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SECTION 12

PROJECT TASK 3

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GROUP 12.1 (POWERPUFF)

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3.1 Introduction to Needed Device

1. Switch

A switch is a networking device that is used to connect multiple devices within a local area network (LAN) and enables the transferring of information between the connected devices. The switch primarily operates on Layer 2 of OSI model (data link layer), but some switches can also operate on Layer 3 (network layer). The function of the switch includes packet switching based on MAC address, perform error checking before forwarding data, and full-duplex communication which improved the network performance. With the help of a switch, traffic overload can be prevented, and the bandwidth of the network can be increased.

2. Monitor

A monitor is an output device that displays the graphic information generated by a computer's Graphics Processing Unit (GPU) that it was connected to. The monitor functions by receiving signals from the computer and converts the signals into visual output that allows users to interact with the computer system in real time. The higher resolution and refreshing rate of the monitor can provide a smoother and greater visual experience.

3. Fiber Optic Cable

Fiber optic is a hair-thin cylindrical fiber of glass that can transmit data in high speed and uses light pulses to carry information over long distances along a glass with minimal loss. The fiber optic cable is made up of three parts which are the core containing fibers, cladding that enables total internal reflection phenomena to occur, and buffer coating to protect the fiber. Although the fiber optic cable supports higher bandwidths, it was also fragile and costly on the other hand.

4. Router

A router is a device that connects two or more packet-switched networks or subnetworks. It manages traffic between these networks by forwarding data packets to their intended IP address and allowing multiple devices to use the same internet connection. It also acts as a traffic director, determining the best path for data to travel from one network to another. It uses an internal routing table, a list of paths to various network destinations. The router reads a packet's header to determine where it is going and then consults the routing table to determine the most efficient path to that destination. It then forwards the packet to the next network in the path.

5. Wireless Access Point

Wireless Access Point (WAP) is a networking device that allows wireless-capable devices to connect to a wired network. It is simpler and easier to install and connect all the computers in the network than wires and cables. It can also help eliminate "dead spots" in a Wi-Fi network. Operating in accordance with the IEEE 802.11 standard, APs act as bridges, linking wireless devices to the network infrastructure, and are integral components in open Wi-Fi networks, delivering mobile internet access.

6. Personal Computer (PC)

PC is a digital computer designed for use by only one person at a time. A typical personal computer assemblage consists of a central processing unit (CPU), which contain the computer's arithmetic, logic and control circuity on an integrated circuit; two types of computer memory, main memory, such as digital random-access memory (RAM), and auxiliary memory, such as magnetic hard disks and special optical compact discs, or read-only memory (ROM) discs (CD-ROMs and DVD-ROMs); and various peripheral devices, including a display screen, keyboard and mouse, and printer. See also computer: History of computing.

7. Printer

Printer is a device that accepts text and graphic output from a computer and transfers the information to paper, usually to standard-size, 8.5" by 11" sheet of paper. Printers vary in size, speed, sophistication and cost. Personal computer printers can be distinguished as impact or non-impact printers. Early impact printers worked something like an automatic typewrite, with a key striking an inked impression on paper for each printed character. The dot matrix printer, an impact printer that strikes the paper a line at a time, was a popular low-cost option. The best-known non-impact printers are the inkjet printer and the laser printer. The inkjet sprays ink from an ink cartridge at very close range to the paper as it rolls by, while the laser printer uses a laser beam

reflected from a mirror to attract ink (called toner) to selected paper areas as a sheet rolls over a drum.

8. Connector

Connector is component that creates an electrical circuit by connecting electrical parts. It can enable contact between wires, cables, printed circuit boards and electronic components. A registered jack is a standardized interface used for network cabling. It's most recognized in its role as the connector at the ends of Ethernet cables, enabling devices such as computers, routers, and switches to communicate over a network. Now, let's look at some of the components that an RJ45 connector consists of and connects to.

9. Patch Panel

Patch panel is a crucial hardware component in any structured cabling system for a Local Area Network (LAN). It is a mounted hardware assembly with multiple ports designed to organize and route data connections between network hardware, such as switches, routers, and end-user devices. A patch panel provides a way to keep large numbers of cables organized, enabling flexible connectivity into network hardware located in a data center or an access or wiring closet.

10. Server

A server is a computer system, either hardware or software, that provides functionality to other programs or devices, referred to as "clients." It operates within a client-server model, where communication follows a request and response process. Servers are designed to offer various services, such as sharing data or resources among multiple clients and performing computations or processing tasks on behalf of clients. Servers can also be specialized for specific roles, including database servers for managing and storing structured data, file servers for storing and sharing files, mail servers for email communication, web servers for hosting websites, and application servers for running specific applications. This functionality enables servers to support efficient communication and resource management across networks, making them essential components of modern IT infrastructure.

11. Projector

A projector is an output device that takes images generated by a computer or Blu-ray player and reproduces them by projection onto a screen, wall, or another surface. In most cases, the surface projected onto it is large, flat, and lightly colored. It is an essential tool for effective communication and collaboration in networking projects and educational environments. A projector is necessary for the hybrid classroom and video conferencing room. It enables displaying digital content for teaching, presentations, and collaborative activities.

12. Microphone

A microphone is a crucial device used to capture audio input by converting sound waves into electrical signals. Different types of microphones are available depending on the application. Dynamic microphones are durable and suitable for loud environments, while condenser microphones provide high-quality sound, making them ideal for video conferencing and recording purposes. Key features to consider when selecting a microphone include noise cancellation for clear audio, USB or XLR connectivity for ease of use, and frequency response to capture voice accurately.

13. Camera

A camera plays a vital role in video communication and monitoring. It is widely used in hybrid classrooms, labs, and video conferencing rooms. Cameras vary in type, from basic webcams for video calls to high-resolution digital cameras for professional recording. IP cameras are particularly advantageous for network-based remote monitoring. Important factors to consider include resolution (HD or 4K for better clarity), field of view (a wide angle for classroom or lab coverage), network capability for IP cameras, and low-light performance for versatility.

14. Ethernet Cable

An ethernet cable is a type of network cable consisting of encased physical wiring that facilitates data travel. It is used to connect devices within a local area network (LAN), enabling them to communicate and share data. These cables are essential for establishing wired Internet connections between devices such as computers, routers, switches, modems and most internet and network-enabled devices.

15. Firewall

A firewall is a network security device or software that is designed to monitor, filter, and control incoming and outgoing network traffic based on predefined security rules. Its major purpose is to establish a barrier between a trusted internal network and untrusted external networks, such as the Internet, to protect systems from unauthorized access, cyberattacks, and other threats.

16. Smartboard

A smartboard is an interactive whiteboard that combines traditional whiteboard functionality with digital technology, which allows users to interact with the digital content. Unlike typical whiteboards, smartboards are touch-sensitive devices that allow users to write on them with the touch of a finger or a special stylus. They can be connected to a computer or other devices to display multimedia content, such as videos, presentations, or documents. It enhanced collaboration and interaction by offering multimedia presentations, internet connectivity, and real-time collaboration.

17. CCTV

CCTV stands for closed-circuit television and is commonly known as a video surveillance system that uses cameras to transmit video footage to a specific, private set of monitors or recording devices. Its signals are not publicly transmitted, but rather "closed" to a particular network. It is commonly used for security purposes to monitor activities and deter crime. Nowadays, modern CCTV displays can be high-resolution color, enabling the administrator to zoom in on image or speak to people within the camera' associated speakers' area has increased situational awareness and provided evidence in case of incidents strongly.

18. Subscriber Connector

SC fibre-optic cable connectors are widely used in optical network applications, such as Internet and cable TV. The name comes from the shape (square connector), although it is actually a rectangular connector. The name may also refer to the standard, subscriber, or stick-and-click connectors. They are inexpensive, durable and easy to use. A locking tab keeps this push-pull connector secure. SC connectors have a 2.5 mm ferrule, and they are commonly used in datacom and telecom applications.

3.2 Table of Devices

Devices	Description	Price (RM/units)	Quantity	Total Price (RM)
Switch 	**TP-Link TL-SG1048** - 48 10/100/1000Mbps RJ45 ports - Energy-efficient technology that saves power consumption - No configuration required - Support MAC address self-learning and auto MDI/MDIX - Standard 19-inch rack-mountable steel case	1299	7	9093
Monitor 	**Dell 24 Monitor - S2425H** - Resolution: Full HD 1920 x 1080 - Integrated 2 x 5W speakers - 100Hz refresh rate - Viewing angle: 178°	559	169	94471
Fiber Optic Cable 	**Unifi TIME Maxis Fiber Optic Cable** - SC-SC connector - Single mode fiber - Simplex cable - Insertion loss: ≤1dB - Return loss: ≥ 50dB	1.50/meter	350	525
Router	**TP-Link Archer AX73** - Dual-band Wi-Fi 6 router - Speeds of up to 5400 Mbps - Connects over 200 devices	474	5	2370

	- HomeShield security - 1.5 GHz Triple-Core CPU, 1x Gigabit WAN port, and 4x Gigabit LAN ports.			
Wireless Access Point 	**TP-Link EAP670** - Special Feature: WPS - Frequency Band Class - Dual-Band - Wireless Communication Standard: 802.11ax - Compatible Devices: Personal Computer - Frequency: 5Hz - Recommended Uses for Product: Home - Included Components: Installation Guide, Power Adapter, Ceiling/Wall Mounting Kits, EAP670 - Connectivity Technology: Ethernet	447.07	5	2235.35
Personal Computer (PC) 	**Precision 3680 Tower Workstation** - Processor: Intel® Core™ i5 14500 (24 MB cache, 14 cores, 20 threads, up to 5.0 GHz Turbo, 65 W) Operating system: Windows 11 Pro, English - Graphics: Intel Integrated Graphics - Memory: 16GB: 1 x 16 GB, DDR5, 4400 MT/s, non-ECC - Storage: 256 GB, M.2 2230, Gen 4 PCIe NVMe, SSD - Chassis Options: Precision 3680 Tower with 300W (80 Plus Platinum) PSU	4749	172	816828
Printer 	**Brother DCP-L3560CDW Laser Printer** - A4 print speed up to 26 ppm (Black/Colour) - Wi-Fi, AirPrint, Mopria, Wi-Fi Direct, LAN, USB 2.0 - Auto 2-sided (Duplex) printing, 50 sheets Auto-Document Feeder	1999	2	3998

	(ADF), 3.5" Color LCD touchscreen - Full capacity toner included. Yield up to 1000/1000 pages (black/color) * - Compatible with Mobile Connect app			
Connector 	**High Quality AMP RJ45 CAT5E CAT5 CAT6 CAT 6 Modular Plug Connector** - Brand: Cable Matters - Connector Type: RJ45 - Cat 6 RJ45 pass through connector for custom-length cables - Supports 23-26 AWG round or flat stranded wire	24.11/pack 1pack=100	5	120.55
Patch Panel 	**Rapink Patch Panel 24 Port Cat6 with Inline Keystone 10G Support** - **Toolless Termination**: Simplifies installation by allowing cables to be connected without specialized tools. - **Supports Cat6 with 10G Speeds**: Ensures high-speed connectivity essential for modern LANs, especially with growing demands on bandwidth. - **Expandable and Repairable**: Designed for easy port repair and expansion, which is helpful in educational setups with varying needs. - **Durability**: Features a detachable back bar and gold-plated pins to ensure long-term performance and reduce maintenance issues.	189.16	18	3404.88

Server 	**Cisco UCS C480 M5 High-Performance Rack Server** - **Special Feature:** High scalability and performance for enterprise workloads - **Processor:** Up to 4 Intel Xeon Scalable processors (28 cores per processor) - **Memory:** Up to 6TB DDR4 RAM - **Storage:** Supports NVMe, SAS, and SATA drives for flexible configurations. - **Connectivity:** Multiple PCIe slots for network and storage expansion. - **Management**: Cisco Integrated Management Controller (IMC) for monitoring and troubleshooting.	28,812.80	2	57625.60

	- **Energy Efficiency**: Designed for high performance with reduced power consumption. - **Applications**: Data analytics, AI/ML workloads, cloud computing, database management, and virtualization.			
Projector 	**<u>Epson VS250 SVGA</u>** - **Special Feature:** Portable, Lightweight - **Connectivity Technology:** HDMI - **Projection System**: 3LCD, 3-chip technology - **Native Resolution**: SVGA (800 x 600) - **Brightness**: 3,200 lumens (Color and White) - **Color Accuracy**: High Color Brightness and Wide Color Gamut - **Throw Distance**: Supports various projection distances (via Throw Distance Calculator) - **Applications**: Ideal for everyday business presentations with compatibility for the latest laptops and media players.	2,506.21	3	7518.63
Microphone	**Blue Yeti Nano Multi-Pattern USB Condenser Microphone** **Key Features:**	479.00	1	479.00

	• Broadcast-quality sound for versatile use. • Enhanced **Blue VO!CE** effects for rich, clear audio. • Cardioid and Omni pickup patterns for focused or wide sound capture. • Supports 24-bit/48kHz recording. • Built-in headphone output, volume control, and mute button. • Compact and easy to set up with optional accessories like a boom arm or shock mount. **Specifications:** • Compatibility: Windows 10+, macOS 10.14+, USB 1.1/2.0/3.0. • Frequency Response: 20Hz–20kHz. • Dimensions: 10.9cm x 9.6cm x 21.1cm (with stand). • Weight: 0.63kg.			
Camera 	**Logitech BRIO 4K Ultra HD Pro Stream Webcam** **Key Features:** • Adjustable field of view and privacy shade. • Certified for Skype for Business, Microsoft Teams, Zoom, and more. • Plug-and-play USB connectivity for Windows, macOS, and Chrome OS. • Supports 4K recording (requires USB 3.0) and full HD streaming.	774.00	2	1548.00

	• Includes mounting options and a carrying pouch. **Specifications:** • Camera Dimensions: 27mm x 102mm x 27mm, Weight: 63g. • Clip Dimensions: 63mm x 36mm x 19mm, Weight: 44g. • Cable Length: 2.2m. • Compatibility: Windows 7 or higher, macOS 10.10 or higher, Chrome OS. • System Requirements: USB 2.0 or 3.0, 2GB RAM or more, hard drive space for recordings.			
Ethernet Cable 	**Cable Matters 10Gbps Snagless Long Cat6 Ethernet cable** Brand: Cable Matters Connector Type: TJ45 Data transfer Speed: Up to 10Gbps Bandwidth: 550 MHz **Features:** • **Snagless Design:** Protective boots around the RJ45 connector can prevent damage during installation and pulling through narrow and crowded spaces. • **Gold-Plated Contacts:** Enhances signal quality, corrosion resistance, and increases the durability of the cable. • **Backward Compatibility:** Supports 10 Gbps speeds for high-performance but also works seamlessly with Gigabit Ethernet (1 Gbps) and Fast Ethernet (100Mbps), making it	142.70 / 1524 cm	180	25686.00

	versatile for different devices and networks. • **Twisted Pair Construction:** Reduces crosstalk and electromagnetic interference (EMI), ensuring stable and reliable connections.			
Firewall 	**Cisco Meraki MX84 Firewall** Brand: Cisco Device Type: Cloud-managed firewall appliance Interfaces: 2 x WAN, 8 x LAN (Gigabit Ethernet) Throughput: 500 Mbps Users Supported: Up to 200 users **Features:** • **Cloud Management via Meraki Dashboard:** Simplifies network configuration, monitoring and troubleshooting with centralized, user-friendly management tools. • **Advanced Security Features:** Provides robust protection with Layer 7 application control, IDS/IPS, content filtering, and malware scanning. • **Scalability and Performance:** Supports up to 200 users with high throughput, VLAN segmentation, and reliable dual-WAN connectivity.	7,056.00	2	14112.00
Smartboard 	**Huawei IdeaHub Pro 64"** Brand: Huawei Screen Size: 64 inches Resolution: 4K Ultra HD Touch Technology: Multi-touch (up to 20 simultaneous touch points)	26,950.00	4	107800.00

	AI Features: • AI-powered noise cancellation for clear audio during meetings • AI-driven handwriting recognition and real-time translation **Camera:** Built-in 4K camera with voice tracking for enhanced video conferencing. **Operating System:** Android-based system with apps for whiteboarding, screen sharing, and collaboration. **Connectivity:** HDMI, USB, Ethernet, Bluetooth, and Wi-Fi **Cloud Integration:** Works with Huawei CloudLink for video conferencing.			
CCTV 	**Reolink RLC-410** Brand: Reolink Type: Bullet Camera Resolution: 4 MP (1440p) IR Range: Up to 30 meters (Night Vision) **Features:** • **Motion detection with alerts:** Sends instant notifications when motion is detected in the camera's field of view. • **H.264 video compression for efficient storage:** Reduces file size while maintaining good video quality, optimizing storage. • **Wide viewing angle for monitoring large spaces:** Ideal for covering wide areas in both small and large indoor settings.	324.88	10	3248.80

Subscriber Connector 	**SC UPC FTTH fiber optic connector** • FTTH project suitable for use • field-installable • Insert loss less than 0.15 dB • Metal v-shaped cavity works well in high and low temperature. • Installation less than 1 minutes • Reliable and superior optical performance	9.68/10 pc	2	19.36

3.3 Reflections

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

Yes, we were surprised by the prices of the devices and the total price required for the building. The total price required costs RM1,151,083.17, which is almost 23% of our overall budget (RM5,000,000). We were surprised because we did not expect a single unit of devices to cost more than one thousand although they were not the best devices, while many units were required, which increased the total price. Moreover, some other devices such as keyboard and mouse have not been discussed.

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

We did not fully consider cost as a factor for choosing networking devices. Instead, we choose the networking devices at their best price based on their functionality and suitability with this project, but not choosing the best options because the best devices may not be suitable with this project. We carefully evaluated multiple networking devices choices to get the most suitable device that can perform well, and not too costly at the same time so that the total price will not exceed the budget.

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

example, Cisco and Huawei Routers.

Switch:

For the switch, we have chosen TP-Link TL-SG1048. We use D-Link DES-1024A to compare with the chosen switch model.

Specification	TP-Link TL-SG1048	D-Link DES-1024A
Ports	48 x 10/100/1000 ports	24 x 10/100 ports
Packet Forwarding Rate	71.4 Mpps	3.57 Mpps
Switching Capacity	96 Gbps	4.8 Gbps
Maximum Power Consumption	32.29W	3.69W
Maximum Heat Dissipation	110.17 BTU/h	9.19 BTU/h

Based on the table above, TP-Link TL-SG1048 has a greater number of ports compared to D-Link DES-1024A. Besides, the packet forwarding rate of TP-Link TL-SG1048 is greater than D-Link DES-1024A. Moreover, TP-Link TL-SG1048 has a greater switching capacity compared to D-Link DES-1024A. Since TP-Link TL-SG1048 has a greater number of ports and switching capacity, its power consumption is greater than D-Link DES-1024A. Other than that, TP-Link TL-

SG1048 also has greater maximum heat dissipation compared to D-Link DES-1024A. Thus, TP-Link TL-SG1048 is the most suitable switch due to its high performance.

Monitor:

For the monitor, we have chosen the Dell 24 Monitor - S2425H. We use Acer Vero CB241Y to compare with the chosen device.

Specification	Dell 24 Monitor - S2425H	Acer Vero CB241Y
Refresh Rate	100 Hz	75 Hz
Contrast Ratio	1500:1	1000:1
Speaker	Integrated dual 5W speakers	Integrated 2W speakers

Based on the table above, Dell 24 Monitor - S2425H has a greater refresh rate compared to Acer Vero CB241Y. Moreover, the contrast ratio of Dell 24 Monitor - S2425H is greater than Acer Vero CB241Y. Besides, the speaker of ARRIS SB8200 delivers more powerful audio output than Acer Vero CB241Y. Thus, Dell 24 Monitor - S2425H is the most suitable switch.

Fiber Optic Cable:

For the fiber optic cable, we have chosen the Unifi TIME Maxis Fiber Optic Cable. We use SC/APC-LC/UPC Singlemode Simplex Fiber Optic Patch Cable to compare with the chosen device.

Specification	Unifi TIME Maxis Fiber Optic Cable	SC/APC-LC/UPC Singlemode Simplex Fiber Optic Patch Cable
Insertion Loss	≤1 dB	<0.3 dB
Return Loss	≥50 dB	>55 dB

Based on the table above, Unifi TIME Maxis Fiber Optic Cable has lower insertion loss compared to SC/APC-LC/UPC Singlemode Simplex Fiber Optic Patch Cable. Besides, the return loss of Unifi TIME Maxis Fiber Optic Cable is also lower than SC/APC-LC/UPC Singlemode Simplex Fiber Optic Patch Cable. Thus, Unifi TIME Maxis Fiber Optic Cable is the most suitable fiber optic cable.

Router:

For the router, we have chosen the TP-Link Archer AX73. We use NETGEAR R6700AX to compare with the chosen device.

Specification	TP-Link Archer AX73	NETGEAR R6700AX
Maximum Wi-Fi Speed	5400 Mbps	1800 Mbps
USB Port	1x USB 2.0	1x USB 3.0 Type-A + 1x USB 2.0 Type-A

Based on the table above, TP-Link Archer AX73 has a higher maximum Wi-Fi speed compared to NETGEAR R6700AX. Moreover, TP-Link Archer AX73 has more USB ports than NETGEAR R6700AX. Thus, TP-Link Archer AX73 is the most suitable router.

Wireless Access Point:

For the wireless access point, we have chosen the TP-Link EAP670. We use NETGEAR WAC104 to compare with the chosen device.

Specification	TP-Link EAP670	NETGEAR WAC104
Coverage	Wide (Medium to large office)	Medium (Home/ small office)
Seamless Roaming	Yes	No
Maximum Throughput	Up to 5.4 Gbps	Up to 1.2 Gbps

Based on the table above, TP-Link EAP670 has a wide coverage compared to NETGEAR WAC104. Moreover, TP-Link EAP670 has seamless roaming but NETGEAR WAC104 doesn't have seamless roaming. The maximum throughput for TP-Link EAP670 can be up to 5.4 Gbps, while NETGEAR WAC104 can be up to 1.2 Gbps. Thus, TP-Link EAP670 is the most suitable wireless access point.

Personal Computer (PC):

For the personal computer, we have chosen the Dell Precision 3680 Tower Workstation. We use Dell OptiPlex 5090 Desktop to compare with the chosen device.

Specification	Dell Precision 3680 Tower Workstation	Dell OptiPlex 5090 Desktop
Processor	Intel Core i5/i7/i9 or Xeon W-series CPUs	Intel Core i5/i7/i9
Graphics	NVIDIA Quadro (Workstation GPUs)	Integrated Intel UHD
RAM	Up to 128 GB DDR5 ECC	Up to 64 GB DDR4
Storage	Up to 16 TB (multiple drives, SSD/HDD)	Up to 4 TB (SSD/HDD)

Based on the table above, Dell Precision 3680 Tower Workstation has more processor options compared to Dell OptiPlex 5090 Desktop. Moreover, Dell Precision 3680 Tower Workstation has better graphics card than Dell OptiPlex 5090 Desktop. Besides, Dell Precision 3680 Tower Workstation has bigger RAM size and storage than Dell OptiPlex 5090 Desktop. Thus, Dell Precision 3680 Tower Workstation is the most suitable personal computer.

Printer:

For the printer, we have chosen the Brother DCP-L3560CDW Laser Printer. We use DCP-L3560CDW Laser Printer to compare with the chosen device.

Specification	DCP-L3560CDW Laser Printer	Canon imageCLASS MF641Cw
Print Speed	Up to 24 ppm (color and mono)	Up to 18 ppm (color and mono)
Duplex Printing	Automatic	No
ADF (Auto Document Feeder)	Yes, 50 sheets	No

Based on the table above, DCP-L3560CDW Laser Printer has faster print speed compared to Canon imageCLASS MF641Cw. Moreover, DCP-L3560CDW Laser Printer can handle duplex printing but Canon imageCLASS MF641Cw cannot. Besides, DCP-L3560CDW Laser Printer has auto document feeder but Canon imageCLASS MF641Cw doesn't have. Thus, DCP-L3560CDW Laser Printer is the most suitable printer.

Connector:

For the connector, we have chosen the High-Quality AMP RJ45 CAT5E CAT5 CAT6 CAT 6 Modular Plug Connector. We use TRENDnet RJ45 Modular Plug Connector to compare with the chosen device.

Specification	High Quality AMP RJ45 CAT5E CAT5 CAT6 CAT 6 Modular Plug Connector	TRENDnet RJ45 Modular Plug Connector
Material	High-grade plastic with gold-plated contacts	Standard plastic with gold-plated contacts
Durability	Enhanced durability and crack resistance	Good, but may not withstand as much tension
Cable Support	CAT5, CAT5E, CAT6	CAT5, CAT5E

Based on the table above, High Quality AMP RJ45 CAT5E CAT5 CAT6 CAT 6 Modular Plug Connector has higher quality material compared to TRENDnet RJ45 Modular Plug Connector. Moreover, High Quality AMP RJ45 CAT5E CAT5 CAT6 CAT 6 Modular Plug Connector has longer duration than TRENDnet RJ45 Modular Plug Connector. Besides, High Quality AMP RJ45 CAT5E CAT5 CAT6 CAT 6 Modular Plug Connector can support more types of cable compared to TRENDnet RJ45 Modular Plug Connector. Thus, High Quality AMP RJ45 CAT5E CAT5 CAT6 CAT 6 Modular Plug Connector is the most suitable router.

Patch Panel:

We have chosen Rapink Patch Panel 24 Port Cat6 with Inline Keystone for the patch panels of this project. The major difference between Rapink Patch Panel and other different brands we can compare is TRENDnet 24-Port Blank Keystone 1U Patch Panel.

Specification	Rapink Patch Panel 24 Port Cat6 with Inline Keystone 10G Support	TRENDnet Patch Panel
Connector Types	VGA, HDMI, RJ45	RJ45
Cable Types	Cat6, Cat5e, Cat7, HDMI, VGA	Cat6 Ethernet only
Cable Management	Detachable back bar with zip ties	Basic
10G Support	Yes	No

Durability	Gold-plated pins	Standard
Dimensions	20 x 4.5 x 2.5 inches	19 x 1.77 x 0.4 inches
Price	Higher	Lower

The **Rapink Patch Panel** provides superior functionality with support for multiple cable types (Cat6, Cat5e, Cat7, HDMI, VGA), 10G speed, and detachable cable management for easier setup. Additionally, its gold-plated pins ensure durability and reliable long-term performance. These features make it highly suitable for modern, high-speed educational setups where flexibility and robustness are essential.

In contrast, the **TRENDnet Patch Panel** offers a more basic setup with limited cable type support and no 10G capability. However, it is more cost-effective, making it a suitable choice for smaller or less demanding installations. Despite the higher cost, the Rapink Patch Panel is the better option for scalability and future-proofing.

Server:

For the servers used in this project, we have chosen Cisco UCS C480M5 High-Performance Rack Server. The major difference between Cisco UCS C480M5 High-Performance Rack Server with other different brands we can compare is Dell PowerEdge R740.

Specification	**Cisco UCS C480 M5**	**Dell PowerEdge R740**
Processors	Up to 4 Intel Xeon Scalable (28 cores each)	Up to 2 Intel Xeon Scalable (28 cores each)
Memory	Up to 6TB DDR4 RAM	Up to 3TB DDR4 RAM
Storage	NVMe, SAS, SATA	NVMe, SAS, SATA
Connectivity Management	Multiple PCIe slots Cisco IMC	Multiple PCIe slots Dell iDRAC
Energy Efficiency	Reduced power consumption	High efficiency
Applications	AI, ML, cloud computing, database management	General-purpose workloads, virtualization
Price	Higher	Lower

The **Cisco UCS C480 M5** is a high-performance server offering exceptional scalability with up to 4 processors and 6TB RAM, making it ideal for AI, ML, and other enterprise-level workloads. It

is specifically designed for high-demand applications like data analytics and cloud computing. Additionally, its Cisco Integrated Management Controller (IMC) provides comprehensive monitoring and troubleshooting.

The **Dell PowerEdge R740**, while also powerful, is more suited for general-purpose workloads and offers less scalability with a limit of 2 processors and 3TB RAM. It is more cost-effective but may fall short in meeting the needs of data-intensive tasks. For large-scale deployments requiring scalability and high performance, the Cisco UCS C480 M5 is the optimal choice.

Projector:

For the projectors used in this project, we have chosen Epson VS250 SVGA. The major difference between Epson VS250 SVGA with other different brands we can compare is ViewSonic PA503W.

Specification	Epson VS250 SVGA	ViewSonic PA503W
Resolution	SVGA (800 x 600)	WXGA (1280 x 800)
Brightness	3,200 lumens (Color and White)	3,600 lumens
Projection System	3LCD	DLP
Throw Distance	Variable (via Throw Distance Calculator)	Short and standard throw options
Color Accuracy	High Color Brightness and Wide Gamut	SuperColor Technology
Portability	Lightweight and portable	Lightweight
Price	Lower	Slightly higher

The **Epson VS250** is a lightweight, budget-friendly projector offering sufficient brightness and color accuracy for everyday business presentations. Its 3LCD technology ensures excellent color reproduction, while its portability makes it a convenient choice for classrooms or small meeting rooms.

The **ViewSonic PA503W**, however, delivers better resolution (WXGA) and higher brightness (3,600 lumens), making it more suitable for larger rooms or settings with more ambient light. Its DLP technology provides crisp visuals but may sacrifice some color vibrancy compared to the Epson VS250.

For smaller setups or cost-conscious projects, the Epson VS250 is a solid choice. However, for higher-resolution needs or larger rooms, the ViewSonic PA503W offers better performance.

Microphone:

Specification	Blue Yeti Nano Multi-Pattern USB Condenser Microphone	HyperX QuadCast S
Sound Quality	24-bit/48kHz broadcast-quality sound	16-bit/48kHz optimized for gaming/streaming
Pickup Patterns	Cardioid, Omnidirectional	Cardioid, Stereo, Omnidirectional, Bidirectional
Additional Features	Blue VO!CE effects for enhanced audio	RGB lighting, built-in anti-vibration shock
Dimensions/Weight	Compact, lightweight (0.63kg)	Larger, heavier (0.71kg)
Price	Higher, for premium quality	Moderate, value for features

Based on the comparison table above, the **Blue Yeti Nano** offers higher sound quality (24-bit/48kHz), which is ideal for professional voice recordings, podcasts, and video conferences. It is compact and lightweight, making it suitable for mobile or smaller desk setups. In contrast, the **HyperX QuadCast S** provides additional versatility with four pickup patterns, making it more suitable for gaming and streaming setups. It also features RGB lighting for a stylish look and a built-in shock mount to reduce vibration noise.

Although the Blue Yeti Nano has fewer features, it offers exceptional audio quality and simplicity, making it the most suitable option for professional use in hybrid classrooms and conference rooms. On the other hand, the HyperX QuadCast S is more expensive but caters better to gamers and content creators who value aesthetics and flexibility.

Camera:

For the camera, we have chosen the **Logitech BRIO 4K Ultra HD Pro Stream Webcam.** We use Razer Kiyo Pro camera to compare with the chosen device.

Specification	Logitech BRIO 4K Ultra HD Pro Stream Webcam	Razer Kiyo Pro Camera

Resolution	4K Ultra HD (up to 60 FPS in 1080p)	1080p HD (up to 60 FPS)
Field of View (FOV)	Adjustable (65°, 78°, 90°)	Adaptive (up to 80°)
Low-Light Performance	HDR support for all lighting conditions	Adaptive light sensor for excellent low-light
Zoom	5x HD zoom	No zoom feature
Compatibility	Certified for Zoom, Teams, Skype, etc.	Works with all major platforms
Dimensions/Weight	27mm x 102mm x 27mm (63g)	71mm x 70mm x 50mm (200g)
Best Use	Professional setups, hybrid classrooms, conferencing	Gaming, streaming, moderate professional use
Price	Higher, for premium quality	Moderate, value for features

Based on the comparison table above, the **Logitech BRIO** stands out with its 4K Ultra HD resolution, adjustable field of view, and 5x zoom capability. These features make it highly suitable for professional video conferencing and hybrid classrooms, where high-quality visuals and flexibility in framing are essential. Additionally, its HDR support ensures excellent image quality, even in challenging lighting conditions.

On the other hand, the **Razer Kiyo Pro** excels in low-light environments due to its adaptive light sensor, making it a great option for streamers or casual users. However, it lacks zoom functionality and 4K support, which limits its use in larger professional setups.

While the Logitech BRIO is more expensive, it offers superior features and is better suited for professional applications, making it the preferred choice for hybrid classrooms or video conferencing rooms.

Ethernet Cable:

For the Ethernet cable, we selected the **Cable Matters 10Gbps Snagless Long Cat6 Ethernet Cable** and compare it to the **AmazonBasics RJ45 Cat6 Ethernet Cable**.

Specification	Cable Matters 10Gbps Snagless Long Cat6	AmazonBasics RJ45 Cat6
Brand	Cable Matters	AmazonBasics
Connector Type	RJ45	RJ45
Data Transfer Speed	Up to 10Gbps	Up to 1Gbps
Bandwidth	550 MHz	250 MHz
Design	Snagless protective boots	Basic design without snagless protection
Construction	Twisted pair and gold-plated contacts	Basic twisted pair construction
Length Options	Multiple	Limited
Price	Higher for advanced features	Lower and more economical

Referring to the comparison outlined above, the **Cable Matters Ethernet cable** is an ideal choice for high-speed networks, offering 10Gbps performance and 550 MHz bandwidth. Its snagless design prevents wear and tear during installation, and the gold-plated contacts enhance durability and signal quality, making it suitable for professional use.

The AmazonBasics RJ45 cable serves as a budget-friendly option for basic setups with up to 1 Gbps speeds, but it lacks the advanced features and robustness needed for demanding environments.

Therefore, for networks requiring high reliability and performance, the Cable Matters cable justifies its higher price, making it the preferred option.

Firewall:

For the firewall, we chose the **Cisco Meraki MX84** and compared it with the **Fortinet FortiGate 60F.**

Specification	Cisco Meraki MX84 Firewall	Fortinet FortiGate 60F
Brand	Cisco	Fortinet
Device Type	Cloud-managed firewall appliance	Next-generation firewall
Interfaces	2 x WAN, 8 x LAN (Gigabit Ethernet)	1 x WAN, 7 x LAN (Gigabit Ethernet)
Throughput	500 Mbps	10 Gbps

User Supported	Up to 200 users	Up to 100 users
Management	Cloud-based Meraki Dashboard	Local and cloud-based options
Security Features	Layer 7 control, IDS/IPS, malware scanning	Application control, IPS, antivirus
Price	Moderate for cloud features	Higher for advanced features

From the details highlighted in the table, the **Cisco Meraki MX84** offers cloud-based centralized management, making it an excellent choice for medium-size organizations, like our faculty computing. Its robust security features, such as Layer 7 application control and malware scanning, ensure reliable network protection, supporting up to 200 users.

The **Fortinet FortiGate 60F** delivers superior performance with 10 Gbps throughput, catering to high-speed requirements. However, it is designed for smaller networks with up to 100 users and comes at a higher cost.

While both are powerful solutions, the **Cisco Meraki MX84** stands out for its scalability and ease of management, making it ideal for faculty, prioritizing usability and security.

Smartboard:

For the smartboard, we decided on the **Huawei IdeaHub Pro 64″** and evaluated it against the **Microsoft Surface Hub 2S 50″.**

Specification	**Huawei IdeaHub Pro 64″**	**Microsoft Surface Hub 2S 50″**
Screen Size	64 inches	50 inches
Resolution	4K Ultra HD	4K Ultra HD
Touch Technology	Multi-touch (20 points)	Multi-touch (10 points)
Camera	Built-in 4K camera with voice tracking	Built-in 1080p camera
AI Features	Noise cancellation and handwriting recognition	None specified
OS	Android-based	Windows 10-based
Connectivity	HDMI, USB, Ethernet, Wi-Fi, Bluetooth	HDMI, USB, Ethernet, Wi-Fi
Price	Moderate for cloud features	Higher for brand and ecosystem

Analyzing the information above, the **Huawei IdeaHub Pro 64″** shines with a larger screen, advanced AI capabilities like handwriting recognition, and built-in 4K camera. Its multi-touch support for up to 20 points is excellent for collaborative work.

While the **Microsoft Surface Hub 2S 50″** integrates seamlessly into Windows-based environments and provides robust software compatibility. However, its smaller screen, lower resolution camera, and limited touch support may not suit all professional settings such as academic exchange conference or team presentation.

Thus, given its better hardware and cost-effectiveness, the **Huawei IdeaHub Pro 64″** is the more practical option for collaborative and profesional use in faculty computing.

CCTV:

For the CCTV, we identified the **Reolink RLC-410** as our choice and assessed it in comparison with the **Hikvision DS-2CD2042WD-I.**

Specification	Reolink RLC-410	Hikvision DS-2CD2042WD-I
Brand	Reolink	Hikvision
Type	Bullet camera	Bullet camera
Resolution	4 MP (1440p)	4 MP (1440p)
Storage	64 GB (microSD supported)	Not specified
IR Range	Up to 30 meters	Up to 30 meters
Camera	Built-in 4K camera with voice tracking	Built-in 1080p camera
Motion Detection	Yes, with instant alerts.	Yes, with basic alerts.
Video Comparison	H.264	H.265
Viewing Angle	Wide, suitable for large spaces	Wide, suitable for large spaces
Price	Affordable	Higher for additional features

With reference to the comparison provided, the **Reolink RLC-410** is a cost-efficient option for surveillance, offering clear 4MP resolution, night vision, motion detection alerts and support for up to 64 GB pf local storage. Besides, the use of H.264 video compression provides a good balance between image quality and storage efficiency.

The **Hikvision DS-2CD2042WD-I,** while offering the same 4MP resolution and night vision capabilities, uses H.265 compression for improved storage optimization. However, its lack of local storage specifications and higher price point make it less desirable to those who seek affordability and simplicity.

Overall, the **Reolink RLC-410** provides excellent value for reliable surveillance setups, with its budget-friendly and local storage support.

MEETING MINUTES #1

DATE/TIME	20 Dec 2024 2pm		
LOCATION	M01, KTDI		
AGENDA	1. Review and discuss details about task 3 2. Determine selection of possible devices and budget considerations 3. Allocate tasks among all members		
Meeting MC	Gui Kah Sin		
ATTENDANCE			
NAME	**TIME**	**REASON FOR ABSENCE**	
Lau Yee Wen	2:00PM	-	
Cheryl Cheong Kah Voon	2:00PM	-	
Chua Jia Lin	2:00PM	-	
Gui Kah Sin	2:00PM	-	
MINUTES			
NO.	**ITEM DISCUSSED**	**IDEAS/SUGGESTIONS AND PERSON GIVING IT**	**PERSON IN CHARGE & DATE**
1	Review and discuss details about task 3	- Each member opened the Word document of project Task 3 on their laptops. - The members collectively reviewed the question and rubric. - The team engaged in a discussion about the requirements for Task 3.	All members
2	Research the different network devices needed and its price and brand	- Jia Lin suggested dividing research into device categories such as routers, switches and so on. - Cheryl suggested looking into budget-friendly devices. - Kah Sin suggested prioritizing scalability and reliability. - Yee Wen emphasized compiling a comparison table for different brands to evaluate. - Lastly, we determined selection devices needed.	All members
3	Task Distribution	- All members on average need to do research and compare devices needed. - Cheryl and Yee Wen were assigned to do more device comparisons.	All Members

		- Jia Lin was assigned to conclude our reflections for the top 2 reflections. - Kah Sin was assigned to arrange the list of references and format the report for Task 3.	
4	Next meeting	Scheduled for December 26, 2024. Tasks 3 part 1 and 2 need to be completed before the next meeting.	
5	Meeting ended	At 5:00 pm, the meeting ended after all discussions had been done.	

MEETING MINUTES #2

DATE/TIME		21 Nov 2024 2pm	
LOCATION		M01, KTDI	
AGENDA		1. Review progress on Task (Part 1 and Part 2). 2. Discuss challenges and solutions. 3. Plan next steps and finalize remaining tasks.	
Meeting MC		Gui Kah Sin	
ATTENDANCE			
NAME		**TIME**	**REASON FOR ABSENCE**
Lau Yee Wen		2:00PM	-
Cheryl Cheong Kah Voon		2:00PM	-
Chua Jia Lin		2:00PM	-
Gui Kah Sin		2:00PM	-
MINUTES			
NO.	**ITEM DISCUSSED**	**IDEAS/SUGGESTIONS AND PERSON GIVING IT**	**PERSON IN CHARGE & DATE**
1	Progress Updates on Task 3 (Part 1 and Part 2).	Each member shared progress on their assigned tasks: - Cheryl and Yee Wen shared updates on devices options - Jia Lin and Kah Sin presented draft reflections and outlined the initial report structured	All members
2	Challenges and Solutions	- After each member updated, Cheryl raised concerns about	All members

		missing detailed specs for some devices. - Jia Lin suggested using vendor websites for additional specs or research more reliable websites. - Yee Wen mentioned difficulty in finding local pricing for some brands. - Kah Sin offered to explore additional suppliers.	
3	Plan Next Steps	- Each member is assigned to complete their selected devices' comparison table and budget estimate. - Jia Lin and Kah Sin will revise reflections and integrate them into the report. - Cheryl and Yee Wen will format and finalize the full report draft. - The deadline for Task 3 is set on 30 December 2024.	All members
4	Meeting ended	The meeting concluded at 5:00 PM and the final report reviewed and prepared for submission will be done online.	

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