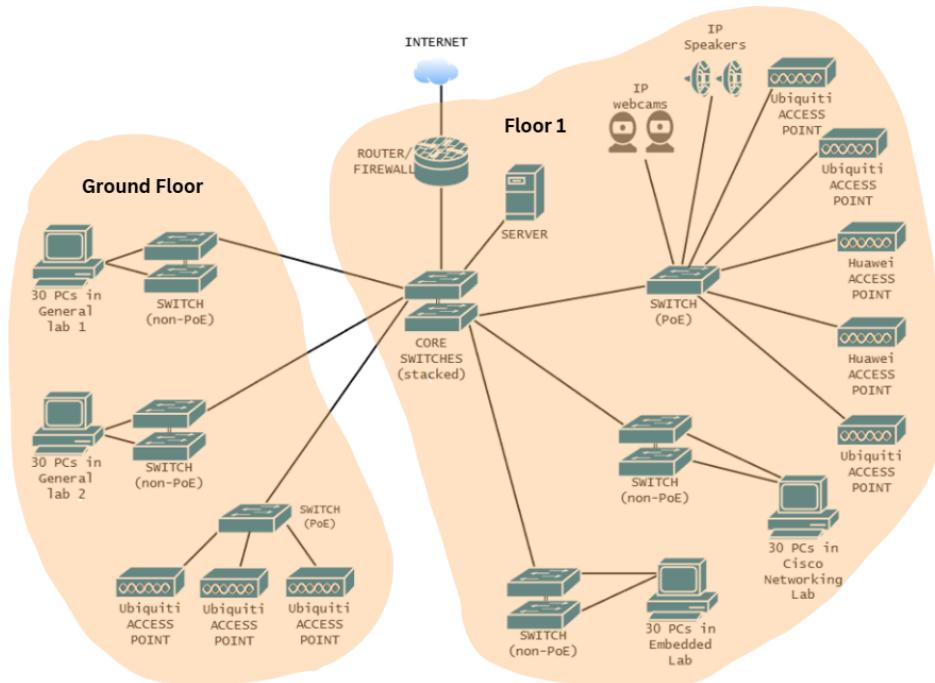


Figure 1.4 Connectivity Breakdown (Physical Placement 1)

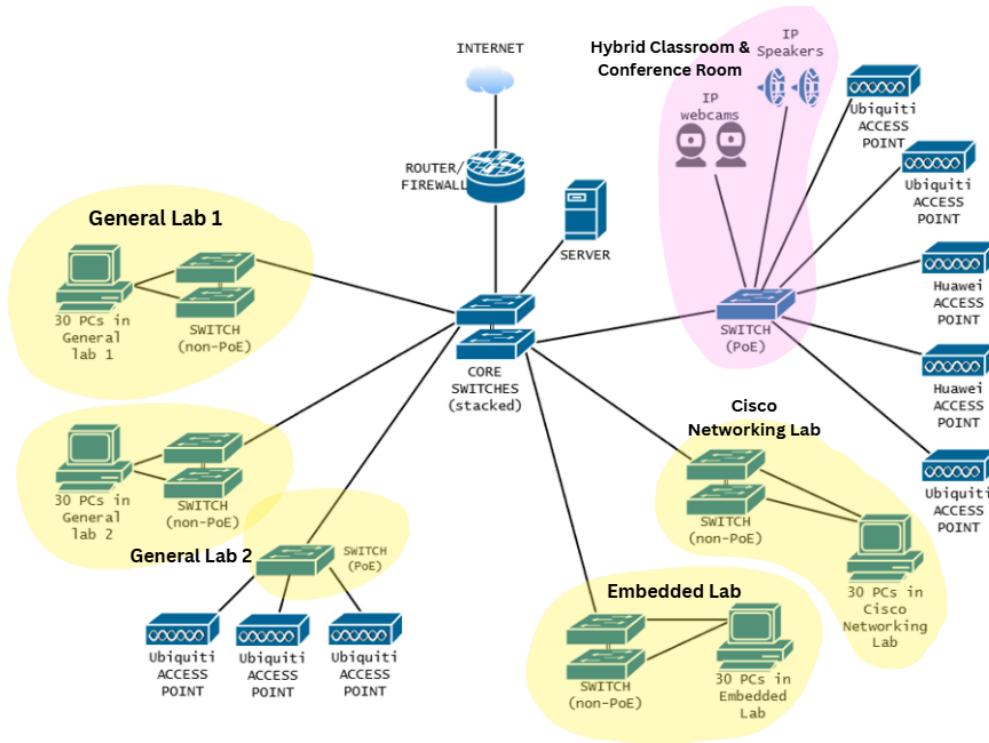


Figure 1.5 Connectivity Breakdown (Physical Placement 1)

E. Logical Segmentation: VLAN Strategy

To optimize performance and security, the network is logically divided into Virtual Local Area Networks (VLANs).

- **Broadcast Domain Reduction:** Each distinct room or function (e.g., General Lab 1, Cisco Network Lab, Staff Office) is assigned its own unique VLAN ID and subnet.
- **Traffic Isolation:** This ensures that broadcast traffic, such as a PC searching for a connection, is contained within a specific lab. For example, a broadcast storm caused by a student error in the Embedded Lab will not slow down other networks. This is crucial for maintaining network stability in a high-density student environment.

Transmission media (Cabling Standards)

To support high-speed data transfer and future scalability, two distinct cabling standards were implemented:

- **Vertical Cabling (Backbone):** We implement OM4 Multi-Mode Fiber Optic cables to connect the Floor 1 Huawei Core Switch to the Cisco Access Switches on the Ground Floor. Fiber was chosen for this riser link because it is immune to electromagnetic interference (EMI) and supports 10Gbps speeds over the distance between floors, which can reduce possible bottlenecks.
- **Horizontal Cabling:** For connections between the Access Switches and end devices (Workstations, WAPs), we are utilizing the CommScope CS30CM Category 6 (Cat6) U/UTP cable.

Wireless connectivity (SSIDs)

Although the Access Points are physically connected to the PoE switches, the wireless network is logically divided into specific Service Set Identifiers (SSIDs) to maintain security:

- "**Campus_Student**": Broadcasted by the Ubiquiti APs in the labs and lounge. This network provides internet access but is isolated from the secure Staff VLANs to prevent unauthorized access to sensitive exam data or admin files.
- "**Campus_Staff_Secure**": Broadcasted by the Huawei AirEngines in the offices. This hidden or encrypted network provides full access to internal servers and printers, strictly authenticated via WPA3-Enterprise to ensure only authorized personnel can connect.

WORK AREA MAPPING

Horizontal cabling

Connects the wiring closets (Access Switches) to end user wall outlets (PCs, WAPs) on the same floor. We use CommScope CS30CM Cat6 copper cabling routed through ceiling trays. Strict adherence to the 90-meter limit is enforced for every run to guarantee stable 1 Gbps Gigabit Ethernet performance.

Vertical cabling (backbone)

Connecting the Main Distribution Facility (MDF) on Level 1 to the Ground Floor cabinets. To ensure that we achieve the 4th goal of the new system which is “Capability to support high-performance to the core backbone”, we use OM4 Multi-Mode Fiber Optic cabling running through the secure building riser, it is chosen for its 10 Gbps capacity and immunity to electromagnetic interference between floors.

Floor Plan

Legends:

Label	Description
	Wireless Access Point (Ubiquiti)
	Wireless Access Point (Huawei)
	Switch (PoE)
	Switch (Non-PoE)
	Server
	Core Switch
	Cable Entrance
	Firewall / Router
	Cable (Fiber)
	Cable (Copper, Non-WAP)
	Cable (Copper, WAP)

Table 1.0 Legends

Ground Floor:

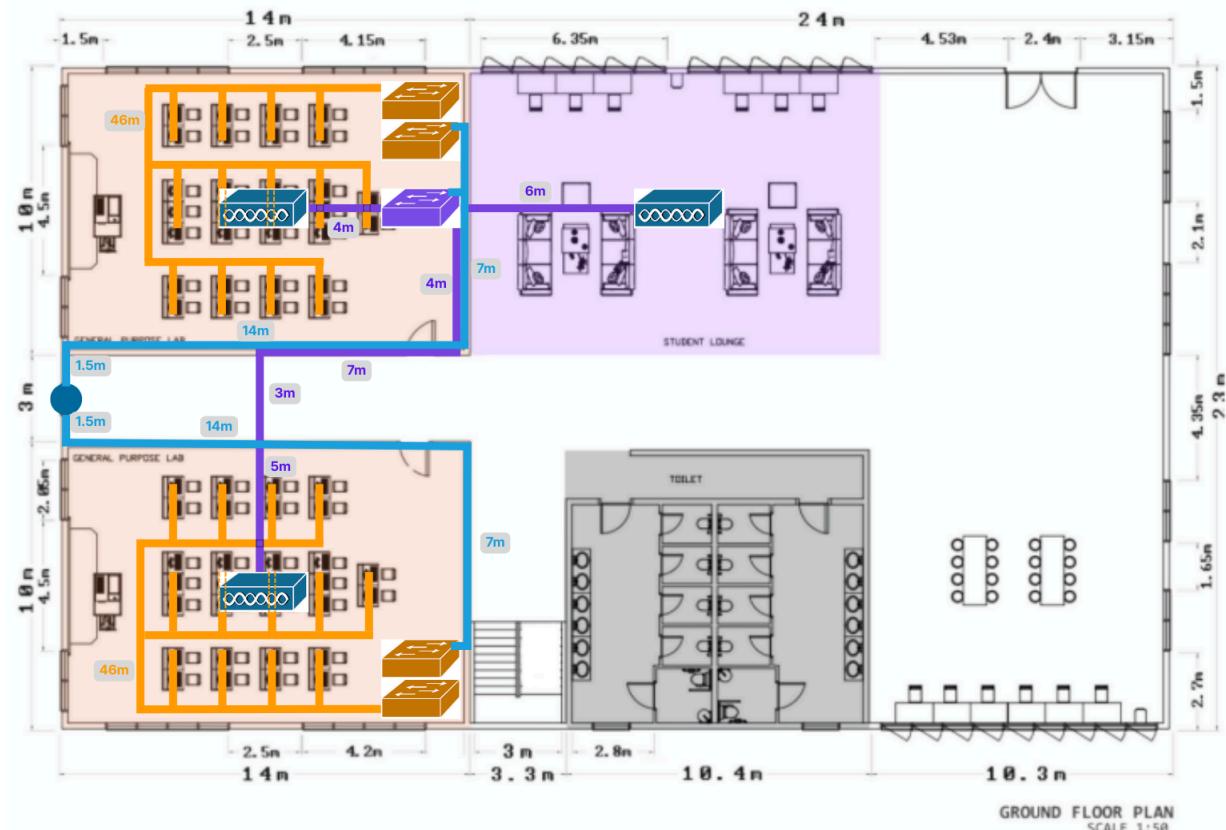


Figure 2.1 Ground Floor layout

A. Room by room device placement (Ground Floor)

1. **General Purpose Lab 1:**
 - **Cabinet:** 6U Wall Mount Rack.
 - **Switches:** 2x Cisco C9200L (Non-PoE) for the 30+ PCs.
 - **WAP:** 1x Ubiquiti UniFi 6 Enterprise (Ceiling Center).
 - **Cabling:** Fiber uplink goes from this cabinet UP to the Level 1 MDF.
2. **General Purpose Lab 2:**
 - **Cabinet:** 6U Wall Mount Rack.
 - **Switches:** 2x Cisco C9200L (Non-PoE).
 - **WAP:** 1x Ubiquiti UniFi 6 Enterprise (Ceiling Center).
3. **Student Lounge:**
 - **Devices:** 1x Ubiquiti UniFi 6 Enterprise (Ceiling Center).
 - **Connection:** Uses a Cat6 cable running through the ceiling to the **Ground Floor PoE Switch** (located in General Lab 1 or Utility Closet).

Floor Plan Level 1:

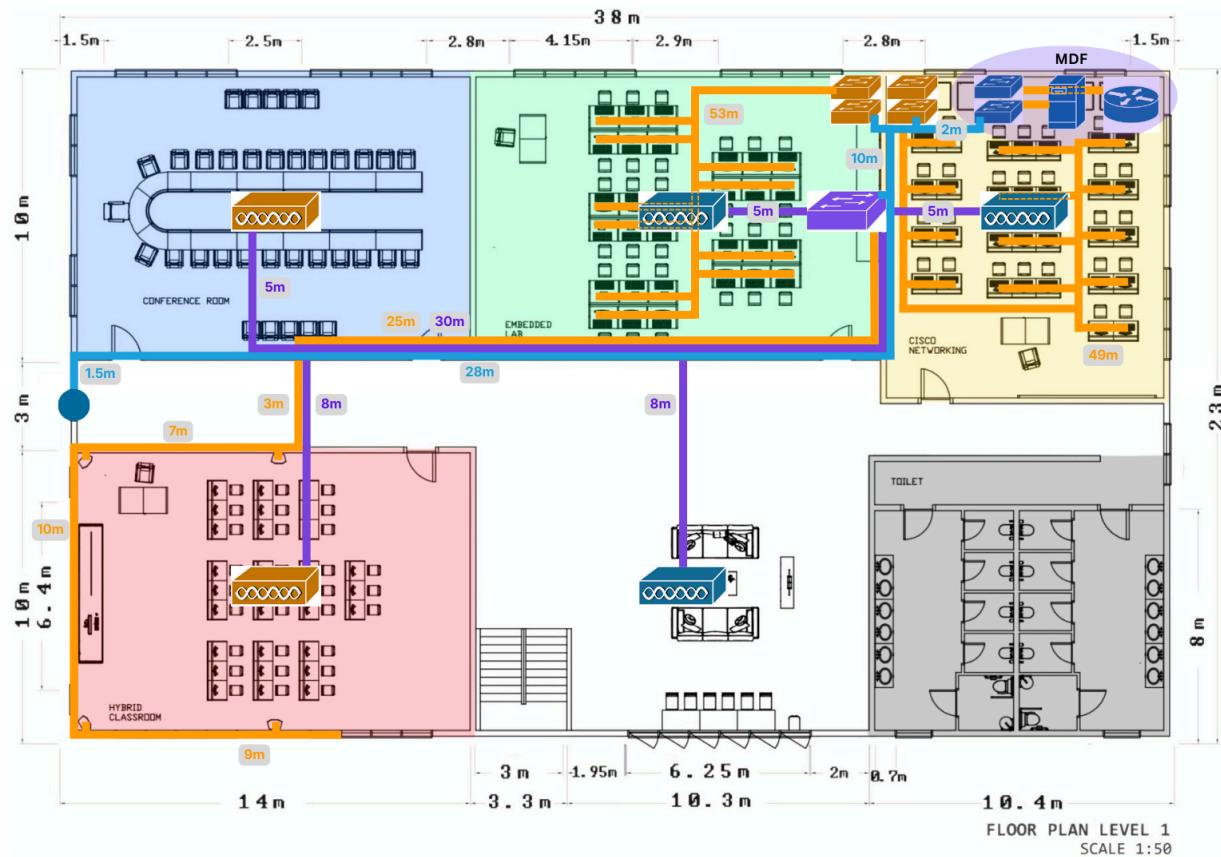


Figure 2.2 Level 1 layout

A. The MDF area

Since the Core Switch is here, this is the most critical area. We have designated a secure, partitioned area at the back of the Cisco Lab to serve as the Main Distribution Facility (MDF).

B. Room by room device placement (Level 1)

Since we are using a Distributed Switching Model (placing switches inside the labs), each room will have a small 6U Wall-Mounted Cabinet to house its specific equipment.

1. Cisco Networking Lab (Contains MDF):

- **Cabinet:** The main MDF Rack.
- **Switches:** 2x Cisco C9200L (Non-PoE) for student PCs.
- **WAP:** 1x Ubiquiti UniFi 6 Enterprise (Ceiling Center).

2. Embedded Lab:

- **Cabinet:** 6U Wall Mount Rack.
- **Switches:** 2x Cisco C9200L (Non-PoE) connected via Fiber/Copper uplink to MDF.
- **WAP:** 1x Ubiquiti UniFi 6 Enterprise (Ceiling Center).

3. Hybrid Classroom:

- **Devices:** This room likely uses Wi-Fi and instructor PCs. It connects back to the nearest switch stack (likely Embedded or Cisco Lab) to save ports, or has its own small switch if port count requires it.

4. Conference Room:

- **Devices:** 1x Huawei AirEngine WAP (Ceiling) for staff/admin meetings.
- **Connection:** Cabling runs through the ceiling tray back to the PoE Switch.

DEVICE ARRANGEMENT

Ground Floor

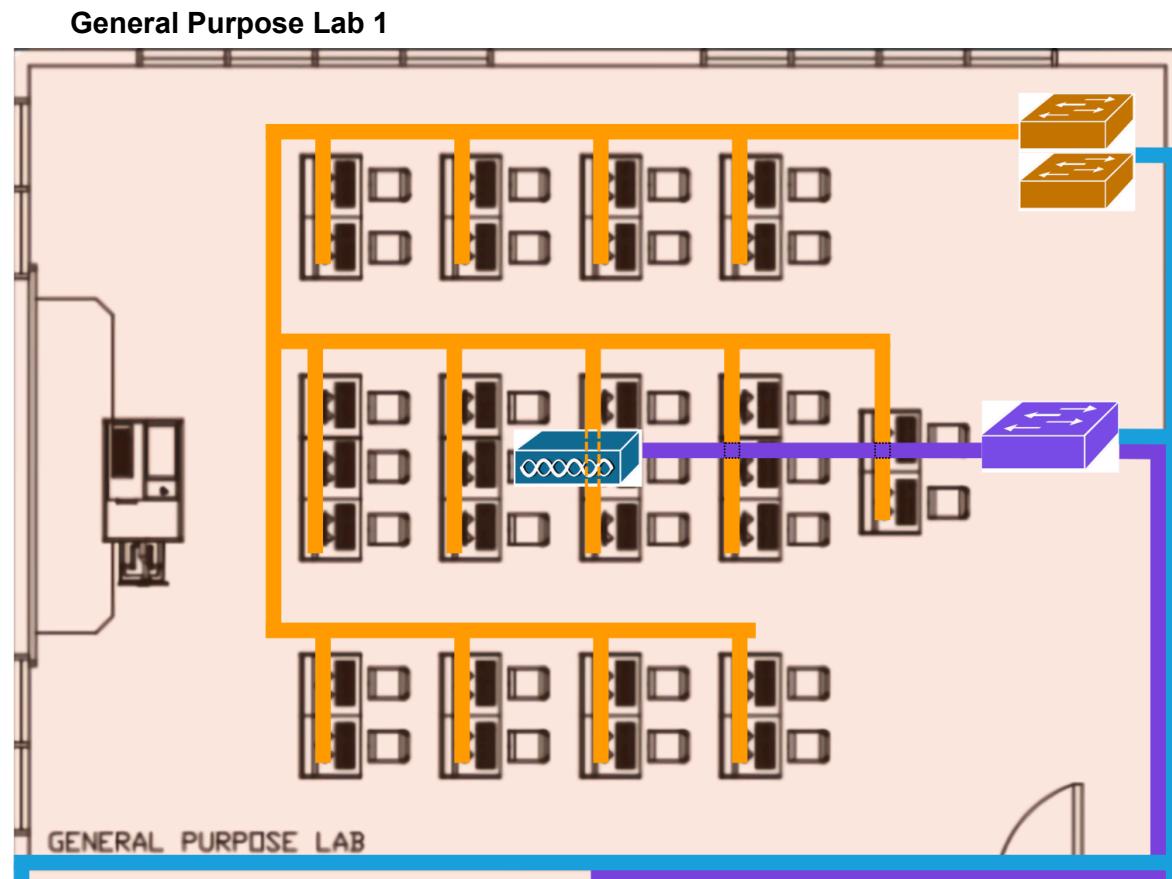


Figure 3.1 General Purpose Lab 1 layout

General Purpose Lab 2

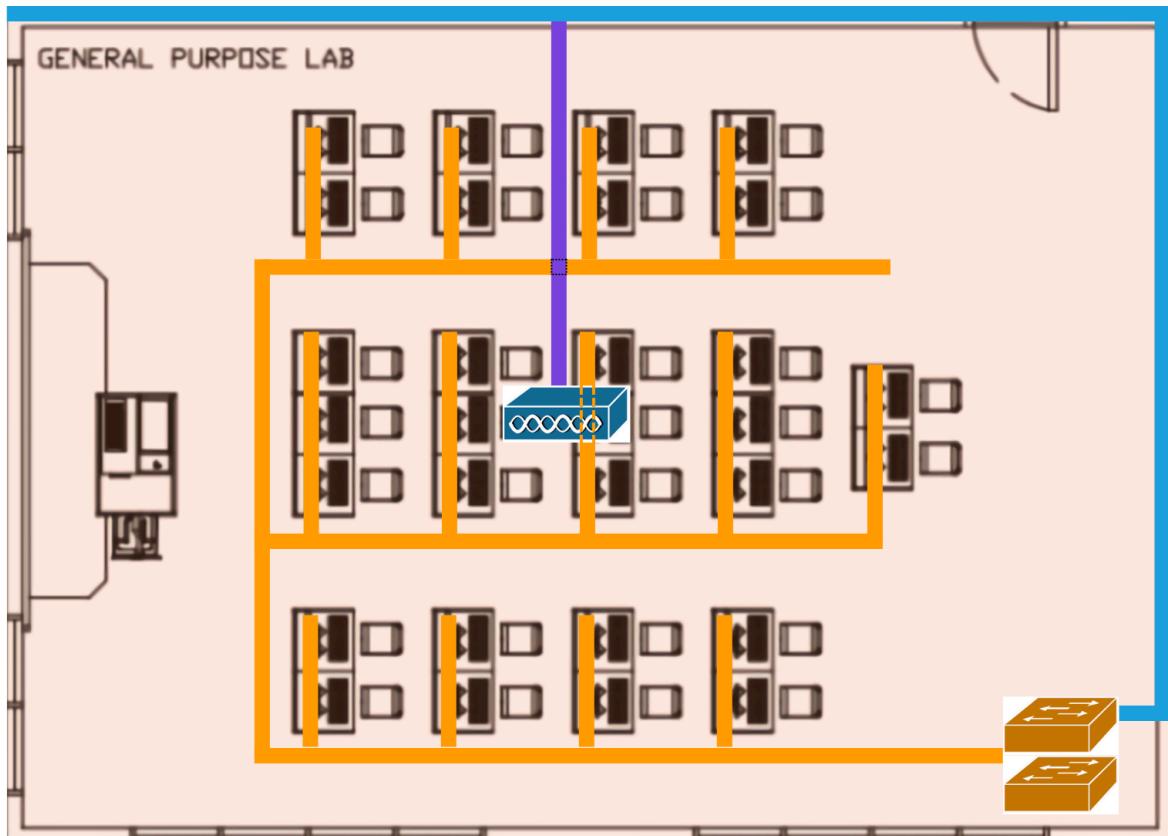


Figure 3.2 General Purpose Lab 2

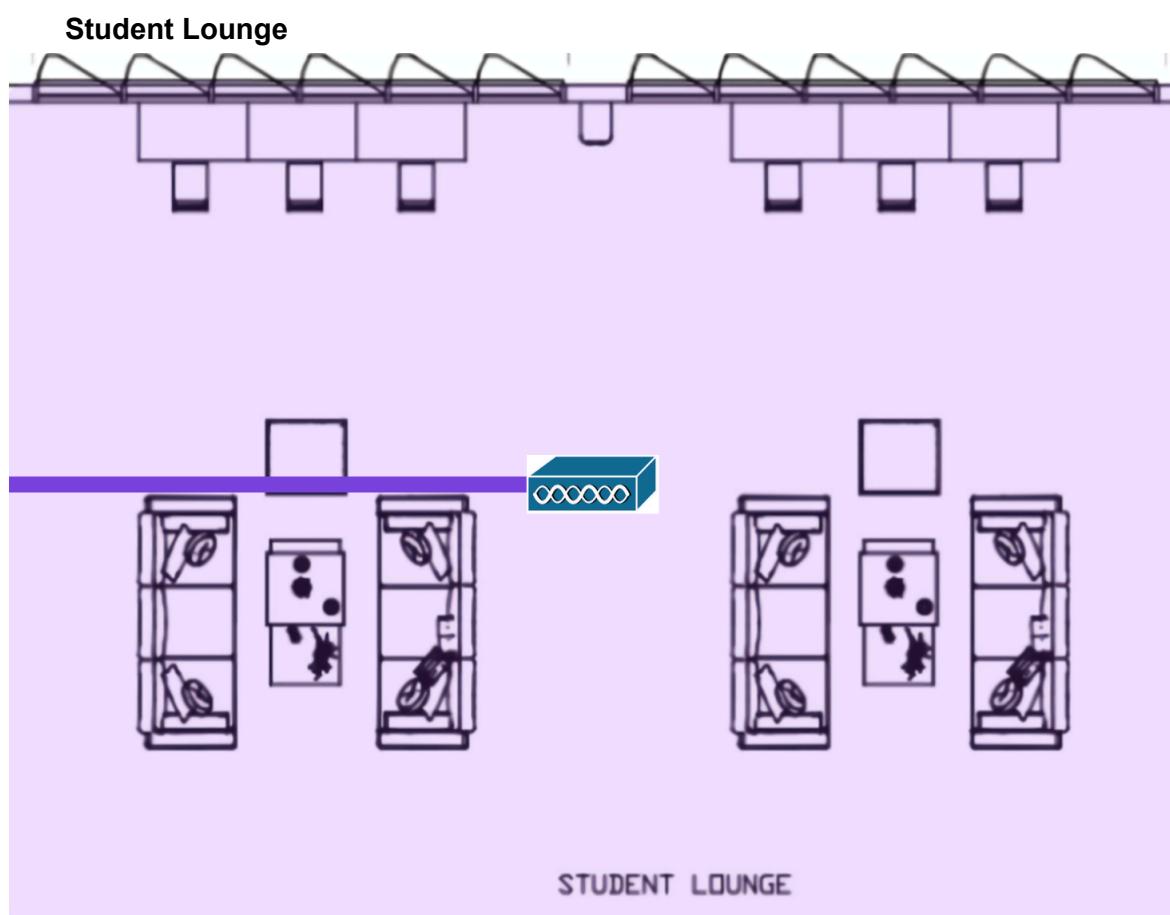


Figure 3.3 Student Lounge

Level 1

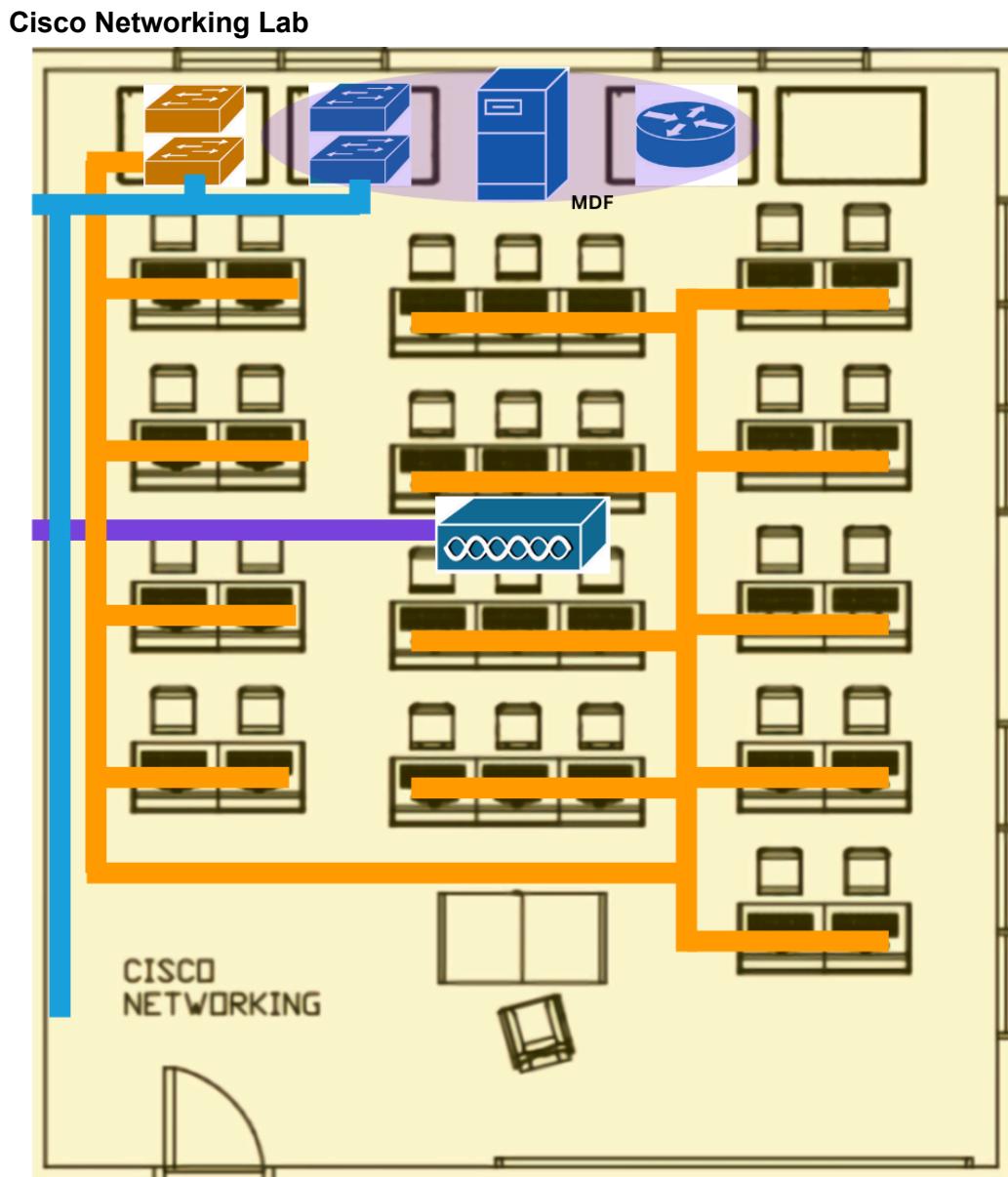


Figure 3.4 Cisco Networking Lab layout

Conference Room

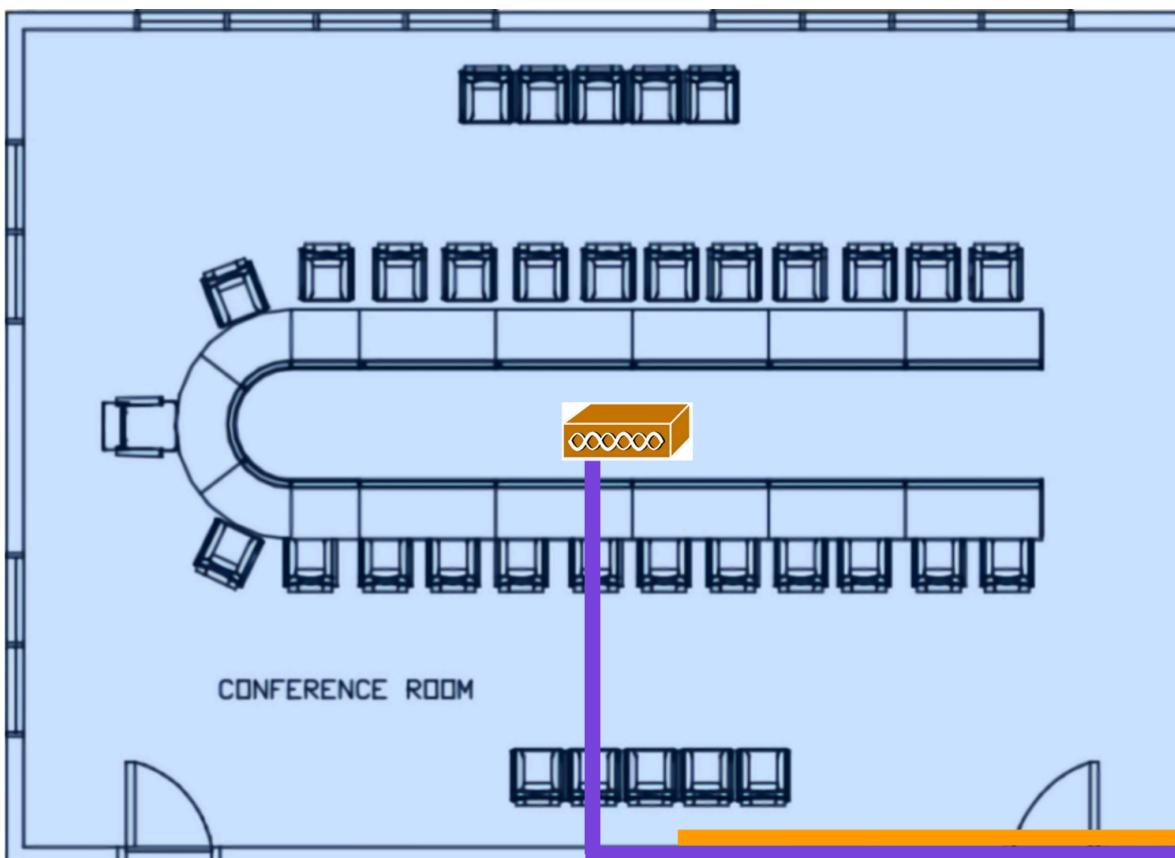


Figure 3.5 Conference Room layout

Embedded Lab

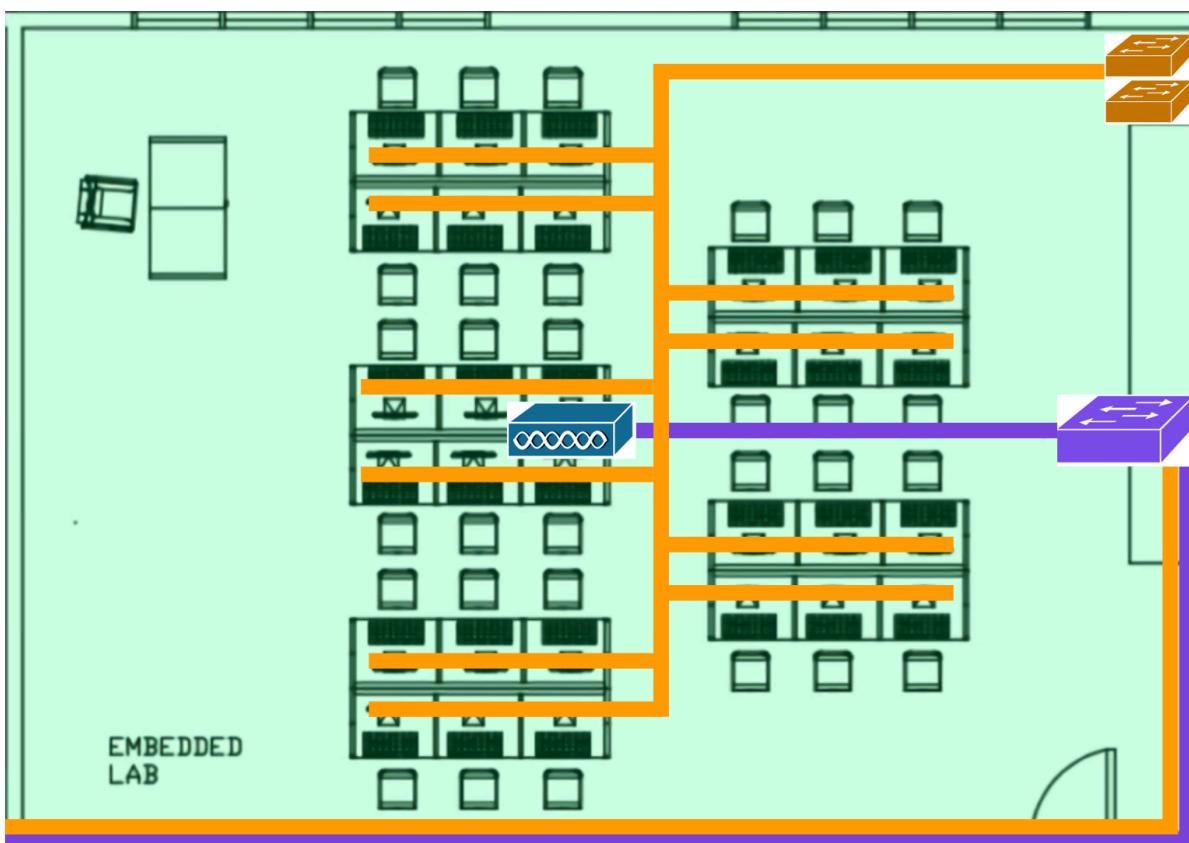


Figure 3.6 Embedded Lab layout

Hybrid Classroom

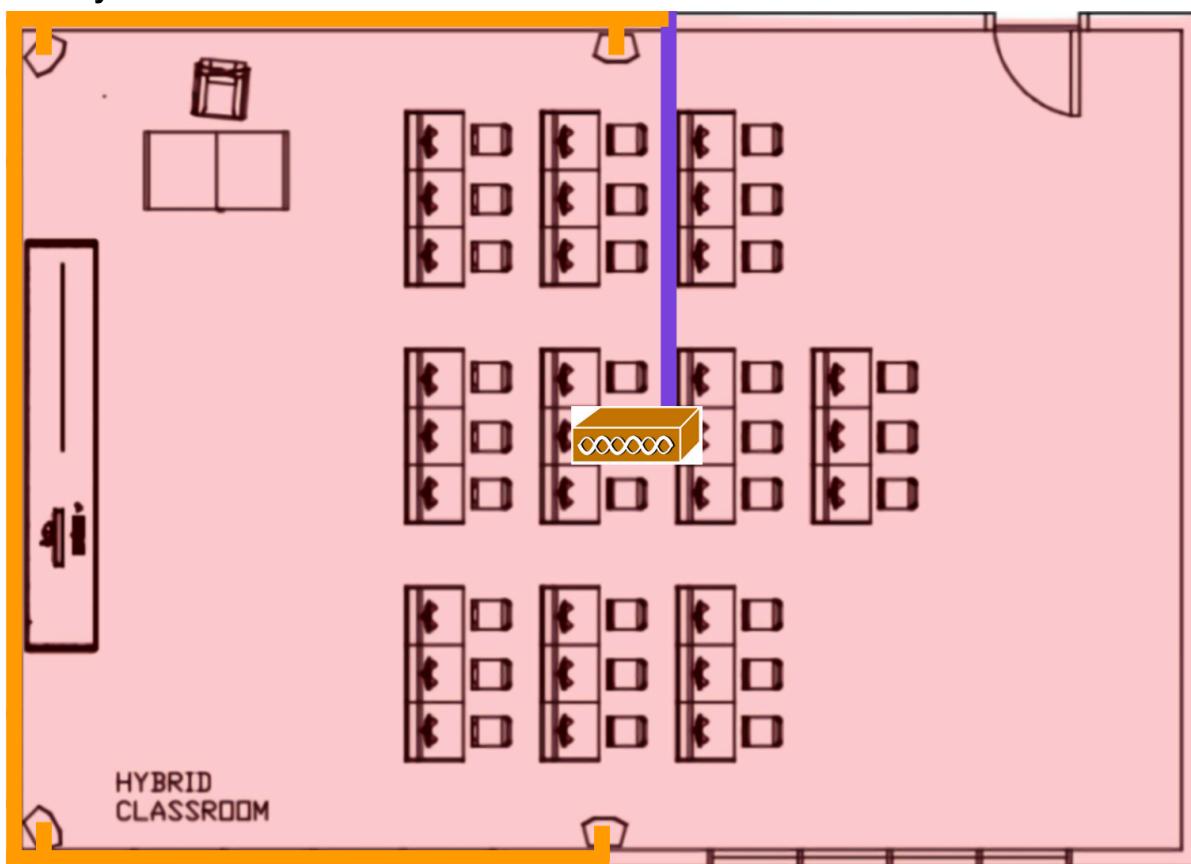


Figure 3.7 Hybrid Classroom layout

CONNECTIVITY

Ground Floor Connectivity

Item	Model	Function	Total Needed
Access Switch (PoE)	Cisco Catalyst 9200L-24P-4X-E	Power & connect APs	1
Access Switch (Non-PoE)	Cisco Catalyst 9200L-24T-4X-E	PCs & wired devices	4
Wireless AP (Ubiquiti)	Ubiquiti UniFi 6 Enterprise	High-density Wi-Fi	3
Patch Panel	CommScope 24-Port	Cable termination	1

Table 4.1 Ground Floor Connectivity

Level 1 Connectivity

Item	Model	Function	Total Needed
Core Switch	Huawei CloudEngine S6730-H24X6C	Core & aggregation	2
Access Switch (PoE)	Cisco Catalyst 9200L-24P	AP connectivity	1
Access Switch (Non-PoE)	Cisco Catalyst 9200L-24T	PCs & devices	4
Wireless AP (Ubiquiti)	Ubiquiti UniFi 6 Enterprise	Student areas	3
Wireless AP (Huawei)	Huawei AirEngine 6760-X1	Smart classroom	2
Server	Right Power F1000E	Central services	1
Firewall / Router	Fortinet FortiGate 80F	Gateway to the Internet	1
Patch Panel	CommScope 24-Port	Cable termination	1

Table 4.2 Level 1 Connectivity

MEDIA MEASUREMENTS & SPECIFICATIONS

Cable Estimation – Ground Floor

Media Type	Specification	Usage	Total
Ethernet	Cat6	PC → Access Switch	121m
Fiber Optic Cable	Cat6	MDF→ IDF	45 m
Subtotal (Ground Floor)			166 m

Table 5.1 Cable Estimation – Ground Floor

Cable Estimation – Level 1

Media Type	Specification	Usage	Total
Ethernet	Cat6	PC → Access Switch, Speakers → PoE Switch	217m
Fiber Optic Cable	Cat6	MDF→ IDF	41.5m
Subtotal (Level 1)			258.5m

Table 5.2 Cable Estimation – Level 1

Final Cable Summary

Description	Length
Ground Floor Total	166 m
Level 1 Total	258.5m
Riser Backbone	4m
Subtotal	428.5m
Extra Allowance (12.55%)	61.5m
Final Required	≈ 490m

Table 5.3 Final Cable Summary

APPENDIX

Meeting Minutes Bil.01

DATE / TIME	24 December 2025, 9:00 P.M
LOCATION	WA2, KDSE
AGENDAS	<ul style="list-style-type: none"> 1. Understand Task 4 2. Task Distribution 3. Set next meeting
Meeting MC	DANIEL IMAN HAQIMIE BIN YUSOFF

ATTENDANCE		
NAME	TIME	REASON FOR ABSENCE
ABDURRAFIQ BIN ZAKARIA	21:00	
AHMAD MUNIF BIN BAHARUM	21:00	
NAJMUDDIN BIN KAMARUDIN	21:00	
DANIEL IMAN HAQIMIE BIN YUSOFF	21:00	

MINUTES			
NO.	ITEM DISCUSSED	OUTCOME	PERSON IN CHARGE
1	Opening	- Rafiq starts the meeting with Surah Al-Fatihah and explain the agendas	Rafiq
2	Task requirements & deliverables	- Project scope, tasks, and expected deliverables were explained and agreed upon by all members	All members
3	Task distribution	- Tasks were distributed equally among team members based on roles and strengths	Daniel
4	Timeline & deadlines	- Project timeline and submission deadlines were discussed and confirmed	Daniel, Munif

5	Next meeting	<ul style="list-style-type: none">- Next meeting scheduled to review progress and discuss issues	Rafiq
6	Meeting ended	<ul style="list-style-type: none">- Rafiq ends this meeting with tasbeeh kifarah and surah al-asr- The meeting ends at 12:00 A.M	Rafiq

Meeting Minutes Bil.02

DATE / TIME	26 December 2025, 3:00 P.M
LOCATION	MA5, KTDI
AGENDA	<ol style="list-style-type: none"> 1. Update the progress of each member 2. Feedback from all members 3. Update the task distribution 4. Set for next meeting
Meeting MC	NAJMUDDIN BIN KAMARUDIN

ATTENDANCE		
NAME	TIME	REASON FOR ABSENCE
ABDURRAFIQ BIN ZAKARIA	15:00	
AHMAD MUNIF BIN BAHARUM	15:00	
NAJMUDDIN BIN KAMARUDIN	15:00	
DANIEL IMAN HAQIMIE BIN YUSOFF	15:00	

MINUTES			
NO.	ITEM DISCUSSED	OUTCOME	PERSON IN CHARGE
1	Physical Zone & Work Area Mapping	- Finalized layout for 120 workstations across four key zones: Work Area, MDF (Telecom Room), Backbone, and Horizontal cabling.	- Rafiq & Munif
2	Device & Switch Arrangement	- Confirmed placement of access switches and core backbone to ensure a 4IR-ready infrastructure and manageable workstation layout.	- Rafiq & Munif
3	Connectivity & Cabling Strategy	- Approved Fiber Optics for vertical/backbone links and Cat6 for horizontal runs to support 10Gbps performance requirements.	- Najmuddin & Daniel

4	Budget & Media Measurement	<ul style="list-style-type: none"> - Validated cable run measurements (including wall climbs/routing) to ensure the project stays within the RM 0.9 Million budget. 	<ul style="list-style-type: none"> - Najmuddin & Daniel
5	Next meeting	<ul style="list-style-type: none"> - Review of final hardware procurement list and installation timeline. 	<ul style="list-style-type: none"> - Najmuddin
6	Meeting ended	<ul style="list-style-type: none"> - Rafiq ends this meeting with tasbeeh kifarah and surah al-asr. - The meeting ends at 5:00 P.M 	<ul style="list-style-type: none"> - Najmuddin

Meeting Minutes Bil.03

DATE / TIME	30 December 2025, 9:00 P.M
LOCATION	WA2, KDSE
AGENDA	<ol style="list-style-type: none"> 1. Update progress of each members 2. Feedback from each members 3. Every member contributes to completing any unfinished part. 4. Finalize the answer for the project.
Meeting MC	NAJMUDDIN BIN KAMARUDIN

ATTENDANCE		
NAME	TIME	REASON FOR ABSENCE
ABDURRAFIQ BIN ZAKARIA	21:00	
AHMAD MUNIF BIN BAHARUM	21:00	
NAJMUDDIN BIN KAMARUDIN	21:00	
DANIEL IMAN HAQIMIE BIN YUSOFF	21:00	

MINUTES			
NO.	ITEM DISCUSSED	OUTCOME	PERSON IN CHARGE
1	Member Progress Update	<ul style="list-style-type: none"> - Each member reported successful completion of assigned tasks for the physical design phase. 	All members
2	Member Feedbacks	<ul style="list-style-type: none"> - Conducted a review session; members shared insights on cabling layouts and budget optimization. 	All members
3	Task Consolidation	<ul style="list-style-type: none"> - Collaborative effort to identify and complete all unfinished parts of the network plan. 	All members
4	Project Finalization	<ul style="list-style-type: none"> - Finalized the official project answers and documentation for submission. 	Rafiq & Najmuddin
5	Final check	<ul style="list-style-type: none"> - All members re-checked 	Munif & Daniel

		<p>their tasks for the last time to ensure that we are satisfied and there are no problems or issues when submitting the report.</p> <ul style="list-style-type: none"> - We agreed to finalize the report and prepare to submit it when the link to submit is given in the e-learning. - Munif and Daniel made sure the report's writing is readable and fixed grammatical errors. 	
6	Meeting ended	<ul style="list-style-type: none"> - Rafiq ends this meeting with tasbeeh kifarah and surah al-asr - The meeting ends at 12:30 A.M 	Rafiq

TASK DISTRIBUTIONS

Member	Task/Responsibilities	Works completed
AHMAD MUNIF BIN BAHARUM	<ul style="list-style-type: none"> - Design the network topology & how the devices are connected to each other - Research & study the work area mapping logic & rules 	<ul style="list-style-type: none"> - Connectivity logic - Network topology
ABDURRAFIQ BIN ZAKARIA	<ul style="list-style-type: none"> - Design the work area mapping - Devices arrangement 	<ul style="list-style-type: none"> - Work area mapping designed using Canva - Devices arranged
DANIEL IMAN HAQIMIE BIN YUSOFF	<ul style="list-style-type: none"> - Designing the floor plan - Researching vertical cabling and length 	<ul style="list-style-type: none"> - Cabling estimations - Legend designs
NAJMUDDIN BIN KAMARUDIN	<ul style="list-style-type: none"> - Research connectivity cabling - Estimate the cable used in the design to estimate the price 	<ul style="list-style-type: none"> - Did the cabling design - Price and length are done estimated

TASK 4	
ITEM	MARKS
<i>Identify connections and cables</i>	
Connections, patch cord, switchport identified	2
Cable length and types identified	2
Choices are suitable and appropriate	2
Sketch of PC and Network device arrangement (+cable) clearly shown and labelled	3
Scale: is appropriate	1
TOTAL	10