



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF COMPUTING
UTM Johor Bahru

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SECR1213-07 NETWORK COMMUNICATIONS

PROJECT : PHASE 3

GROUP : Darksystem

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TABLE OF CONTENT

1.0 TABLE OF DEVICES.....	3
2.0 REFLECTION.....	19
3.0 MINUTE MEETING.....	25
4.0 REFERENCE.....	26

1.0 TABLE OF DEVICES

Devices	Description	Price per unit (RM)	Quantity	Total price (RM)
CABLING				
Fiber Optic Cable 	Fiber Optic Pigtail Single Mode 0.9mm SC/UPC and SC/APC Fiber Type:Single Mode Fiber Mode:SMF 9/125um Insertion Loss:0.15dB Return Loss:53.6dB Fiber Class:G.657A Compliants:RoSH, ISO9001 Wavelength:1310/1550nm	1.20/1m	300	360.00
Adapter 	Fiber Optic SC/UPC & SC/APC Adaptor Single Mode Simplex Precision machining size, high reliability, stability. Low insertion loss, high return loss, good interchangeability. Insertion loss: $\leq 0.2\text{dB}$ Return Loss: $\geq 50\text{dB}$ Working temperature: -30 - + 75 Storage temperature: -40 - + 85 Interchangeability: $\leq 0.2\text{dB}$ Vibration test: $\leq 0.1\text{dB}$ (10-60Hz, 1.5mm amplitude) Repeatability: ≥ 1000 times	0.30	300	90.00
Connector 	ZOERAX RJ45 Cat6 Pass Through Connectors Brand: ZOERAX Connector Type: Pass-through RJ45 connectors for Cat6 and Cat5e cables	127.99 for 200pcs	2/400pcs	256.00

COOLING SYSTEM				
Aircond 	Mitsubishi 2.5 HP JS Series MSY-JS24VF Cooling Capacity: 2.5 HP, suitable for large rooms or spaces, depending on insulation and heat load. Inverter Technology: Ensures energy efficiency by adjusting the compressor speed to maintain the desired temperature while reducing energy consumption. Refrigerant: R32 refrigerant, which is eco-friendly and has a lower Global Warming Potential (GWP). Energy Efficiency: Designed to provide efficient cooling with lower electricity consumption.	2725.00	10	27250.00
WIFI				
WIFI Router 	Asus RT-AX57 (AX3000) Dual Band WiFi 6 Router Asus RT-AX57 has Wi-Fi 6 technology, ultra-fast 3000 Mbps speed, MU-MIMO and OFDMA for efficient multi-device communication and lifetime free AiProtection for network security which is perfect for high-demand environments like computer labs. Wifi Standard: Wi-Fi 6 (802.11ax) CPU: 1.7 GHz Quad-Core Wifi Speed: 2.4 GHz for 574 Mbps , 5 GHz for 2402 Mbps and Total speed of 3000 Mbps Antenna: 4 external high-performance antennas Coverage setup: AiMesh support for mesh networking	499.00	9	4491.00

Access Point 	<p>Zyxel WAX610D WiFi 6 PoE Access Point</p> <p>An access point (AP) is a device that connects to a wired network and creates a wireless network for devices to connect to. It extends Wi-Fi coverage, enabling multiple devices to access the network.</p> <p>Wi-Fi 6 Technology: Fast and efficient connectivity with 802.11ax standard.</p> <p>High Performance: 6 spatial streams (4x4:4 on 5GHz, 2x2:2 on 2.4GHz) for better multi-device support.</p> <p>Cloud Management: Remotely managed via a free Zyxel app.</p> <p>High-Speed Port: 2.5Gbps Ethernet for faster backhaul connections.</p> <p>This AP is suitable due to its high performance features.</p>	1120.00	2	2240.00
Network Switch 	<p>EnGenius ECS2552FP</p> <p>48 Ports: Includes 32 x 1GbE ports and 16 x 2.5GbE ports, providing ample connectivity for various devices.</p> <p>4 x 10G SFP+ Ports: Offers high-speed connectivity for future scalability or linking multiple switches.</p> <p>740W PoE Power: Supports PoE+ power on all copper ports, allowing it to power devices like IP cameras, phones, and access points.</p> <p>Cloud & Mobile App Management: Allows for remote management and monitoring, offering convenience and control for IT administrators.</p> <p>Scalable:the SFP+ ports enable network</p>	3117.00	4	12468.00

	<p>expansion.</p> <p>It is suitable because of its high port density, scalability, and PoE capabilities, which are essential for supporting a large number of devices like computers, access points, and other networking equipment.</p>			
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CISCO DEVICES

Router 	CISCO2901/K9 Enclosure Type :Rack-mountable - modular - 1U Connectivity Technology:Wired Data Link Protocol:Ethernet, Fast Ethernet, Gigabit Ethernet Data Link Protocol: Ethernet, Fast Ethernet, Gigabit Ethernet Network / Transport Protocol:IPSec, L2TPv3 RAM:512 MB (installed) / 2 GB (max) Flash Memory: 256 MB (installed) / 8 GB (max)	11716.00	2	23432.00
Switch 	WS-C2960L-24TS-LL Catalyst 2960-L Switch The WS-C2960L-24TS-LL is a Cisco Catalyst switch designed to provide reliable and efficient Layer 2 networking for small to medium-sized environments. It features 24 Gigabit Ethernet ports for connecting devices like computers, servers, or other network equipment, along with 2 SFP uplink ports for linking to higher-level network infrastructure or additional switches. Switching capacity: 56 Gbps. Forwarding rate: 41.67 Mpps RAM: 512MB Flash memory: 128MB	8842.20	2	17684.40

HANDS-ON TOOLS

Arduino Tools	Starter Kit	165.00	40	6600.00
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	<p>Component listing:</p> <p>1pcs UNO R3 Controller Board; 1pcs LCD1602 Module (with pin header); 1pcs Breadboard Expansion Board; 1pcs Power Supply Module WARNING: Pls. do not use the voltage higher than 9V 1pcs Joystick Module; 1pcs IR Receiver; 1pcs Servo Motor (SG90); 1pcs Stepper Motor; 1pcs ULN2003 Stepper Motor Driver Board 1pcs Ultrasonic Sensor; 1pcs DHT11 Temperature and Humidity Module; 1pcs 9V Battery with DC; 1pcs 65 Jumper Wire 1pcs USB Cable; 1pcs Active Buzzer; 1pcs Passive Buzzer; 1pcs Potentiometer; 1pcs 5V Relay 1pcs Breadboard; 1pcs Remote; 1pcs Tilt Switch; 5pcs Button (small); 1pcs 1 digit 7-segment Display; 1pcs 4 digit 7-segment Display 5pcs Yellow LED; 5pcs Blue LED; 5pcs Green LED; 5pcs Red LED; 1pcs RGB LED 2pcs Photoresistor; 1pcs Thermistor; 2pcs Diode Rectifier (1N4007); 2pcs NPN Transistor (PN2222) 1pcs IC 74HC595; 120pcs Resistor; 10pcs Female-to-male Dupont Wire</p>			
Raspberry Pi 	<p>Raspberry Pi Compute Model 5</p> <p>Compute Module 5 is a powerful and scalable system-on module with a 64-bit Arm processor @ 2.4GHz, an I/O controller, video and PCIe interfaces, and a range of wireless, SDRAM and eMMC options.</p>	180.00	40	7200.00
Digital Logic Trainer Board	<p>Global Specialties PB-502</p> <p>Digital logic Trainer Board include with breadboards/protoboards</p>	1717.10	40	68684.00

				
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COMPUTING AND IT DEVICES

Desktop 	<p>HP 24 inch All-in-One Desktop PC cr0016d</p> <p>This HP Essentials All-in-One desktop is ideal for a student computer lab due to its balance of performance, affordability, and practical features</p> <p>Operating System:Windows 11 Home Single Language</p> <p>Processor:AMD Ryzen™ 3 7320U (up to 4.1 GHz max boost clock, 4 MB L3 cache, 4 cores, 8 threads)</p> <p>Memory and storage:8 GB memory; 512 GB SSD storage</p> <p>Graphics:AMD Radeon™ Graphics</p> <p>Screen:23.8 inch</p> <p>Network interface:Integrated 10/100/1000 GbE LAN</p> <p>Wireless:Realtek RTL8852BE Wi-Fi 6 (2x2) and Bluetooth® 5.3 wireless card (supporting gigabit data rate)</p> <p>The desktop is suitable for the computer lab as it meets the requirements and it also comes with Microsoft Office Home and Student 2021 which is suitable for students to do their projects in the lab. It also safe space as all the parts are built in.</p>	2199.00	60	131940.00
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Desktop	<p>HP Pro Tower 400 G9 PCI Desktop PC</p> <p>This HP Pro Tower Desktop PC is suitable for higher performance, more storage, or flexibility in upgrading hardware.</p> <p>Operating System:Windows 11 Pro</p> <p>Processor:Intel® Core™ i5-13500 (up to 4.8 GHz with Intel® Turbo Boost Technology, 24 MB L3 cache, 14 cores, 20 threads)</p> <p>Memory and storage:8 GB memory; 1 TB HDD storage; 256 GB SSD storage</p> <p>Graphics:Intel® UHD Graphics 770</p> <p>Wireless:Intel® Wi-Fi 6E AX211 (2x2) and Bluetooth® 5.3 wireless card (supporting gigabit data rate)</p> <p>Includes:HP Wired Mouse and Keyboard</p> <p>This Desktop PC is suitable to be used as lecturer's PC and PC for the Cisco Lab as it is suitable for higher performance and customization.</p>	3537.00	35	123795.00
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Monitor 	HP M27 27 inch Webcam Monitor This monitor is suitable for the lecturers as it has a big screen and high quality webcam which enables the lecturer to conduct hybrid classes if needed. Screen:27 inch Resolution:FHD (1920 x 1080) Display Type:IPS Display Features:On-screen controls; AMD FreeSync™; Low blue light mode; Dual speakers (2W per channel); Anti-glare; Height adjustable; Webcam; Integrated microphone	1299.00	5	6495.00
Monitor 	HP P24v G5 23.8 inch FHD Monitor This monitor is suitable for the students as it meets the requirement and is simple to operate with a high resolution screen. Screen:23.8 inch Resolution:FHD (1920 x 1080) Display Features:On-screen controls; Low blue light mode; Anti-glare Display Input Type: 1 HDMI 1.4	684.00	30	20520.00

Television	<p>SHARP Full HD Android LED TV 2TCEG2X (42-inch)</p> <p>This is suitable TV for the Student Lounge Room. It has pre installed apps such as Youtube and Netflix which are suitable for students to use during rest and leisure time.</p> <p>Screen Size: 42 inch</p> <p>Resolution:1,920 x 1,080</p> <p>Engine:Quad Core</p> <p>OSD Language:English, Simplified Chi, Traditional Chi TW / HK, Arabic, Thai, Vietnamese, Indonesian, French, Portuguese, Russian , Malay</p> <p>Connectivity:HDMI</p>	1099.00	1	1099.00
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Digital Board  	<p>75TC3D-B Interactive Digital Board</p> <p>The 75" LG interactive digital board is suitable for the embedded lab and hybrid lab as it offers a UHD display, multi-touch support, versatile connectivity, and durability making it ideal for engaging, collaborative, and modern classroom teaching.</p> <p>Screen: 75 inch</p> <p>Resolution: 3,840 x 2,160 (UHD)</p> <p>Touch Type: P-Cap(Ag Metal Mesh)</p> <p>Classroom-Friendly Software Compatibility:</p> <p>Content Management: Compatible with SuperSign Premium for organizing and displaying lesson materials efficiently.</p> <p>Monitoring Software: SuperSign Link helps monitor and control the board remotely, which is helpful for IT support.</p> <p>Cross-Platform Support: Works with both Windows and macOS, ensuring compatibility with various school devices.</p>	19412.00	2	38824.00
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Laptop	<p>IdeaPad 1i (15", Gen 7)</p> <p>This laptop is suitable for the students as it equips with basic needed features and portability. The processor and RAM are sufficient for light computing tasks such as word processing, web browsing, and accessing online learning materials.</p> <p>Processor: Intel® Celeron® N4500 Processor (1.10 GHz up to 2.80 GHz)</p> <p>Operating System: Windows 11 Home in S mode Single Language 64</p> <p>Graphic Card: Integrated Intel® UHD Graphics</p> <p>Memory: 4 GB DDR4-2933MHz (Soldered)</p> <p>Storage: 128 GB eMMC</p> <p>Display: 15.6" FHD (1920 x 1080), TN, Anti-Glare, Non-Touch, 45%NTSC, 220 nits, LED Backlight, Narrow Bezel</p> <p>Camera: 1 MP with Dual Array Microphone and Privacy Shutter</p>	1009.00	30	30270.00
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Projector	<p>Epson EB-1785W Wireless WXGA 3LCD Projector</p>  <p>The Epson EB-1785W projector is ideal for the labs and video conferencing room due to its ultra-portability, ease of setup, and seamless connectivity. Its wireless mirroring and iProjection app support allow effortless connection with smart devices, while gesture control and auto keystone correction enhance usability for smooth, hassle-free presentations. The split screen and quick corner features are perfect for displaying multiple sources simultaneously, making it ideal for interactive classroom activities.</p> <p>White Light Output 3,200 lumens, Colour Light Output 3,200 lumens</p> <p>WXGA Resolution</p> <p>Real-Time Auto Keystone Correction</p> <p>Split Screen Projection</p> <p>Hassle-Free Presentation with USB 3-in-1 Display Feature and Epson iProjection</p> <p>Can present thru mobile phone by using the Epson iProjection app that is compatible to both ios and android.</p>	4089.00	4	16356.00
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Printer	<p>HP Smart Tank 615 Wireless All-in-One Printer</p>  <p>This HP Smart Tank printer is ideal for students and lecturers due to its multifunctionality, offering print, scan, copy, and fax capabilities. Its high print resolution ensures sharp documents and images, while the wireless connectivity (Wi-Fi, Bluetooth, and mobile printing support) allows seamless use with various devices, including smartphones and laptops.</p> <p>Functions: Print, copy, scan, fax, ADF, wireless</p> <p>Wireless Capability: Yes, built-in dual band Wi-Fi 802.11b/g/n, Wireless direct, BLE</p> <p>Print Technology: HP Thermal Inkjet</p>	999.00	2	1998.00
Tablet	<p>Galaxy Tab S6 Lite (2024)</p>  <p>This tablet is suitable for student learning due to its combination of performance, portability, and multimedia capabilities. The processor and RAM provide sufficient power for multitasking, running educational apps, and browsing the web. It has a high resolution which ensures clear, vibrant visuals for reading, watching educational videos, and interactive learning.</p> <p>Processor: Octa-Core</p> <p>Display: 10.4 inch</p> <p>Storage and memory: 4GB RAM and 128GB Storage</p> <p>Operating System: Android</p>	1299.00	60	77940.00

	Sensors:Accelerometer, Gyro Sensor, Hall Sensor, RGB Light Sensor			
SECURITY				
Firewall Router 	Fortinet FG-100F FortiGate Network Security Firewall Protection Supported: <ul style="list-style-type: none">• Application Control• ICSA Certified OS• Secure IPsec VPN Connectivity• SSL Encrypted Traffic Protection• Threat Protection Firewall Throughput: Up to 20 Gbps VPN Throughput: 11.5 Gbps (IPsec) Number VPN supported: 500 Ports: 22	16215.56	7	113508.92
Small Rack 	APC by Schneider Electric NetShelter WX 9U Wall Mountable Rack Cabinet for Networking, Airflow System - 482.60 mm Rack Width x 528 mm Rack Depth Rack Height: 9U Form Factor: Wall Mountable Features: Side to side airflow Weight capacity: 91.91 kg Height: 485 mm Width: 600 mm Depth: 600 mm	1941.33	3	5824.00
Medium Rack 	15U Server Rack Rack Units: 15U Weight: 39.6 kg External Dimensions: 610 x 772 x 553 mm	3321.02	3	9963.06

Big Rack 	APC NetShelter SX 42U 600mm Wide x 1200mm Deep Enclosure with Sides Black (AR3300X717) Height: 199.1 cm Width: 60 cm Depth: 120 cm Weight: 134.9 kg	9116.00	3	27348.00
SD WAN 	Nuclias Cloud SD-WAN Security Gateway Powerful and enduring multi-aspect protection for SMB cloud networks that keeps the network and users secure on all fronts. Number of Ports: 4 Ethernet Technology: Gigabit Ethernet Network Technology: 10/100/1000Base-T Networking Standards: IEEE 802.3u, IEEE 802.3x, IEEE 802.3az, IEEE 802.3i, IEEE 802.3ab	2309.00	7	16163.00
VPN Router 	Asus RT-AC86U Wi-Fi Standard: 802.11ac (Wi-Fi 5) Wireless Speed: <ul style="list-style-type: none">● 2.4GHz: 800Mbps● 5GHz: 2100Mbps Processor: 1.8 GHz Dual-Core Processor Memory: <ul style="list-style-type: none">● 256 MB Flash● 512 MB RAM VPN supported: <ul style="list-style-type: none">● VPN Client L2TP● VPN Client Open VPN● VPN Client PPTP● VPN Server IPSec● VPN Server Open VPN● VPN Server PPTP Security: <ul style="list-style-type: none">● AiProtection powered by Trend Micro (advanced security)● Parental controls● Adaptive QoS (Quality of Service)	830.00	10	8300.00

IP CAMERA (MINIDOME) 	Honeywell HC35W45R3 5 Megapixel Resolution: Capture high-quality images and videos with crisp detail. Rugged Design: Built to withstand tough environments, ensuring durability and longevity. Wide Dynamic Range: Provides clear images in both bright and dark areas, enhancing visibility. Infrared Night Vision: Allows for clear surveillance even in low-light or no-light conditions.	1034.00	12	12408.00
IP CAMERA (PAN TILT) 	VIGI C540 V2 Pan/Tilt Range: Pan: 0° to 350°, Tilt: 0° to 120° Max. Resolution: 2560 X 1440 Audio Communication: Two-Way Audio Cloud: Yes Built-in Microphone: Yes Built-in Speaker: Yes	264.00	5	1320.00

2.0 REFLECTION

Are you surprised by the prices? How were you surprised?

Yes. The total amount expected to spend on the equipment and networking devices for the planned computing building is RM 814,827.38 . We never thought that having these devices and equipment could be very costly, since this cost does not include some other equipment such as microphones, speakers, recorders, and other things like furniture such as chairs, tables, cabinets and other lab tools. Furthermore, not all network devices and equipment chosen are the top or second-best choices. So, having these devices without top or second-best choices with the total cost almost reaching the one million is actually quite impressive and it shows that equipment needed to set up a computing building is very expensive.

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

Yes, cost could influence our choice of devices and equipment, but we still prioritize quality, depending on our project's requirements. We carefully evaluated various networking device options and selected those that offered the most suitable balance of performance, cost-effectiveness, and alignment with our project goals.

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

FIBER OPTIC CABLE

FEATURES	Fiber Optic Pigtail SC/UPC and SC/APC	SC UPC to SC UPC Fiber Patch Cable
Fiber Type	Single Mode	Single Mode
Fiber Mode	SMF 9/125um	9/125um
Insertion loss	0.15dB	≤0.3dB
Return loss	≥53.6dB	≥50dB
Jacket OD	0.9mm	2.0mm

For insertion loss, A has lower insertion loss (0.15dB) which is better for signal integrity, while B has higher insertion loss (≤0.3dB) that may result in slightly more signal loss. In term of return loss, A has higher return loss (≥53.6dB) is better as it reflects less light back into the source, while B has lower return loss (≥50dB), though acceptable, is slightly less ideal compared to A. For jacket OD, A has slimmer jacket (0.9mm) may be more flexible but less robust and B has thicker jacket (2.0mm) provides better durability.

CONNECTOR

For this project, we have chosen ZOERAX RJ45 Cat6 Pass Through Connectors. We compared the ZOERAX brand with Cable Matters brand.

FEATURES	ZOERAX RJ45 Cat6 Pass Through Connectors	Cable Matters 200-Pack Cat 6 Pass Through RJ45 Connectors
Material	Durable plastic housing with 50-micron gold-plated contacts	High-quality plastic housing with gold-plated contacts
Gold Thickness	Thicker gold plating for lower resistance and enhanced longevity	Standard gold plating
Signal Integrity	Superior signal integrity due to thicker gold plating	Good, suitable for high-speed networks up to Gigabit Ethernet
Durability	Higher durability, particularly in demanding environments	Reliable for general networking purposes

For material, ZOERAX connectors offer more durable plastic housing and better gold-plated contacts compared to Cable Matters. Next, for gold thickness, ZOERAX has thicker gold plating, which enhances longevity and reduces resistance, while Cable Matters has standard gold plating. Furthermore, for signal integrity, ZOERAX provides superior signal integrity due to its thicker gold plating, whereas Cable Matters offers good performance for high-speed networks like Gigabit Ethernet. Lastly, for durability, ZOERAX is more suited for demanding environments, whereas Cable Matters is reliable for general networking use.

ADAPTER

FEATURES	Fiber Optic SC/UPC & SC/APC Adaptor Single Mode Simplex	Linkwell FC Adapter
Mode	Single-mode	Single-mode and multi-mode options available
Material	Plastic or ceramic body	Metal housing for enhanced durability and shielding

Durability	Moderate durability; typically used in controlled environments	High durability, suitable for rugged applications
Return Loss	$\leq 0.2\text{dB}$	$\geq 45\text{dB}$ (PC), $\geq 50\text{dB}$ (UPC), $\geq 65\text{dB}$ (APC)
Working Temperature	-30°C to +75°C	-40°C to +85°C
Storage Temperature	-40°C to +85°C	-55°C to +85°C

To start with, Both adapters support single-mode, but the Linkwell FC Adapter also offers multi-mode options, making it more versatile. Then, for the material, the SC/UPC & SC/APC Adapter uses plastic or ceramic, while the Linkwell FC Adapter's metal housing provides better durability and shielding. Next, The Linkwell FC Adapter is more durable and suitable for rugged environments, whereas the SC adapter is better for controlled environments. For return loss, Linkwell FC Adapter offers superior return loss, especially with APC and UPC finishes, compared to the SC adapter. Lastly, the temperature range for Linkwell FC Adapter has a broader working and storage temperature range, making it more suitable for extreme conditions.

FIREWALL ROUTER

FEATURES	Fortinet FG-100F	Cisco Meraki MX64
Firewall Throughput	<i>Up to 20 Gbps</i>	<i>250 Mbps</i>
VPN Throughput	<i>11.5 Gbps (IPsec)</i>	<i>70 Mbps</i>
Number VPN supported	500	50
Ports	22	5

Fortinet FG-100F offers 20 Gbps of firewall throughput while Cisco Meraki MX64 only offers 250 Mbps whereby Fortinet works better in high network traffic. High throughput ensures better performance and faster data flow. Fortinet FG-100F has higher VPN Throughput allowing it to handle more secure, encrypted connections simultaneously. Fortinet FG-100F have higher VPN support making it ideal for large organization. Fortinet FG-100F also provides far better flexibility for connecting devices via setups with wired, fiber or uplink connections due to higher number of ports compared to Cisco Meraki MX64. Hence, Fortinet FG-100F is the best choice for Firewall Router.

VPN ROUTER

FEATURES	Asus RT-AC86U	Netgear Nighthawk R7000
Speed	2.4 GHz: 800Mbps 5GHz: 2100Mbps	2.4 GHz: 600Mbps 5GHz: 1300Mbps
Processor	1.8 GHz Dual-Core Processor	1 GHz Dual-Core Processor
Memory	256 MB Flash 512 MB RAM	128 MB Flash 256 MB RAM
Security	AiProtection	NETGEAR Armor™

The specs of Asus RT-AC86U is superior compared to Netgear Nighthawk R7000 in terms of speed, processor and memory. High speed connection allows faster download, handles multiple tasks effectively and enhances user experience. High end processor allowing the router to handle heavy load hence maintaining the wifi stability and VPN. Large memory would enable the router to handle more tasks simultaneously without slowing down. In terms of security, Asus RT-AC86U provides AiProtection which provides protection against malware, instrusion and malicious activity. On the other hand, Netgear Nighthawk R7000 provides NETGEAR Armor™ as its security feature allows its user to block/manage unauthorized devices that are trying to connect to the network. However, AiProtection seems to provide better protection compared to NETGEAR Armor™ in the long term since it is using Artificial Intelligence (AI). Hence, Asus RT-AC86U is the best choice for VPN Router.

WIFI ROUTER

FEATURES	Asus RT-AX57 (AX3000) Dual Band WiFi 6 Extendable Router	TP-Link Archer AX55 WL AX3000 Dual Band Gigabit Wi-Fi 6 Router
WIFI Standard	Wi-Fi 6 (802.11ax)	Wi-Fi 6 (802.11ax)
CPU	1.7 GHz Quad-Core	Qualcomm
WIFI Speed	- 2.4 GHz: 574 Mbps - 5 GHz: 2402 Mbps - Total: 3000 Mbps	- 2.4 GHz: 574 Mbps - 5 GHz: 2402 Mbps - Total: 3000 Mbps
Antenna Setup	4 external high-performance antennas	4 external high-gain antennas with Beamforming

Coverage Features	AiMesh support for mesh networking	Beamforming for extended range
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Based on the comparison, the Asus RT-AX57 wifi router is more suitable for computer labs because it offers a high performance 1.7 GHz Quad-Core CPU, which ensures smooth handling of high network traffic and multiple simultaneous connections. The AiMesh support allows for seamless expansion of the network and providing excellent coverage. The high-performance external antennas ensure stable and reliable connectivity, which is critical for maintaining uninterrupted access to online resources or local servers. While the TP-Link Archer AX55 is a strong contender with features like Beamforming, the Asus RT-AX57's combination of performance, adaptability, and scalability makes it a better fit for computer labs.

ACCESS POINT

FEATURES	Zyxel WAX610D WiFi 6 PoE Access Point	Netgear WAX214 WiFi 6 PoE+ Access Point
Wifi Standard	Wi-Fi 6 (802.11ax)	Wi-Fi 6 (802.11ax)
Antennas and Streams	6 spatial streams (4x4:4 on 5GHz, 2x2:2 on 2.4GHz)	Dual-band (2.4GHz, 5GHz)
Power over Ethernet (PoE) support	Yes	Yes
Ethernet Ports	2 (1x 2.5Gbps)	1 (Gigabit Ethernet)
Management	Cloud-managed via free Zyxel app	Web-based configuration

From above we can see that both access point wifi standards are the same which is Wifi 6 (802.11ax). The Zyxel WAX610D WAP supports 6 spatial streams and a 2.5Gbps Ethernet port, ensuring better performance for high-bandwidth and multi-device environments. It also offers free cloud-based remote management, which is ideal for IT administrators managing multiple access points across a large building. This makes the Zyxel WAX610D WAP a better choice compared to Netgear WAX214 WAP. Based on the specification the Netgear WAX214 WAP is better suited for smaller-scale setups or less intensive use cases. Due to the Zyxel WAX610D WAP superior performance features it is suitable for a demanding environment such as a building with multiple computer labs.

NETWORK SWITCH

FEATURES	EnGenius ECS2552FP	TRENDnet 8-Port Gigabit Long Range PoE+ Switch
PoE Standard	IEEE 802.3af/at (PoE+)	IEEE 802.3af/at (PoE+)
Number of Ports	48 (32 x 1GbE, 16 x 2.5GbE) + 4 x 10G SFP+	8 Gigabit Ethernet Ports
PoE Power Output	740W	65W
Scalability	4 x 10G SFP+ for future expansion	Limited to 8 ports
Cloud/Management Support	Yes (Great cloud support, mobile app)	No management support (unmanaged switch)

Based on the table both of the network switches have the same PoE Standard which is IEEE 802.3af/at (PoE+). However, the EnGenius ECS2552FP is the better due to its high performance, scalability, and cloud management capabilities. With 48 ports, 740W of PoE power, and the ability to expand using SFP+ ports, it supports a large number of devices and provides better network management. Its advanced features make it ideal for demanding environments. Compared to the TRENDnet 8-Port PoE+ Switch which is a basic solution and suitable for smaller setups with fewer devices. It lacks scalability and advanced management features, making it less suitable for a larger and more complex networking system.

3.0 MINUTE MEETING

DATE/TIME	27/11/2024, 8.10 PM		
LOCATION	Google Meet (Online)		
AGENDA	Discussion about device that is essential for lab in the faculty		
MEETING MC	THAYAALLAN NAIDU A/L GANESAN		
ATTENDANCE			
NAME	TIME	REASON FOR ABSENCE	
IZZAT FAKHRULLAH BIN KARIM	8.07 PM	-	
MOHAMMAD IRFAN DANIAL BIN KEFLI	8.08 PM	-	
THAYAALLAN NAIDU A/L GANESAN	8.05 PM	-	
MINUTES			
NO.	ITEM DISCUSSED	IDEAS/SUGGESTIONS AND PERSON GIVING IT	PERSON IN CHARGE & DATE
1.	Discussion for task 3	- Izzat shared the information about task 3 and its rubric	Izzat
2.	Suggestion for network devices that will be included in project	-All members suggested possible devices -All members gave their opinions regarding the chosen devices - All members discuss the right quantity for each device	All members
3.	Task distribution	-Izzat distributed the task to all members equally -All members had to do research to select the model and brand of network	All members

		<p>devices based on the assigned task</p> <ul style="list-style-type: none"> -Izzat was assigned to do research on cabling, cooling device, and Cisco devices -Thayaallan was assigned to do research on wifi and computing and it devices -Danial was assigned to do research on hands-on tools, and security 	
4.	Finalize	<ul style="list-style-type: none"> -All members were assigned to calculate their total cost after finished do research -Thayaallan calculated the total cost and see whether it's still in our budget or not 	All members
5.	Meeting ended	<ul style="list-style-type: none"> -at 9:21 pm, the meeting ended after all discussion were done 	All members

4.0 REFERENCE

1. Fiber Optic Cable :
[\[https://shopee.com.my/SC-UPC-APC-Fiber-Optic-Pigtail-Simplex-0.9mm-9-125-Single-Mode-1-core-SC-UPC-Optical-Fiber-Patch-Cord-Cable-i.424514699.9268495934?sp_atk=f5620519-10fe-4e3f-b84a-92652697561b&xptdk=f5620519-10fe-4e3f-b84a-92652697561b\]](https://shopee.com.my/SC-UPC-APC-Fiber-Optic-Pigtail-Simplex-0.9mm-9-125-Single-Mode-1-core-SC-UPC-Optical-Fiber-Patch-Cord-Cable-i.424514699.9268495934?sp_atk=f5620519-10fe-4e3f-b84a-92652697561b&xptdk=f5620519-10fe-4e3f-b84a-92652697561b)
2. Connector :
[\[https://www.google.com/aclk?sa=l&ai=DChcSEwiN6oih64aKAxVEDoMDHadoBd0YABABGgJzZg&co=1&gclid=Cj0KCQiAr7C6BhDRARIaOUKifZgOVHVflymVkJZNQzr4Fb_V87HMOseMRdHr_pyPvZH-3ejWkJJotwaAkMsEALw_wcB&sig=AOD64_08PthVhL30pG7bQgbWtVsTVWP6CQ&ctype=5&q=&ved=0ahUKEwjPuYOOh64aKAxUrSWwGHeJwN6QQww8liAg&adurl=\]](https://www.google.com/aclk?sa=l&ai=DChcSEwiN6oih64aKAxVEDoMDHadoBd0YABABGgJzZg&co=1&gclid=Cj0KCQiAr7C6BhDRARIaOUKifZgOVHVflymVkJZNQzr4Fb_V87HMOseMRdHr_pyPvZH-3ejWkJJotwaAkMsEALw_wcB&sig=AOD64_08PthVhL30pG7bQgbWtVsTVWP6CQ&ctype=5&q=&ved=0ahUKEwjPuYOOh64aKAxUrSWwGHeJwN6QQww8liAg&adurl=)
3. Adapter :
[\[https://shopee.com.my/Fiber-Optic-SC-UPC-SC-APC-Adaptor-Single-Mode-Simplex-SC-UPC-SC-APC-Coupler-i.138409792.25850102882?sp_atk=da038657-71c9-429a-a28a-c802463fd4db&xptdk=da038657-71c9-429a-a28a-c802463fd4db\]](https://shopee.com.my/Fiber-Optic-SC-UPC-SC-APC-Adaptor-Single-Mode-Simplex-SC-UPC-SC-APC-Coupler-i.138409792.25850102882?sp_atk=da038657-71c9-429a-a28a-c802463fd4db&xptdk=da038657-71c9-429a-a28a-c802463fd4db)

4. Cooling System :
[<https://www.airconexpert.com.my/product/mitsubishi-2-5-hp-js-series-msy-js24vf/>]
5. WIFI Router :
[<https://www.allithypermarket.com.my/collections/router/products/asus-rt-ax57-ax3000-dual-band-wifi-6-extendable-router-subscription-free-network-security-instant-guard-advanced-parental-controls-built-in-vpn-aimesh-compatible-gaming-streaming-smart-home>]
6. Access Point :
[<https://www.techradar.com/reviews/zyxel-wax610d-wifi-6-poe-access-point>]
7. Network Switch :
[https://store.engeniustech.com/products/ecs2552fp?srsltid=AfmBOoq_9QeWHmj5DJ6EWUm0BA6ypPwCL7y6J4U09sEtiS7RAdzdxL]
8. Desktop 1:
[<https://www.hp.com/my-en/shop/hp-all-in-one-24-cr0016d-pc-85w13pa.html?facetref=126637080d2804ae>]
9. Desktop 2:
[<https://www.hp.com/my-en/shop/hp-pro-tower-400-g9-pci-desktop-pc-9e491pt.html?facetref=d9aeb0ec858bde33>]
10. Webcam Monitor :
[<https://www.hp.com/my-en/shop/hp-m27-webcam-monitor-459k0aa.html?facetref=67ae6054d6b0209d>]
11. Monitor :
[<https://www.hp.com/my-en/shop/hp-p24v-g5-fhd-monitor-64w18aa.html?facetref=5317c8c7997dacd8>]
12. TV :
[https://senq.com.my/items/139700101738133?dxid=Cj0KCQiAr7C6BhDRARIaOUKifjAGHMx6FvTQV2TlrUsY6sMIQLhYNkhqd5LBwLvLuV4_UK8W_jBNI4aAimDEALw_wcB&utm_id=Cj0KCQiAr7C6BhDRARIaOUKifjAGHMx6FvTQV2TlrUsY6sMIQLhYNkhqd5LBwLvLuV4_UK8W_jBNI4aAimDEALw_wcB&gad_source=1&gclid=Cj0KCQiAr7C6BhDRARIaOUKifjAGHMx6FvTQV2TlrUsY6sMIQLhYNkhqd5LBwLvLuV4_UK8W_jBNI4aAimDEALw_wcB]
13. Interactive Digital Board :
[<https://www.lg.com/my/business/information-display/digital-signage/special-digital-signage/75tc3d-b/>]
14. Laptop :
[[https://www.lenovo.com/my/en/p/laptops/ideapad/ideapad-1/ideapad-1i-gen-7-\(15-inch-intel\)/82lx008rmj?cid=my:sem:9b3nh0&gad_source=1&gclid=Cj0KCQiAr7C6BhDRARIaOUKifgmMUbQ2n2V3NrRsY2NRuTTxQ27geJCbi9a2HeAn7eb31sdUtKpdEEaAuD1EALw_wcB](https://www.lenovo.com/my/en/p/laptops/ideapad/ideapad-1/ideapad-1i-gen-7-(15-inch-intel)/82lx008rmj?cid=my:sem:9b3nh0&gad_source=1&gclid=Cj0KCQiAr7C6BhDRARIaOUKifgmMUbQ2n2V3NrRsY2NRuTTxQ27geJCbi9a2HeAn7eb31sdUtKpdEEaAuD1EALw_wcB)]
15. Projector :

[<https://www.epson.com.my/Projectors/Epson-EB-1785W-Wireless-WXGA-3LCD-Projector/p/V11H793052>]

16. Printer :

[<https://www.hp.com/my-en/shop/hp-smart-tank-615-wireless-all-in-one-y0f71a.html?facetref=80c968e7ad4637bf>]

17. Tab :

[<https://www.samsung.com/my/tablets/galaxy-tab-s/galaxy-tab-s6-lite-mint-128gb-sm-p620nlgexme/>]

18. Cisco Switch:

[<https://www.router-switch.com/ws-c2960l-24ts-ll.html#tab-specification>]

19. Cisco Router:

[<https://www.router-switch.com/cisco2901-k9-p-155.html#tab-specification>]

20. Fortinet FG-100F:

[https://www.dell.com/en-us/shop/fortinet-fortigate-fg-100f-network-security-firewall-apppliance/apd/aa720456/wifi-and-networking#techspecs_section]

21. Cisco Meraki MX64:

[https://documentation.meraki.com/MX/MX_Overviews_and_Specifications/MX64_and_MX65_Overview_and_Specifications]

22. Asus RT-AC86U:

[<https://www.asus.com/my/networking-iot-servers/wifi-routers/asus-wifi-routers/rt-ac86u/techspec/>]

23. Netgear Nighthawk R7000:

[<https://www.netgear.com/home/wifi/routers/r7000/>]

24. Small Rack:

[<https://www.dell.com/en-my/shop/apc-by-schneider-electric-netshelter-wx-9u-wall-mountable-rack-cabinet-for-networking-airflow-system-48260-mm-rack-width-x-528-mm-rack-depth-black/apd/aa906784/power-cooling-data-center-infrastructure>]

25. Medium Rack:

[<https://my.rs-online.com/web/p/server-racks/1863284?srslid=AfmBOor7sGVdsqvjeQL2QA73JPSSpz89s0haEKwM-8bpnsh91ibSuCP2>]

26. Big Rack:

[<https://www.dell.com/en-my/shop/apc-netshelter-sx-42u-600mm-wide-x-1200mm-deep-enclosure-with-sides-black-ar3300x717/apd/ab118548/power-cooling-data-center-infrastructure>]

27. SD WAN:

[<https://www.dlink.com.my/product/nuclias-cloud-sd-wan-security-gateway>]

28. IP Camera (Minidome):

[<https://prod-edam.honeywell.com/content/dam/honeywell-edam/hbt/en-us/documents/literature-and-specs/datasheets/security-de/HBT-SEC-35S-HC35W4xR3-DS-US-EN.pdf>]

29. IP Camera (Pan Tilt):

[<https://www.tp-link.com/my/business-networking/vigi-network-camera/vigi-c540/#specifications>]

30. Arduino Tools:

[<https://store.arduino.cc/collections/internet-of-things>]

31. Raspberry Pi:

[<https://www.raspberrypi.com/products/compute-module-5/?variant=cm5-104032>]

32. Digital Logic Trainer Board:

[https://www.utmel.com/productdetail/globalspecialties-pb502-2865440?srsltid=AfmBOoop3g-QeTkuAkKfp3eh5r9lTwrMfUyyjgrKTc_ZA-wqIZ7w2PM6aOw]