Network Report

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Contents

[Introduction 1](#_Toc119932258)

[Aim and objectives 2](#_Toc119932259)

[Network Design 2](#_Toc119932260)

[Configuration Details 2](#_Toc119932261)

[Network Verification 2](#_Toc119932262)

[Evaluation and Discussion 2](#_Toc119932263)

[Conclusion 3](#_Toc119932264)

[References 4](#_Toc119932265)

[Appendix A: 5](#_Toc119932266)

# Introduction

An advertising client has requested a customised network for their business. The client’s business has 50 employees in total. These employees have been spread across a building that has 2 floors. Each floor has 2 offices, each office having 10 open plan desks. The client has also requested that the network have both wired and wireless connectivity for the employees. Due to the building being 2 floors and having only 50 employees, the network will be a local area network.

In this report, I will be demonstrating the skills I have learnt by creating a medium level network for the business that will accommodate all the employees. The skills I will be demonstrating are my ability to plan a suitable network with the requirements given and setting up the network so that is working effectively.

# Aim and objectives

The client has only requested 40 devices on the network but has 50 employees. My overall aim is to create a network to accommodate all 50 employees of the business for the chance that they are all working in the office at the same time. My goal to complete this aim, is to add wireless connectivity for the extra 10 employees. My main objective is to ensure that the network is secure. One of the goals I have in order to accomplish this is to configure SSH on the routers that are used within the network. Other Objectives are to configure DHCP, RIP Routing and to verify these work accordingly.

# Network Design

The client’s network will be within a building with 2 floor and each floor containing 2 offices. The client requested both wired and wireless connectivity. For my network design, I have taken in the client’s information and applied it so that all the requirements are met. I decided to create a simple and straight forward design that is easy to understand for client. The client specified wanted 40 open plan desks but has 50 employees, so I added 10 wireless devices for the extra 10 employees that were not accounted for. In my design I have used 2 routers, 4 switches, 1 wireless access point.

Chart, diagram

Description automatically generated

When implementing my design I started by sectioning the page via floor and room so it was split into 4 subsections. I started by adding two 2811 routers and connecting them via a serial link, so they have direct communication with each other, therefore making the transmission speed quicker which is essential for sending emails across the network. I decided to use a router for each floor as it much more cost effective as the client has multiple users on the network and too many users on a router can slow down the performance of it. I chose to use four switches within the design. The reason behind using four switches is to create a subnet for each office as there are 4 offices in total spread across the 2 floors. I chose to use multiple subnets as it reduces network traffic and provides security to each subnet as they aren’t affected by the other subnets on the network. I connected two switches to each router via a fast ethernet cable. This is due to there being 2 offices on each floor. The fast ethernet cable will allow quicker transmission time from the PCs to the routers in order to send data across the network. The client requested 40 open plan desks which I have split evenly amongst the 4 offices so each switch will be connected to 10 PCs. I have connected the PCs to the switch via a fast ethernet cable. Splitting the PCs evenly amongst the offices allows the offices to run similarly to each other so they will have similar transmission speed and also helps to reduce the overall network traffic as multiple PCs aren’t trying to send data at the same time which will cause collisions and delays. The client requested to have both wired and wireless connections, so I have included a wireless access point onto one of the switches, which is subnet 30. The wireless access point allows the business to extend their transmission range to become much wider and helps to accommodate any additional devices that need to be connected. The price of the wireless access point is expensive hence why I have opted for only 1, however, installation of the wireless network is cheaper (*Advantages and disadvantages of wireless communication* 2023) and easier than the wired connections.

# Configuration Details

**Router Configuration:**

Graphical user interface, application

Description automatically generated

Once I had designed my network, I moved onto writing the configurations. I started with creating the serial link between the 2 routers on s0/1/0. I assigned the IP address and subnet mask for each router within the connection. I then changed the hostname of the routers so that once the network started growing and becoming more complex, I wouldn’t be confused between the routers. I named router0 as R0 and router1 as R1.

A screenshot of a computer

Description automatically generated

The router has no security which means that if a hacker tried, they could get access to the router. This could lead to the hacker restricting, removing or gaining access to any devices on the network. As this is a business, some of the hosts will be holding confidential information so it is essential to reduce the probability of someone gaining unauthorised access. In order to reduce the likeliness, I decided to add passwords onto the router, auxiliary, console and vty 0 15 line. The passwords are a form of a security as someone who doesn’t have the password won’t be able to gain access.

Graphical user interface, application

Description automatically generated

After configuring the serial link and the passwords, I then set up the fast ethernet link between the switch and the router. I assigned the IP address and the subnet mask on the interface f0/0 on both the routers.

**DHCP pool configuration:**

Graphical user interface, application

Description automatically generated

As there are multiple hosts on the network, it will be time consuming to manually assign each individual host the default gateway, the unique IP address, and the subnet mask. I used a DHCP pool to automatically assign this information to each host on the network. This helps to reduce the set-up time for a new host in the future as once the host is connected it will automatically get the information required to communicate within the network.

Graphical user interface, application

Description automatically generated

After creating the DHCP pool, I needed to manually swap the IP of each host from static to DHCP so that they would all be assigned their the IP configuration information. In the Image above, I manually set the PCs IP to DHCP, and the IP and subnet mask were automatically assigned.

**Switch Configuration:**

Graphical user interface, application

Description automatically generated

For all of the switched, I configured hostnames for the switch; the “10” within the hostname represents the subnet that the switch is a part of. I have chosen these names so when the network gets more complex it is obvious which switch is a part of which subnet. I also configured passwords for the line vty 0 15 and line console 0 for the security of the switches.

**Router RIP configuration:**

Graphical user interface, application

Description automatically generated

I configured the router RIP v2 for each of the routers. RIP routing is used for the topology information to be shared so I made sure to include all the subnets. This is so if the topology of the subnets gets changed then RIP routing will share the updates to the rest of the network.

Graphical user interface, diagram

Description automatically generated

**SSH Configuration:**

A screenshot of a computer

Description automatically generated

Configuring Secure Shell (SSH) helps to prevent unauthorised access by providing a way to establish a secure connection to network devices. I configured SSH for both the routers to provide extra security. (Harry, 2017)

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# Network Verification

After Configuring each part, I went to check that my connections were working. This is essential as it helps me to identify any possible errors before the rest of the network is created and becomes too complex to understand the error. This makes it easier for me to identify the problem and find a solution to fix it. It helps to ensure that everything is working before moving onto the next step. Doing this also helps the business as I can also identify any future errors that may occur and stop them from disrupting the network later on which will affect the business.

**Router Connections:**

The first connection I verified was the connections for the routers. These connections are the serial link between the routers and the fast ethernet wires that are connecting the routers to the switches. In order to check the connection, I used the command “show IP route”, within the router, to verify that both the fast ethernet and serial link were successfully created. As shown below the connections were successful.

Graphical user interface, application

Description automatically generated

I also pinged from a PC on the subnet 192.168.10.0 to the router 192.168.10.1. The ping as shown below was successful which means the connection is working.

Graphical user interface

Description automatically generated

**DHCP Pool:**

I then verified the DHCP Pool by checking the IP configuration on a wireless and wired device. The verification of the DHCP is important as if the DHCP isn’t working then it will require the client to need to manually insert all the IP configuration details which is time consuming.

Graphical user interface, application

Description automatically generated

Graphical user interface, application

Description automatically generated

Shown above are the IP configuration for both a wired and wireless device. The IP configuration is set to DHCP and the IP address, subnet mask and default gateway have been assigned.

Graphical user interface, application

Description automatically generated

I also used the command “show ip dhcp pool” in one of the routers CLI and it shows that 1 subnet is currently in the pool for that router.

**RIP Router:**

In order for me to verify RIP routing, I needed to configure “show ip protocols” within one of the routers.

Graphical user interface, application

Description automatically generated

As shown above, the routing for networks shows all of the RIP routes that were created. It is important that this is working as it sets the number of hops allowed between sender and destination. It also holds the topology information and updates every time the network topology changes. This change is shared with the rest of the network.

**Secure Shell (SSH):**

I verified that my SSH was working by accessing it through one of the devices in the network. I used the command “ssh -l admin (ip address of router) “in the host command prompt to check if it works. To ensure that it is working I will be using both a wired and wireless device.

Graphical user interface, application

Description automatically generated

As shown above, I entered the command into the PC’s command prompt and was able to use ssh.

Graphical user interface, application

Description automatically generated

As shown above, I entered the command into the laptop’s command prompt and was able to use ssh.

**Pinging:**

To verify that my pinging is working, I will be pinging from one host to another.

PC7 (192.168.10.9) to PC32 (192.168.40.4)

This travels from PC7 >> Switch-10 >> R0 >> R1 >> Switch-40 >> PC32

This Ping contains 2 routers and 2 switches.

Graphical user interface

Description automatically generated

As shown above, the ping was successful even though some packets were lost.

Laptop 5(192.168.30.12) to PC14 (192.168.20.6)

This travels from Laptop 5 >> Switch-30 >> R0 >> R1 >> Switch-20 >> PC14

This ping contains 2 routers and 2 switches.

A screenshot of a computer

Description automatically generated with medium confidence

As shown above the ping was successful.

# Evaluation and Discussion

After designing and implementing the network design, I feel as through my network is suitable for what the client requested. One of the requirements that the client had asked for was having both wired and wireless connectivity on both floor, which is something I had failed to add. The reason for this was due to the wireless access point being expensive. However, this error will affect the performance of the wireless access point in the future as more devices are added. Due to the wireless access point being a layer 1 device it’s more likely to experience data collisions as all the devices connected to it have to share one port. The more devices added the more collision which will become more noticeable as the devices involved in the collision need to wait a random period of time before resending. This will make the wireless access point redundant in the future.

Due to this being a small business, one of the biggest concerns what the cost of the network design and components. I tried to be mindful of this hence why I used less components. However, the network is still expensive as there are lots of wired devices which are more expensive than the wireless. With the wireless only the wireless access point and the devices for it will need to be bought. With wired, the devices and the wires connecting them to the network need to be bought which is expensive.

I wasn’t able to use DHCP on all of the subnets due to them failing and APIPA needing to be used, so I had to manually type some of the IP configurations in. This is a problem, when the client decides to add another host into the network they might need to manually configure the IP which will cost time and money because if they are unsure on how to do it they will need to call in an expert to configure it for them. As this is a small business, they might not have the funds to call in an expert which means their business will be affected as they are unable to add new hosts which will decrease their chance of expanding their number of employees.

Another concern I had, was the security of the network. I added passwords into the router and switch configurations but they weren’t strong passwords so if someone was to hack into the business, they would most likely succeed. This is a vital concern as the business being small, is already vulnerable as it most likely easier for someone to gain unauthorised access as there won’t be much security like bigger companies have due to the security being expensive.

# Conclusion

After designing and implementing the network design, I think that I have met most of the client’s requirements. The network that I implemented was able to accommodate all of the employees within the business and had both wired and wireless. I achieved the aims and objectives that I stated at the beginning of this report. One of my aims was to create a network that accommodated all the employees, which I did achieve as my network had 50 hosts on it and was able to take more via the wireless access point. If I were able to redo this network, I would make sure to spend more time researching other ways to increase the security of the network as this is a small business so it will be more vulnerable. I would also spend time trying to make sure the network would stay reliable in the future and not decrease in performance with the more hosts added on.

# References

Add your references here using MMU Harvard format. All references should be cited in the main body of the report.

*Advantages and disadvantages of wireless communication* (2023) *GeeksforGeeks*. GeeksforGeeks. Available at: <https://www.geeksforgeeks.org/advantages-and-disadvantages-of-wireless-communication/>(Accessed: January 24, 2023).

Harry, J. (2017) *SSH configuration on Cisco router*, *Pluralsight*. Available at: <https://www.pluralsight.com/blog/tutorials/configure-secure-shell-ssh-on-cisco-router#:~:text=Secure%20Shell%20(SSH)%20improves%20network,preventing%20hackers%20from%20gaining%20access>.(Accessed: January 24, 2023).

# Appendix A:

Include any additional configuration details not already in the body of the report.