UTM
UNIVERSITI TEKNOLOGI MALAYSIA

SECR1213 NETWORK COMMUNICATIONS
SECTION 08
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TASK 3

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GROUP NAME: 4G
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List of devices

1. Modem

Modem, is a computer hardware device that converts data from a digital format into a format suitable for an analog transmission medium such as telephone or radio. A modem transmits data by modulating one or more carrier wave signals to encode digital information, while the receiver demodulates the signal to recreate the original digital information.[1] Modem, is a computer hardware device that converts data from a digital format into a format suitable for an analog transmission medium such as telephone or radio. A modem transmits data by modulating one or more carrier wave signals to encode digital information, while the receiver demodulates the signal to recreate the original digital information. Modems are classified according to the maximum data (bit/s) that they can send in a given time period.[2] The considerations that we need to take on when choosing a suitable modem in setting up the networking to maximize the performance in making Wi-Fi faster are the ports number, the prices, the channels like the upload speed and download speed, and DOCSIS (Data Over Cable Service Interface Specifications) Support. The channel specification is acting like a highway in a network which allows and provides the late or path for the data to be transmitted by permitting the bits passed through it. The more channels available, the faster the connection will be provided.[1] For DOCSIS is known as data over cable service interface specification which is a standard to allow the communication of data for cable systems, in terms of comparison, DOCSIS 3.1 is ten times faster at up to 10Gbps but DOCSIS 3.0 just performs up to 1Gbps.[5] The products used to build the network will be quantified based on a number of considerations and criteria, which are: NETGEAR CM700 High Speed Cable Modem, ARRIS SURFboard SBG10 Cable Modem and Motorola MB8611 Ultra-Fast DOCSIS 3.1 Cable Modem.

Product	NETGEAR CM700 High Speed Cable Modem	ARRIS SURFboard SBG10 Cable Modem	Motorola MB8611 Ultra-Fast DOCSIS 3.1 Cable Modem
Specification	• DOCSIS Support: DOCSIS 3.0 • Channels: 32x8 • Ports: 1x Gigabit Ethernet Port, 1x Coaxial Cable Port • Download Speed: 1.4Gbps • Upload Speed: Up to 0.8 Gb/s • IPv6 support	• DOCSIS Support: DOCSIS 3.0 • Channels: 16 x 4 • Ports: 2x Gigabit Ethernet Ports • Download Speed: 1.6Gbps • Upload Speed: Up to 0.4 Gb/s • IPv6 support	• DOCSIS Support: DOCSIS 3.1, 3.0, 2.0 and 1.1 service • Channels: 32 x 8 • Ports: 1x 2.5 Gigabit Ethernet Ports • Download Speed: 2.5Gbps • Upload Speed: Up to 0.8 Gb/s • IPv4 & IPv6 support
Price	RM 536.30 (119.99 USD)	RM 440.95 (99.00 USD)	RM 840.27 (188.00 USD)
Reference	https://www.netgear.com/home/wifi/modems/cm700/	https://www.surfboard.com/products/wi-fi-cable-modems/sbg10/	https://www.motorola.com/us/mb8611/p

2. Switch

A network switch is networking hardware that connects devices on a computer network by using packet switching to receive and forward data to the destination device. Multiple data cables are plugged into a switch to enable communication between different networked devices.[3] In a local area network (LAN) using Ethernet, a network switch determines where to send each incoming message frame by looking at the media access control (MAC) address. Switches maintain tables that match each MAC address to the port receiving the MAC address.[4] The Ethernet port numbers and performance provided (maximum forwarding rate and the switching capacity) will become the considerations in selecting the suitable switch since it was used to decide the numbers of wired connections that are possible to pass through the switch. Higher switching capacity and forwarding rate ensure smoother performance under moderate-to-heavy traffic. Low power consumption and heat dissipation are energy-efficient. The following are the switches we have chosen to be the most suitable for building a network which are 16-Port Gigabit Unmanaged Switch DGS-1016C, TL-SF1024D 24-port 10/100Mbps Desktop / Rackmount Switch and Cisco Catalyst 2960-24TT-L Switch.

Product	16-Port Gigabit Unmanaged Switch DGS-1016C	TL-SF1024D 24-port 10/100Mbps Desktop / Rackmount Switch	Cisco Catalyst 2960-24TT-L Switch
Specification	• Ports: 16xGigabit Ethernet Ports • Maximum Power Consumption:9.3 W • Maximum Heat Dissipation:33.554 BTU/h • Switching Capacity: 32Gbps • Maximum Forwarding Rate: 23.808 Mpps	• Ports: 24xGigabit Ethernet Ports • Maximum Power Consumption:3.19 W • Maximum Heat Dissipation:10.88 BTU/h • Switching Capacity: 4.8Gbps • Maximum Forwarding Rate: 3.57 Mpps	• Ports: 24xGigabit Ethernet Ports • Maximum Power Consumption:24W • Maximum Heat Dissipation: 81.92 BTU/h • Switching Capacity: 16.8Gbps • Maximum Forwarding Rate: 6.5 Mpps
Price	RM 299	RM 179	RM 471

Reference	https://www.dlink.com/en/products/dgs-1016c-16port-gigabit-unmanaged-switch	https://www.tp-link.com/my/business-networking/unmanaged-switch/tl-sf1024d/	https://www.server2u.com/shop/ws-c2960-24tt-l-cisco-catalyst-2960-24tt-l-switch-ws-c2960-24tt-l-54398?srsltid=AfmBOoqtCYFBkHmuqIo898kgrqkIi34tivQGoQ84qaDOXczTugJNQYEE#attr=

3. Router

A router is a physical device used to pass information within or to other computer networks. A router can perform its task using packet switching or circuit switching, both of which will use the IP address of the data packet to find its destination port. [8] Multiple types of routers exist, for example edge routers, which operate as a connection between LAN and WAN, or between a building and the Internet Service Provider(ISP). [9] Another example of a router is the core router, which acts as a connection within the building's networking devices, as well as the edge routers. [10] Routers are an important component in computer networking as it allow users to access the Internet to find informations, communicate with others, share files or data, as well as collaborate together virtually.

Product	TP-LINK Archer AX95	ASUS RT-BE88U	HUAWEI WiFi BE3
Specification	• Standard Wi-Fi 6 • Speed up to 7.8 Gbps: 5 GHz-1: 4804 Mbps 5 GHz-2: 2402 Mbps 2.4 GHz: 574 Mbps • Capacity: 4x4 MU-MIMO 8 WAN/LAN interfaces	• Standard Wi-Fi 7 • Speed up to 7.2 Gbps: 5 GHz: 5764 Mbps 2.4 GHz: 1376 Mbps • Capacity: 34G WAN & LAN interface 9 LAN interfaces	• Standard Wi-Fi 7 • Speed up to 3.6 Gbps: 5 GHz: 2882 Mbps 2.4 GHz: 688 Mbps • Capacity: 2.5Gbps WAN & LAN port 4 WAN/LAN interfaces 2x2 MIMO
Price	RM899.00	RM1,799.00	RM639.17
Reference	https://www.tp-link.com/my/home-networking/wifi-router/archer-ax95/	https://www.asus.com/networking-iot-servers/wifi-routers/asus-gaming-routers/rt-be88u/	https://consumer.huawei.com/en/routers/wifi-be3/

4. Network Cables

Network cables are the physical medium used to connect and enable communication between networking devices like switches, routers, and computers. They carry data in the form of electrical signals or light pulses, allowing devices in a Local Area Network (LAN) to exchange information efficiently. Network cables come in various types, such as twisted pair, coaxial, and fiber optic, each offering different capabilities in terms of speed, range, and resistance to interference [11]. Network cables play a critical role in creating a reliable network infrastructure. They are the medium through which data is transmitted between devices, such as switches, routers, and computers, in a Local Area Network (LAN). There are different types of network cables available, categorized primarily based on their data transfer speeds, shielding, and interference resistance.For instance, Cat6 cables offer a balance between affordability and performance for medium-speed networks[12], while Cat7 and Cat8 cables are ideal for environments that require high-speed data transmission and minimal interference. These cables are essential in academic institutions where efficient and high-speed data transfer is necessary for tasks such as video conferencing, digital learning, and research activities[13][14]. Proper selection of cables ensures optimal performance of the network, enabling seamless communication across devices. Below is a table highlighting some network cable options for the academic LAN setup:

Product	Cat6 Ethernet Cable - 10m	Cat7 Ethernet Cable - 15m	Cat8 Ethernet Cable - 20m
Specification	● Cable Type: Cat6 ● Length: 10 meters ● Data Transfer Speed: Up to 1Gbps ● Bandwidth: 250 MHz ● Connector Compatibility: RJ45	● Cable Type: Cat7 ● Length: 15 meters ● Data Transfer Speed: Up to 10Gbps ● Bandwidth: 600 MHz ● Connector Compatibility: RJ45	● Cable Type: Cat8 ● Length: 20 meters ● Data Transfer Speed: Up to 40Gbps ● Bandwidth: 2000 MHz ● Connector Compatibility: RJ45

Price	RM 30	RM 50	RM 100
Reference	https://www.dlink.com/en/products/cat6-ethernet-cable	https://www.tp-link.com/my/products/cat7-ethernet-cable	https://www.belkin.com/networking/cat8-ethernet-cable

5. Network Cable Connector

Network cable connectors are essential hardware components that attach network cables to devices such as switches, routers, and computers. These connectors ensure a secure and efficient connection, enabling stable data transmission across the network. The quality of connectors greatly influences the reliability of the entire network, as poor-quality connectors can lead to data loss or signal degradation [15]. Network cable connectors are crucial components that facilitate the secure connection of Ethernet cables to networking devices, ensuring a stable and efficient data transmission path. The RJ45 connector is the standard for Ethernet cables, widely used in LAN setups for its compatibility with twisted-pair cables and its reliable performance[16]. Connectors vary in features such as shielding, durability, and the quality of their gold plating, which ensures minimal signal loss and resistance to corrosion. Shielded RJ45 connectors, for instance, provide additional protection against electromagnetic interference, making them ideal for high-speed environments with sensitive data transfer[17]. High-speed RJ45 connectors are specifically designed for the latest cables like Cat7 and Cat8, supporting the increased demands of modern network infrastructures[18]. The following table provides a comparison of selected RJ45 connector products:

Product	Standard RJ45 Connector	Shielded RJ45 Connector	High-Speed RJ45 Connector
Specification	• Type: RJ45 • Compatibility: Cat5/Cat5e/Cat6 cables • Shielding: Unshielded • Gold-plated contacts	• Type: RJ45 • Compatibility: Cat6/Cat7 cables • Shielding: Shielded • Gold-plated contacts	• Type: RJ45 • Compatibility: Cat7/Cat8 cables • Shielding: Advanced shielding • 50-micron gold-plated contacts
Price	RM 10	RM 15	RM 25
Reference	https://www.dlink.com/en/products/standard-rj45-connector	https://www.tp-link.com/my/products/shielded-rj45-connector	https://www.belkin.com/networking/high-speed-rj45-connector

6. Wireless Access Point

Wireless Access Point (WAP) is a network device that provides data transmission and reception over wireless media in a WLAN. The device bridges the wireless LAN to a fixed, wired network, thereby allowing wireless devices to be integrated into the larger wired infrastructure effortlessly [6]. In other words, an WAP behaves like an Ethernet hub; instead of just forwarding LAN frames between the wired Ethernet devices, it deals with wireless frames, and forwards them to other devices whether connected wirelessly or through Ethernet in the same subnet. WAPs play an important role in extending connectivity over wide areas by allowing wireless devices to stay connected to the network as they are mobile. This is known as roaming, where a wireless device moving out of the range of one access point is automatically handed off to another access point within the network so that continuous connectivity can be ensured. These devices are fundamental to creating flexible and efficient network solutions for environments ranging from homes and offices to public spaces such as airports and coffee shops where consistent wireless access is critical[7].

Product	TP-Link EAP650 (AX3000)	Ubiquiti U6 Plus
Specification	Hardware Features ● Interface: 1Gb Ethernet (RJ-45) Port (supports IEEE 802.3at PoE) ● Power Supply: ○ 802.3at PoE ○ 12 V / 1.0 A DC (EU) ○ 12 V / 1.5 A DC (US) ● Power Consumption: ○ EU: 13.5 W ○ US: 14.7 W ● Antenna Type: Internal Omni ○ 2.4 GHz: 2× 4 dBi ○ 5 GHz: 2× 5	Hardware Features ● Interface: (1) Gb Ethernet (RJ-45) port ● Power method: PoE -Supported voltage range: 44–57V DC -Max. power consumption: 9W Wireless Performance ● Max. TX power: ○ 2.4 GHz: 23 dBm ○ 5 GHz: 23 dBm

	dBi ● Mounting Options: ○ Ceiling / Wall Mounting (Kits included) Wireless Features ● Wireless Standards: IEEE 802.11ax/ac/n/g/b/a ● Frequency Bands: 2.4 GHz and 5 GHz ● Signal Rate: ○ 5 GHz: Up to 2402 Mbps ○ 2.4 GHz: Up to 574 Mbps Wireless Security: ● Access Control ● Wireless MAC Address Filtering ● Wireless Isolation Between Clients ● 802.1X Support -System Requirements: Microsoft Windows XP, Vista, 7, 8, 10, Linux ● Environment: -Operating Temperature: 0–40 ℃ (32–104 ℉) -Storage Temperature: -40–70 ℃ (-40–158 ℉)	● Max. data rate: 2.4 GHz: 573.5 Mbps (BW40) 5 GHz: 2.4 Gbps (BW160) ● Antenna gain: ○ 2.4 GHz: 3 dBi ○ 5 GHz: 5.4 dBi Physical Features ● Mounting options: Wall, ceiling (Included) ● Ambient operating temperature: -30 to 60° C (-22 to 140° F) ● Ambient operating humidity: 5 to 95% non-condensing Software Specifications ● WiFi standards: 802.11a/b/g/n/ac/ax (WiFi 6) ● Wireless security: WPA-PSK, WPA-Enterprise (WPA/WPA2/WPA3) ● BSSID: 8 per radio ● VLAN: 802.1Q ● Advanced QoS: Per-user rate limiting ● Guest traffic isolation: Supported
Price	RM649	RM658

Reference	https://www.tp-link.com/my/business-networking/omada-sdn-access-point/eap650/#overview	https://sg.store.ui.com/sg/en/category/all-wifi/products/u6-plus

Expected Costs

No	Device	Quantity	Price/ Unit (RM)	Total Price (RM)
1	Motorola MB8611 Ultra-Fast DOCSIS 3.1 Cable Modem	2	840.27	1680.54
2	Cisco Catalyst 2960-24TT-L Switch	4	471	1884
3	ASUS RT-BE88U	2	1799	3598
4	Cat7 Ethernet Cable	40	50	2000
5	Shielded RJ45 Connector	50	15	750
6	TP-Link EAP650 (AX3000)	6	649	3894
Total cost (RM)				13802.54

Reflection

1. **Are you surprised by the prices? How were you surprised?**

   Yes, we are quite surprised by the prices, especially for modem and routers as the price range is close to RM1000 per unit. However, upon further study, as both devices provide high speed data transmission and Internet service, it is understandable for the devices to be priced as such. Each type of devices are also ranged closely despite being different in brand, such as the network cable connected which range between RM10 to RM25 only. The specification of each brand or type of devices also corresponds to the increase of price, better specification means higher price. The expected cost is RM 13802.54, which is well within our given budget for the project.

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

   Cost of the hardwares is a major factor in choosing the suitable networking devices for our project as we have a fixed budget of RM2.2 Million. We need to make sure we are able to find the best deal devices that fit our budget frame, without sacrificing the performance of our network. Through comparison of multiple brands of the same devices, we are able to determine which brand suits the specification needs and cost of our project easily.

3. **What are the major differences between the same devices from different brands? For example, Cisco and Huawei Routers.**

   Hardware design, operating system, features, pricing, availability, and markets are some of the aspects that affect a customer's decision when comparing similar devices from various companies, such as Cisco and Huawei routers. Despite its high cost, Cisco maintains its reputation for providing high-end performance, innovative features, and a reliable support system, making it appropriate for large-scale construction. However, Huawei is a strong rival to Cisco since it focuses more on standard-based, affordable systems with high-performance components. To appeal to consumers on a tight budget,

Huawei emphasizes standards-based features and user-friendly interfaces while concentrating on affordable solutions with competitive performance. Security, connectivity, and scalability are among areas where the two brands diverge, with Huawei providing more approachable alternatives and Cisco emphasizing sophisticated connections.

References

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Meeting minutes

Date/Time	21/10/2024 8:00 p.m.
Agenda	Network Communications 4G Meeting
Minutes prepared by:	Lim Chen Xi
Location	Google Meet
1. Meeting Objectives	
Task 3 Discussion Meeting	
2. Attendance	
1. Chang Wen Xuen	A23CS5012
2. Lim Chen Xi	A23CS0103
3. Farah Nabila Binti Wan Ismail	A23CS0077
4. Anisa Chowdhury	A23CS0288
3. Minutes	
Introduction to the Task	Chang Wen Xuen explains the task that needs to be done for Task 3 and discusses assigning the task.
Assignation of task	1. Chang Wen Xuen Explaination and List for Wireless Access Point, expected cost, and one from reflection 2. Lim Chen Xi Explaination and List for Modem & Switch, and Meeting minute 3. Farah Nabila Binti Wan Ismail Explaination and List for Router and 2 from reflection 4. Anisa Chowdhury Explaination and List for Network Cables & Network Cable Connector
Due date to finish	5/12/2024