UTM

UNIVERSITI TEKNOLOGI MALAYSIA

NETWORK COMMUNICATION
SECR1033

SECTION 05

LECTURER: DR. RAJA ZAHILAH

PROJECT
TASK 1

GROUP : 3

Name	Matric No
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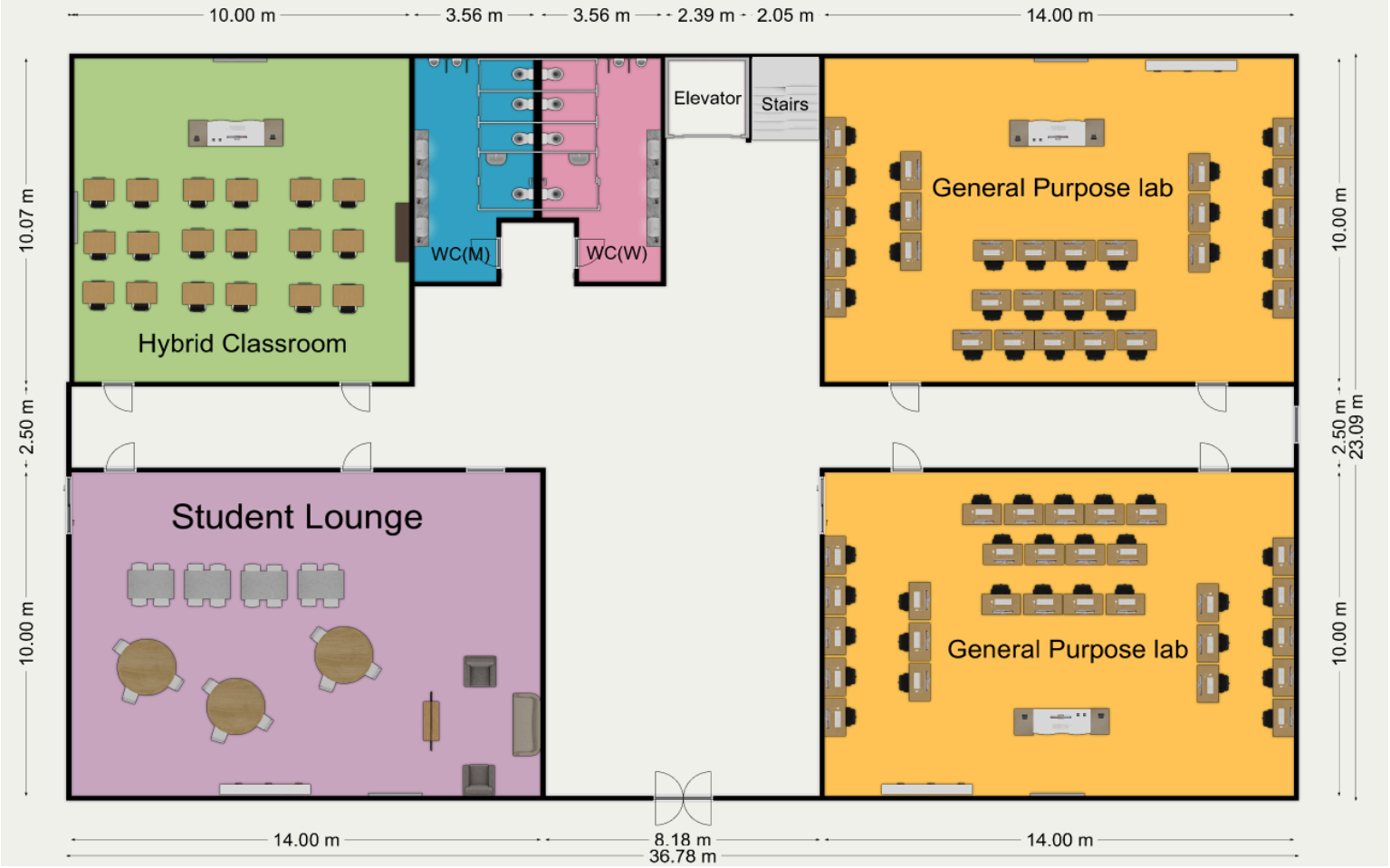
1.0 Overview of the Group:-

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

1.0 Design Layout for the building:-



FIrst storey

Second storey

1.0 Preliminary Analysis

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

1.1 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 .

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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

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.

3.1 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.

4.0 Appendix

Meeting minute 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	Rami (11/10)

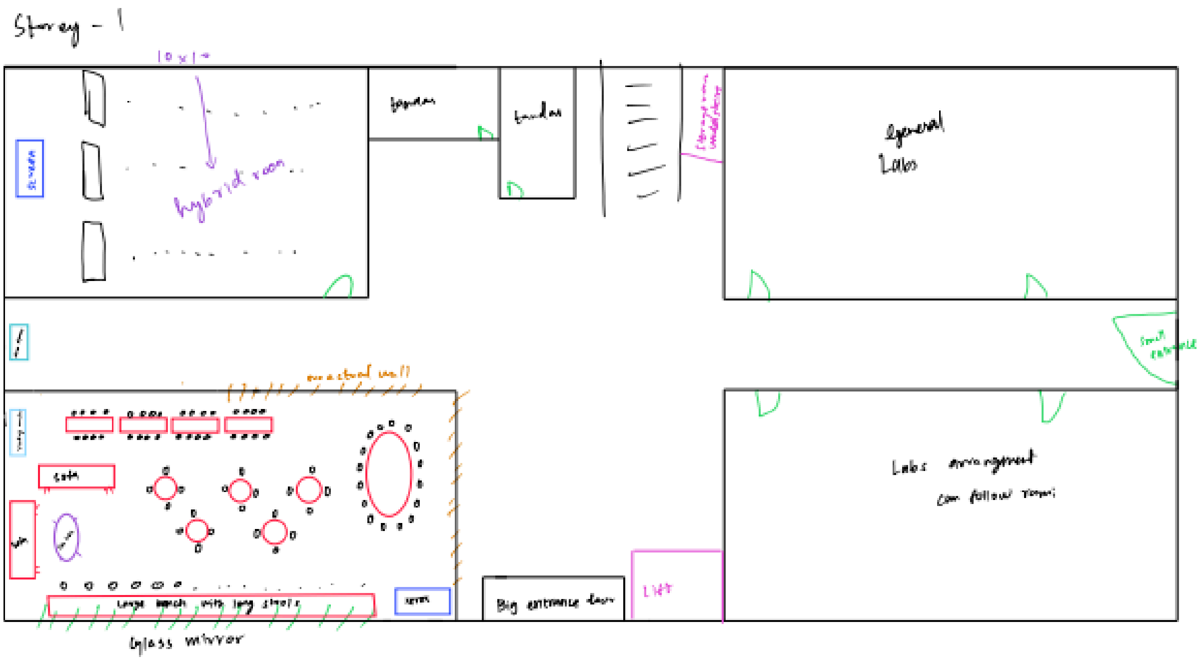
		floorplanner	
2	Rough Ideas for the floor plan	-Anjum suggested that the building should have the 2 general labs next to each other for future better network connection along with student lounge being in the first storey and the hybrid class , she also sketch an idea of how the design should look like	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)

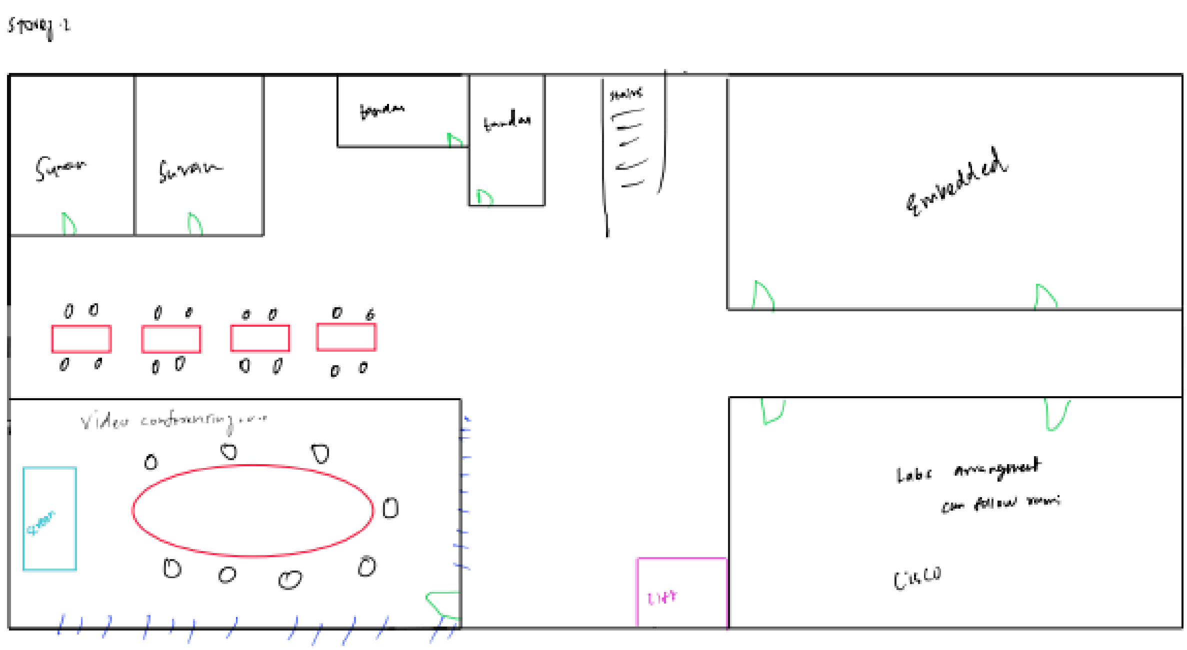
Meeting minute Task 2:

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	Ram(26/10)

		included before doing the feasibility.	
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 focus on the connectivity and bandwidth to be used. - Overall both were important, so we decided to include both.	Anjum(26/10) Mathaba(26/10)
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)

Sketch:


Storey - 1
hybrid room
General Labs
Labs arrangement
sofa
Large bench with long stools
glass mirror
Big entrance door
Lift


Storey 2
Embedded
Labs arrangement
Cisco
Video conferencing
stairs
Lift