Networking Final Assignment

Background pattern

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The instructor :

DR. Sami Al Mashaqbeh

DR.Issra

Submited by :

Issam Awamleh

Part 1

* Part 1 (1.1)

1\_personal area network(PAN):

This is the smallest and most basic kind of network, it’s also contain of one device has connection with the internet, and that devices connect with other devices. The range is 10M there’re tow ways of connection wireless and wired way the wireless such as:

* Bluetooth
* Infrared
* NFC

The wired way is by:

* USB .

the laptop could be a good example of the (PAN),you can connect your laptop with the printer by wireless way, and use a mouse and connect it with the laptop by USB cable, also charge the Airpods, That we call a PAN. In addition we use it to connect devices in user’s immediate area.

* 1\_ advantages:
* No more of extra space requirement or cables .
* Remote control use in this device so it’s reliable.
* it’s secure.
* Easy to use and you can use it anywhere for example it’s used in conferences and offices etc. .
* 2\_ disadvantages:
* Limited area to use.
* Low speed of transferring data and unsuitability between the devices.
* The healthy threats that could have in the person life receiving Infrared signals that could impact on your life.

2\_Local Area network(LAN):

The network contain of tow computer or more connected with each other, but this type is in small graphicly area, like department(IT support),building and the floors of that building. The range is 150 M, the LAN put some devices, in it such as switches ,cables, routers, hubs and access point and so many more. Usually this kind of networks has a single router, and that router access to the internet, also it could extra switches be used.

The LAN’s use Wi-Fi, or ethernet, or could be both. Ethernet a protocol for physical network, and the radio waves is for Wi-Fi protocol, the LAN usage is to let the internal employee get access in the services and printers.

* 1\_advanteges :
* every single part has mutual things with the other devices in the same LAN such as the resource and the software resources such as DVD , hard disk driver and printer that can easily share it and the same software that all work under one license .
* you can be comfort while you exchanging any data or massages because it’s placed in the server and it’s accessible for the LAN’s user.
* the device that connect to the internet can share the internet with the others devices on the same LAN .
* 2\_disadvantages:
* The LAN save lot of money and Time but still need primary requirements to setup one(the initial cost).
* the LAN doesn’t has strong security the administrator should apply set of privacy policies and rules to make it more secure .
* LAN often faces some issues like hardware and system in maintenance also need an administrator has well Knowlagent in the networking fields with full time job to look after those issues .

3\_ campus Area Network(CAN):

It’s a computer network in a relatively limited geographic area. The range is 1-5 KM, like group of buildings that close to each other. And contain of many LANs, in most of the CANs has connection with the internet, also it’s smaller than the MAN and the WAN.

* Advantages :
* Most of the CANs connection with the internet.
* In addition it’s organized by IT support team that can deal easily with the network, and set the privacy and security protocols such a firewall and other instruction, with transferring of the data smoothly.
* Disadvantages :
* the maintenance is expensive.
* Limited connection with the nodes (computers).
* it’s cover only 40 meters.

4\_ wide area network(WAN):

It’s a kind of network that a relatively large geographic area, that could extends in a city, region, country, large region like Asia or Africa and the whole world, like the internet and contain of many subnetwork (LANs). The range is nationwide so it’s use for sharing the data , and the information much more easily, also around the world and in wide range.

* Advantages:
* the range that the network covered which consider very wide.
* Sharing the software and the resource like the LAN
* The files that will be shared for all the user and the user won’t use the previous version.
* WAN support the global markets and global business
* The speed of the transferring data of the WAN was developed by the appearance of IOT(internet of things)also the improvement that happened to LAN and LAN Advanced .
* Disadvantages :
* The cost of investment is high
* IT support has experience and skillful to maintenance the network.
* The technology that can apply in the WAN in wires and wireless protocols and so many more could rise up so many problems and errors you should take in to consideration the size of the network
* Less secure than MAN or LAN
* To avoid the attackers you should put so many firewalls also many security protocols in many points around the network.

WAN VS LAN:

You should put in consideration the different area that covered both of them, and the connectivity to the internet. The LAN has one point or device that connect to the internet, in the WAN function is to provide the internet to large distance, and make from many LANs. The WAN also depends on infrastructure that outside its control, for example New York and Paris offices(cables across the Atlantic). The LAN has only one router to connect to the internet, but the WAN could has more than one.

My choice : the suitable networks for the project should be LAN and WAN. According to the huge distance that we should cover, also the local area(limited distance ), that we should cover in the project .

* Part 1 (1.2)

1\_ point to point (P2P):

The simplest topology There are 2 devices contact directly with each other, one of them should be the sender, and other side is the receiver.

* Characteristic:
* The device can send and receive at the same time,
* the subnets is /30 and it’s common.
* The data go through a tunnel(cable) for better performance, we could use various of cables.
* Additionally it’s use a simple protocol which is access media control protocol.

2\_ Star topology :

Star topology required point-to-point connection between the central node, and connection devices to improve the commination. The central node could provide the services of reconditioning and amplification for signals .

* Characteristic:
* Every single central node is isolated, because the fear of the central node failure, so if something happen to one of the central node it won’t impact on the other nodes .
* Facilities add remove any kind of device to and from this topology the performance could be bad in this topology because the trying to access the central nodes from many devices.

3\_Bus topology)point to multi point );

All the nodes are connected together in one cable(coaxial), and called the backbone lead to a computer or a server.

* Characteristics:
* Add or remove any devices easily for and to the liner bus.
* Less cable than star topology.
* Reliability is good in this topology.

4\_Tree topology:

It’s contain of one or more star and bus network, and the base of Tree topology is the sub axes, connect with main axes to make Tree topology.

* Characteristics:
* It’s make hierarchical shape that absolutely make a data center for nodes.
* Ability for developing in great extent.
* If there’re a node that get damaged or shut down the topology will not get impact from it.
* Easy maintenance and with smooth determine the problems of the system.
* Reliable and highly secure and used for WAN.

5\_ Ring topology :

The topology which the node has point-to -point configuration, with the tow side so the signal go through the node after the another, until it get to the destination.

* Characteristics:
* no restriction in number of the devices in the network.
* High speed of transfer.
* The interruption doesn’t impact on its performance.
* Easy adaption with the new devices and that won’t any problems or delaying on the network.
* Using different direction of data movement.
* Ensure the data flow in one direction without collision.

6\_Mesh topology:

The connection established between tow nodes, but with many different ways to it. Every single node has at least 3 bus with the other nodes.

* Characteristics:
* It’s work better with large number of the nodes.
* More than way to transfer data from node to another without restriction.
* the devices work together in result you don’t have to depend on single point for Wi-Fi.
* This kind of network work to cover as possible as that it can work even the dead zone.
* Easy configuration not complicated one with less failure

7\_hybrid topology:

It’s kind that one or more from the kinds above that make a hybrid shape.

* Characteristics:
* Reliable the node that get damaged it will determinate and the suitable step will taken
* The good data reliability available in ring topology also the capability in star topology and the both features are available in star-hybrid topology .
* Easy to developed without damage other chassis.
* Fixability one of the properties so depends on the resources also the company requirements.

My choice is the ring topology .

Bus topology VS Ring topology :

|  |  |  |
| --- | --- | --- |
|  | Bus topology | Ring topology |
| Connection way | The devices connect with single cable which known as backbone | Every single the device connected with 2 devices on the 2 side in circular fashion |
| Sending data | The data sent directly from the sender to thee receiver device | The data sent from device to another until the data get to its destination (in circle path) |
| Cost | lower than the ring | Higher than the bus |
| Reliability | More reliable | Less reliable because failure of one device that will impact on the network |
| Tracking fault | Difficult to find the fault | Much easier to find the fault |
| Adding devices | Easy to easy add devices | Pretty hard to add devices on the network |
| speed | Slow because the sequential access | Speed |
| terminators | Has terminators at both ends | Doesn’t contain a terminators |

* Part1 (1.3)

Advantages :

* The flow of data in one direction that will decrease the possibility of collisions.
* The performance in data sent is better than the bus topology.
* No need for the router to mange the connectivity among the nodes.
* Qualities to reach to the resources.
* easy to know the source of the problem.

Disadvantages:

* The ring topology the packet must go through every single node.
* If there’s a node shut down the whole network will shut down.
* High cost (expensive).
* Quiet hard to change the nodes its could lead to problems in the system.
* In order to the devices communicate with each other it have to be turned on.

I chose the ring topology, because of its speed ,and flowing data in one direction ,also the good performance of this topology. In addition the great troubleshooting feature.

* Part 1 (1.4)

\*The publishers of the protocols are:

(IEEE),(IETF),(ISO),(ITU),(W3C).

* Application layer protocols:

1\_ Hypertext transfer protocol and the secure version of it (HTTP,HTTPS):

This protocol determinate the amount data that will transfer, and how web browsers and servers should respond of the commons, that give by the user. There are the also the secure version of HTTP is HTTPS. And you see it in the beginning of the URL, in the domain(web address).

2\_ dynamic host configuration protocol (DHCP):

DHCP it’s a protocol that automatically give a unique IP address, to the devices that connect to the network. So it’s give the IP from the range that is given by the user, and it has its own IP from the user statically. So it’s work on client-server model.

3\_Domain Name System protocol (DNS):

The main function of this protocol is to replace the calling of the devices, from IP addresses to the normal name. It also work in client-server model, also it’s has its own unique IP address statically entrance by the user.

4\_ file transfer protocol (FTP):

This protocol make the file transferring between the devices available, according to the authority or futures that available and allowed to do. This protocol using TCP, to transfer those files.

5\_Post Office Protocol (POP3) version 3,:

You can easily receive any kind of emails by this protocol, without internet connection you can read the emails. The email messages deleted from the sever to save spaces.

6\_ Simple Mail Transfer Protocol (SMTP):

The protocol that designed to sending the emails efficiently and reliable, when the POP3 is received those emails. Although the transferring could happen in the same network, or between 2 different networks.

7\_Terminal Emulation Protocol (Telnet):

In this protocol communication with the remote devices is possible, but the network administration should has a IP of the device, that would reach it or the name of that device.

* Transport layer network protocols :

1\_TCP (Transmission Control Protocol ):

It’s a protocol work on the transferring the data, also TCP one of them it has a extent of reliability slow with transforming the data. And that because in this protocol the connection will check by establishing it first, then the protocol send, then it get a conformation massage from the receiver and it used in the money exchange , browsing and send emails .

2\_User Datagram Protocol (UDP):

It’s a protocol that transferring data it’s unreliable, but quick in sending data without checking if the data has received, with low quality. It’s used for live streaming ,chatting online and gaming online.

* Network layer protocols :

1\_ Internet Protocols (IPV4)version 4:

Its’s addressing control information protocol work with TCP to deliver packet to the destination, each host has 32 bits contain of network number and host number, the TCP work to put them in a right way in this system you can use 4 billion addresses.

2\_ Internet Protocols (IPV6)version 6:

Its’s addressing control information protocol, work with TCP and that is newest version of the IPV4, and the IPV6 has decrease the capacity of the addresses to reach 340 billion billion billion.

* Part1(1.5)

1\_ router:

It’s a device that redirect the packet, that encapsulated of many layers to reach to destination IP, and send the packet to it. Also If that destination in the same network it will send it to that network or if it’s not, the router will send to the router that has the destination. The router is smart device that save the data, which go through the router about the network, that connect with. In addition it could be firewall to filtration of the packets, and to apply the security and privacy protocols, so how the router know how and to who should send the packet? and that happen in 3 steps and the router go over them in order :

* Static routing : and that happen from the user instruction to the router.
* Dynamic routing: it has many ways that you can do it dynamic without user interventions :
  + RIP
  + OSPF
  + EIGRP
* The ISP: it’s work to work to pass the IP to the right destination, if the router disable to recognize the destination of the packet, or not connect with the network’s destination.

2\_swittch:

It’s a device that transfer the packets and messages around the LAN, additionally it keep the privacy and secure so it’s keep the network secure, also it has plenty ports. Also it’s more reliable than the hub because its deal with the physical IP address (MAC), in addition the switch is full-duplex that means it used the both way at a time.

3\_ access point:

It’s a devices that transfer the signals that receive it from the devices, which connect with it and convert it to wire connection with the switch directly .

4\_ modem :

This device work to deal with digital(the language which understood for the devices) and analog(the kind of wave that received by the modem),this device can provide the internet to the networks by converting the various type of waves.

5\_Gateway :

It’s a device can work like a router and like a gate for many network, and I need to be the gate of the whole network and the place of it will be after the modem, because it play the role of router and firewall at the same time, So that will increase the security in the network and this deceive. The Gateway called the protocol converter so it’s could have more than one protocol, so we could use a more sucre protocol after the modem to avoid any threats.

* Part1 (1.6)

Servers: a computer or system provide a source of information or service to a another devices call a client in the network there are many kind of servers such as :

* Web server
* Database server
* Email server
* proxy server
* DNS server
* FTP server
* File server
* DHCP server

The devices always connect with the server in a local area, or wide area using router or switch, and the server is always on, it couldn’t be shut down to save the data, It already did in proxy server it’s give permission for devices to access the data on the server it also do three main things:

* Security
* Filtering
* Improve the network performance and that happen because of cashing

\*Cashing\*: it’s a way of dealing the data, when call up data from the server from particular time, so that data will be able for every device on a stronger and faster server.

The cost of the server:

in general is a licenses for it, people has experience that could monitor the satiation of the server, also the cost of maintenance you should put in consideration the security cost and the physical space.

So what about the hardware? The cost will be in CPU, RAM, storage, communication, High availability and the order of the server it will be scalability.

Operating system of the servers:

1\_ windows server 2016 and 2019:

The minimum requirements of this version server of Microsoft is: 1.4 GHz ,with 512 GB Ram, and 32 GB in disk space, it should include DVD-ROM drive.

2\_ Red Hat Linux 7.2, 7.3, or 8.0:

The requirements is:1 GHZ CPU, and Intel x86-compatible, also at least 1 Gbyte RAM, with 2 Gbyte HD free space.

* Part1(1.7)

Workstation :it’s a level of independency that the device could have, and the device that reach this level called the workstation, it’s like a mediator between the user and the network. The benefit of the workstation is to control and manage the network with central structure it, also for security purpose also to order access and get provided by a services.

The relevant of the workstation and the software of the network:

* It’s absolutely more powerful than the ordinary computer.
* You can use it as independent unit because of the features that its has .
* (NIC) Network Interface Card it’s hardware part that enable the devices to combined in a LAN also work as translator it’s get permission to the devices to send and receive data on the LAN .
* The devices communicate with each other in a certain protocols to exchange the data.
* This card is very useful in the (IT) field to set up the connection weather wireless or wire.

there are many platform can the client and the server use such as :

* windows.
* Linux.
* Macintosh.

You should purchase the computers that has the same brand to keep the standardization, of the company to increase the productivity, otherwise you will face many problems such as :

* Extra spare of parts and expansion hardware
* Little bit hard to deal with software titles and having a license
* The server have to deal with two different platform that will make it complicated and hard to deal with .
* If you need an application and that kind of application support one platform and that going to be big problem.
* The compounding work it’s not good choice when you use dual platform that make a problems.

If you convinced of the disadvantages and you want to choose a platform you should put in consideration some instruction:

* The user need
* The kind of application you want to run on it
* The suitable platform that support the application needed
* The primary drives that will run the user need and you need to applications that the company need

So why is the platform pretty important?

* In this field there’s a strong competition in price between the companies
* Attract the developer of the software and hardware application
* It’s benefit for the infrastructure
* Part 2(1.1)A

Diagram, schematic

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* Part2(2.1)B:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Network ID | First valid IP | Last valid IP | Broadcast IP | Subnet mask | The rang of valid IPs |
| USA | 172.16.16.0 | 172.16.16.1 | 172.16.16.30 | 172.16.16.31 | 255.255.255.224 | 172.16.16.1-172.16.16.30 |
| UK | 172.16.16.32 | 172.16.16.33 | 172.16.16.62 | 172.16.16.63 | 255.255.255.224 | 172.16.16.33-172.16.16.62 |
| AMMAN | 172.16.16.64 | 172.16.16.65 | 172.16.16.94 | 172.16.16.95 | 255.255.255.224 | 172.16.16.65-172.16.16.94 |
| AMMAN (data base) | 172.16.16.96 | 172.16.16.97 | 172.16.16.126 | 172.16.16.127 | 255.255.255.224 | 172.16.16.97-172.16.16.126 |
| INDIA | 172.16.16.128 | 172.16.16.129 | 172.16.16.158 | 172.16.16.159 | 255.255.255.224 | 172.16.16.129-172.16.16.158 |

And that is the configuration of the devices and the range of IP, also it’s done by DHCP services, because of the router redirect the packet for the server, and the tablet below is the configuration of the router either in a Gigbitethernet or by serial.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Gigbitethernet0/0/0 | Gigbitethernet0/0/1 | Serial 0/1/0 | Serial 0/1/1 |
| USA | 172.16.16.1/27 | x | 50.0.0.0/30 | 50.0.0.18/30 |
| UK | x | 172.16.16.33/27 | 50.0.0.2/30 | 50.0.0.5/30 |
| AMMAN | 172.16.16.65/27 | 172.16.16.97/27 | 50.0.0.6/30 | 50.0.0.9/30 |
| INDIA | 172.16.16.129/27 | x | 50.0.0.10/30 | 50.0.0.17/30 |

* Part2(2.1)C:

One of the main services that I used in the project is DHCP I use other services like:

DNS

FTP

HTTPS/HTTP

Email

And that all in a 2 server the first hold an IP address 172.16.16.98/27, and has 2 services Email and DHCP, and that server exist in Amman server in the data center branch.

The IP of the server put statically, because of the DHCP doesn’t give a continuous IP it’s temporarily. In cisco system every 24 hours the server check if the IP address is still used, by massage of the server if the device is done of it, won’t replay on the message and the server will take that IP and give it to other device that need, the IP or the device will respond in this case the server keep the IP for another 24 hours :

Email : this service can configure by adding a domain name (the name of the web site that wanted work in or joining), with username and password for every single device.

DHCP: can configure this kind of service by adding the range of every single network, with some entering information such as: DNS server ,default gateway and the expected number of host, and every rang that you enter its saved in the DHCP as pool.

the second server has 3 service DNS,FTP and HTTPS/HTPP, also has the IP 172.16.16.99/27 in the data center in the Amman network, and that IP put statically and that because of the temporarily IP:

DNS: this kind of servers should put a name with the address to use instead .

HTTPS/HTTP: It’s configuration process put the HTTP off and let HTTPS on, with little editing of the content of the web site, by enter index in edit option and write whatever you want like a text to appear in the web site .

FTP: it’s need a user with password with determine the permission of every user.

* Part2 (2.2)

So we going check 3 essential things and those are our axes :

* Connectivity
* Serves
* Routers
* PC configuration
* Connectivity :

Lets start with the PC’s with a switch in small LAN, and you can test connectivity in any PC in the LAN via the command (ping), and that command check the connectivity not only in the LAN between any 2 devices(routers, PC’s ,servers), whatever if they’re in the same LAN or not. And that done by sending the device a 4 echo request, so the destination (the other device) will receive it then, there will be echo replay from the destination to the device (if there connectivity) .

(if there is not connectivity) There is tow problem could face in ping :

1\_Request timed out :

that’s happened because the destination device is down or the request has blocked .

2\_Unreachabel :

That’s happen because the route to the destination can’t be found.

And you can know where is the problem exactly by writing a command(tracert), with the wanted destination device, so that command will show the exact devices and the path that will the massage pass through, with the routers that will pass through as well .

You can use a type of pinging that will give you the updates of the network, its (extend ping )and it’s work on giving an echo request without interruption, until you get enough of information, the command write like (ping -t IP address that you wanted to reach).

* Server :
* DHCP: we can check this service by switching the PC’s in the configuration, from the static to DHCP(dynamic)and wait for it to be successful process.
* DNS: the checking of this service it’s through the CMD from any PC, in the network and via PING command but this time it will be a name instead of the IP. And there tow possibility connected with the echo replay or not, also we could check DNS in another way, we can ask the DNS to provide us of the IP address of any name that contain in its list, like the website domain and that gets done by (nslookup).
* FTP : the checking of this could happen by go to the CMD in any PC and write the calling command (ftp with the IP of the server), then write the user and the password then, you can upload the file by command(put with the name of the file with the extinction of that file). So from any other PC you can enter to the ftp from the CMD, with IP and use the command (get with the name of the file and extension), then the file will be transferred and that will .
* HTTPS: you can access any website via go to website option from the desktop, of any PC then write the domain of the website then you will be in the site.
* Email: it’s quiet easy to send an Email just follow the steps:
* First of all open the desktop of any devices that want to be the sender in the process then chose Email option.
* Complete the information of the configuration mail be attention that you should do this in the both devices.
* After you done chose compose to send the email then you put the email of the receiver and the title of the massage.
* And you can write whatever you want then send .
* The other side will open the Email then chose replay then will find the email .
* And with all the previous steps will know if the email services is active or not.
* You can do the same steps for the other side to check and be sure that everything is good .
* Routers: in this part you can make a test, by using a feature in the packet tracer is useful for check connectivity between the routers, is( add simple PDU) that will check the interface serial. It will send a massage from the device from your choosing, to the receiver to device from your choosing as well, and you can see the result in the bottom in like a bar.

About the check of the inter face of the LANs, we could use Ping method to check of the Gigbitethernet interface.

You can see from a command that insert in the CLI which is (show IP route), and this for knowing the interfaces of the router that connect with whom, and the way of connection and to access of the all information of the router you can use (show running configuration).

* PC’s checking configuration:

We can know the configuration of any device by this command which is( ipconfig), it’s will show you few information of the device like : IPv4, IPv6, Subnet mask and Default getaway .

So if you need to know the address of the servers that this device connect with and the physical address(MAC)also the IPv4,6 you going to use(ipconfig /all).

* Part 2(1.3):

Maintenance should take an group of people who have an experience and they called (IT team support)

A picture containing application

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\*note\*: this excel work it 100% my work it isn’t anyone else.

* Part 3(3.1,3.2,3.3):
* Testing resulte
* Ping (Connectivity ) :

Diagram, schematic

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* Kind of ping to see every single device that the message go through it(trace routing).

A picture containing text

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\*We can notice here there’s more than 4 echo replay.\*

* Servers:
* DHCP: switching static IP to dynamic IP via DHCP .

Graphical user interface

Description automatically generated with medium confidence

* DNS: Ping to a name of a device to check if the DNS is active.
* Ping

Text

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* Nslookup: to access to the server and looking for any name in the list.

Text

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* FTP: trying to access to the server to upload the files from the user that permitted to.

Text

Description automatically generated

* Here is the command to do download the files.

Text

Description automatically generated

* HTTPS: access to a website.

Graphical user interface, text, application, email

Description automatically generated

* Email: exchanging emails between tow devices.

Graphical user interface, application

Description automatically generated

* Routers: the way to make a check of connectivity between routers.



* In this option we use it to get the information of the router .

Text

Description automatically generated

Text

Description automatically generated

* Pc configuration: to figure out the information of the device.

Text

Description automatically generated

Text

Description automatically generated

* Part 3(3.4):
* The first thing that I would change the cables between the routers, and convert it from the ring to mesh topology, whatever is it partly or fully. And that to be much easier also it’s better in the traffic management, and good handling of the collision, so any failure of any device on the network won’t be impact on it.
* The second thing that I would do is increase the security on my network, as a network engineering that from my top priority:
* by securing my router more.
* keep your software update .
* with install a reliable and strong firewall .
* remove any unused software and services.
* backup your data just in case.
* Part 3(3.5):

In general who has the data has the power, so everyone either organization or individual to save them dates, so that raise up an important question why is the security is important?

Well the data is essential and important source that would make it impossible to share, and that because the sensitive of it. It also protect the data of the clients. Additionally it’s improve the performance, and that won’t able to the hackers to hack the system, then have benefit from the data to harm an organization, or used it illegally.

So it’s useful in any field even in the military, the countries use hacking as a weapon to spy on other countries, and that dimension of this issue. So the network is a station of exchanging the data, so one of primary that you must think about is the security.

* Part 3 (3.6):

I think I did well in the project, but I think I somewhere mentioned many thing that I didn’t need to mentioned it, but I did that for increasing my knowledge, that’s what I can say about the theory section.

I’d like to spotlight on the practical section I choose a topology that has many disadvantages, that I could talk about them in the evaluation part, and I have another purpose that I want to reflect that I am understand what I am doing, and to be an evidence that all that was my work 100%.

Finally that’s what I can evaluate my work, because I am not an expert so I can’t see the excite downside or the weakness points, but what I can see it I wrote it so I really need to heard the feedback.

Text

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