



SECR 1213 - 06
Network Communications

Lecturer: Dr. Ts. Raja Zahilah binti Raja Mohd Radzi

Task #4
LAN Device Selection and Optimization



Group 4: NetLink Solutions

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Introduction

Task Objectives

This task involves construction of a network cabling system for the new developed facility that will include LAN and WAN network. The work requires the determination of the work areas, choice of network devices, determination of cable types and their lengths, and determination of the network architecture. The task also focuses on recommendations to policy best practices to create ideal network infrastructure to operate at the highest possible efficiency, with lowest costs, and with further scalability capabilities.

The deliverables include:

PC and network devices placement plan that contains detailed sketches.

Assessment of cable lengths and the determination of proper types of cables.

Full coverage notes of team-sessions providing detailed account of discussion and outcomes.

Network Architecture

The network design proposed in this paper is in line with the needs of the facility which will consist of several laboratories, a flexi-class, a students' bench, and a video conferencing room. Structured cabling with Cat6 Ethernet Cabling belongs to each workstation, server and Networking devices while fiber optics complete the circuit. The choice of cables and devices guarantees high reliability of the connections and signal loss in both floors.

CAT 6 forms the network backbone where vertical cabling connects MDF to all the rooms horizontally while the latter supports all end devices at work areas. Switches, patch panels, and access points are located and designed with regard to growth and for efficient cabling and retrofitting. The plan also looks at physical issues like cable distances to ensure that the various signals being transmitted to the various institutions meet the required standards of the institution.

This introduction also creates the semantic map for the technical and practical use of the LAN and WAN setup. It is relevant to the tasks to be accomplished in delivering the design and guarantees the overall compliance with the academic and operational standards. network cabling structure that supports both LAN and WAN connectivity for a newly developed facility. This involves identifying the work areas, selecting appropriate network devices, calculating cable types and lengths, and designing a scalable and efficient network layout. The task also emphasizes adhering to best practices in network infrastructure planning to ensure optimal performance, cost-efficiency, and future-proofing.

Meeting minutes

Date/time	14/12/2024, 9:02 p.m.
Location	Google Meet (online)
Meeting discussion task	<ol style="list-style-type: none"> 1. The task. 2. The suggested idea. 3. The drawing tool. 4. Task division. 5. Working on the project.
Meeting MC	Abdalla Ali Abdalla Ali

Attendance

Name	Time	Reason of absence
1- Abdalla Ali Abdalla Ali	9:02	---
2- Nouredin Mamdouh	9:06	---
3- Mohammed abdelgawwad	9:02	---

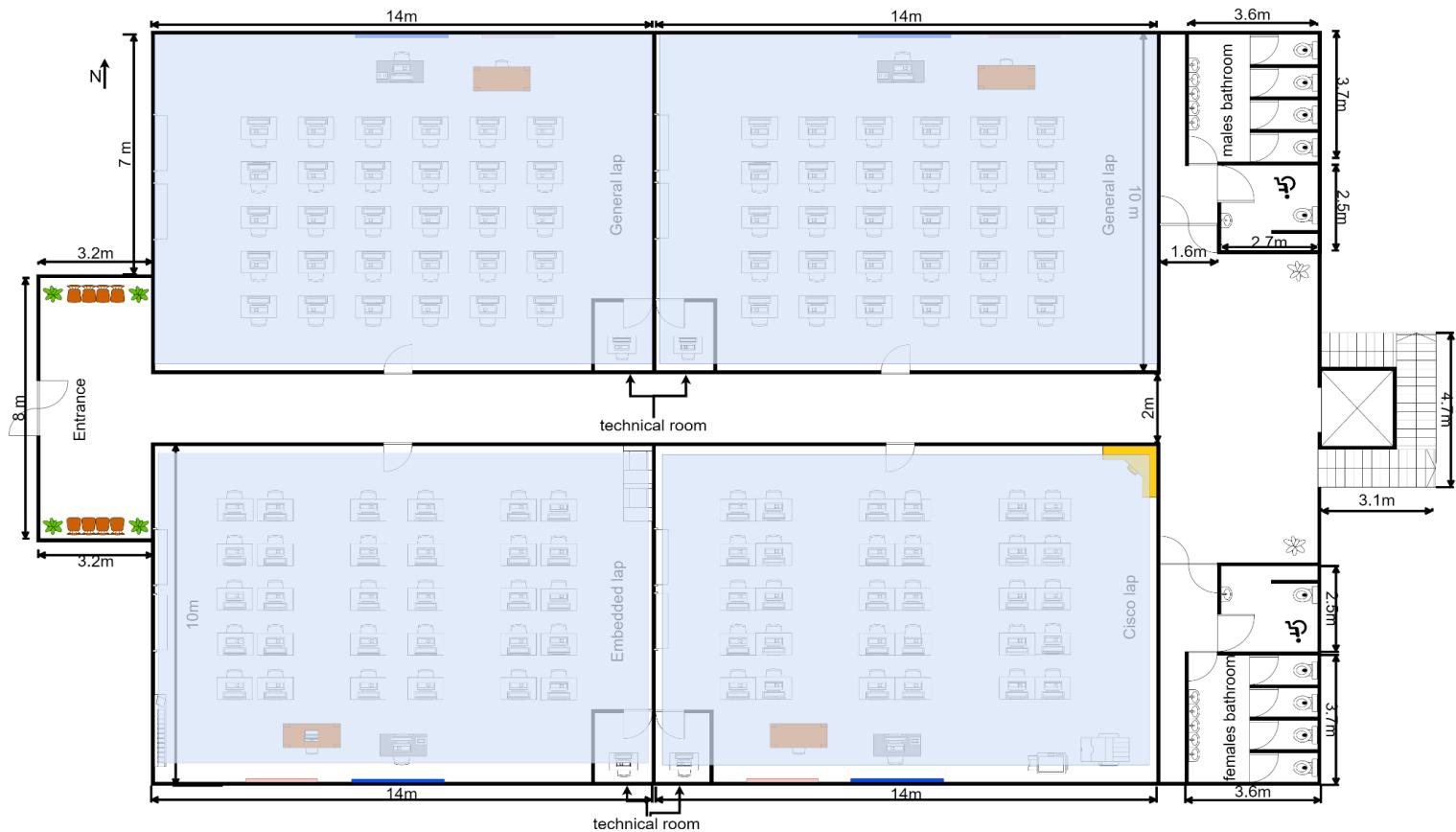
Minutes

No	Item discussed	Result	Person in charge/Time
1.	The task.	Noureldin and Abdalla thoroughly read the task and explained each part in details, while explaining some terms, the team had a good understanding of the overall task.	Nouredin Mamdouh (9:06 pm – 9:18 pm) Abdalla Ali(9:18 pm - 9:24 pm)
2.	The suggested idea.	Mohammed talked about what should be done in this phase, what are the available resources, and the amount of work to be done	Mohammed abdelgawwad (9:25 pm – 9:42 pm)

3.	The drawing tool.	Nouredin discussed which tools are most suitable, Abdalla and Mohammed gave their opinions and options on which tools are suitable, Abdalla suggested Adobe illustrator, Mohammed suggested Draw.io because it's easy and everyone knows how to use the tool.	Abdalla Ali (9:43 pm – 9:50 pm) Mohammed abdelgawwad (9:51 pm - 9:59 pm)
4.	Task division.	Nouredin suggested that each part of the design should be taken by a member with Abdalla taking the responsibility to review the work on the finished designs, Mohammed will take most part of the report while taking some part of designing, Nouredin will focus on the report design and participate in the floor and cable designing.	Nouredin Mamdouh (9:33 pm – 9:59 pm)
5.	Working on the project	Each member started doing the task assigned to him and the meeting kept open for further collaboration and communication.	Abdalla Ali (9:59 pm – 11:50 pm) Mohammed abdelgawwad (9:59 pm - 11:50 pm) Nouredin Mamdouh (9:59 pm – 11:50 pm)
Meeting Ended		11:51 PM	
		<p>1 PM etf-srjo-ggd</p> <p>Activate Windows Go to Settings Activate Windows</p>	

Working areas

First Floor Working Areas



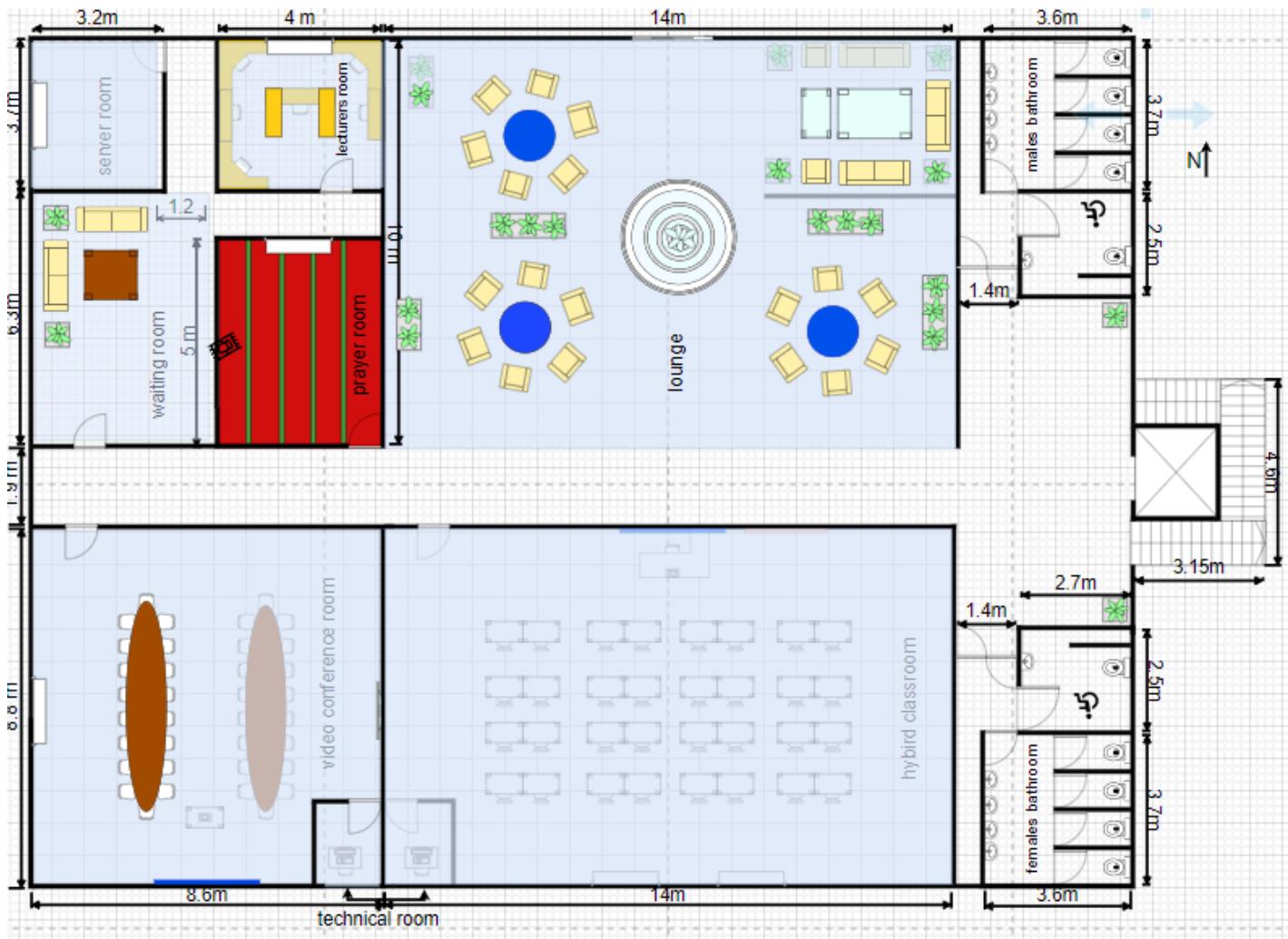
General Labs, Embedded lap and Cisco lap:

- Each lab is designed with 5 rows of workstations accommodating 30 workstations in total (per lab).
- The dimensions of each lab are approximately 14m x 10m.
- These labs are intended for general-purpose computing activities, networking activities and multi-purpose activities for students.
- Each of the labs will have full wifi coverage.

Technical/Telecommunications Rooms (near the center):

- There are small technical rooms, each adjacent to the general labs.
- These rooms will house network devices (patch panels) for distributing connectivity

Second Floor Working Areas



- **Student Lounge** where students can sit down and connect their devices to wireless access networks .provided by the WAP that covers the entire area and can hold more than 50 students at the same time, the dimensions are 10m x 14m.
- **Hybrid Classroom** that included a projector and a camera connected to the patch panel also included full wireless network coverage, the dimensions are 10 x 14 m.
- **Video Conferencing** that has a camera connected to the patch panel and a smart screen that is connected to the patch panel as well, the wifi coverage covers all the video conferencing rooms, the dimensions are 8.8m x 8.6m.
- **Server Room** has two servers that connect the entire building, the dimensions are 3.2m x 3.7 m
- **Other Rooms** include the waiting room and lecturers rooms that have full wifi coverage, the dimensions are (4.4m x 3.6 m for the waiting room), (4m x 3.7m for the lecturer's room).

Network Cabling

Cable Type	Color	Purpose
Vertical Cable	Black	Connects floors or devices vertically within the building.
Fiber Optic Cable	Yellow	High-speed backbone connections between rooms or labs.
Cat 6 Cable	Purple	Connects workstations, switches, and end devices locally.
Double Fiber Optic Cable	Red	Redundant high-speed backbone connections for routers topology.

First Floor Cabling Analysis



Backbone Cabling

The backbone cabling provides the main horizontal and vertical connectivity between labs, switches, and key network devices. It consists of fiber optic cables for high-speed connections.

Horizontal Backbone Cabling

- The central corridor acts as the main pathway for horizontal cables connecting the switches.
- Switches are strategically located in the hallways near the labs to minimize cable lengths.
- Backbone cables branch into each lab:
 - Main router is connected through the servers by a double connection (~ 20m) and ~13.5m for the switch.
 - The main switch is connected to a router and each switch connects a lab.
 - Each wireless access point is connected by a lap switch through fibre optic.
 - General Labs(2) : Cables run horizontally from the corridor into the labs (14m) and about(5 m - 10 m) for connecting wireless AP.
 - Embedded Lab : Cables run (~14m)horizontally and about(5 m) for connecting wireless AP into the lab.
 - Cisco Lab (Bottom-Right): Cables run ~14m horizontally into the lab and 10m for the wireless AP.

Vertical Backbone Cabling

- Vertical runs connect the network switches to:
 - Technical Rooms in each lab for localized cable management.
 - Connecting the router.

Devices Connected to Backbone Cables

Switches

- Location: 5 switches positioned along the corridor, one central and each lab has its own switch.
- Purpose:
 - Connect all workstations in the labs to the main network.
 - Act as distribution points for local traffic from each lab.

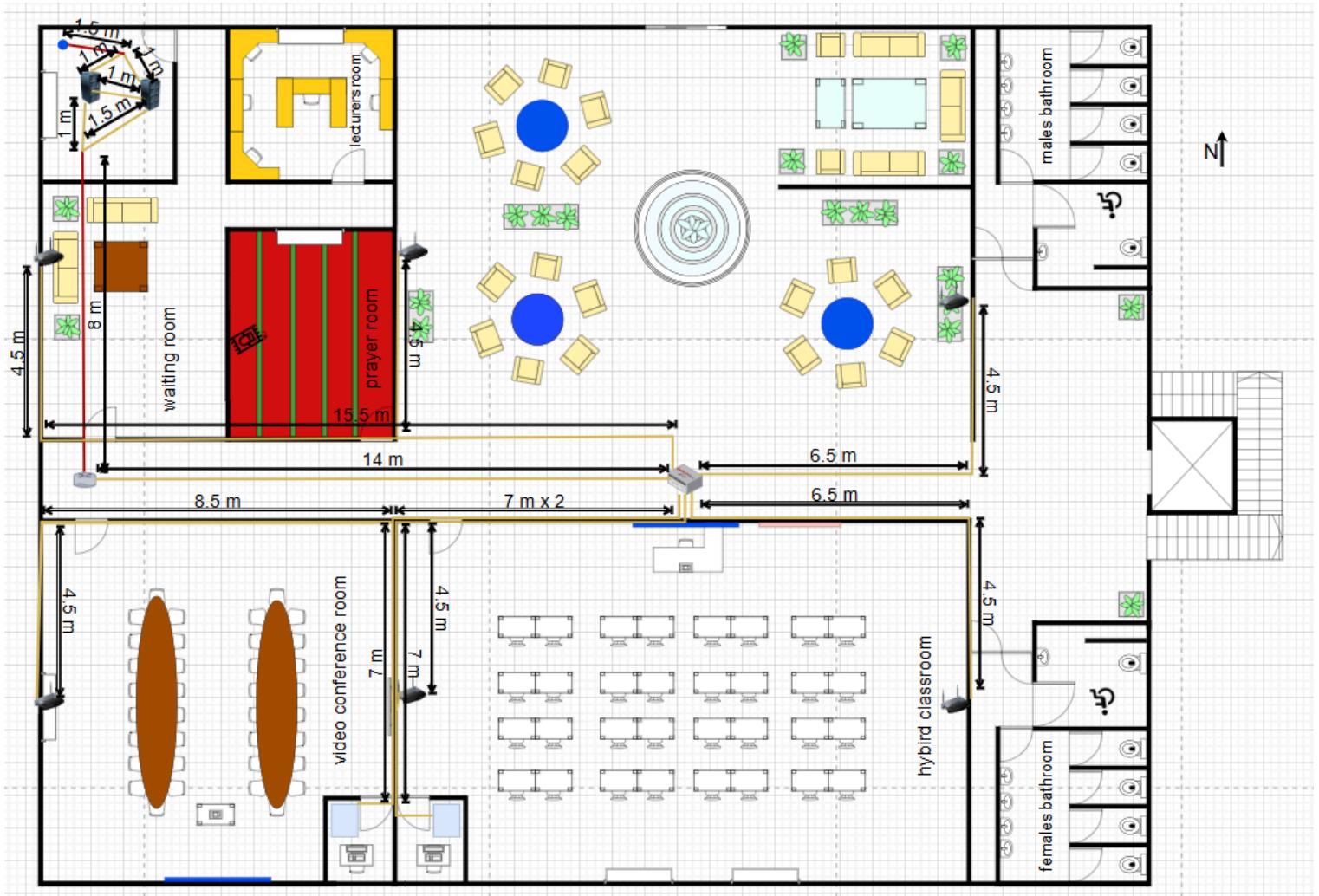
Router

- Location: near the entrance along the middle for forwarding and routing the data.

Wireless Access Point (AP)

- Location: in the middle of each class wall offering full coverage.

Second Floor Cabling Analysis



Backbone Cabling

The backbone cabling provides connectivity across the working areas in the floor plan, with horizontal and vertical connections running throughout the rooms.

Horizontal Backbone Cables

- Cables run along the main corridor horizontally to connect rooms such as the video conference room, hybrid classroom, and lounge.
- Lengths:
 - ~5m (main server connection).
 - ~43m connections branch off into the hybrid classroom and conference room.
 - ~45.5m connection for the wireless AP.

Vertical Backbone Cables

- Vertical connections run within each room to connect local devices to network switches or technical rooms.

Devices Connected to Backbone Cables

Video Conference Room

- Purpose: This room is used for virtual meetings.
- Devices Connected:
 - 2 Conference tables equipped with desktop computers and monitors.
 - Projector at the front for shared presentations.
 - Network Switch: Positioned near the room's edge for connecting all devices.
 - Wireless Access Point (AP): For Wi-Fi coverage.
- Cabling:
 - Backbone cables provide connectivity from the main corridor switch to:
 - Desktop computers
 - Projector
 - Wireless AP

Hybrid Classroom

- Purpose: This room is designed for modern learning with a mix of virtual and in-person teaching.
- Devices Connected:
 - Desktop computers: Positioned for students and teachers.
 - Projector: For instructional presentations.

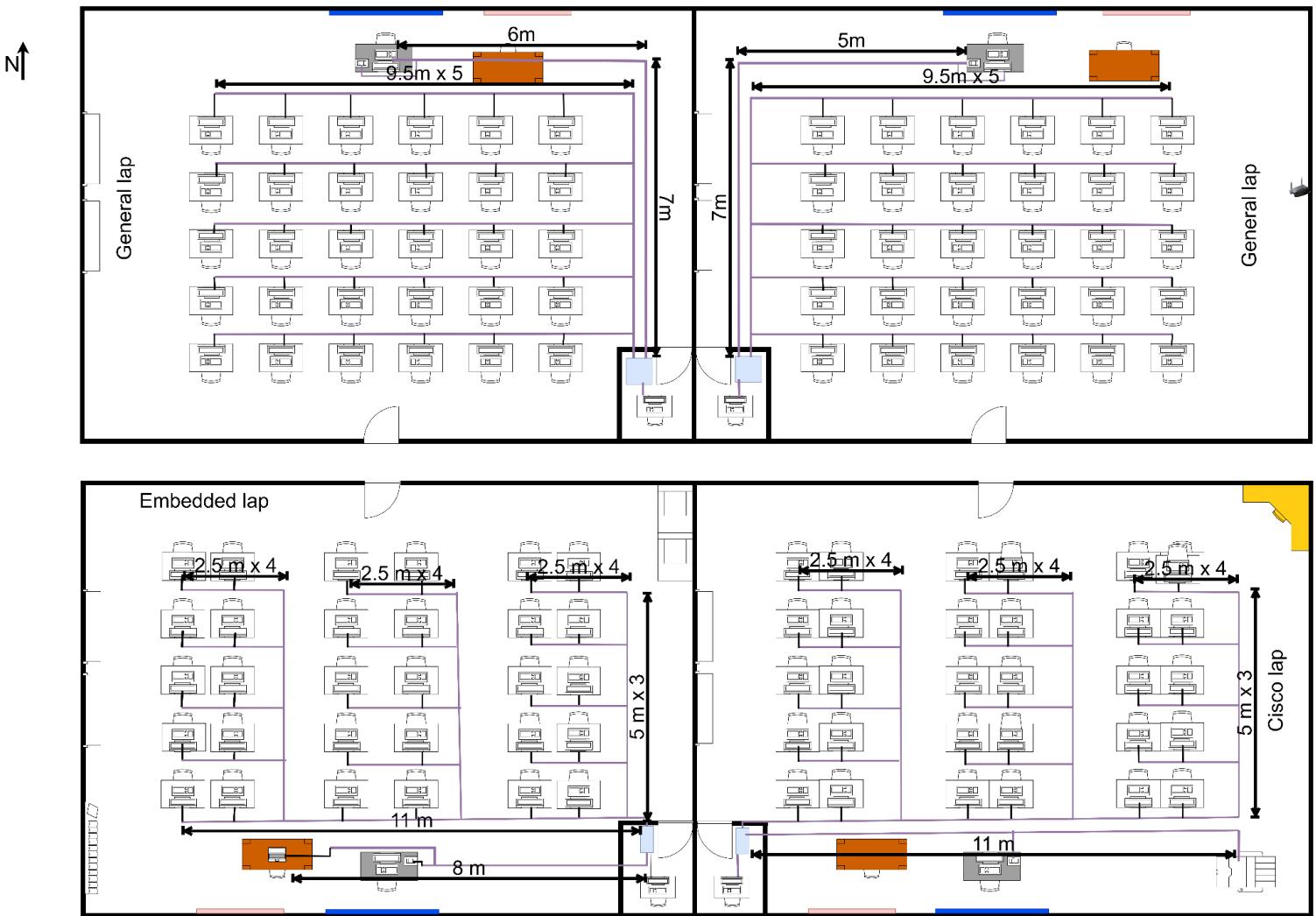
- Wireless AP: Ensures Wi-Fi coverage for mobile devices.
- Cabling:
 - Horizontal backbone cables run into the classroom to connect:
 - Network switch
 - Desktop computers

Lounge Area

- Purpose: A recreational and working area for students.
 - Devices Connected:
 - Wireless APs: Strategically placed to provide seamless Wi-Fi coverage.
 - Cabling:
 - Horizontal cables branch out to connect APs to the backbone switches in the corridor.
-

Cabling and Connected Devices

First Floor



Device Cabling Layout

Type of Cable

- The backbone cabling is **Cat6 Ethernet cables** for high-speed data transmission (up to 10 Gbps).
- It connects each lab patch panel to its computers and projectors.

Horizontal

- Horizontal cables branch out from the corner positioned patch panel into each workstation row.
- These cables distribute network connectivity across the labs.

Vertical

Vertical runs connect devices in each lab.

Breakdown of Devices Connected to the Cables

General Labs

- **Workstations:**

- The patch panel is the main source of connection.
- Each workstation (desktop computer) in the rows is connected to the network via **Cat6 cables**.
- **Cable Length:** Approximately **2.5 meters** per workstation, $9.5m \times 5$ for lab connection, 7m for the main connection that branches to another computer.
- The length for the projector and the lecturer's computer is ~7m and ~6m for main branching.

Embedded Lab

- **Workstations:**

- The patch panel is the main source of connection.
- Rows of desktop computers connected via **Cat6 cables**.
- **Cable length:** approximately **2.5 x 12 meters** per workstation, $5m \times 3$ for lab connection, 11m for the main connection that branches to another computer.
- The length for the projector and the lecturer's computer is ~8m.

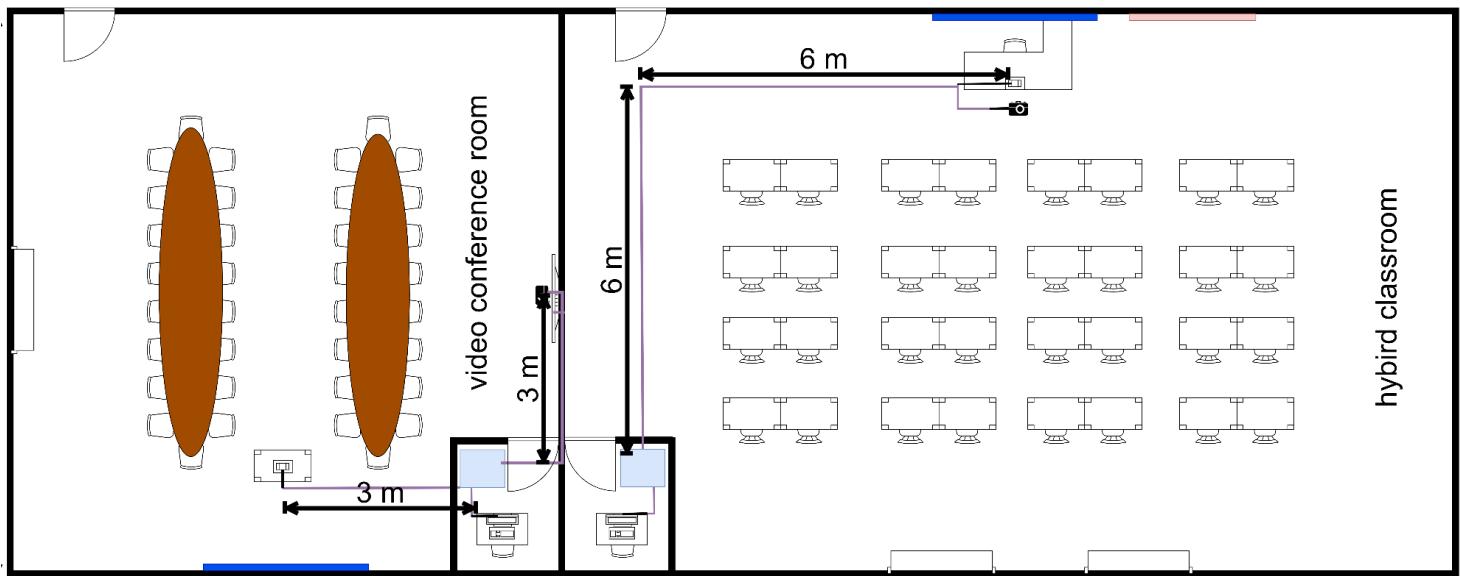
Cisco Lab

- **Workstations:**

- The patch panel is the main source of connection.
- Rows of desktop computers connected via **Cat6 cables**.

- **Cable length:** approximately **2.5 x 12 meters** per workstation, 5m x 3 for lab connection, 11m for the main connection that branches to another computer.
 - The length for the projector and the lecturer's computer is ~8m.
 - Additional 3m for connecting the printer.
-

Second Floor



Device Cabling Layout

Type of Cable

- The backbone cabling is **Cat6 Ethernet cables** for high-speed data transmission (up to 10 Gbps).
- It connects each room patch panel to its computers and projectors.

Horizontal

- Horizontal cables branch out from the corner positioned patch panel into each room.
- These cables share the network connectivity into the room.

Vertical

Vertical runs connect devices in each room.

Breakdown of Devices Connected to the Cables

Hybrid Classroom

- **Devices:**

- The patch panel is the main source of connection.
- Connecting a camera, projector and the lecturers' computer(optional).
- The lecturer's computer, projector and camera is connected to the network via **Cat6 cables**.
- **Cable Length:** Approximately **12 m** for the lecturer's computer and projector, 3m additional for the camera.

Video Conferencing Room

- **Devices:**

- The patch panel is the main source of connection.
 - Connecting a camera, projector and smart screen.
 - **Cable length:** approximately **3 meters** for the projector, 4 for camera and smart screen connection.
-

Summary of Connected and Network Devices

First floor:

1. **General Labs (2):**

- 30 workstations per lab
- 1 teacher workstation
- 1 projector
- 1 switch
- 1 patch panel

2. **Embedded Lab:**

- 30 workstations
- 1 switch
- 1 teacher workstation
- 1 projector
- 1 patch panel

3. **Cisco Lab:**

- 30 workstations
 - 1 switch
 - 1 teacher workstation
 - 1 projector
 - 1 patch panels
 - 1 printer
-

Total Cables Table

Working Area	Double Fiber (Yellow)	CAT6 (Purple)	Price (Fibre Optic)	Price (CAT6)
General Lab(2)	43m	181m	129 RM	362 RM
Cisco Lab	38m	98m	114 RM	196 RM
Embedded Lab	33m	95m	100 RM	190 RM
First Floor Connection	38m	-	114 RM	
Student Lounge	23m	-	69 RM	
Hybrid Classroom	37.5m	15m	112.5 RM	30 RM
Video Conferencing Room	28m	7.5m	84 RM	15 RM
Waiting and Lecturer's Room	20m	-	60 RM	
Second Floor Connection	40.5m	-	122 RM	
Total	301m	396.5m	~ 900 RM	~ 800 RM
Total Price				~ 1,700 RM

Total Used Network Devices

Patch Panels: 6

- 1 per lab (3 labs)
- 1 for the video conferencing room
- 1 for the hybrid classroom

Routers: 2

- 1 for the first floor
- 1 for the second floor

Servers: 2

- Centralized servers for managing the entire network connection

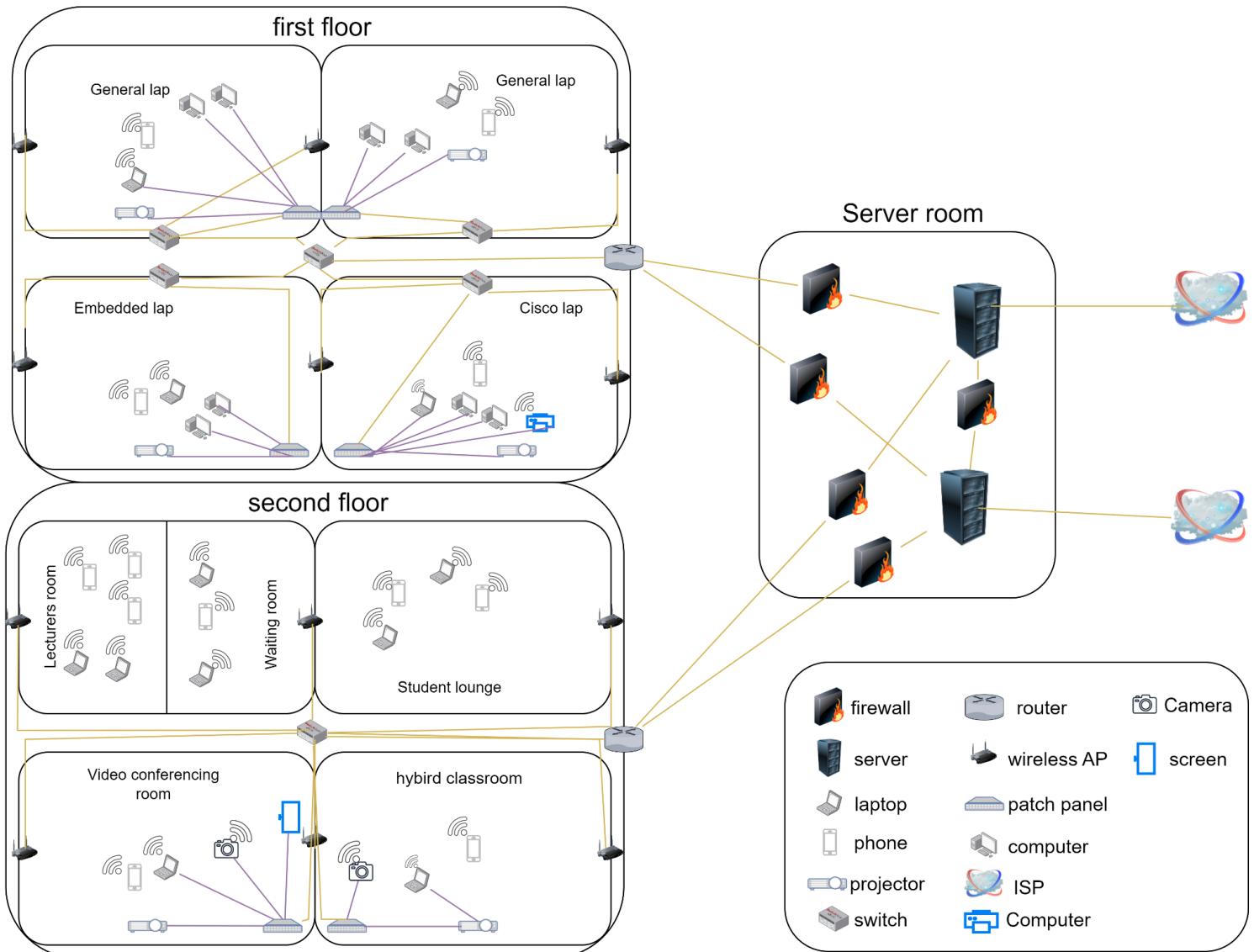
Switches: 6

- 5 on the first floor:
 - 1 central switch
 - 1 switch for each lab (3 total)
- 1 on the second floor

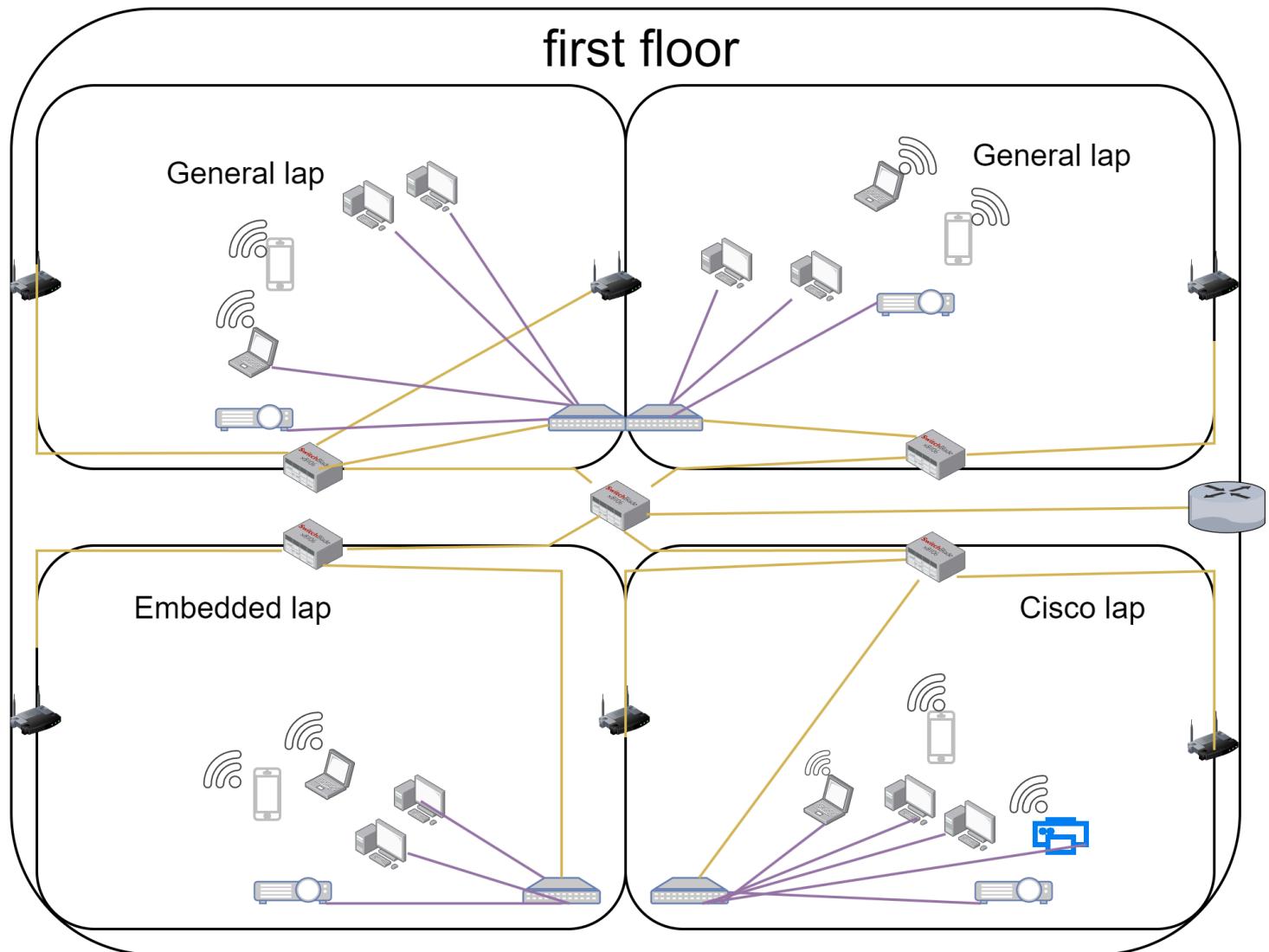
Wireless Access Points (WAPs): 12

- 6 on the first floor
- 6 on the second floor

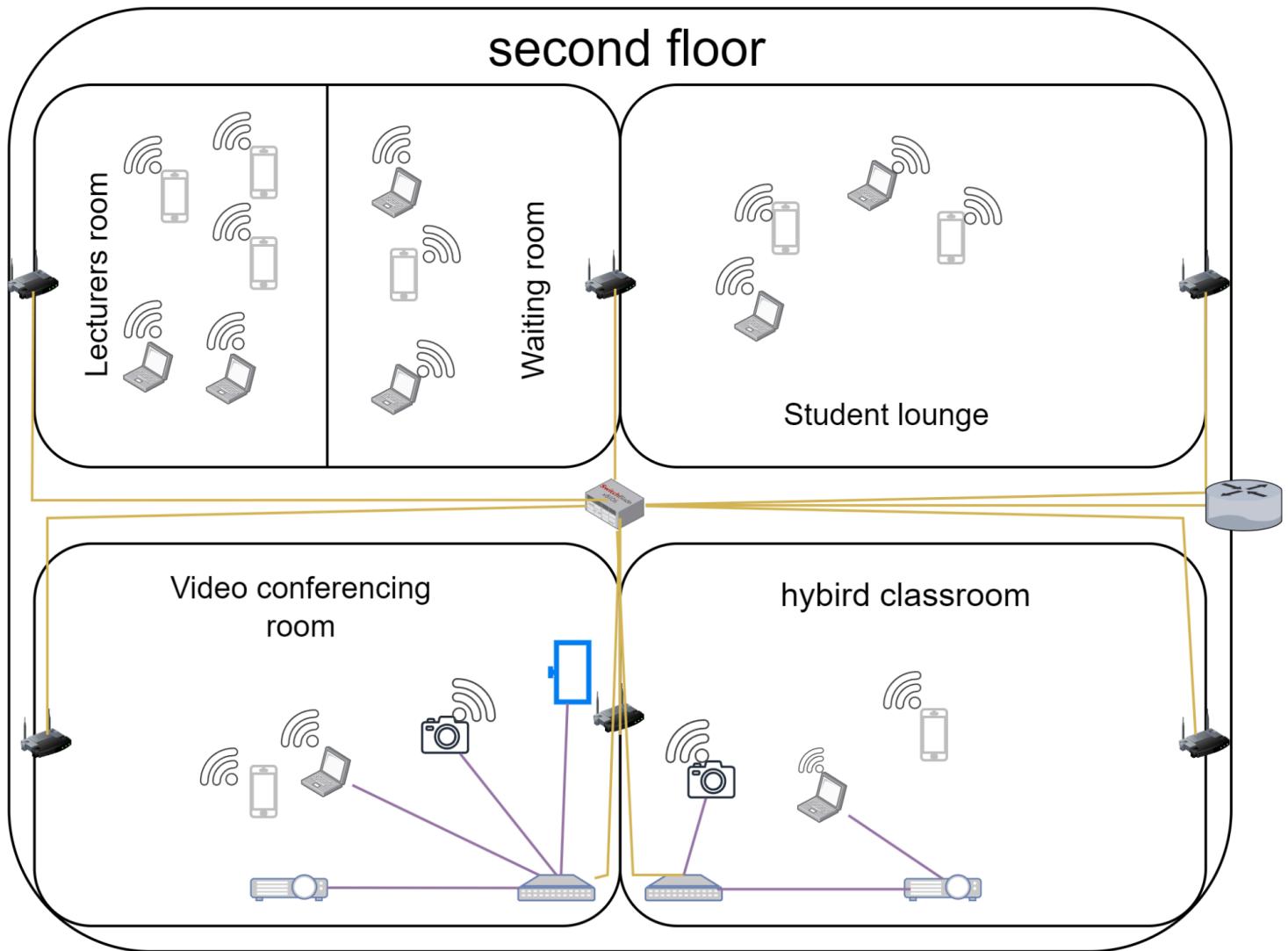
Network Layout and Topology



First Floor Layout



Second Floor Layout



Extra information

- Each of the servers is connected to the ISP through fibre optic.
- The chosen local ISP was Telekom Malaysia.
- The routers are not directly connected to each other.
- The number of devices stated in Task3 is still the same regardless of the cable length.
- Devices are connected to the network via CAT6 cables.
- The length of cables used is approximated and the actual length might be a little shorter.