**SCHOOL OF ENGINEERING AND TECHNOLOGY**

**ASSIGNMENT COVER SHEET**

**COURSE:** NET1014 – Networking Principles

**LEVEL:** BCNS, BIT, BCS, BSE, BDS - Year 1

**ACADEMIC SESSION:** January 2024 Semester

**DEADLINE:** 17th Mar 2024

**GROUP NO: 6**

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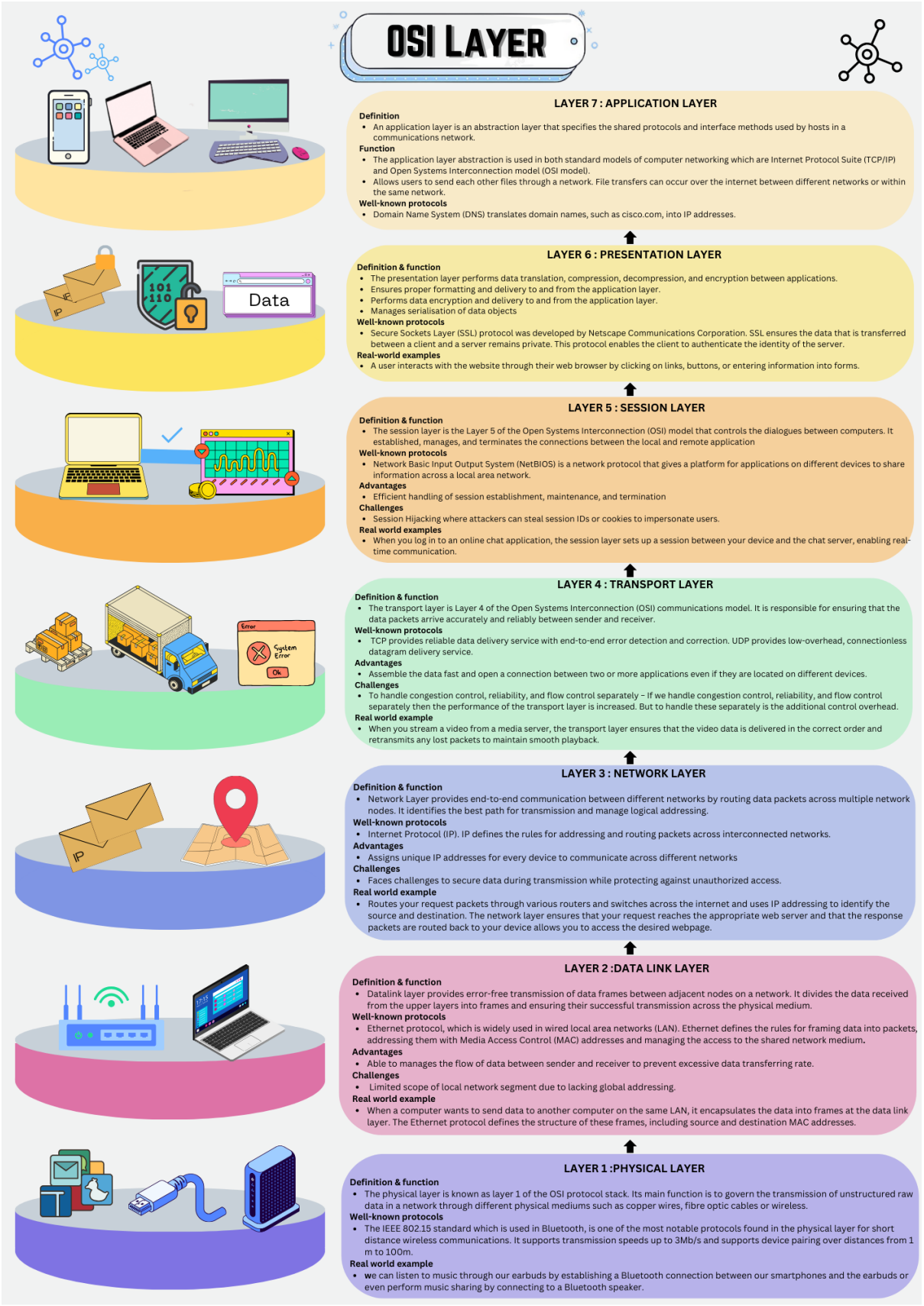
**PART 1: Comprehensive Analysis of OSI Protocol Stack**

**Advantages and disadvantages of OSI Protocol Stack**

| Advantages | Disadvantages |
|---|---|
| It acts as a learning tool to help people understand the communication process in a network as well as to develop a network model. | It is more complex compared to TCP/IP stack as it consists of more layers and some layers such as the session layer and presentation layer serves very little purpose when it is practically deployed. |
| It allows for easier troubleshooting as network administrators can identify the issues based on the particular layer instead of searching throughout the whole network. | There is duplication in services offered in different layers such as addressing, flow control and error control. |
| The OSI protocol stack supports both connection-oriented services and connectionless services. | Each layer cannot work in parallel; they must wait to receive data from the previous layer. |

# Visualization of interconnection between each layer in the OSI protocol stack.



**PART 2: Design and implementation of a network**

**PART A: Design**

1. **List of Required Equipment and their prices.**

Before designing a network, we need to determine the type of equipment required, function of the equipment in the network and the cost of the equipment. The table below describes the list of equipment required and their prices.

| Required Equipment | Function | Cost |
|---|---|---|
| Cisco 2960TT-L campus LAN switch | Connects devices in each subnet. | Approximately RM1100 per unit. |
| Cisco 2911 integrated service router | Performs routing and data transmission to devices located on different subnets. | Approximately RM1500 per unit. |
| Copper straight through cable | Connection medium to transfer data between host devices and the switch as well as between the switch and the router. | A cat5e unshielded twisted pair copper straight through cable cost approximately RM30 per meter. |
| Copper crossover cable | Connection medium to transfer data between intermediary devices such as switch to switch. | A cat5e unshielded twisted pair copper crossover cable cost approximately RM25 per meter. |
| PC and laptop | Exchange data and share resources with each other. | Approximately RM4000 per unit for PC.<br><br>Approximately RM2000 per unit for laptop. |

2. **Estimated Cost of Equipment**

| Required Equipment | Amount | Cost Per Unit (RM) | Total (RM) |
|---|---|---|---|
| Cisco 2960TT-L campus LAN switch | 5 | 2900 | 14500 |
| Cisco 2911 integrated service router | 1 | 2700 | 2700 |
| Copper straight through cable (10 meter) | 28 | 300 | 8400 |
| Copper crossover cable (10 meter) | 3 | 250 | 750 |
| PC | 24 | 4000 | 96000 |
| Laptop | 2 | 2000 | 4000 |
| **Total estimated cost of all equipment in the network** | | | **126350** |

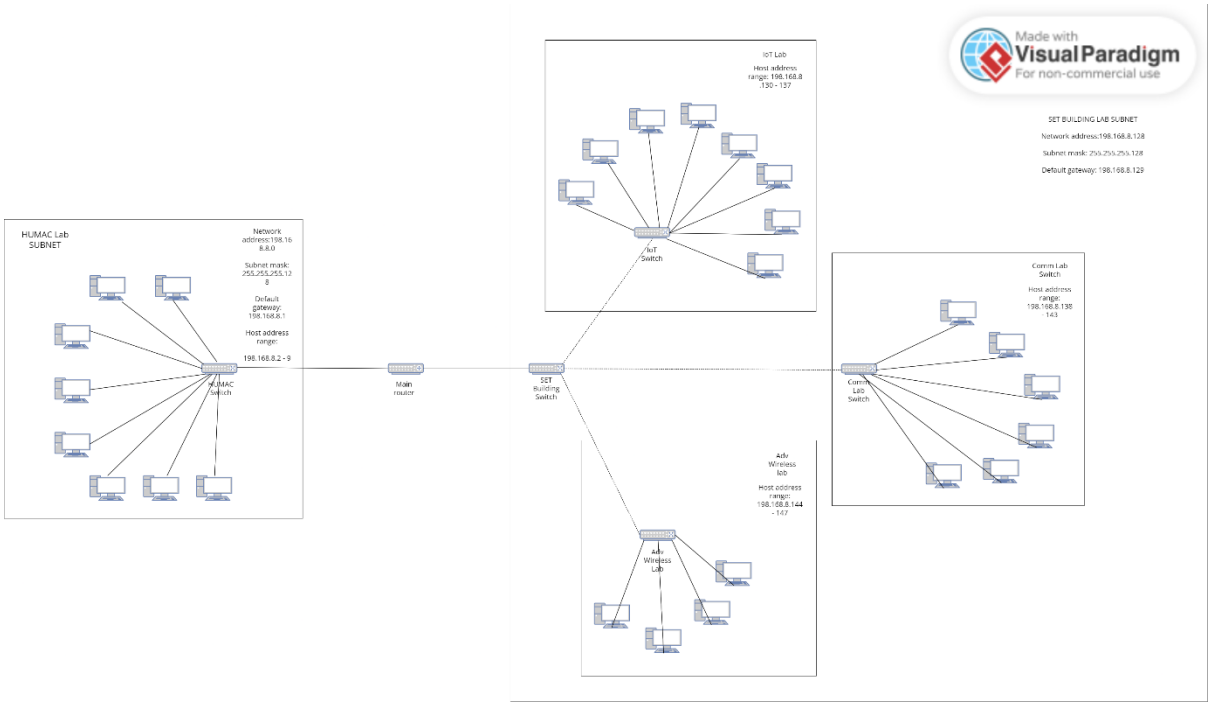
## 3. Physical topology

The physical topology describes the actual layout of the network such as the placement of network devices and the connection of network medias. Based on the project's physical topology, the switch is placed inside each lab to connect all the lab devices together in a local area network and it is usually enclosed inside a small server rack for better accessibility and security. Each of the switch is then connected to the main router located inside a server room.

## 4. Logical topology

The logical topology defines how the nodes are connected and how data is transmitted in the network. According to the requirements of the project, we need to segment the network by allocating three labs in the school of engineering and technology new building (SET) to one subnet and placing the HUMAC lab in another different subnet. Based on the given network address, which is 198.168.8.0/24, 2 subnets are created whereby the first subnet is allocated to HUMAC lab with the network address of 198.168.8.0 whereas the next subnet is allocated to the labs located in the SET building with the network address of 198.168.8.128. The following logical topology shows the connection of devices for data transmission between different subnets.

Firstly, a switch is assigned to the HUMAC lab and each lab in the SET building to connect all the devices in their respective local network. Moving on, all the devices located on the HUMAC subnet are then assigned with the host address ranging from 198.168.8.2 to 198.168.126. The process is then repeated with the SET building subnet whereby all devices of the lab located in the SET building are assigned an IP address with the host address ranging from 198.168.8.129 to 198.168.8.254. The respective switches located on each of the lab on the SET building is then connected to a centralized switch on the SET building. Lastly, both the HUMAC switch, and the SET building switch are connected to a router to facilitate data transmission between both subnets vice versa.



**PART C: Lessons learned.**

The group project provided a valuable learning experience in collaboration and teamwork. Effective communication turned out to be the key to our success as we prioritized open and transparent communication throughout the whole project. We had a virtual meeting on Microsoft Teams and WhatsApp where we exchanged updates and addressed any challenges that arose. Furthermore, we divided the tasks into manageable parts to ensure timely and high-quality completion of the work. Every team member took pride in their contributions and held themselves accountable for meeting deadlines and delivering quality work. Therefore, we were able to foster a supportive environment where everyone felt empowered to take initiative and give their best effort. Although we were conducting the assignment with notable progress, it is not without its technical challenges. We encountered several technical challenges such as the subnetting process to determine the accurate network address for each subnet. The process involves splitting a network into subnetworks, each having its own unique network address. Due to the lack of understanding of subnetting, we had difficulty establishing the precise boundaries for each subnet, leading to faulty network addresses. To solve the issue, we browsed the web for more information on how to perform subnetting. We found a mathematical formula used to calculate subnetting which is the magic number technique. Firstly, we need to find the subnet mask which determines the number of bits used for the network portion and the host portion of an IP address. Then, we can calculate the number of subnets based on the requirement, which also determines the number of bits needed for host portion. Next, we need to find the magic number which is calculated by subtracting the number of hosts per subnet from maximum number of hosts per sub subnet. Lastly, start with the base number of network address and add the magic number repeatedly to get network address for each subnet. Based on the magic number technique, we are then able to allocate IP Addresses for each subnet based on the calculation. Not only that, setting up the router to enable data transmission between the two subnets presented another hurdle for us. Initially, we encountered issues in sending data across subnets due to router misconfigurations in which we configured inaccurate routing settings. This resulted in communication failures and dropped data packets. To solve the issue, we also watched some video tutorials on how to setup a router to connect two subnets together. Upon watching the video, we notice that we made a crucial mistake by not assigning the appropriate default gateway to the correct interface on the router. By assigning the appropriate default gateway settings on each router interface, the data can now be delivered across the subnets. In conclusion, the assignment emphasizes not only teamwork, but also valuable knowledge in the subject of networking. We learned to apply our knowledge in performing subnetting and configuring networking devices such as routers, switches, and other devices with the necessary information such as IP address, subnet mask and default gateway. Moreover, we have improved our troubleshooting skills in managing connectivity issues, analysing network traffic, and diagnosing network issues which often occur in this field of networking. Lastly, we have learned about the importance of documentation and best practices in networking. From creating network diagrams to writing our report, we learned the significance of building a well-organized documentation to ensure efficient network management. Overall, hands-on learning is necessary in the networking field as it deepens our understanding of concepts, sharpens our problem-solving skills, and fosters confidence in managing network environments and this assignment has been instrumental in our journey toward mastering the knowledge of networking. By building a solid foundation through these practical experiences,

we acknowledge the importance of hands-on learning in networking for our future studies and projects within this dynamic field.