UNIVERSITI TEKNOLOGI MALAYSIA, JOHOR BAHRU

FACULTY COMPUTING,

SEMESTER 1, SESSION 2024/2025

Task-6a

Network Design for Faculty of Computing Block N28B

YEAR/COURSE	**2024/2025 - SECJH**
SECTION	**08**
SUBJECT NAME	**NETWORK COMMUNICATIONS**
SUBJECT CODE	**SECR1213**
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ABSTRACT

"Network Infrastructure Upgrade for Faculty of Computing, Block N28B" is the focus of this project. It reflects the team's efforts to design a robust and future-proof network plan. The Faculty of Computing requires an upgraded technological infrastructure to enhance the learning and teaching experience for students and staff. The primary goal is to provide a seamless transfer from traditional technology while developing a system that is affordable, scalable, and prepared to adapt to future requirements. Since there are four labs in this two-story structure, the project's concept is seamless connectivity. Network interactions between hardware and software will ensure staff and student performance. The enhanced system should have strong and reliable performance, be easy to use, need little to no training for users, and have strong network security against viruses and cyber-attacks. Among the several goals of this project is to install a fast internet with modern hardware such as Cisco devices, while also establishing advanced security measures, as well as secured VPN connections for remote access. We were given a RM 950K budget, it is expected to utilize the amount of cutting-edge technology that will efficiently support academic, educational, and research activities. It is well known that wireless technology basically does overcome the limitations of a wired network and opens up possibilities for scalability and mobility. The upcoming deployment of 5G technology would be advantageous for the network in terms of fulfilling modernization requirements.

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INTRODUCTION

This project focuses on designing and implementing a wired network infrastructure for a two-story building for the Faculty of Computing. The facility shall cater for a total of four computer labs, and a student lounge, and will also have a hybrid classroom and video conferencing room. The basic task of this project is to develop a network that is secure, reliable, and scalable for the current and future needs of students and staff.

The project aims at the realization of a cost-effective solution for cutting-edge technologies, seamless connectivity, and welcoming user experience. It also includes modern networking principles to make the infrastructure efficient, secure, and relevant for the next 20 years. With more flexibility and scalability, the network will be ready to host emerging technologies related to the Fourth Industrial Revolution (4IR), such as IoT and AI, while also embracing the next generations of wireless connectivity.

The new project is composed of six major tasks: designing the floor plan of the building, studying the demand to find out the present and future needs, selecting best potential LAN devices, establishing connectivity, creating structured cabling and IP addressing, and documenting the system for the user and maintenance purposes. These tasks will involve identifying user needs, optimizing performance, adhering to industry standards, and preparing for future growth.

This project assumes that the allocated budget is sufficient for procuring all necessary hardware and infrastructure. It also assumes that the building's design will accommodate efficient placement of network devices, telecommunication rooms, and cabling paths. With these assumptions in mind, the project aims to deliver a future-ready network infrastructure that supports educational excellence and fosters innovation at the School of Computing.

PROJECT BACKGROUND & OVERVIEW

The Faculty of Computing at UTM has made plans for a new two-storey building as the faculty is seeing a drastic increase in the number of students and staff members within the next four years, with a project forecast of 15% increase. This new structure will provide modern facilities to meet undergraduate and postgraduate students' needs, academic staff, and support staff while gearing for advancements in technology in the next 20 years.

The new building will contain four laboratories comprising two general-purpose laboratories, one Cisco Network lab, and one Embedded lab. They have been outfitted with 30 PCs and a server per lab and are focusing on 4IR education. That also means speedy internet provision for seamless access to online resources and advanced learning tools. Other facilities will include a video conferencing room for virtual meetings and a student lounge with Wi-Fi to encourage collaboration and relaxation.

The network infrastructure will be designed to be secure, reliable, efficient, and scalable. It will handle future growth in both capacity and technology while being easy to manage and maintain. Wireless connectivity will cover the entire building, as it will play a crucial role in future communication.

To make the system cost-effective and long-lasting, equipment and technologies will be chosen carefully to deliver the best performance at the lowest cost. The transition from the current system to the new one must be smooth, with minimal disruptions to ongoing activities. The network will also include advanced features like secure VPN connections and hardware-based security measures, such as access control lists (ACLs), to protect against cyber threats.

This project aims to create a future-proof building that meets today’s needs while supporting innovation and growth for years to come.

TASK 1

FLOOR PLAN

GROUND FLOOR

Figure 1 : Ground Floor Floorplan

FIRST FLOOR

Figure 2 : First Floor Floorplan

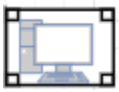
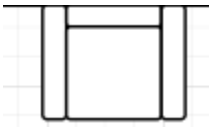
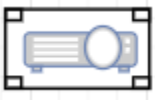
SYMBOL	DESCRIPTION
	**CHAIR**
	**SERVER RACK**
	**WORKSTATION / PC**
	**SERVER**
	**SOFA**
	**PROJECTOR**
	**SCREEN**

Figure 3 : Legend of the figure

REFLECTION ON TASK 1

While working on task 1, my team learned new things, particularly about the structure of a facility that houses offices, labs, and a video conference room. Furthermore, we discovered how important it is to use the cash wisely and efficiently while creating our floor plan because most of us don't know if our design is financially viable and so assume it is. We face a number of challenges with layout design since we don't fully understand floor layout. In contrast, my team succeeds because of our commitment and teamwork.

TASK 2

TASK A

(QUESTION FOR INTERVIEW)

NO.	QUESTION
1	What equipment is required to build the network infrastructure?
2	What kind of connection method is best suited for access network?
3	Which software programs, cloud services, or data-intensive platforms will require network support?
4	What specific hardware components are required for each workstation?
5	What is the minimum required bandwidth for each lab?
6	What type of wiring is needed for the networking system in each lab?
7	What type of security system is recommended for each device?
8	Which network protocol should be implemented in the network plan?

9	Do we need to build a main server room?

10	What measures should be taken if we experience a malware attack?
11	How can a security breach be prevented from affecting our data?
12	How much is the allocated budget for the project?
13	In what ways will the network infrastructure be able to handle the expected increase in devices and users over the next four years?
14	How can high-speed ISPs be chosen while maintaining redundancy and dependability?
15	Which wireless network integration techniques work best for the labs and student lounge to give everyone consistent, quick access to the internet?

TASK B

(INTERVIEW AND RESEARCH FOR THE QUESTION)

1. Building a network infrastructure here at UTM requires core components like routers, switches, firewalls, and servers, which handle both traffic management and security. Routers, for instance, will direct data across different sections of the network, while switches are crucial for connecting various devices within a lab. Firewalls add a layer of security to protect us from external threats. For our labs, it's essential that this equipment is high quality and scalable, meaning it should be able to support growing data needs as we add more devices or expand lab capabilities. Also, we may want to invest in a Network Management System (NMS) to monitor network health and performance in real time, which helps in quickly spotting and fixing any issues that arise.I think access networks are like the "front door" to our system, connecting end-users like students and staff to the broader university network. For our labs, I

would recommend fiber-optic or high-speed Ethernet connections. Fiber-optic cables are fast and handle high
data volumes, which is essential when you consider how much real-time data and large file transfers we do here, whether it's for simulations or research projects. High-speed Ethernet is also reliable and a bit more affordable than fiber, so we could use a mix.

2. Actually, we definitely have quite a few. For example, we frequently use MATLAB for computational simulations, which requires considerable processing power and bandwidth. Then, there's AWS for cloud-based projects and data analytics, as well as platforms like Google Cloud that support our students working on AI and machine learning projects. All of these are data-intensive and rely on a fast, reliable network connection

3. Each workstation really needs to be equipped to handle heavy computational tasks and should be built to last a few years. For instance, I'd suggest a strong processor, like an Intel i7 or AMD Ryzen 5, or even higher, depending on the tasks in the lab. Memory is also critical; 16GB of RAM should be the minimum, though 32GB or more would be ideal in research labs where students work with massive data sets. Storage is another key factor—solid-state drives (SSDs) are much faster than traditional hard drives and are essential for reducing processing delays. Each workstation will also need a high-quality network card to maintain stable and fast connectivity with the network, especially when working on data-heavy applications.

4. Bandwidth is like a highway; it determines how much traffic can flow at once. A minimum of 1 Gbps (gigabit per second) is typically adequate for standard labs where students use moderate applications. However, research labs handling large data transfers, simulations, or streaming high-definition content may require much higher speeds, maybe up to 10 Gbps. The goal is to prevent bottlenecks that could slow down access or performance, especially during peak times when many users are connected.

5. Wiring may seem simple, but it's incredibly important. For our purposes, CAT6 or CAT7 Ethernet cables are ideal. CAT6 can handle gigabit speeds and offers a reliable connection over longer distances. CAT7 is even more advanced, supporting higher frequencies and data speeds, which makes it great for future-proofing. With structured cabling, we'd also ensure that the network is organized and can support higher speeds if we upgrade our equipment. So, installing proper conduits and cable trays is another detail to consider these make it easier to maintain and organize the network, especially as it grows.

6. Security is essential, especially with the amount of sensitive data we handle. Each device should have robust antivirus software, and we should install firewalls that monitor traffic and block any malicious activity. In addition to software-based security, we could implement device encryption so that even if a device is compromised, the data on it remains secure. Access controls, like two-factor authentication, also provide an additional layer of protection. This approach ensures that both personal and research data are safeguarded, helping us comply with university data protection policies and making sure we can respond quickly to any threats.

7. The TCP/IP protocol is a reliable standard, ensuring compatibility and smooth data exchange across devices and applications. Within TCP/IP, there are additional protocols we might implement, such as HTTPS for secure web browsing and SFTP for secure file transfers. For remote access, VPNs (Virtual Private Networks) are essential because they encrypt data traffic, ensuring privacy when connecting from off-campus. Network protocols provide a framework that helps keep our network stable and secure, supporting our diverse needs—from everyday tasks to advanced research.

8. A central server room is crucial for storing and managing our data and network resources. It helps us consolidate network hardware and provides a secure environment for our equipment. A dedicated server room also simplifies maintenance, since all

critical infrastructure is in one place, allowing us to monitor, troubleshoot, and scale more effectively. This is especially important at a large institution like UTM, where we may need to handle significant amounts of data on a daily basis.

9. If there's a malware attack, the first priority is to isolate the affected devices to prevent the malware from spreading. Next, running thorough scans to identify and remove the malicious software is key. Regular data backups are also crucial because they allow us to restore affected files. We should also conduct routine checks to prevent future attacks, ensuring our antivirus software is updated and that users are educated on safe browsing practices.

10. Preventing a security breach from causing data loss requires a multi-layered approach. This includes regularly updating all software and operating systems, implementing strict access controls, and using encryption to secure sensitive data. Network segmentation is also effective it separates sensitive data from less critical areas of the network, reducing exposure if there's a breach.

11. Budgets vary widely depending on specific lab requirements, but the allocation should cover high-spec equipment for processing-intensive work, structured wiring, and the necessary software and security measures. Cloud services and subscriptions for data platforms like AWS may add recurring costs. It's wise to have a contingency in the budget to account for unforeseen costs or upgrades, particularly with rapid technological advancements.

12. At UTM's Faculty of Computing, scalability is key. AI-based network management tools can help automate tasks like load balancing and bandwidth allocation to support growing numbers of devices. Pair this with 5G and edge computing—these technologies bring processing closer to users, which is essential in academic settings where low latency is

crucial for research and collaborative projects. Plus, deploying multi-cloud platforms allows seamless integration across labs, classrooms, and research centers, enhancing both flexibility and resilience.

13. For UTM, selecting ISPs that provide multi-tiered connectivity options is a good start. This ensures redundancy—if one provider faces downtime, another takes over. Providers with robust service-level agreements (SLAs) are a must for dependable connections, especially during large-scale academic events or research submissions. Adding 4G/5G failovers can also be a backup solution for critical applications, ensuring constant connectivity for both students and staff.
14. In shared spaces, like UTM's labs or student lounges, deploying Wi-Fi 6 or 7 ensures high-speed, stable connections for everyone, even during peak usage. A mesh network can eliminate dead spots, while dynamic bandwidth allocation prioritizes essential tasks like programming labs or virtual classes over less critical usage. Finally, having centralized monitoring tools will help IT staff troubleshoot and maintain a consistent experience across all devices.

TASK C

(FEASIBILITY STUDY)

This paper presents the new building upgrade project to transform the Faculty of Computing to meet the needs of the Fourth Industrial Revolution (4IR) in its learning environment. This feasibility study assesses the technical feasibility of the project based on important factors such as standardization of lab environments, security and reliability of systems, and extensibility of the current infrastructure to accommodate future expansion. Combined, these factors make certain that the proposed new building will suit the needs of students, staff and faculty, is affordable and can be completed in a sustainable manner.

This means that at the primary level, the project seeks to ensure that all the labs have a set template of infrastructure. Laptops, routers, networking devices and work stations all should be standardized regarding hardware; this reduces overall costs in procurement due to volume purchasing as well as avoidance of difficulties in management and services. This will apply to all spaces including the general purpose working labs, the Cisco Networking Lab, the Embedded Lab and any other that may be developed later These special equipments although oriented more in particular labs will fall into this standard which will allow for reduced costs and yet the equipment will be scalable enough to allow for future expansion. Further, by delivering some of the bulk buying discounts, savings back to the right areas such as IoT items, network security or hybrid class learning infrastructure.

Another important factor that has to do with this project is the provision of a secure and reliable network service. The work has proposed a well-protected network platform with security features like access control, firewalls, and idols to protect the faculty from cyber threats such as DoS and malware. The use of the role-based authentication will make it possible to restrict the access of the network by allowing only the authorized personnel to access the network thus improving on the general security. Because of this, a data backup and recovery system will be established to ensure continuity of the business operations in the undergraduate business school. These actions ensure that the computing environment is secure and efficient, thus allowing students and staff to perform their tasks with little or no interruption and worry about security issues.

Another essential factor concerns scalability to accommodate the expected enrollment increase of students and staff by 15% in the next 4 years. The said network will also be develop in line with modularity, with enhanced probabilities of adding on devices, increasing levels of bandwidths and incorporating new technologies. The hybrid classroom and general-purpose labs will be designed to be flexibly configurable for assembly to meet the developmental changes to education delivery. Wired connections and WiFi coverage are expected to be fast to cater for the tendency of remote and or hybrid learning that may prevail in the future.

Therefore, the basic proposition of this project is the fact it is in line with the objectives of the Faculty of Computing. Therefore, the current need for certain standardized hardware, safety of systems, and accommodating growth in the future shows that the new building is feasible.

These measures make the upgrade not only possible but reasonable and enables the faculty to place itself at the vanguard of pedagogy.

REFLECTION ON TASK 2

In order to generate ideas for our preliminary examination of this task, our team convened via Google Meet. After that, we investigated our initial analysis using the data from task 1 and several investigations. Additionally, we learn about the requirements for a specific piece of hardware and software that an organization uses, such as whether to utilize Cisco or Huawei. The floorplan finished in the previous task dictates the network architecture implementation we will employ. We get to construct the network infrastructure's framework and then modify it in accordance with the floor layout.

TASK 3

In order to develop a network system for the new building, all of these equipment are necessary. We thoroughly examined every piece of equipment and devices to determine which ones would work well in the newly constructed structure. Result of our research:

Equipments and LAN devices required for the construction of the new building include:

- Router
- Switch
- Access Point
- Firewall and VPN
- Server
- Server Rack
- Patch Panel
- Cable
- Optical Fiber
- Storage
- Adapter
- PC Desktop
- Projector
- Network Connector

List of devices

Device	Device Name	Per Unit (RM)	Quantity	Total Price (RM)
Router	TP-Link ER8411	1,915.00	3	5,745.00
Switch	TP-Link SG6654XHP	19,000.00	1	19,000.00
Access Point (Wireless)	TP-Link Omada EAP660 HD AX3600 Wireless Dual Band Multi Gigabit Ceiling Mount Wifi 6 Access Point with PoE Support	1,759.00	5	8,795.00
Firewall and VPN	Juniper Networks SRX380	20,598.00	1	20,598.00
Server	Lenovo ThinkStation P620 DELL Precision 3680 Tower Workstation	14,169.00 4,962.88	30 30	425,070.00 148,890.00
Server Rack	NavePoint 18U Swing Gate Wallmount Rack with 18in Depth	809.33	15	12,140.00
Patch Panel	TRENDnet 24-Port Cat 6 Unshielded Patch Panel	186.69	15	2,801.00
Cable	MONOPRICE 9795 Ethernet Cable	9.65	2275	21,975.00

Optical Fiber	FC-FC SMF Duplex Single Mode Fiber Optic Patch Cord Cable	45.00	10	450.00
Storage	Seagate IronWolf 4TB NAS Internal Hard Drive	559.00	5	2,795.00
Adapter	Adaptor SM Square FC Optical Fiber; Fibre Optic Adapter	3.00	10	30.00
PC Desktop	HP ELITEDESK 800 G4 SFF	850.00	60	51,000.00
Monitor	Dell 22 Monitor	533.00	120	63,960.00
Keyboard & Mouse	Dell KB216 & MS116 Wired Keyboard and Optical Mouse Combo	42.00	120	5,040.00
Camera	Logitech PTZ Pro 2	2,899.00	1	2,899.00
Projector	BenQ MW560	1,950.00	6	11,700.00
Network Connector	Pass-Through RJ45 Connectors	26.00	3	78.00
Total Expense				RM 802,888.00

Router

The TP-Link ER8411 offers an effective solution that adapts to the evolving needs of the Faculty of Computing. Because of its convincing features, it offers a network that is reliable, secure, and efficient. Its high-speed performance supports up to 10 Gbps of routing capacity, a result of its ability to manage heavy workloads and support fast internet connections. Equipped with 2x 10G SFP+ WAN ports and 2x 2.5G RJ45 WAN/LAN ports, it provides options for load balancing and failover. Its strong VPN

and firewall capabilities additionally offer defence against internet threats. It will change to accommodate future expansion and faculty demands. Its dual power source allows for uninterrupted service and offers exceptional value for the money. This complete solution provides an adequate and reasonably priced network infrastructure that supports the faculty's advancement.

Device	TP-Link ER8411	Cisco C1111-8P Integrated Services Router	ASUS RT-AX86U Pro
Specification	● Processor: Quad-core ARM Cortex-A57 2.2 GHz ● Ports: 2 x 10G WAN/LAN SFP+, 8 x Gigabit RJ45 (WAN/LAN) ● Wifi 6 supported	● Processor: Intel Atom C3000 series (Quad-core)1.6 GHz ● Ports: 1 WAN GE, 8 LAN GE ports, USB, and console ports ● Wifi 6 not supported	● Processor: Powered by a 2.0 GHz quad-core ● Ports: 5 (RJ-45), 1 WAN, 4 LAN ● Wifi 6 supported
Price (RM)	1,915.00	2,438.00	1,417.00

Reference	https://www.networkhardwares.com/en-my/products/tp-link-er8411-tp-link-integration-with-omada-sdn-controller-support-ssl-vpn-openvpn-and-ipsec-pptp-er8411?variant=41655734763725&utm_source=google-ads&utm_campaign=&utm_agid=&utm_term=&creative=&device=c&placement=&gad_source=1&gclid=Cj0KCQiAr7C6BhDRARIsAOUKifiQVHVSZibQ36WC2iMty8ZDT7pY9GJVv2hj7f640g0nvk8SxKT	https://www.networkhardwares.com/en-my/products/cisco-c1111-8p-cisco-c1111-8p-integrated-services-router?variant=47451516862669&utm_source=google-ads&utm_campaign=&utm_agid=&utm_term=&creative=&device=c&placement=&gad_source=1&gclid=Cj0KCQiAr7C6BhDRARIsAOUKifgEhfXIJ2Y2NqrryYLxi3rm-MUwVo4yobnjJ1keF6DjnQ-qKXgvmLoaAh2VEALw_wcB	https://www.networkhardwares.com/en-my/products/asus-rt-ax86u-pro-asus-rt-ax86u-pro-wi-fi-6-ieee-802-11ax-ethernet-wireless-router

	pafMaAqZdEALw_wcB		

Switch

The TP-Link SG6654XHP is a reliable and affordable option that fits the main requirements of the UTM Faculty of Computing''s LAN infrastructure. It supports PoE, offers Layer 3 routing, has high-speed uplinks, and is centrally manageable. It offers a great performance-to-cost ratio and is expandable for future expansion. This switch is suitable to function as either a central or peripheral switch in the building's network setup.

Device	TP-Link SG6654XHP	S5860-48XMG-U, 48-Port Ethernet L3 PoE++ Switch	C9300-48T-E - Cisco Switch Catalyst 9300

Specification	• 48× Gigabit RJ45 PoE+ ports • 6× 10 Gbps SFP+ slots • Up to 1440 W total PoE budget • Physical Stacking for built-in redundancy and performance • L3 features: RIP, OSPF, ECMP, VRRP, PIM-DM, DHCP Server/Relay • Security Strategies: ACL, Port Security, DoS Defend, 802.1X	• Equipped with 48x 100M/1000M/2.5G/5 G/10GBase-T, 4x 10G/25G SFP28, and 2x 40G QSFP+ • Up to 48 PoE+ Ports, 90W Per Port & Total Budget 1600W • Broadcom BCM56170 Chip, Support 2 Units Stacking • 1+1 Hot-swappable Power Supplies and 2+1 Smart Fans	• Gigabit Ethernet- 48 10/100/1000 copper ports • L2/L3 Features • Cisco StackWise-480 (480 Gbps stacking bandwidth) • 256 Gbps switching capacity • 5120 QoS scale entries and 5120 ACL scale entries • No PoE+

	• Highly Available with two field-replaceable power supplies, VRRP, and ERPS • Centralized cloud management via the Omada SDN controller • Standalone management via web, CLI, SNMP, and RMON		
Price (RM)	19,000	21,855.00	5,144
Reference	https://ect.my/tp-link-sg6654x hp-omada-48-port-gigabit-stackable-l3-managed-poe-switch-with-6-10g-slots-with-high-speed-connectivity	https://ect.my/tp-link-sg6654x hp-omada-48-port-gigabit-stackable-l3-managed-poe-switch-with-6-10g-slots-with-high-speed-connectivity	https://www.router-switch.com/c9300-48t-e.html

Access Point

For the growing network of the Faculty of Computing, the TP-Link Omada EAP660 HD access point is a great option. It rapidly supports online learning, Internet of Things machines, and other high-demand applications because of its rapid Wi-Fi 6 rates of up to 3550 Mbps. Highly active labs and student areas are appropriate for it since it manages several connections with ease.

Device	TP-Link Omada EAP660 HD AX3600 Wireless Dual Band Multi Gigabit Ceiling Mount Wifi 6 Access Point with PoE Support	TP-Link Omada EAP650 AX3000 Gigabit Dual Band Ceiling Mount Wifi 6 Access Point with PoE Support	NETGEAR WiFi 6 Wireless Access Point Bundle (3x WAX214 + 1x GS305EPP)

Specification	• Ultra-Fast Wi-Fi 6 Speeds: Simultaneous 1148 Mbps on 2.4 GHz and 2402 Mbps on 5 GHz totals 3550 Mbps Wi-Fi speeds. • High-Density Connectivity: 4x increased capacity to connect more devices simultaneously . • Integrated into Omada SDN: Zero-Touch Provisioning (ZTP), Centralized Cloud Management, and Intelligent Monitoring. • Centralized Management:	• Ultra-Fast WiFi 6 Speeds: Simultaneous 574 Mbps on 2.4 GHz and 2402 Mbps on 5 GHz totals 2976 Mbps WiFi speeds.† • High-Efficiency WiFi 6: More connected devices can enjoy faster speeds. • Centralized Cloud Management: Omada SDN integration manages the whole network locally or from the cloud via	• Essentials WiFi 6 AX1800 Dual Band Wall/Ceiling Mount, PoE Powered, Local Management (WAX214) • 2.4GHz and 5GHz • 600Mbps (2.4GHz), 1,200Mbps (5.0GHz) • 1x GbE • Maximum Number of Clients 128

	Cloud access and Omada app for ultra convenience and easy management. ● 2.5G Port: A 2.5 Gbps Ethernet port boosts total internet throughput. ● Seamless Roaming: Even video streams and voice calls are unaffected as users move between locations. ● PoE+ Support: Supports Power over Ethernet (802.3at) for convenient deployment and installation. ● Secure Guest Network: Along with multiple authentication options (SMS/Facebook	web UI or Omada app. ● 160 MHz Channel: Double the data at peak transmission times on a single stream with HE160.‡ ● Seamless Roaming: Video streams and voice calls are unaffected as users move between locations.§ ● Omada Mesh: Enables wireless connectivity between access points for extended range and flexible deployment.§	

	Wi-Fi/ Voucher, etc.) and abundant wireless security technologies.	• PoE+ Powered: Supports both 802.3at PoE+ and	

		DC (DC adapter included) power supply for flexible installations .	
Price	1,759	899	3,029
Reference	https://ect.my/tp-link-eap660-hd-ax3600-wireless-dual-band-multi-gigabit-ceiling-mount-access-point	https://ect.my/index.php?route=product/product&product_id=14688&search=access+point+&page=3	https://netgearstore.my/products/netgear-wifi-6-wireless-access-point-bundle-3x-wax214-1x-gs30 5epp

Firewall and VPN

For the requirements of the Faculty of Computing, the Juniper Networks SRX380 is a beneficial firewall. It provides

4.4 Gbps VPN throughput and up to 20 Gbps firewall throughput, enabling uninterrupted access for IoT devices and high-bandwidth applications. Its 16 PoE+ ports make it easier to deploy wireless access points and Internet of Things devices, and its flexible layout and four 10GbE uplinks allow for adjustable expansion. The network is protected against attacks by advanced security measures including malware prevention.

Device	Juniper Networks SRX380	Cisco ASA 5500-X Series Next-Generation Firewalls	Huawei HiSecEngine USG6500E Series Next-Generation Firewalls

Specification	• High-density ports with up to 16GE POE+ and 4x10GE SFP+ • Expansion flexibility with 4x MPIM slots • Enhanced performance with 4G RAM and 100GB SSD • Comprehensive security and network features with Junos Software Base • Single AC power supply for reliable power input	• Firepower service Supported, including Firesight management Center, ASDM 9.X • Interfaces 8 copper GE ports, 1 copper GE management port, 1 expansion slot • Stateful inspection throughput (maximum) 3 Gbps • 3DES/AES VPN throughput 400 Mbps • IPsec VPN peers 2,500 • Virtual interfaces	• Fixed Interface 2 x 10GE (SFP+) + 8 x GE Combo + 2 x GE WAN • Dedicated management port Yes • USB Port 1 x USB 2.0 + 1 x USB 3.0 • Firewall Throughput1(1518/ 512/64-byte, UDP) 6/6/3.6Gbit/s • Firewall Latency (64-byte, UDP) • 18 s • FW + SA + IPS Throughput2 2.2Gbit/s • FW + SA + IPS +

		(VLANs) 300 • Memory 12 GB • Flash 8 GB	Antivirus Throughput2 2.2Gbit/s
Price	20,598	29,521	12,155
Reference	https://www.router-switch.com/srx380-p-sys-jb-ac.html	https://www.router-switch.com/asa5545-fpwr-k9.html	https://www.router-switch.com/usg6565e-ac.html

Server

Device	Juniper Networks SRX380	Cisco ASA 5500-X Series Next-Generation Firewalls	Huawei HiSecEngine USG6500E Series Next-Generation Firewalls

Specification	● High-density ports with up to 16GE POE+ and 4x10GE SFP+ ● Expansion flexibility with 4x MPIM slots ● Enhanced performance with 4G RAM and 100GB SSD ● Comprehensive security and network features with Junos Software Base ● Single AC power supply for reliable power input	● Firepower service Supported, including Firesight management Center, ASDM 9.X ● Interfaces 8 copper GE ports, 1 copper GE management port, 1 expansion slot ● Stateful inspection throughput (maximum) 3 Gbps	● Fixed Interface 2 x 10GE (SFP+) + 8 x GE Combo + 2 x GE WAN ● Dedicated management port Yes ● USB Port 1 x USB 2.0 + 1 x USB 3.0 ● Firewall Throughput1(1518/512/64-byte, UDP)

		• 3DES/AES VPN throughput 400 Mbps • IPsec VPN peers 2,500 • Virtual interfaces (VLANs) 300	6/6/3.6Gbit/s • Firewall Latency (64-byte, UDP) • 18 s • FW + SA + IPS Throughput2 2.2Gbit/s • FW + SA + IPS + Antivirus Throughput2

		• Memor	2.2Gbit/s

		y 1 2 G B • Flash 8 GB	
Price	20,598	29,521	12,155
Reference	https://www.router-switch .com/srx380-p-sys-jb-ac.h tml	https://www.router-switch .com/asa5545-fpwr-k9.ht ml	https://www.router-switch .com/usg6565e-ac.html

Server Rack

The NavePoint 18U Swing Gate Wallmount Rack is a durable, space-efficient solution designed for organizing IT, AV, and networking equipment in smaller setups like server rooms or data closets. Made from high-quality 1.5mm cold-rolled steel with a black powder-coated finish, it measures 18 inches in depth, 20.8 inches wide, and 36.5 inches tall, accommodating standard 19-inch equipment. It has a weight capacity of 110 lbs and includes a dual-hinged swing gate that opens 180 degrees for easy rear access, allowing flexible left or right-side mounting. The rack features pre-threaded and universal square mounting holes for compatibility with various equipment, and its open design promotes passive cooling for improved performance. Assembly hardware is included, and the rack complies with industry standards like EIA/ECA-310-E

Item	StarTech 25U Server Rack (4-Post)	APC NetShelter SX 42U Server Rack	NavePoint 18U Wall-Mount Server Rack
Specification	Adjustable depth, compatible with various server sizes, durable steel construction.	Lockable front and rear doors, advanced cable management, airflow optimization.	Space-saving wall-mounted design, lockable door, great for compact spaces.
Price (RM)	2,227.00	5,345.00	811.00

References	https://www.startech.com/en-eu/server-management/4postrack25u?srsltid=AfmBOoothhtynByNArkc4MVbF2q-s1-eHmbJFXNwDIf9 A_JZEdeH3gso	https://www.se.com/my/en/product/AR3100/apc-netshelter-sx-server-rack-enclosure-42u-black-1991h-x-600w- x-1070d-mm/	https://navepoint.com/navepoint-18u-swing-gate-wallmount-rack-with-18in-depth/?srsltid=AfmBOooBJuupfL0bRXDmS9VjGjPuZkllbd5ktPE-pe60HwFa7dUh-Cm5

Patch Panel

The TRENDnet 24-Port Cat 6 Unshielded Patch Panel (model TC-P24C6) is a rack-mountable network panel designed for Gigabit Ethernet connectivity. It supports Cat 3, 4, 5, 5e, and 6 cabling and delivers a steady 250 MHz connection, making it suitable for high-speed Ethernet, Fast Ethernet, and Gigabit Ethernet applications. The panel features color-coded labeling for T568A and T568B wiring schemes, ensuring easy and organized cable management. Built with 110D IDC terminal blocks, it supports both 110 and Krone punch-down tools. It meets ANSI/EIA/TIA 568-B.2-1 and ISO/IEC 11801 standards and can operate in temperatures ranging from -40°C to 80°C, making it highly reliable in various environments.

Device	TRENDnet TC-P24C6 24-Port Cat6 Patch Panel	Tripp Lite 48-Port 2U Cat6 Patch Panel (N252-048)	Monoprice 24-Port Cat5e Patch Panel
Specification	• 24 ports with Cat6 compliance for high-speed Ethernet connections. • Clearly labeled ports for easy organization. • Sturdy metal construction for durability.	• 48 ports for larger network setups. • Fully compliant with Cat6 standards. • Includes cable management bar for neat installations.	• Affordable option for basic networking needs. • Compatible with Cat5e cables, backward compatible with Cat5. • Compact and easy to install.
Price (RM)	223.00	669.00	134.00
References	https://www.trendnet.com/products/patch-panels	https://tripplite.eaton.com/1u-rack-mount-cat6-110-high-density-	https://www.monoprice.com/product?p_id=7255&srsltid=AfmBO

	/TC-P24C6	patch-panel-568b-rj45-ethernet-48-port~N2520481U	orTJMPjIplLWpLIvme1w0u2DXtUE3T16yr0WunUP maJkjIDZg4d

Cable

The Monoprice 9795 Ethernet Cable is a high-performance Cat6 patch cable designed for reliable network connectivity. It features unshielded twisted pair (UTP) construction with 24AWG pure bare copper conductors, ensuring robust signal quality and durability. This cable supports speeds up to 550MHz, making it ideal for demanding network setups, including university labs and office environments. Its snagless RJ45 connectors with flex boot design reduce cable wear and improve ease of installation in tight spaces. Available in various lengths and colors, it is suitable for versatile networking needs while being backed by a lifetime warranty.

Device	Vandesail Cat6a Ethernet Cable	Cable Matters Cat6a Ethernet Cable	Monoprice Cat6a STP Ethernet Patch Cable
Specification	· Shielded twisted pair (STP) for enhanced noise resistance. · Up to 10 Gbps speed and 500 MHz bandwidth. · Durable PVC jacket for heavy use.	· Supports 10GBASE-T up to 100 meters. · Snagless design to reduce wear during installation or rearrangement. · Flexible and durable for frequent use.	· Shielded for high interference resistance in crowded setups. · Gold-plated connectors for stable connections and durability. · Meets TIA/EIA standards for structured cabling.

Price (RM)	1.33	1.11	1.33
References	https://vandesail.com/collections/ethernet-ca ble	https://www.cablematters.com/pc-892-160-cat6a-snagless-shielded-sstpsftp-ethernet-patch-cable.aspx?srsltid=AfmBOop59eJP-AfgWTRmYc-fqMcgp1DJQ8TQCrQKGzZvZx57a QFf51TW	https://www.monoprice.com/product?p_id=5898&srsltid=AfmBOoo3DegVKzwSsM81uqp4HbavMRHLUYAU vtF8hvX4SzpUTYEjb QVF

Optical Fiber

The **FC-FC SMF Duplex Single Mode Fiber Optic Patch Cord Cable** offers a dependable and high-speed solution tailored to the Faculty of Computing's network infrastructure needs. Designed to
support modern connectivity, this fiber optic cable delivers outstanding performance for high-bandwidth applications. Its single-mode design minimizes signal loss over extended distances, making it perfect for linking various labs and network zones in the newly planned building. Equipped with FC/FC connectors and duplex

construction, it ensures bidirectional data transfer, fostering a seamless and efficient network environment.

The cable's durable build guarantees consistent performance, a crucial aspect for educational institutions where reliability is paramount. It is future-ready, supporting 10G Gigabit Ethernet, and aligns with the goals of the 4th Industrial Revolution (4IR). Moreover, its cost-effective pricing makes it an ideal choice for large-scale deployment throughout the facility. By selecting this high-performance cable, the Faculty of Computing secures a network infrastructure capable of meeting both present needs and future growth. This cable exemplifies an affordable and scalable solution, perfectly fulfilling the faculty's requirements for reliable and robust connectivity.

Device	FC-FC SMF Duplex Single Mode Fiber Optic Patch Cord Cable	LC-LC OS2 Single Mode Duplex Fiber Optic Patch Cable	FC/APC to FC/APC Single Mode Fiber Optic Patch Cable
Specification	• Connector: FC to FC • Type: Duplex Single Mode • Length: 1m • Supported Bandwidth: 10G Gigabit Ethernet	• Connector: LC to LC • Type: Duplex Single Mode • Length: 10m • High-density networking applications	• Connector: FC/APC to FC/APC • Type: Single Mode • Length: 3m • Reduced back reflections for signal clarity
Price (RM)	45.00	62.00	70.00

Reference	FC-FC SMF Duplex Single Mode Fiber Optic Patch Cord Cable 9/125 SM LAN jumper UPC 10G Gigabit FC/FC Dual core FC to FC | Shopee Malaysia	LC-LC Single Mode Duplex Fiber Optic Patch Cord Cable For LAN SFP - 10M 15M 20M 30M 75M 120M meter 9/125 SM | Shopee Malaysia	FC/APC-E2K/APC Singlemode Duplex Fiber Optic Patch Cable 3M 5M 15M 20M 30M | Shopee Malaysia

Storage

The **Seagate IronWolf NAS Internal Hard Drive** is a high-performance storage solution designed specifically for network-attached storage (NAS) systems. With a capacity of **4TB**, it offers ample space for managing large datasets, backups, and shared resources, making it ideal for the Faculty of Computing's new building. Operating at **7200 RPM**, this drive delivers fast read/write speeds, ensuring seamless performance for data-intensive tasks such as file sharing, virtual machines, and collaborative projects.

Built with NAS optimization in mind, the IronWolf includes features like **AgileArray technology**, which enhances reliability through advanced error recovery, RAID optimization, and 24/7 operational readiness. Its **SATA 6Gbps interface** ensures compatibility with most NAS systems while providing robust data transfer rates. Furthermore, the drive's low power consumption reduces heat generation and ensures energy efficiency, which is crucial for long-term use in a centralized network environment.

With its affordability at **RM 620 per unit**, the IronWolf strikes an excellent balance between performance and cost. It is highly durable, designed to handle the workloads of multi-user environments, and offers a scalable solution for the Faculty of Computing's growing storage needs. By choosing the Seagate IronWolf NAS, the faculty ensures reliable and future-ready storage for its state-of-the-art labs and virtual classrooms.

Device	Seagate IronWolf NAS	Western Digital Red Plus	Toshiba N300 NAS
Specification	• Type: Internal HDD • Capacity: 4TB • Speed: 7200 RPM • Interface: SATA 6Gbps • Designed for NAS systems	• Type: Internal HDD • Capacity: 4TB • Speed: 5400 RPM • Interface: SATA 6Gbps • Optimized for NAS environments	• Type: Internal HDD • Capacity: 4TB • Speed: 7200 RPM • Interface: SATA 6Gbps • Built for 24/7 operations

Price (RM)	559.00	649.00	610.00
Reference	Seagate IronWolf 4TB 3.5" Sata 6Gb/s 5900RPM 64MB NAS Internal Hard Drive HDD – ST4000VN008 | Shopee Malaysia	WD Western Digital Red Plus NAS 2TB / 4TB / 6TB / 8TB/ 10TB / 12TB 3.5-Inch Hard Drive -- FREE SATA CABLE | Shopee Malaysia	[Ready Stock] TOSHIBA N300 NAS DATA CENTER HDD HardDrive 3.5” 4TB 6TB 8TB10TB 12TB 14TB 16TB (100% Original) | Shopee Malaysia

Adapter

The **Adaptor SM Square FC Optical Fiber** is a cost-effective and reliable connectivity solution designed for single-mode fiber optic networks. Featuring **FC/UPC connectors**, this adapter ensures stable and efficient connections, making it an ideal choice for the Faculty of Computing's new building. Its durable design provides long-lasting performance, ensuring consistent reliability in handling high-speed data transfers and critical networking tasks.

Optimized for seamless integration into fiber optic systems, the SM Square adapter offers **low insertion loss**, ensuring minimal signal degradation during data transmission. Its simple design enhances compatibility with a wide range of FC connectors, while its robust construction supports long-term usage in demanding

environments. At a price of **RM 3.00 per unit**, this adapter delivers excellent value, especially for large-scale deployments where cost-effectiveness is a key factor.

The affordability and reliability of the Adaptor SM Square FC Optical Fiber make it an excellent choice for the Faculty of Computing's network infrastructure. By selecting this adapter, the faculty can establish a high-performance, scalable network that meets current needs and anticipates future expansion, aligning with the vision of providing a state-of-the-art educational facility.

Device	Adaptor SM Square FC Optical Fiber	LC/UPC to SC/UPC Fiber Optic Adapter	FC/APC to LC/APC Fiber Optic Adapter
Specification	● Connector: FC/UPC ● Type: Singlemode ● Compatibility: FC connectors ● Durable and reliable for long-term use	● Connector: LC to SC ● Type: Singlemode ● Compatibility: LC and SC connectors ● Precision-aligned for reliable data transfer	● Connector: FC/APC to LC/APC ● Type: Singlemode ● Compatibility: FC and LC connectors ● Low insertion loss for efficient performance

Price (RM)	3.00	73.15	19.00
Reference	Adaptor SM Square FC Optical Fiber ; Fibre Optic Adapter | Shopee Malaysia	Fiber Optic LC/UPC Male to SC/UPC Female Adapter|Fo LC-SC Adapter | Shopee Malaysia	Fiber Optic LC/UPC Male to SC/UPC Female Adapter|Fo LC-SC Adapter | Shopee Malaysia

Pc Desktop

The **HP EliteDesk 800 G4 SFF PC Desktop** is a versatile and powerful solution designed for

high-performance computing in educational and professional environments. Equipped with an **Intel Core i5-8500 processor**, **16GB of RAM**, and a **512GB SSD**, this desktop delivers fast and efficient performance for a wide range of applications, including data processing, programming, and collaborative projects, making it ideal for the Faculty of Computing's new building.

With its **Small Form Factor (SFF) design**, the HP EliteDesk 800 G4 saves valuable space while maintaining robust functionality. Its SSD storage ensures quick boot times and responsive performance, while the ample RAM capacity allows for seamless multitasking. This makes it suitable for the intensive workloads of students and staff in the Faculty of Computing.At a cost of **RM 850 per unit**, the HP EliteDesk 800 G4 offers an affordable yet powerful solution for equipping the faculty's labs and classrooms. Its durability and reliable performance ensure it can handle the daily

demands of educational use, while its energy-efficient design minimizes power consumption, contributing to the overall sustainability of the new facility.

By choosing the **HP EliteDesk 800 G4 SFF**, the Faculty of Computing ensures a future-proof investment that supports high-quality education and research activities, meeting both current demands and future needs. This PC desktop aligns perfectly with the faculty's vision of providing a cutting-edge learning environment.

Device	HP EliteDesk 800 G4 SFF	Dell OptiPlex 7050 SFF	Lenovo ThinkCentre M720 SFF
Specification	• Processor: Intel Core i5-8500 • RAM: 16GB • Storage: 512GB SSD • Form Factor: Small Form Factor (SFF)	• Processor: Intel Core i5-7500 • RAM: 8GB • Storage: 256GB SSD • Form Factor: Small Form Factor (SFF)	• Processor: Intel Core i5-8500 • RAM: 8GB • Storage: 512GB SSD • Form Factor: Small Form Factor (SFF)
Price (RM)	850.00	845.00	980.00

Reference	HP ELITEDESK 800 G4 SFF INTEL CORE I5-8500 16GB RAM 512GB SSD USED DESKTOP REFURBISHED PC | Shopee Malaysia	DELL OPTIPLEX 3060 / 7040 / 7050 / 3040 Mini/SFF DESKTOP CORE I5/i7(7TH/8TH GEN)UPGRADE RAM UP TO 64GB WINDOWS PRO 10/11 | Shopee Malaysia	Fiber Optic LC/UPC Male to SC/UPC Female Adapter|Fo LC-SC Adapter | Shopee Malaysia

Monitor

The Dell 22 Monitor SE2222H is a reliable and high-quality display designed to meet the needs of educational and professional environments. With a 21.5-inch Full HD (1920 x 1080) resolution, it delivers sharp and vibrant visuals, making it ideal for tasks such as programming, data visualization, and collaborative projects in the Faculty of Computing's new labs and classrooms.

Featuring a VA panel, the Dell SE2222H provides excellent contrast ratios and color accuracy, ensuring that users experience deep blacks and vivid colors. This makes it suitable for a variety of applications, from general office tasks to multimedia use. The monitor is equipped with both HDMI and VGA ports, allowing for versatile connectivity options with a wide range of devices. Its compact and space-saving design ensures it fits seamlessly into any workstation setup.

At an affordable price of RM 533 per unit, the Dell 22 Monitor SE2222H strikes a perfect balance between performance and cost. Its durable build and energy-efficient design further enhance its value, ensuring reliable performance over time. By choosing this monitor, the Faculty of Computing invests in a dependable and visually appealing

display that supports productivity and enhances the overall learning experience for students and staff alike.

Device	Dell 22 Monitor SE2222H	Acer V227Q	HP P22 G7
Specification	• Screen Size: 21.5 inches • Resolution: Full HD (1920 x 1080) • Panel Type: VA • Ports: HDMI, VGA	• Screen Size: 21.5 inches • Resolution: Full HD (1920 x 1080) • Panel Type: IPS • Ports: HDMI, VGA, DisplayPort	• Screen Size: 27 inches • Resolution: Full HD (1920 x 1080) • Panel Type: IPS • Ports: HDMI, VGA, DP
Price (RM)	533.00	799.00	869.00
Reference	Dell 22 Monitor: SE2222H with Full HD Resolution (HDMI VGA) for Gaming Student Designer SME Business Office pelajar | Shopee Malaysia	DELL OPTIPLEX 3060 / 7040 / 7050 / 3040 Mini/SFF DESKTOP CORE I5/i7(7TH/8TH GEN)UPGRADE RAM UP TO 64GB WINDOWS	HP P27 G5 FHD Monitor | Shopee Malaysia

		PRO 10/11 | Shopee Malaysia	

Keyboard

The **Dell KB216 & MS116 Wired Keyboard and Optical Mouse Combo** offers a cost-effective and reliable solution for professional and educational use. The **KB216 keyboard** features a full-sized layout with quiet keys and multimedia functions, ensuring comfort and convenience during extended use. Paired with the **MS116 optical mouse**, it provides smooth and precise navigation for everyday tasks.

At just **RM 42.00 per unit**, this combo combines essential peripherals into a single, space-saving package. Its USB connectivity ensures compatibility with a wide range of systems, making it an ideal choice for the Faculty of Computing's labs and classrooms. Durable and easy to use, the combo supports a functional and efficient learning environment.

Device	Logitech K120 USB Keyboard	HP 150 Keyboard	Dell KB216 Wired Keyboard
Specification	• Type: Wired • Connectivity: USB • Features: Spill-resistant, full-size layout,	• Type: Wired • Connectivity: USB • Features: Full-size keyboard with quiet typing	• Type: Wired Keyboard and Mouse Combo • Connectivity: USB

	plug-and-play	and a wired mouse	• Features: Compact keyboard design and optical mouse
Price (RM)	35.00	45.00	42.00
Reference	Logitech K120 USB Wired Keyboard | USB Plug-and-Play | Full-Size | Spill-Resistant (920-002582) | Shopee Malaysia	HP 150 WIRED MOUSE AND KEYBOARD COMBO | Shopee Malaysia	Dell KB216 & MS116 - Wired Keyboard & Optical Wired Mouse [Save Up RM 8] | Shopee Malaysia

Camera

The **Logitech PTZ Pro 2** is an ideal solution for the Faculty of Computing (FC) at UTM, offering advanced features that align with the faculty's mission to create an innovative and connected learning environment. With its **motorized pan-tilt-zoom (PTZ) capabilities**, the camera can capture wide classroom spaces, ensuring that both the lecturer and students remain in focus during sessions. Its **90° field of view** and **10x optical-quality zoom** allow it to record fine details, such as coding demonstrations on whiteboards or student presentations, making it perfect for classrooms and lecture halls. The camera's ability to be remotely controlled enhances flexibility, especially for

dynamic teaching settings where different areas of the room need to be recorded or streamed seamlessly. Its **1080p Full HD resolution** ensures that recorded lectures are crystal clear, providing an immersive experience for students attending in-person or online.

For the Faculty of Computing, the **Logitech PTZ Pro 2** also supports the transition to hybrid and remote learning, a priority in meeting the challenges of the **Fourth Industrial Revolution (4IR)**. The camera's **plug-and-play USB connectivity** ensures compatibility with popular platforms like **Zoom, Microsoft Teams, and Webex**, enabling seamless integration into the faculty's existing digital infrastructure. The simple setup and user-friendly operation make it easy for lecturers and staff to use without extensive technical training, while its **cost-effectiveness** ensures the faculty can invest in multiple units to enhance its recording and streaming capabilities without exceeding its budget. With its robust features, reliability, and affordability, the Logitech PTZ Pro 2 supports the Faculty of Computing's goal of providing a cutting-edge and connected learning experience for students and staff alike.

Device	Logitech C922 Pro Stream Webcam	Logitech PTZ Pro 2	Sony SRG-X120

Specification	• **Type**: Lecture recording and hybrid classes conferencing for large rooms • **Resolution**: 1080p Full HD at 30fps (or 720p at 60fps) • **Dimensions**: 226 x 91 x 119 mm **Features**: • Autofocus • Adjustable lighting	• **Type**: PTZ (Pan-Tilt-Zoom) Camera • **Resolution**: 1080p Full HD at 30fps • **Dimensions**: 146 x 131 x 130 mm (without remote) **Features**: • Remote-controlled PTZ functions • Autofocus • Plug-and-play setup	• **Type**: Professional PTZ Camera • **Resolution**: 1080p Full HD at 60fps (with Clear Image Zoom up to 24x) • **Dimensions**: 145 x 164 x 153 mm **Features**: • Remote-controlled PTZ functions • IP streaming for remote learning • Excellent low-light performance
Price (RM)	450	2,899	12,152

Reference	C922 Pro Stream 1080p Webcam + Capture Software	Logitech PTZ Pro 2 Video Conference Camera & Remote	Sony SRG-X120 PTZ HD Network Camera - 12x Zoom - Malaysia | Ubuy

Projector

The **BenQ MW560 projector** is an excellent fit for the Faculty of Computing at UTM, providing the performance and adaptability needed to support a dynamic and technology-driven learning environment. With its **4,000 ANSI lumens brightness**, it ensures that presentations and lectures remain clear and vibrant, even in well-lit classrooms, which is especially important for daylight sessions. Its **WXGA resolution (1280x800)** offers sharp visuals, making it ideal for showcasing detailed coding demonstrations, intricate diagrams, and multimedia content often used in computing courses. The multiple connectivity options, including **HDMI and VGA**, ensure seamless integration with laptops, tablets, and other devices widely utilized in the faculty's labs and lecture halls. The **SmartEco mode**, which optimizes power usage, reduces maintenance costs, and extends lamp life, is particularly beneficial for the high-frequency usage typical in academic settings.

Another reason the BenQ MW560 aligns well with the Faculty of Computing is its portability and user-friendly design. Weighing just **2.3 kg**, it can be easily shared across classrooms, ensuring flexibility in resource allocation. This is especially useful for collaborative spaces or hybrid teaching setups, where the same projector might be required in different locations. Its straightforward operation allows lecturers and staff to set it up quickly without technical difficulties, enabling smoother and more efficient teaching sessions. Given its affordability, the faculty can deploy multiple units across

labs and classrooms, ensuring an enhanced learning experience without exceeding the budget. With its combination of high-quality visuals, energy efficiency, and ease of use, the BenQ MW560 complements the Faculty of Computing's goal of fostering a state-of-the-art and engaging educational environment.

Device	Epson EB-X41	BenQ MW560	ViewSonic PA503S
Specification	• **Resolution**: XGA (1024 x 768) • **Brightness**: 3,600 Lumens (White and Color Light Output) • **Lamp Life**: Up to 12,000 hours in ECO mode • **Contrast Ratio**: 15,000:1 • **Connectivity** : HDMI, USB, VGA, Wi-Fi (optional with accessory)	• **Resolution**: WXGA (1280 x 800) • **Brightness**: 3,600 Lumens • **Lamp Life**: Up to 15,000 hours in SmartEco mode • **Contrast Ratio**: 20,000:1 • **Connectivity**: HDMI, VGA, USB, Wireless (via dongle)	• **Resolution**: SVGA (800 x 600) • **Brightness**: 3,600 Lumens • **Lamp Life**: Up to 15,000 hours in SuperEco mode • **Contrast Ratio**: 22,000:1 • **Connectivity**: HDMI, VGA, Composite Video, USB
Price (RM)	1,999	1,950	1,399

Reference	EPSON EB-X41 XGA 3600 LUMENS 3LCD	BenQ MW560 Business Projector WXGA 4000 LM	Viewsonic PA503S SVGA Projector

	PROJECTOR	High Brightness High Contrast | Shopee Malaysia	

Network Connector

The **RJ45 network connector** is an ideal choice for the Faculty of Computing (FC) because it directly supports the faculty's goals of creating a reliable, scalable, and future-ready learning environment. As the faculty embraces the challenges of the **Fourth Industrial Revolution (4IR)**, a stable and high-speed network is essential for modern educational practices like hybrid learning, online assessments, and hands-on lab activities. RJ45 connectors ensure smooth, fast connections for these data-heavy tasks, including programming simulations, virtual labs, and group collaborations. With support for **Gigabit and even 10-Gigabit Ethernet**, they can handle the increasing demand for bandwidth while preparing the network for future advancements.

The ease of setup and scalability of RJ45 connectors also meets the faculty's requirement for **standardized lab environments**. By using widely available cables like Cat6 or Cat6a, the faculty can build a unified network across different spaces, such as general-purpose labs, Cisco Networking Labs, and IoT-equipped classrooms. This standardization simplifies maintenance and makes it easier to expand as student enrollment grows by the projected **15% over the next four years**. Additionally, features like **Power over Ethernet (PoE)** enable the faculty to power devices like IoT

sensors and access points directly through network cables, supporting the creation of a secure and interconnected environment.

RJ45 connectors offer compatibility with a broad range of devices, including computers, servers, and network hardware, making them a practical choice for FC's diverse needs. Their reliability ensures minimal disruptions, allowing students and staff to focus on teaching and learning. By providing a cost-effective solution that is both flexible and future-proof, RJ45 connectors help the Faculty of Computing stay at the forefront of education and technology while efficiently meeting its infrastructure goals.

Device	RJ45 Network Connector
Specification	• **Type:** CAT6 4-Pair UTP • **Conductor Gauge:** 23 AWG
Price (RM)	25.89
Reference	ZoeRax Pass Through RJ45 Connector, Cat6 Cat6a 30u Gold Plated Shielded Modular Plug 1.1mm/1.2mm Hole for STP Ethernet Cable 8P8C Ends | Shopee Malaysia

Report

1. Are you surprised by the prices?

Looking at the breakdown in the table, the total expense of RM 772,052 is well within your allocated budget of RM 950,000, leaving you with a comfortable buffer of RM 177,948. This is excellent financial planning, as it allows room for any additional expenses or potential upgrades in the

future.While most of the prices seem appropriate for enterprise-grade hardware, one product that stands out is the **TP-Link SG6654XHP Switch**, priced at RM 19,000 for a single unit. It's a high-end, advanced switch likely designed for large-scale networking with exceptional performance capabilities. Even though it is a critical component for the infrastructure, the price does catch the eye. That said, its specifications might fully justify the cost in terms of reliability, efficiency, and scalability for your setup.

2. Reflect on costs of devices?

Reflecting on the overall costs, the total expense of RM 772,052 demonstrates a well-planned investment in high-quality enterprise-grade equipment. The costs are balanced across critical components such as servers, networking devices, and peripherals, ensuring a robust and scalable infrastructure.The servers and networking equipment, which are essential for performance, security, and connectivity, represent the largest portion of the budget. Items like the TP-Link SG6654XHP switch and Juniper Networks SRX380 firewall, while expensive, are investments in reliability and advanced features.Smaller items, such as cables, patch panels, and peripherals, while individually less costly, collectively account for a significant amount due to their large quantities. This highlights the importance of accounting for every detail in a large-scale setup.Overall, the costs align with the project's goals, staying comfortably within the RM 850,000 budget while prioritizing quality and functionality. The setup is well-suited to meet demanding operational requirements, with room for flexibility if additional expenses arise.

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

When comparing similar devices from different brands, the differences typically revolve around performance, features, build quality, compatibility, and cost. High-end brands tend to focus on reliability and scalability, offering advanced features like faster speeds, centralized management, enhanced security, and seamless integration into enterprise environments. For example, enterprise-grade networking equipment like Cisco or Juniper switches often supports higher traffic loads and more complex configurations compared to budget brands like TP-Link. Similarly, premium servers from Dell or Lenovo are built for 24/7 operations with superior cooling systems, robust power management, and extensive upgrade options.

On the other hand, budget-friendly brands may provide essential features at a lower price point, making them suitable for smaller-scale operations or less demanding environments. However, they might lack advanced functionalities, durability, or the level of support that enterprise brands offer. Customer service and warranty options also differ, with premium brands typically providing better long-term support, software updates, and replacement guarantees. Ultimately, the choice between brands depends on the balance of performance, features, and budget priorities for the intended use case.

REFLECTION ON TASK 3

In the past, we thought it would be simple to buy networking equipment for a newly built facility. Just go to a computer store and find every device on the list. The idea, nevertheless, was entirely wrong. We had to think about making sure the LAN equipment we bought matched the unique usage needs of the building. Every device has a distinct set of requirements that we must adhere to in order for the devices to function as intended. A router with multiple models, settings, and price points, for example, is more than just that. The number of input LAN ports and the transmission rate—which determines how fast data may move between the source and the destination—are two further requirements that need to be established. Furthermore, we found that the list of necessary equipment did not fully account for the project's budget. It is true that we need to account for the cost of wiring, technical and mechanical components, installation, and setup. Every expense will be determined by the budget that has been set aside.

TASK 4

Identify the work areas on the floor plan

GENERAL PURPOSE LAB 1

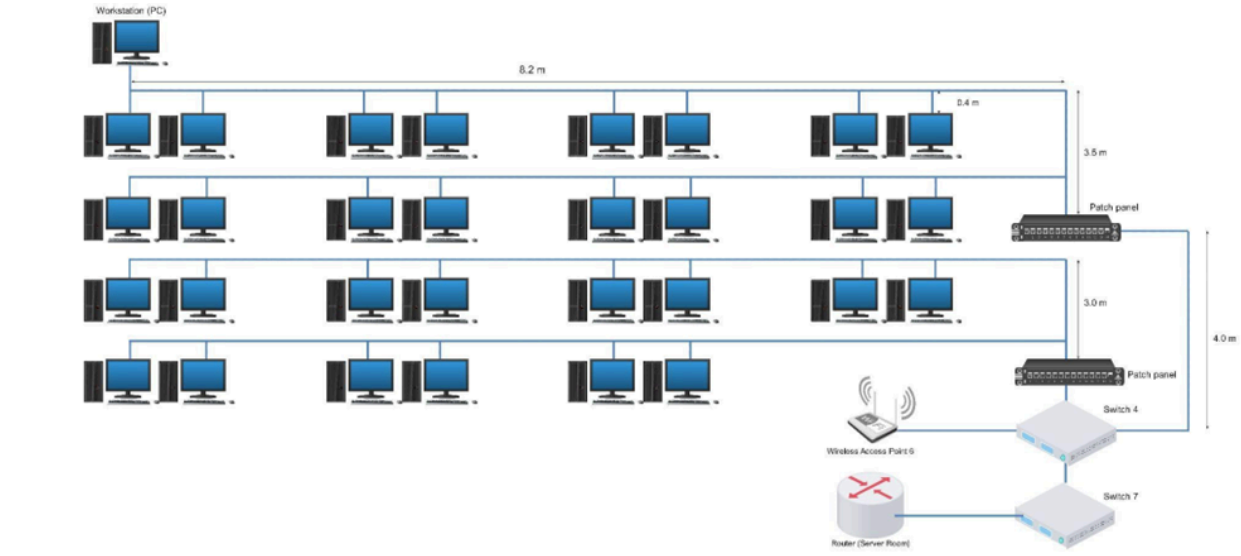


Figure 4

General Purpose Lab 1 is designed for standard use, featuring multiple rows of workstations, each consisting of desktop PCs with monitors. The layout is arranged horizontally, with approximately six rows of workstations evenly spaced across the lab. Each row is connected to a patch panel through horizontal cabling, ensuring organized and efficient data transfer. The cabling distances are clearly marked, such as 8.2 meters between rows and additional lengths for connections to the patch panel and backbone. The patch panels are centrally linked to Switch 4, which acts as the main distribution point for this lab. Switch 4 connects to the institution's main network through a router located in the server room. To enhance connectivity, a wireless access point is strategically placed within the lab, providing wireless coverage for mobile devices and laptops. The cabling structure prioritizes proper horizontal and vertical organization to reduce interference and ensure efficient data flow.

GENERAL PURPOSE LAB 2

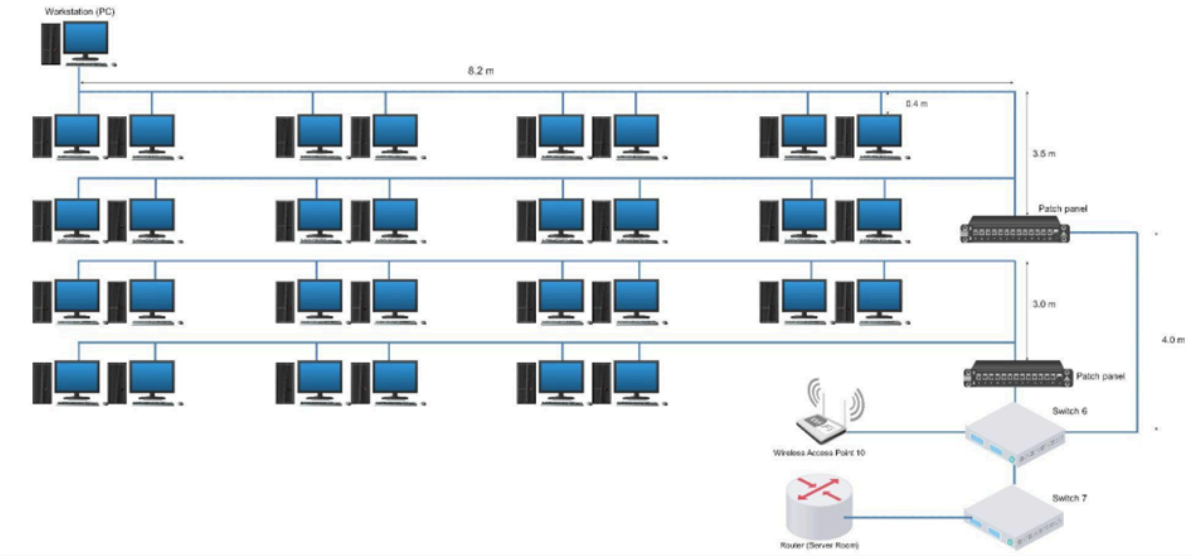


Figure 5

General Purpose Lab 2 follows a similar layout to Lab 1, designed for standard computing needs. It also features multiple rows of workstations, with each row linked to a patch panel through structured horizontal cabling. The arrangement of PCs is consistent and ergonomic, allowing easy access for users. The patch panels in this lab are connected to Switch 6, which serves as the lab's primary switch, forwarding data traffic to the main institution network via a router located in the server room. Like Lab 1, Lab 2 incorporates a wireless access point to provide flexibility for wireless devices, enabling users to connect without the need for physical cabling. The cable lengths in this lab are similarly labeled, with a focus on efficient horizontal cabling between workstations and patch panels, and vertical cabling to the switch and backbone connections. This setup ensures reliability and high-speed communication while maintaining simplicity in infrastructure.

CISCO LAB

Figure 6

The Cisco Lab is more specialized, designed to accommodate networking and hardware-focused activities. This lab includes rows of workstations, each featuring both desktop PCs and dedicated Cisco routers for hands-on networking training. The rows are horizontally arranged, with distances between devices and components carefully planned and labeled. Each row is connected to a patch panel via structured horizontal cabling, which is then linked to Switch 1, the primary switch for this lab. The switch connects to the institution's main network through a router located in the server room. The addition of Cisco routers at each workstation enables users to practice advanced networking configurations and protocols, making this lab ideal for educational purposes in networking and IT. A wireless access point is also included to support mobile and wireless devices, offering an additional layer of connectivity. The cabling structure here includes detailed planning for both horizontal cabling between workstations and vertical cabling to the

backbone network. The Cisco Lab's design reflects a focus on advanced capabilities, ensuring students can perform a wide range of networking activities while maintaining efficient and organized connectivity.

EMBEDDED LAB

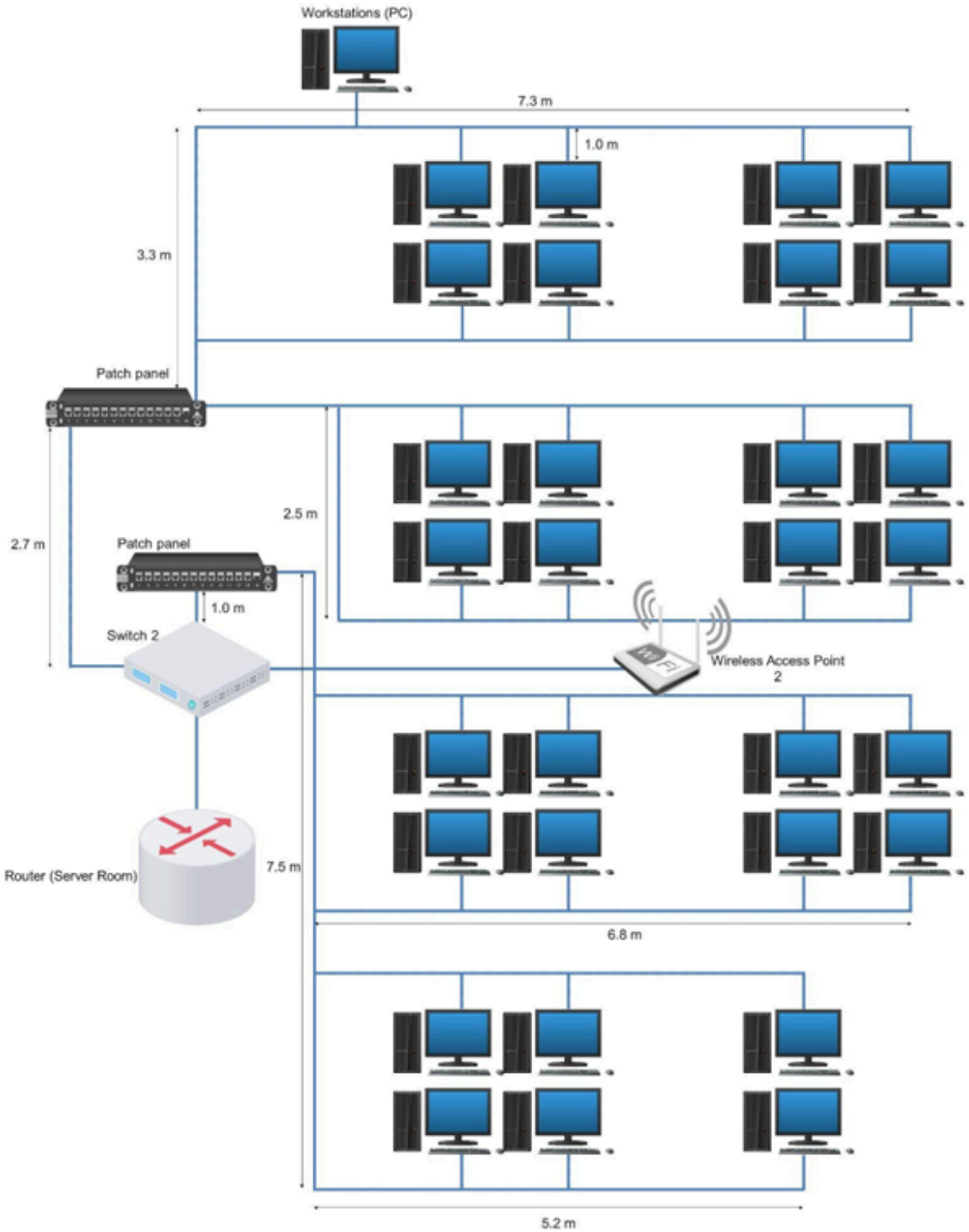


Figure 7

The Embedded Lab is designed to support a structured network layout with multiple workstations connected in rows. Each workstation is linked to patch panels through horizontal cabling, which then connects to a central switch. The switch, in turn, is connected to the router in the server room via backbone cabling. Cable lengths are clearly defined for proper planning, such as 3.3 meters and 2.7 meters between key points. Additionally, a wireless access point is included to provide wireless connectivity for devices that require flexibility. This setup likely uses twisted pair cabling for horizontal connections, while the backbone may rely on fiber optic cables for improved speed and performance.

HYBRID CLASSROOM

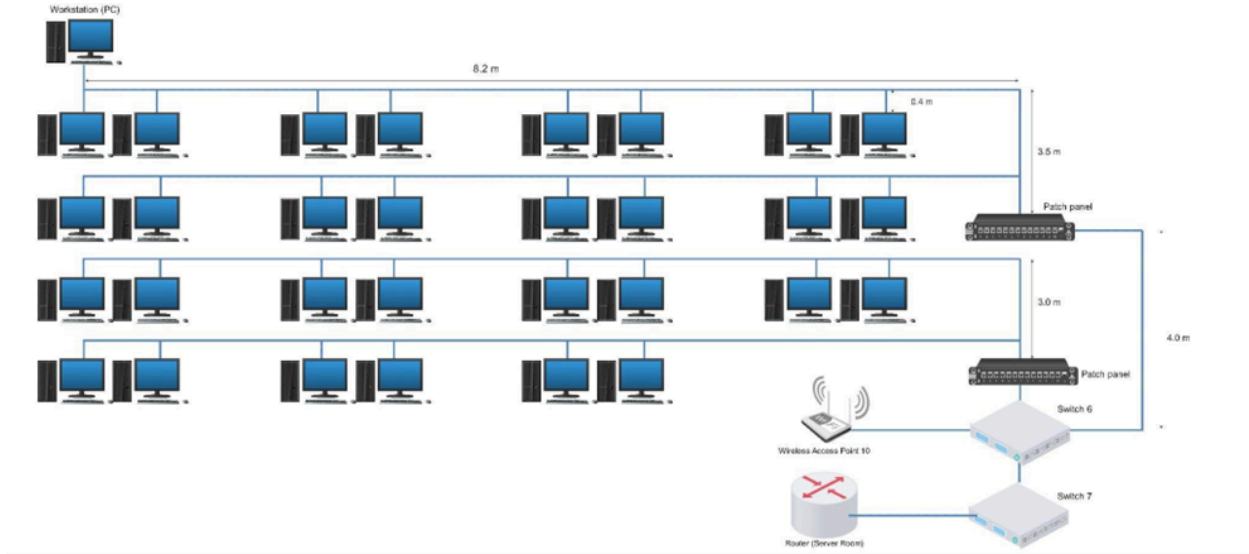


Figure 8

The Hybrid Classroom features a more extensive network to accommodate a larger number of workstations spread across multiple rows. Workstations are connected to patch panels through horizontal cabling, and two switches (Switch 6 and Switch 7) manage the

data distribution efficiently. The switches are linked to the main router in the server room via backbone cabling, with distances carefully specified, such as 8.2 meters for horizontal connections and 4.0 meters for vertical links. A wireless access point is also included to enable connectivity for mobile and wireless devices. Twisted pair cabling is used for workstation connections, while fiber optic cabling is likely employed for the backbone to ensure high bandwidth and reliability.

VIDEO CONFERENCE ROOM

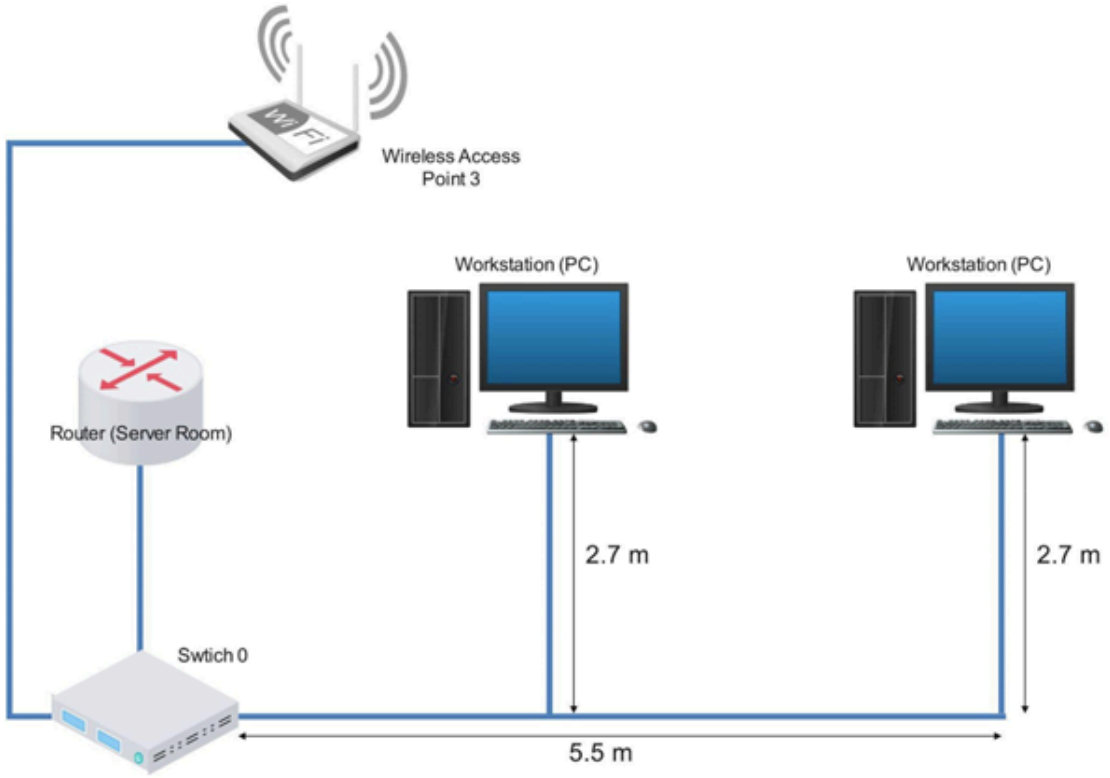


Figure 9

The Video Conference Room showcases a simpler network design tailored for video conferencing needs. It includes two workstations connected to a switch via horizontal cabling, with the switch linked to the router in the server room. The layout ensures clear

and efficient connectivity, with cable distances such as 5.5 meters and 2.7 meters specified for precise installation. A wireless access point is also provided to support wireless devices, enhancing flexibility for users. The cabling structure primarily uses twisted pair cables for the workstations, while the backbone connection to the server room may utilize fiber optic cabling to maintain high-speed data transmission.

(a) How many connections, patch cords, switch ports and cable length have you determined you need?

Lab Name	Workstations	Patch cords (Quantity)	Switch (Quantity)	Connection Type
General Purpose Lab 1	30	30	1	Horizontal
General Purpose Lab 2	30	30	2	Horizontal
Cisco Network lab	30	30	1	Vertical
Embedded lab	30	30	1	Vertical
Wireless Access Points	5	5	1	Horizontal
Hybrid Classroom	1	1	2	Horizontal
Video Conference room	1	1	-	Vertical

Ground Floor			
Description	Cable Type	Length(m)	Connection Type
General Purpose Lab 1	Ethernet	100	Horizontal
General Purpose Lab 2	Ethernet	100	Horizontal
Wireless Access Points	Ethernet	50	Horizontal

Hybrid Classroom	Ethernet	15	Horizontal
Video Conference room	Ethernet	15	Vertical
The total length of the Ground Floor (m)	280		

First Floor			
Description	Cable Type	Length(m)	Connection Type
Cisco Network Lab	Ethernet	120	Vertical
Embedded Lab	Ethernet	120	Vertical
Video Conference room	Ethernet	15	Vertical
The total length of the First Floor (m)	255		

(b) Identify cable types

CAT 6A cable:

We have taken CAT 6A twisted copper wire as it is a stranded copper wire that conducts the 10 gigabits per second Ethernet data at a maximum length of 100 meters. The single cable has a total bandwidth of 500 MHz. It ensures reliable connections essential for intensive bandwidth applications planned in the new labs and classrooms.Additionaly, it supports Ethernet network connections in most buildings. Hence, we concluded that the installation of the unshielded cable was effective, and the building was located in an area of low electromagnetic interference (EMI) as far away from airports or medical centres would have a major impact on cable performance. The wire itself reduces EMI's effects on the

cable. Cat 6A provides an adequate solution that meets current demands and allows for future expansion while staying within a reasonable budget.

Optic Fibre cable:

The greatest data transfer, like internet and other telecommunications, is made possible by fibre optic cables. These are just network wires transferring data signals in the form of light via flexible glass lines. They are thinner and lighter as compared to traditional copper cables and are thus easier to handle and install. While the cost of fibre optic cables may be higher, it is often more of a long-term benefit, featuring high and better speeds, enhanced reliability, and more resistance against electromagnetic interference, making it a better investment for the future.

REFLECTION ON TASK 4

We must design and link the building's network in order to complete this task. To calculate the maximum distance we had to travel, we took measurements of the case study's floor plan. Following the completion of the floor plan measurement, we identified the first floor and ground floor work areas. The reception, general purpose lab, computer security lab, and printing services are the four physical spaces on the ground floor. Each of these spaces has a server room. Additionally, there are three physical spaces on the first floor: a lobby, network lab, and IoT lab. Each of these spaces has a server room. Next, we looked at the physical connections required for networking to function properly. Through this assignment, we defined the general cabling structure for the entire building, accounting for the length of cable needed for the chosen work locations, the number of connections, switch ports, patch cords, and routers needed, as well as the kind of media that is compatible and necessary. We have examined every factor required for network distribution in order to guarantee the effective connectivity of work zones.

TASK 5

1.0 IP ADDRESSING SCHEME

1.1 Network Address

In this group, we are assigned to use 192.21.0.0/8 as the network address to proceed with the division of the subnetwork.

1111 1111.0000 0000.0000 0000.0000 0000 = 255.0.0.0

1.1 Subnet Mask

192.0.0.0/8

1100 0000.0000 0000.0000 0000.0000 0000

Number of subnets = 12-8=4

= 2^4=16

Subnet No.	Area	IP Address/Subnet Mask (Decimal)	IP Address/Subnet Mask (Binary)
0	General Purpose Lab 1	192.21.0.0/12	1100 0000.0000 0000.0000 0000.0000 0000
1	General Purpose Lab 2	192.21.16.0/12	1100 0000.0001 0000.0000 0000.0000 0000
2	Cisco Network Lab	192.21.32.0/12	1100 0000.0010 0000.0000

			0000.0000 0000
3	Embedded lab	192.21.48.0/12	1100 0000.0011 0000.0000 0000.0000 0000
4	Video conferencing room	192.21.64.0/12	1100 0000.0100 0000.0000 0000.0000 0000
5	Hybrid classroom	192.21.80.0/12	1100 0000.0101 0000.0000 0000.0000 0000
6	Student Lounge	192.21.96.0/12	1100 0000.0110 0000.0000 0000.0000 0000
7	For Future Expansion	192.21.112.0/12	1100 0000.0111 0000.0000 0000.0000 0000
8	For Future Expansion	192.21.128.0/12	1100 0000.1000 0000.0000 0000.0000 0000
9	For Future Expansion	192.21.144.0/12	1100 0000.1001 0000.0000

			0000.0000 0000
10	For Future Expansion	192.21.160.0/12	1100 0000.1010 0000.0000 0000.0000 0000
11	For Future Expansion	192.21.176.0/12	1100 0000.1011 0000.0000 0000.0000 0000
12	For Future Expansion	192.21.192.0/12	1100 0000.1100 0000.0000 0000.0000 0000
13	For Future Expansion	192.21.208.0/12	1100 0000.1101 0000.0000

			0000.0000 0000
14	For Future Expansion	192.21.224.0/12	1100 0000.1110 0000.0000 0000.0000 0000
15	For Future Expansion	192.21.240.0/12	1100 0000.1111 0000.0000 0000.0000 0000

***From subnet 7 to 15, these subnets are reserved for future expansion.**

2.0 IP ASSIGNATION

Range of IP address, Network and Broadcast address for the subnet

Subnet	Area	Network Address	Broadcast Address	Range of usable IP Address	Subnet Mask
0	General Purpose Lab 1	192.21.0.0	192.21.15.255	192.21.0.1 - 192.21.15.254	255.240.0.0
1	General Purpose Lab 2	192.21.16.0	192.21.31.255	192.21.16.1 - 192.21.31.254	255.240.0.0
2	\Cisco Netwo	192.21.32.0	192.21.47.255	192.21.32.1 - 192.21.47.254	255.240.0.0

	rk Lab				
3	Embedded Lab	192.21.48.0	192.21.63.255	192.21.48.1 - 192.21.63.254	255.240.0.0
4	Video Conferenci ng Room	192.21.64.0	192.21.79.255	192.21.64.1 - 192.21.79.254	255.240.0.0
5	Hybrid Classroom	192.21.80.0	192.21.95.255	192.21.80.1 - 192.21.95.254	255.240.0.0
6	Student Lounge	192.21.96.0	192.21.111.255	192.21.96.1 - 192.21.111.254	255.240.0.0

2.1 GENERAL LAB 1

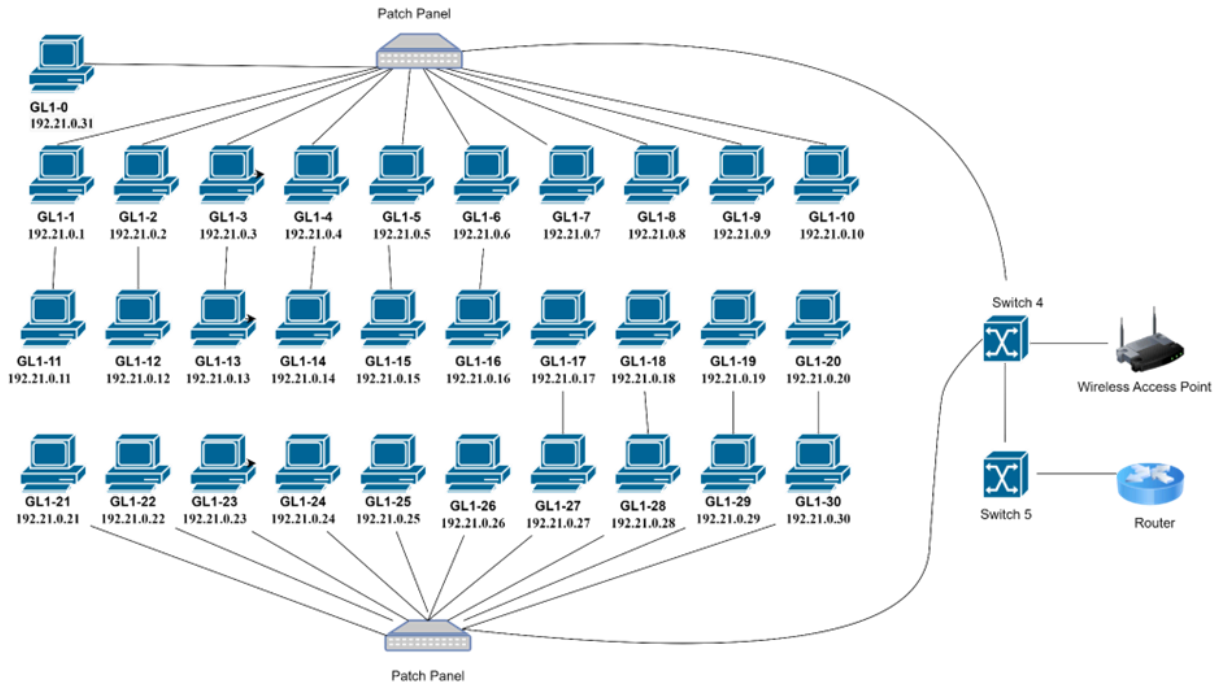


Figure 10

PC	IP ADDRESS
GL1-0	192.21.0.31
GL1-1	192.21.0.1
GL1-2	192.21.0.2
GL1-3	192.21.0.3
GL1-4	192.21.0.4
GL1-5	192.21.0.5

GL1-6	192.21.0.6
GL1-7	192.21.0.7
GL1-8	192.21.0.8
GL1-9	192.21.0.9
GL1-10	192.21.0.10
GL1-11	192.21.0.11

GL1-12	192.21.0.12
GL1-13	192.21.0.13
GL1-14	192.21.0.14
GL1-15	192.21.0.15
GL1-16	192.21.0.16
GL1-17	192.21.0.17
GL1-18	192.21.0.18
GL1-19	192.21.0.19
GL1-20	192.21.0.20
GL1-21	192.21.0.21

GL1-22	192.21.0.22
GL1-23	192.21.0.23
GL1-24	192.21.0.24
GL1-25	192.21.0.25
GL1-26	192.21.0.26
GL1-27	192.21.0.27
GL1-28	192.21.0.28
GL1-29	192.21.0.29
GL1-30	192.21.0.30

2.2 GENERAL LAB 2

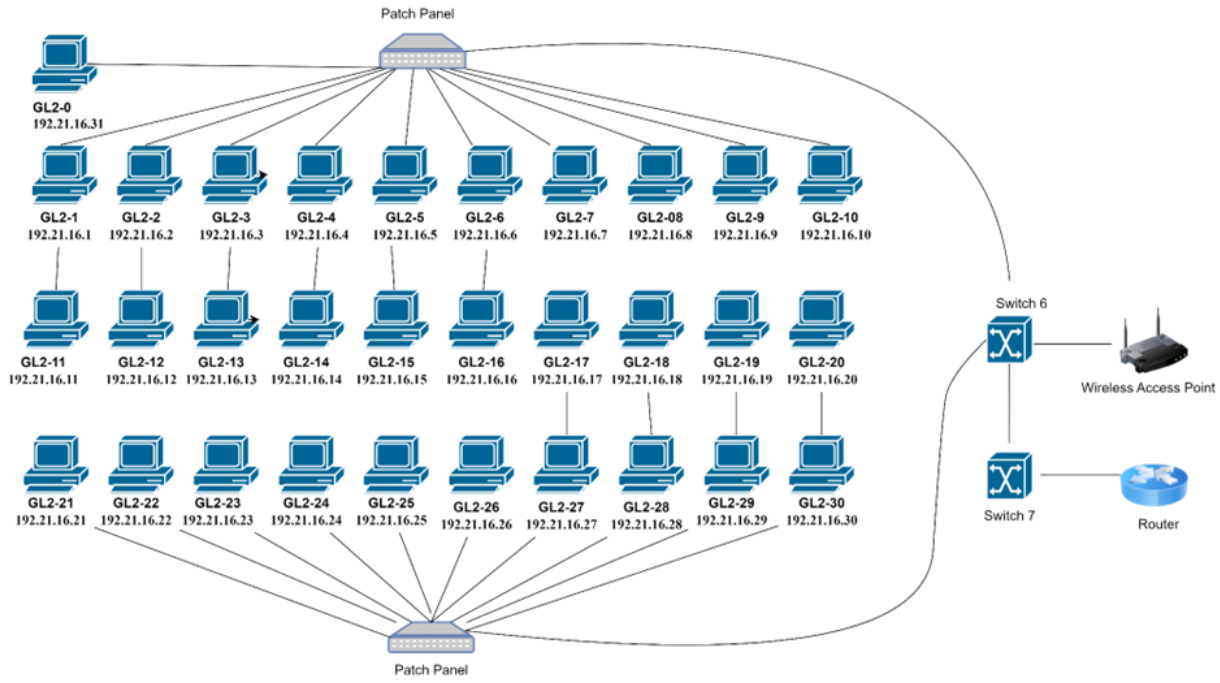


Figure 11

PC	IP ADDRESS
GL2-0	192.21.16.31
GL2-1	192.21.16.1
GL2-2	192.21.16.2
GL2-3	192.21.16.3
GL2-4	192.21.16.4

GL2-5	192.21.16.5
GL2-6	192.21.16.6
GL2-7	192.21.16.7
GL2-8	192.21.16.8
GL2-9	192.21.16.9
GL2-10	192.21.16.10
GL2-11	192.21.16.11
GL2-12	192.21.16.12

GL2-13	192.21.16.13
GL2-14	192.21.16.14
GL2-15	192.21.16.15
GL2-16	192.21.16.16
GL2-17	192.21.16.17
GL2-18	192.21.16.18
GL2-19	192.21.16.19
GL2-20	192.21.16.20

GL2-21	192.21.16.21
GL2-22	192.21.16.22
GL2-23	192.21.16.23
GL2-24	192.21.16.24
GL2-25	192.21.16.25
GL2-26	192.21.16.26
GL2-27	192.21.16.27
GL2-28	192.21.16.28
GL2-29	192.21.16.29
GL2-30	192.21.16.30

2.3 CISCO NETWORK LAB

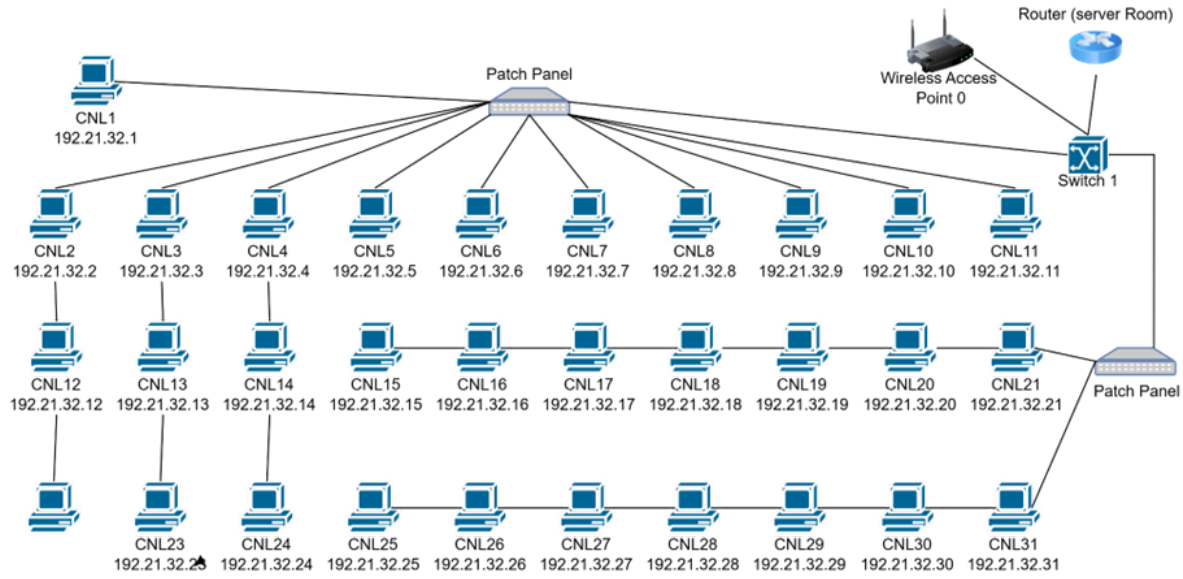


Figure 12

PC	IP ADDRESS
CNL1	192.21.32.1
CNL2	192.21.32.2
CNL3	192.21.32.3
CNL4	192.21.32.4
CNL5	192.21.32.5
CNL6	192.21.32.6

CNL7	192.21.32.7
CNL8	192.21.32.8
CNL9	192.21.32.9
CNL10	192.21.32.10
CNL11	192.21.32.11
CNL12	192.21.32.12
CNL13	192.21.32.13
CNL14	192.21.32.14

CNL15	192.21.32.15
CNL16	192.21.32.16
CNL17	192.21.32.17
CNL18	192.21.32.18
CNL19	192.21.32.19
CNL20	192.21.32.20
CNL21	192.21.32.21
CNL22	192.21.32.22

CNL23	192.21.32.23
CNL24	192.21.32.24
CNL25	192.21.32.25
CNL26	192.21.32.26
CNL27	192.21.32.27
CNL28	192.21.32.28
CNL29	192.21.32.29
CNL30	192.21.32.30
CNL31	192.21.32.31

2.4 EMBEDDED LAB

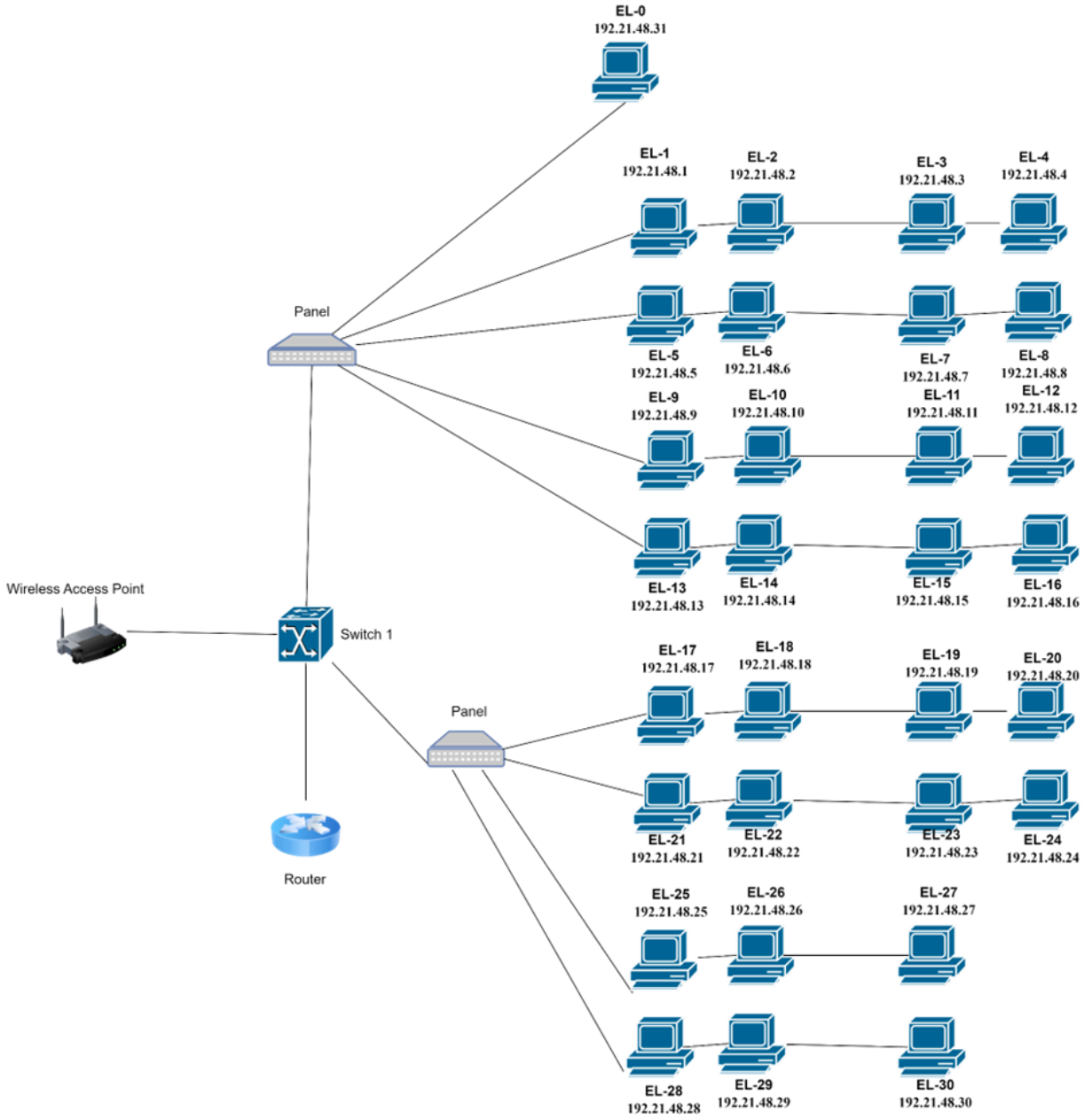


Figure 13

PC	IP ADDRESS
EL-0	192.21.48.31
EL-1	192.21.48.1
EL-2	192.21.48.2
EL-3	192.21.48.3

EL-4	192.21.48.4
EL-5	192.21.48.5
EL-6	192.21.48.6
EL-7	192.21.48.7
EL-8	192.21.48.8
EL-9	192.21.48.9
EL-10	192.21.48.10
EL-11	192.21.48.11
EL-12	192.21.48.12
EL-13	192.21.48.13
EL-14	192.21.48.14

EL-15	192.21.48.15
EL-16	192.21.48.16
EL-17	192.21.48.17
EL-18	192.21.48.18
EL-19	192.21.48.19
EL-20	192.21.48.20
EL-21	192.21.48.21
EL-22	192.21.48.22
EL-23	192.21.48.23
EL-24	192.21.48.24
EL-25	192.21.48.25
EL-26	192.21.48.26
EL-27	192.21.48.27
EL-28	192.21.48.28
EL-29	192.21.48.29
EL-30	192.21.48.30

2.5 VIDEO CONFERENCING ROOM

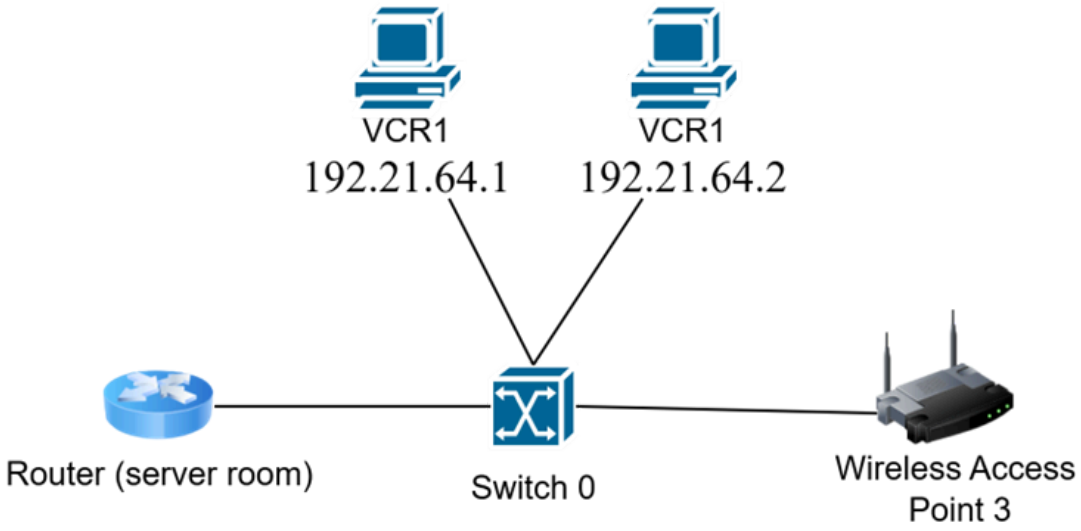


Figure 14

PC	IP ADDRESS
VCR1	192.21.64.1
VCR2	192.21.64.2

2.6 HYBRID ROOM

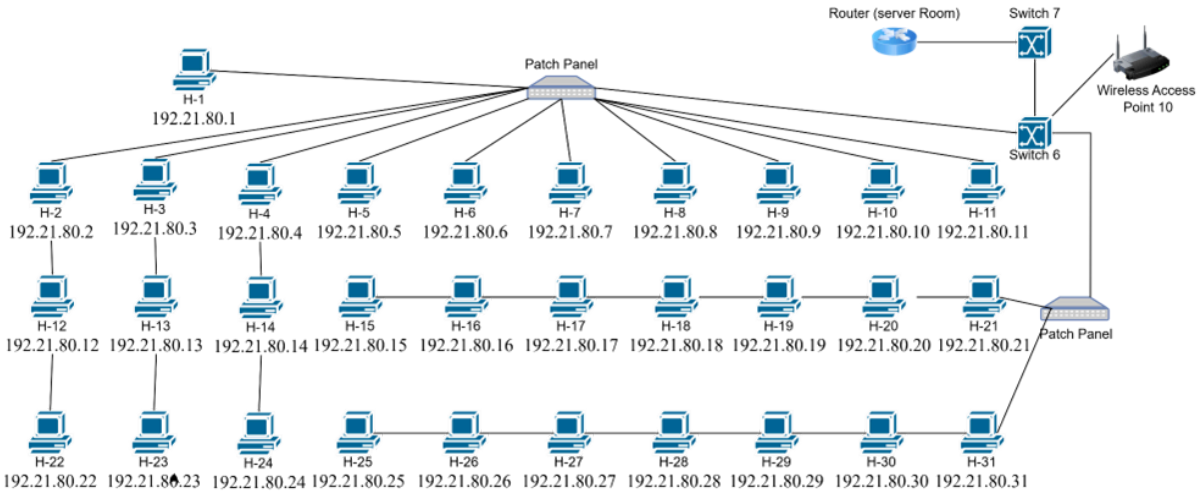


Figure 15

PC	IP ADDRESS
H-1	192.21.80.1
H-2	192.21.80.2
H-3	192.21.80.3
H-4	192.21.80.4
H-5	192.21.80.5
H-6	192.21.80.6
H-7	192.21.80.7

H-8	192.21.80.8
H-9	192.21.80.9
H-10	192.21.80.10
H-11	192.21.80.11
H-12	192.21.80.12
H-13	192.21.80.13
H-14	192.21.80.14
H-15	192.21.80.15
H-16	192.21.80.16

H-17	192.21.80.17
H-18	192.21.80.18
H-19	192.21.80.19
H-20	192.21.80.20
H-21	192.21.80.21
H-22	192.21.80.22
H-23	192.21.80.23

H-24	192.21.80.24
H-25	192.21.80.25
H-26	192.21.80.26
H-27	192.21.80.27
H-28	192.21.80.28
H-29	192.21.80.29
H-30	192.21.80.30
H-31	192.21.80.31

REFLECTION ON TASK 5

The team learned new things while creating task 5, particularly about IP addressing schemes and subnetting, which are essential for ensuring that all hosts may connect to the network without experiencing address conflicts. We gain an understanding of IP addressing on every device and subnetting by consulting the course slides and other educational resources. Subnetting facilitates simplification, lowers network traffic, and preserves IP addresses. We can more easily distribute the IP addresses thanks to the implementation of creating the lab work area and addressing the IP address in each host using the timetable on the report.

CONCLUSION

The proposed upgrade of the Faculty of Computing's network infrastructure represents a strategic response to the evolving technological demands of academic and research environments, ensuring the faculty remains a leader in innovation and education. This project meticulously addresses key aspects of modern networking, including standardization, security, scalability, and future-proofing, making it an exemplary model for institutional infrastructure development.

By standardizing equipment across all laboratories and facilities, the project not only reduces overall procurement costs but also ensures compatibility, simplified maintenance, and operational efficiency. The use of cutting-edge technologies such as high-speed Ethernet, fiber-optic connections, and advanced wireless standards like Wi-Fi 6 guarantees robust connectivity capable of supporting data-intensive applications, cloud-based systems, and collaborative tools. These measures are critical in fostering a seamless experience for students, staff, and researchers, thereby enabling the faculty to meet the demands of the Fourth Industrial Revolution (4IR).

The project also places significant emphasis on sustainability and cost-efficiency. Bulk procurement strategies, the optimization of resources, and the prioritization of reusable and scalable components contribute to a cost-effective implementation. These efforts align with the university's commitment to long-term value creation while reducing environmental impact.

In conclusion, this proposal marks a pivotal step forward, combining innovation, security, and scalability to create an infrastructure that is both forward-thinking and resilient. It exemplifies the faculty's commitment to fostering an environment of continuous learning, innovation, and collaboration, empowering it to adapt to the future challenges and opportunities of the digital age.

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APPENDICES

MEETING MINUTE

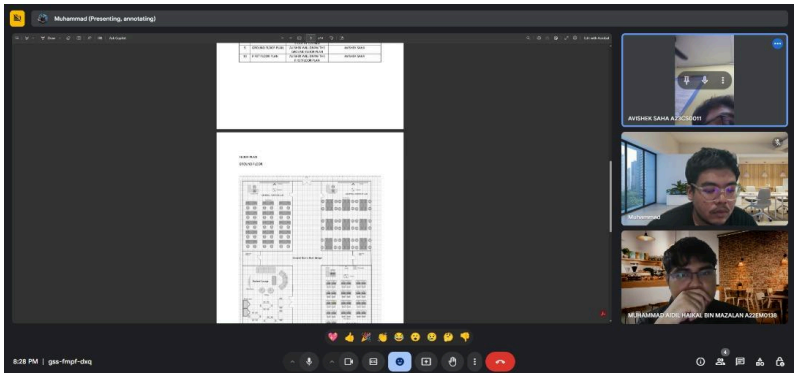
MEETING MINUTES

DATE / TIME	16 OCT 2024 (8 : 30 PM)
LOCATION	GOOGLE MEET
AGENDA	PROJECT AND FLOORPLAN DISCUSSION
MEETING MC	MUHAMMAD AIDIL HAIKAL BIN MAZALAN

ATTENDANCE

NAME	TIME	REASON FOR ABSENCE
MUHAMMAD AIDIL HAIKAL BIN MAZALAN	8.29	
MUHAMMAD BIN ZULNIZAM	8 : 29	
MUHAMMAD FATHURRAHMAN BIN AYUB	8 : 30	
AVISHEK SAHA	8 : 30	

NO.	ITEM DISCUSSED	IDEAS / SUGGESTIONS AND PERSON GIVING IT	PERSON IN CHARGE & DATE
1	BUDGET	PRESENTING OUR PROJECT BUDGET WHICH IS 950K	MUHAMMAD ZULNIZAM
2	LISTING NETWORK ITEM	AVISHEK VOLUNTEER TO LIST NETWORK ITEM FOR THE PROJECT	AVISHEK SAHA
3	SOFTWARE FOR PROJECT	USING SMARTDRAW	ALL MEMBERS
4	GENERAL LAB	PRESENTING ITEM FOR GENERAL LAB	MUHAMMAD ZULNIZAM
5	CISCO LAB	PRESENTING ITEM FOR CISCO	MUHAMMAD AIDIL HAIKAL
6	EMBEDDED LAB	PRESENTING ITEM FOR EMBEDDED	MUHAMMAD AIDIL HAIKAL
7	HYBRID CLASS	FATHURRAHMAN PRESENTING ITEM FOR HYBRID CLASS	MUHAMMAD FATHURRAHMAN
8	STUDENT LOUNGE	FATHURRAHMAN PRESENTING ITEM FOR STUDENT LOUNGE	MUHAMMAD FATHURRAHMAN
9	GROUND FLOOR PLAN	AVISHEK WILL DRAW THE GROUND FLOOR PLAN	AVISHEK SAHA
10	FIRST FLOOR PLAN	AVISHEK WILL DRAW THE FIRSTFLOOR PLAN	AVISHEK SAHA



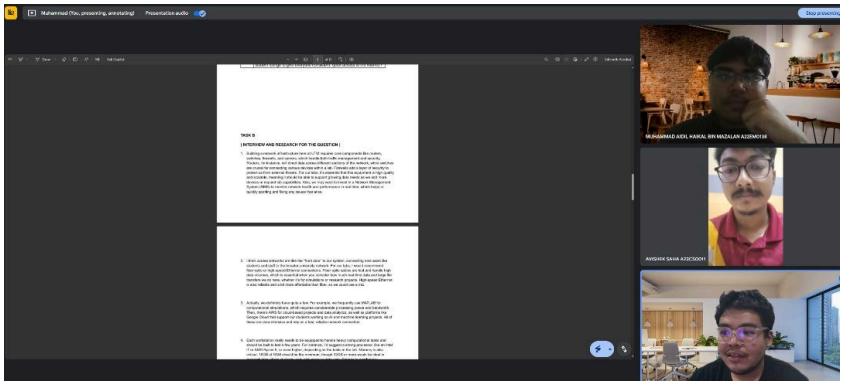
MEETING MINUTES

DATE / TIME	2 NOV 2024 (3 : 00 PM)
LOCATION	GOOGLE MEET
AGENDA	PROJECT AND FLOORPLAN DISCUSSION
MEETING MC	MUHAMMAD AIDIL HAIKAL BIN MAZALAN

ATTENDANCE

NAME	TIME	REASON FOR ABSENCE
MUHAMMAD AIDIL HAIKAL BIN MAZALAN	2 : 58	
MUHAMMAD BIN ZULNIZAM	2 : 54	
MUHAMMAD FATHURRAHMAN BIN AYUB	2 : 56	
AVISHEK SAHA	2 : 59	

NO.	ITEM DISCUSSED	IDEAS / SUGGESTIONS AND PERSON GIVING IT	PERSON IN CHARGE & DATE
1	INTRODUCTION FOR TASK 2	PRESENTING TASK 2 REQUIREMENT	MUHAMMAD AIDIL HAIKAL
2	DISTRIBUTION FOR TASK 2	SEPARATE TASK 2 INTO 3 , TASK A , B AND C	MUHAMMAD AIDIL HAIKAL
3	TASK A (QUESTION FOR INTERVIEW)	AVISHEK VOLUNTEER TO DO TASK A	AVISHEK SAHA
4	TASK B (INTERVIEW AND RESEARCH)	AIDIL AND FATHURRAHMAN VOLUNTEER TO DO TASK B	MUHAMMAD AIDIL HAIKAL MUHAMMAD FATHURRAHMAN
5	TASK C (FEASIBILITY)	MUHAMMAD VOLUNTEER TO DO TASK C	MUHAMMAD BIN ZULNIZAM
6	DISCUSSION SESSION	AVISHEK ASKING ABOUT WHAT KIND OF QUESTION THAT NEED TO BE INCLUDED	AVISHEK SAHA



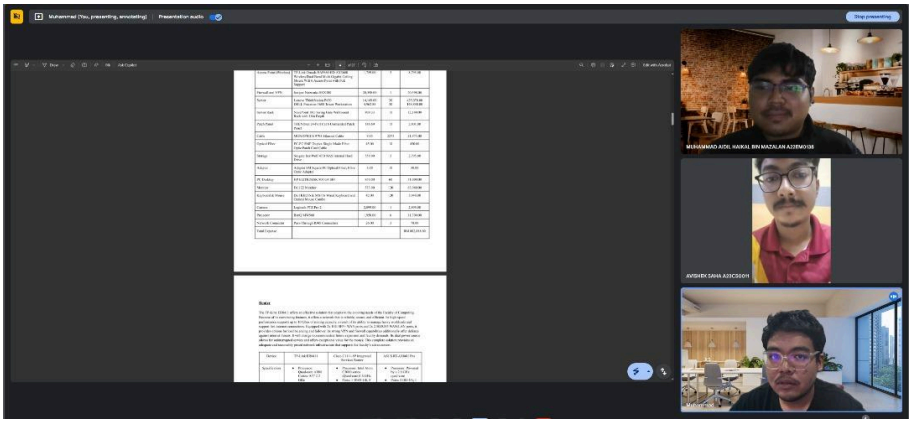
MEETING MINUTES

DATE / TIME	28 NOV 2024 (3 : 00 PM)
LOCATION	GOOGLE MEET
AGENDA	TASK 3
MEETING MC	AVISHEK SAHA

ATTENDANCE

NAME	TIME	REASON FOR ABSENCE
MUHAMMAD AIDIL HAIKAL BIN MAZALAN	3 : 00	
MUHAMMAD BIN ZULNIZAM	3 : 00	
MUHAMMAD FATHURRAHMAN BIN AYUB	3 : 00	
AVISHEK SAHA	3 : 00	

NO.	ITEM DISCUSSED	IDEAS / SUGGESTIONS AND PERSON GIVING IT	PERSON IN CHARGE & DATE
1	BUDGET	PRESENTING OUR PROJECT BUDGET WHICH IS 950K	MUHAMMAD ZULNIZAM
2	LISTING NETWORK ITEM	AVISHEK VOLUNTEER TO LIST NETWORK ITEM FOR THE TASK	AVISHEK SAHA
3	RESEARCHING	EQUIPMENTS AND LAN DEVICES	ALL MEMBERS



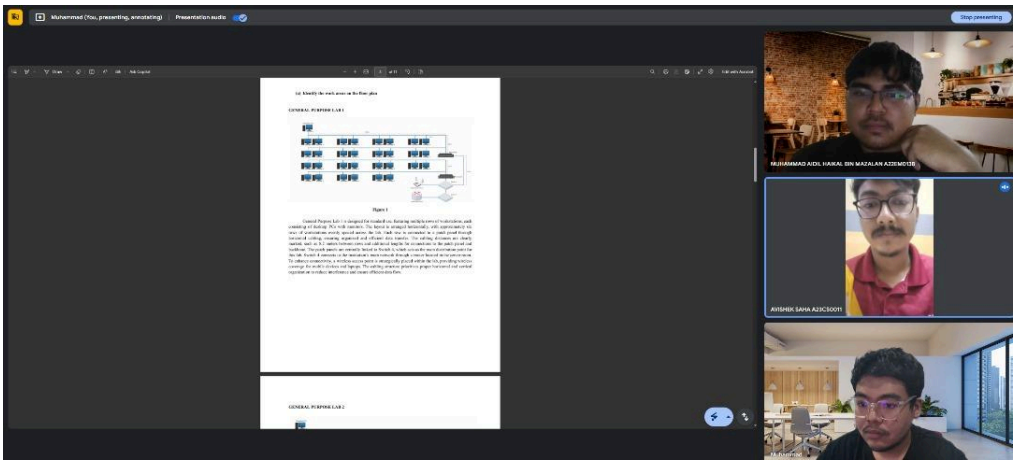
MEETING MINUTES

DATE / TIME	20 DEC 2024 (8 : 30 PM)
LOCATION	GOOGLE MEET
AGENDA	PROJECT AND FLOORPLAN DISCUSSION
MEETING MC	MUHAMMAD AIDIL HAIKAL BIN MAZALAN

ATTENDANCE

NAME	TIME	REASON FOR ABSENCE
MUHAMMAD AIDIL HAIKAL BIN MAZALAN	8.29	
MUHAMMAD BIN ZULNIZAM	8 : 29	
MUHAMMAD FATHURRAHMAN BIN AYUB	8 : 30	
AVISHEK SAHA	8 : 30	

NO.	ITEM DISCUSSED	IDEAS / SUGGESTIONS AND PERSON GIVING IT	PERSON IN CHARGE & DATE
1	TASK A	PRESENTING TASK A	MUHAMMAD AIDIL HAIKAL MUHAMMAD FATHURRAHMAN
2	TASK B	APRESENTING TASK B	MUHAMMAD ZULNIZAM
3	TASK C	PRESENTING TASK C	AVISHEK SAHA



MEETING MINUTES

DATE / TIME	15 JAN 2025 (8 : 30 PM)
LOCATION	GOOGLE MEET
AGENDA	TASK 5
MEETING MC	MUHAMMAD AIDIL HAIKAL BIN MAZALAN

ATTENDANCE		
NAME	TIME	REASON FOR ABSENCE
MUHAMMAD AIDIL HAIKAL BIN MAZALAN	8.29	
MUHAMMAD BIN ZULNIZAM	8 : 29	
MUHAMMAD FATHURRAHMAN BIN AYUB	8 : 30	
AVISHEK SAHA	8 : 30	

NO.	ITEM DISCUSSED	IDEAS / SUGGESTIONS AND PERSON GIVING IT	PERSON IN CHARGE & DATE
1	TASK 5 TASK CONTRIBUTION SESSION AND BRAINSTROMING	PRESENTING TASK 5	MUHAMMAD AIDIL HAIKAL MUHAMMAD FATHURRAHMAN
2	PART 1.0	VOLUNTEER TO DO 1.0	AVISHEK SAHA
3	PART 2.0	VOLUNTEER TO DO 2.0	MUHAMMAD BIN ZULNIZAM MUHAMMAD AIDIL HAIKAL MUHAMMAD FATHURRAHMAN