**Networking Report**

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| Module Tutor Name | Mustafa Ghashim |
| STUDENT ID | T0438462 |
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*I confirm that this assignment is my own work.*

*Where I have referred to academic sources, I have provided in-text citations and included the sources in the final reference list.*

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# INTRODUCTION

In today's competitive marketplace, a reliable and strong network is important for any organization to survive. Therefore, it is important to carefully design and implement a network solution that satisfies the company's unique requirements. This report provides a detailed analysis of a small network for a hypothetical corporation, following network device selection, IP distribution and subnetting, and topology selection. The evaluation also considers the security of the network to guarantee that private information is protected from unauthorized access. The main goal of this report is not only to present the subnetting and IP assignment of each host and the distinctions between variable length subnet masking and fixed length subnet masking (FLSM) but also an overall analysis of the network solution, focusing on both advantages and disadvantages.

# Part A

**Network Representation**

**The Design**

**A diagram of a computer network

Description automatically generated**

**Data Analysis Room**

**A diagram of a computer network

Description automatically generated**

**Visitor Waiting Area and Reception**

A white background with black text and blue icons

Description automatically generated

*Here the logo for SMART TV and Robot assistant was changed using Laptop and PC respectively.*

**Brainstorming Room**

**A diagram of a computer

Description automatically generated**

**Demonstration Room**

**A close up of a computer

Description automatically generated**

*Here the logo for SMART TV was changed using Laptop.*

**Hall**

**A diagram of a computer network

Description automatically generated**

**Server Room**

**A diagram of a server room

Description automatically generated**

**Improving the NIC (Network Interface Cards)**

The 10 BASE-T network card was something big in the 1990s because it helped a lot of computers connect and share information in local networks. In 10 BASE-T, “10” means it could transfer data at a speed of 10 megabits per second and “BASE” tells us it used a single signal on special twisted cables. Since the company requires to transfer 120MB files in this network, it is best to upgrade the NIC to 100 BASE-T cards. We do this because we do not want any delays while sending these files because the transmission needs to be regular and to send 120MB of files regularly the 100 BASE-T cards would do great and therefore we won’t notice any delays.

# Explanation for the choice of the network devices

**Topology**

Topology is the configuration of a network that defines how the various devices on the network are connected. Here star topology is used mainly because it is user friendly and would not cause any confusion during connection. For this scenario it is used by either connecting all the devices in the room to a switch or wirelessly to a wireless router. Here either a switch is acting as a star or the wireless router because they are the center of all connections.(1)

**Advantages and limitations for star topology**

In a star topology, if one of the computers fails, it does not affect the others, and this also contributes to its good performance. The hosts do not need to compete for bandwidth as every host is connected to the central node directly. This guarantees effective communication between devices. The centre of a star network is a good place to diagnose network faults and if one computer fails, the whole network is not disturbed. Replacement or removal of devices can be easily done. When a problem occurs in the network, there is no need to break down the whole network. Instead, the break point could be isolated and fixed without influencing the rest of the network.

On the contrary, this type of topology is expensive to install as it requires more cable, it costs more for all network cables must be directed to one central point. This requires more cable length than other types of networking topologies. Since the network depends upon the hub, or the central node, if it fails to operate, then the whole network also fails to operate. Therefore star topology is used as other topologies will only bring more disadvantages.

**Switches**

Switches are key building blocks for any network. They connect multiple devices, such as computers, wireless access points, printers, and servers; on the same network within a building or campus. A switch enables connected devices to share information and talk to each other. A large network may include multiple switches, which connect different groups of computer systems together. These switches are typically connected to a router that allows connected devices to access the Internet.(2)

In this network, we chose to use 2960-24TT switches instead of other types. These switches are considered good for a few reasons. According to Cisco , these switches are great at managing power and use power efficiently. They also perform well, providing up to 16Gbps of bandwidth and about 6Mpbs of forwarding rate. Because of these features, the 2960-24TT switches are the best choice for this network.

In the server room, an empty switch is used. This switch is used to set up the fibre optic ports in a switch, and the servers are connected to this switch using fibre optic cables. Regular switches don't have fibre optic ports, so this special empty switch is needed for that purpose.

**Cables**  
In this network, CAT-5e standard UTP cables are used for all connections, except for the link between the wireless router and the modem. Although CAT-6 cables can achieve gigabit data transfer rates, such high speeds are unnecessary for this specific small network. According to CDW (2021), CAT-5e cables provide a suitable solution as they offer data transfer rates ranging from 100 to 1000Mbps, aligning with the upcoming upgrade of network interface cards (NICs) to 100Base-T by the company. The decision to opt for CAT-5e cables is also influenced by their widespread availability, backward compatibility with older cables and devices, and the presence of four twisted pairs of copper wires, which enhances resistance to noise—a valuable feature in busy business environments. Therefore, CAT-5e cables are chosen for their optimal balance of speed and compatibility in this network (CDW, 2021). (3)

**Wireless Connections**

Wireless connections in this network are represented as a star topology with a wireless router acting as the central node. The wireless router is placed in the hallway from which the network signal can reach all the rooms. For connection to the whole network, it is connected to the switch in the server room via a crossover cable and switches in each room . For internet connection, it is connected directly to the cable modem in the hall. All wireless devices will connect to this router, forming a star topology. If this network were to expand in the future, access points would need to be placed in each of the rooms so that the network signal does not weaken. The current network does not have a requirement for this, therefore, only a wireless router is used to connect all wireless devices in every room. Even the farthest device from the router has 82 % signal strength proving that there is no need for access points.

In this case WRT300N model wireless router is used because Linksys (Linksys, 2006) claims that the MIMO-based router is capable of up to 12 times the speed and 4 times the range of older 802.11g routers and as all the devices will have 10 Base-T or 100 Base-T NICs hence these ports will fit perfectly.(4)

At last, the router is connected to the modem with Copper Cross-Over in order to be connected to the internet. Furthermore, the modem is connected to cloud in the hall in order to establish a fiber connection.

**Privacy**   
It's important to keep this small business network safe and not let anyone from outside access it. To do this, each device in the network has a firewall installed. Also, the wireless connections are made secure by using a strong password, and they use WPA2 security. To make sure everything stays safe, it's a good idea to change the password every month or at least every two months. Besides having a strong password, all the data that's sent in the network is encrypted. This helps to stop anyone from getting unauthorized access or listening in on the network.

To keep things secure, it's necessary to regularly update all the software and firmware on the devices in the network. This includes not only the main operating system but also any apps and services that are actively being used on the network. Doing these updates helps fix any security problems that might come up.

**NAS Devices**

NAS Device is a storage device connected to a network which allows retrieval of data from a central location for authorized network users and varied clients. These devices are flexible meaning we can add additional storage to what we have. Many problems are reduced when we use these in our network such as decreasing wasted capacity, improving data availability and allowing clients to share more and more data among themselves according to Gibson and Van Meter (2000). At last, setting them up would cater every users problem as it can store some of the sensitive data as a backup.(5)

**Cost Analysis**

**Network devices**

|  |  |  |  |
| --- | --- | --- | --- |
| Network Devices | Amount | Approx (cost of 1) | Cost |
| 100Base-T NIC | 29 | 25 | £725 |
| Wireless Router | 1 | 70 | £70 |
| Modem | 1 | 100 | £100 |
| 100m Cables | 4 | 60 | £240 |
| 2960-24TT Switches | 3 | 80 | £240 |
| Total Cost (£) | N/A | N/A | £1327 |

*\*Prices are taken from Amazon* *(9,10,11)*

**Host devices**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Device Type |  |  |  |  |
| PC |  |  |  |  |
| Tablet |  |  |  |  |
| Laptop |  |  |  |  |
| Smart TV |  |  |  |  |
| Printer |  |  |  |  |
| Server |  |  |  |  |
| Robot Assistant |  |  |  |  |
| Total |  |  |  |  |

**Use of physical topologies based on scalability and reliability**

**SCLABILITY**

The ability of a system, network, or procedure to extend or add resources in response to an increasing volume of work, demand, or data without noticeably lowering functionality or performance is known as scalability**.**

We have used star topology because in the network because they are highly scalable and changing or removing peripheral nodes does not break the connections that already exist. This functionality is especially helpful for growing enterprises or those whose network requirements change frequently.(7)

**RELIABILITY**

The degree to which a system or procedure continuously carries out its intended tasks without malfunctioning or degrading over time is known as its reliability. You can rely on a dependable system to perform as intended in a variety of scenarios.

Reliability refers to the dependability and stability of the network's operation hence adding or removing devices in a star topology is relatively straightforward. It is simple to grow the network without affecting the devices that are already in the place.(8)

**Recommendations for Expansion of Network in the Future**

If the network gets bigger in the future, a better idea is to use better cables like CAT-6. Right now, the CAT-5e cables in this small network, with a speed of 100Mbps, are fine. But if more devices are added and more data is sent and received, CAT-5e might struggle to handle all the traffic. Hence, CAT-6 or even higher standard cables would be better.

The second suggestion is to upgrade the NICs once again. The current 100Base-Ts are okay for this small network, but as it grows, there will be more devices and more data moving around. To avoid those delays later on, devices need to be able to send and receive data faster than before.

Upgrading the switches and routers to more modern models is another suggestion. For example, compatible 9600 series switches are now used in place of the 2960 series switches, and a more capable router has replaced the WRT300N router. More access points would be required in every room if the network expanded, as the wireless signal would no longer be able to reach every device as it already does. Additionally, more routers would be required—something the existing approach does not require—in order to better the subnet in the network.

**Problems encountered**

I wanted to use copper straight through wire to connect the wireless router to the modem but I used the copper crossover wire because that was the only one working. I was unable to Identify the problem.

# Part B

**Method used**

As there are two methods for subnetting in networking: Fixed-Length Subnet Masking (FLSM) and Variable-Length Subnet Masking (VLSM). Here are the reasons why I chose FLSM over VLSM.

First of all, FLSM is dependable, and since each subnet has the same size, planning for IP address distribution is simple. In this scenario where a predictable distribution of IP addresses is sufficient, FLSM is a suitable choice.

Secondly, due to the fact that every subnet has an equal number of host addresses, resource allocation is simple and reliable. Since each subnet needs a fixed number of hosts, FLSM simplifies resource allocation.

At last, FLSM is less complicated to use. It entails creating subnets of the same size within the IP address space. Here the network design is straightforward, and subnets are of uniform size, Hence FLSM solves the problem.

**Differences between FLSM Subnetting and VLSM Subnetting**

|  |  |
| --- | --- |
| FLSM (Fixed Length Subnet Masks) Subnetting | VLSM (Variable Length Subnet Masks) Subnetting |
| All subnets are equal in size. | Subnets are variable in length. |
| All subnets have an equal number of hosts. | Subnets have a variable number of hosts. |
| All subnets use the same subnet mask. | Subnets use different subnet masks. |
| It is easy to configure and manage. | It is complex in configuration and administration. |
| It wastes a lot of IP addresses. | It wastes minimum IP addresses. |
| It is also known as classful subnetting. | It is also known as classless subnetting. |
| It supports both classful and classless routing protocols. | It supports only classless routing protocols. |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Network Name/Number** | **Subnet** | **First host** | **Last host** | **Broadcast Address** | **Subnet mask** |
| Data Analysis Room | 192.148.10.0 | 192.148.10.1 | 192.148.10.14 | 192.148.10.15 | 255.255.255.240 |
| Brainstorming Room | 192.148.10.16 | 192.148.10.17 | 192.148.10.30 | 192.148.10.31 | 255.255.255.240 |
| Server Room | 192.148.10.32 | 192.148.10.33 | 192.148.10.62 | 192.148.10.63 | 255.255.255.240 |
| Wireless Devices | 192.148.10.64 | 192.148.10.65 | 192.148.10.126 | 192.148.10.127 | 255.255.255.240 |

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