Computer Network Project

FCDS Case Study

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Computer Networks
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2024/2023

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Case Study New Building of FCDS

1.Project's Structure

Structure	Topology Used
Whole project	Star
Data Science Dep	Ring
AI Dep	Partially connected
Media Dep	Bus
Business	Tree
Cybersecurity	Tree

Department's internal structure: -

Structure	# of Routers	# of Switches	# of PCs
Whole project	8	34	68 as prototype
Data Science Dep	1	8	16
AI Dep	1	7	14
Media Dep	1	5	10
Business	1	7	14
Cybersecurity	1	7	14
Backbone Router	1	X	X
General Router	1	X	X
Special Router	1	X	X

Basic details

After the construction of the project was done, we made 3 copies of the project, to apply different types of routing techniques, while applying NAT to save private IPs and also making the consumption of the internal IPs much lesser, and finally we applied Security to save Servers from any unknown Actions.

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2.Subnetting Step

Subnetting steps just to show the importance of saving the cost of buying a million IP's.

What's the main IP for this case study?

For All Departments, we have found our departments.

Department	Number
Data Science	212
AI	47
Cyber Security	36
Business	125
Media	10
Total	430

So, by supplying 193.158.1.0 for DS is enough for it.

Giving Ai and CS with Media to 193.158.2.0

And setting 193.158.3.0 Business to fit all data on.

This step will show the subnetting for Each Department

1. **Data Science**

Subnetwork	255.255.255.0
Network	193.158.1.0
Broadcast	193.158.1.255
Usable Range for Ips	193.158.1.1 to 193.158.1.254
Number of Needed	212
Number of Usable	254
Achieved Requirements	Yes

2. **Business**

Subnetwork	255.255.255.128
Network	193.158.3.0
Broadcast	193.158.3.127
Usable Range for Ips	193.158.3.1 to 193.158.3.126
Number of Needed	126
Number of Usable	128
Achieved Requirements	Yes

Subnetting Steps Next

3. Media

Subnetwork	255.255.255.240
Network	193.158.2.0
Broadcast	193.158.2.15
Usable Range for Ips	193.158.2.1 to 193.158.2.14
Number of Needed	14
Number of Usable	16
Achieved Requirements	Yes

4. AI

Subnetwork	255.255.255.192
Network	193.158.2.64
Broadcast	193.158.2.127
Usable Range for Ips	193.158.2.65 to 193.158.2.126
Number of Needed	47
Number of Usable	64
Achieved Requirements	Yes

5. Cybersecurity

Subnetwork	255.255.255.192
Network	193.158.2.128
Broadcast	193.158.2.191
Usable Range for Ips	193.158.2.129 to 193.158.2.190
Number of Needed	36
Number of Usable	64
Achieved Requirements	Yes

6. Server for General

Subnetwork	255.255.0.0
Network	172.125.0.0
Broadcast	172.125.255.255
Needed IP Ranges Only	172.125.12.9 - 172.125.12.10
Number of Needed	2
Achieved Requirements	Yes

7. Server for Special

Subnetwork	255.255.0.0
Network	174.125.0.0
Broadcast	174.125.255.255
Needed IP Ranges Only	174.125.12.9 - 174.125.12.10
Number of Needed	2
Achieved Requirements	Yes

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1. Serials

Subnetwork	255.255.255.252
Main IP Network	10.0.0.0

2. Backbone and Data Science

Subnetwork	255.255.255.252
Main IP Network	10.0.0.0
First IP	10.0.0.1
Second IP	10.0.0.2
Broadcast	10.0.0.3

3. Backbone and AI

Subnetwork	255.255.255.252
Main IP Network	10.0.0.4
First IP	10.0.0.5
Second IP	10.0.0.6
Broadcast	10.0.0.7

4. Backbone and CS

Subnetwork	255.255.255.252
Main IP Network	10.0.0.8
First IP	10.0.0.9
Second IP	10.0.0.10
Broadcast	10.0.0.11

5. Backbone and Business

Subnetwork	255.255.255.252
Main IP Network	10.0.0.12
First IP	10.0.0.13
Second IP	10.0.0.14
Broadcast	10.0.0.15

6. Backbone and Media

Subnetwork	255.255.255.252
Main IP Network	10.0.0.16
First IP	10.0.0.17
Second IP	10.0.0.18
Broadcast	10.0.0.19

7. Backbone For General and Special

Subnetwork	255.255.255.252
Main IP Network	10.0.0.20 – 10.0.0.24
First IP	10.0.0.21 – 10.0.0.25
Second IP	10.0.0.22 – 10.0.0.26
Broadcast	10.0.0.23 – 10.0.0.27

3.Routing Steps

Routing is the process of path selection in any network.

✓ Each routing technique is applied in a unique copy of the project, to make sure each technique is working independently.

As explained in the project introduction, we used 3 types of routing techniques: -

1. OSPF (Open Shortest Path First)
   - Builds a complete map of the network topology and shares it with all routers in the same area.
     - ❖ Configuration code for the OSPF: -
       1. router ospf (process ID)
       2. network (Network IP) (Wild mask) area #
       3. network (Serial IP) (Wild mask) area #
2. EIGRP (Enhanced Interior Gateway Routing Protocol)
   - EIGRP sends partial updates to neighbors only when there is a change in the network topology.
   - EIGRP has a fast convergence time due to its partial updates and Diffusing Update Algorithm (DUAL).
     - ❖ Configuration code for the EIGRP:-
       1. router eigrp (process ID)
       2. network (Network IP) (Wild mask)
       3. network (Serial IP) (Wild mask)
3. RIP (Routing Information Protocol)
   - Is a distance-vector routing protocol that uses hop count as its metric.
   - Has a slow convergence time due to its periodic updates and count-to-infinity problem.
     - ❖ Configuration code for the RIP: -
       1. router rip (process ID)
       2. network (Network IP)
       3. network (Serial IP)

Protocol	Type	Metric	Convergence Time	Complexity
RIP	Distance-Vector	Hop count	Slow	Low
OSPF	Link-state	Multiple	Fast	High
EIGRP	Hybrid	Composite	Fast	Medium

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4.NAT Steps

There are 3 types of NAT-TING.

1. Static NAT
2. Dynamic NAT
3. PAT

Why NAT-TING?

1. Legally registered IP addresses are preserved by NAT.
2. The IP address of the device transmitting and receiving communication is concealed.
3. Removes the need for address renumbering as the network changes.

1. Static NAT

- Using static NAT, internal private IP addresses can be translated into static public IP addresses, allowing for reliable one-to-one mapping of incoming and outgoing traffic.

Static NAT code:

```
ip nat inside source static <local_ip> <global_ip>
```

2. Dynamic NAT

- Several private IP addresses are translated to a pool of public IP addresses in this kind of NAT. It is used when we are aware of the total number of fixed users wishing to connect to the Internet at any moment.

Dynamic NAT code:

```
ip nat pool POOL_TEST <Pool beginning> <Pool ending> netmask <Subnet Mask>

ip nat inside source list <access_list> <interface>
```

3. PAT (Port Address Translation)

- In PAT, Private IP addresses are translated into the public IP address via Port numbers.
- PAT also uses IPv4 address but with a port number.

PAT code:

```
access-list <#> permit <ip address> <wild mask>

ip nat inside source list <access_list> <interface> overload
```

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5.Security Steps

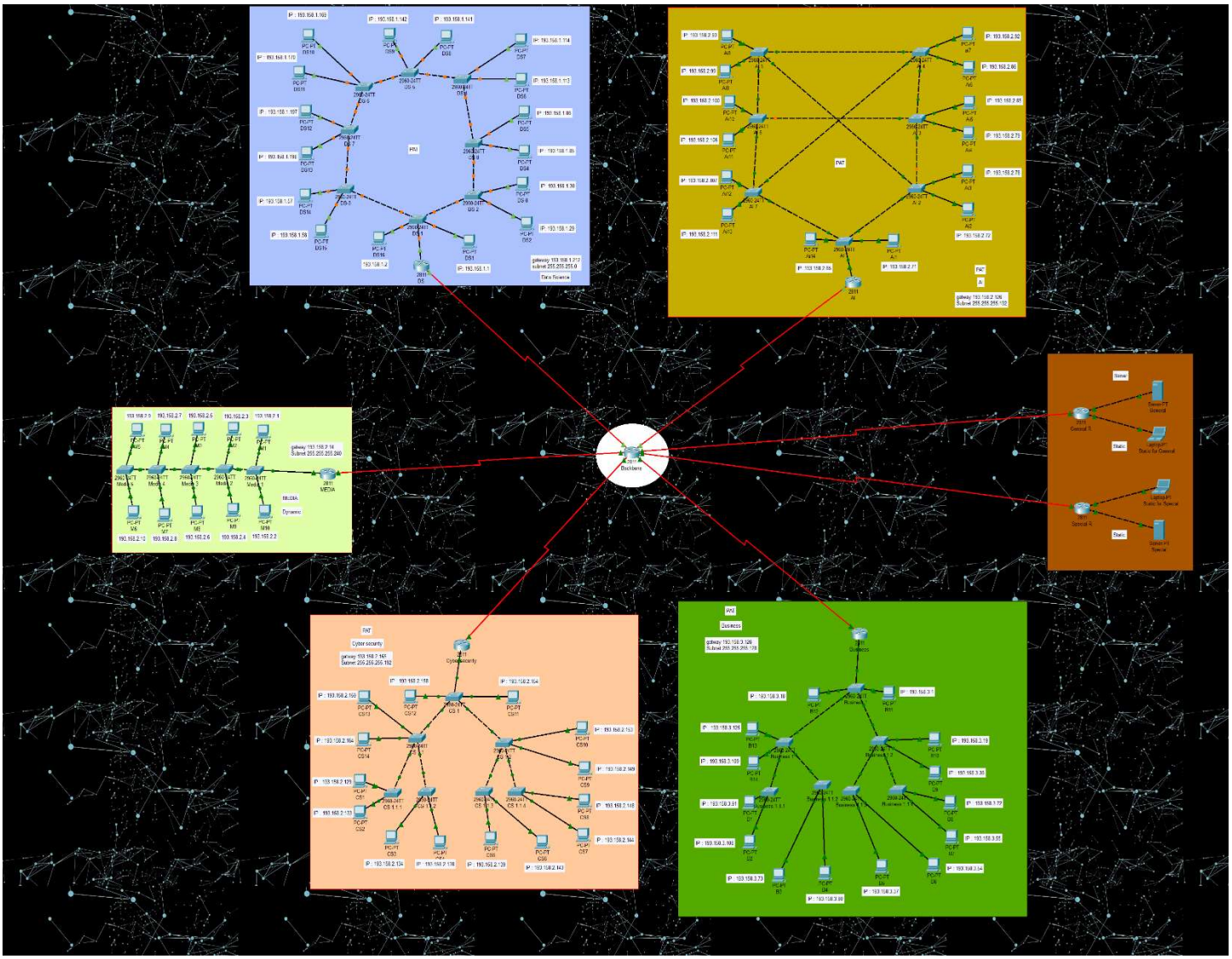
After performing all these tasks, we need to secure our server that there's no device in other department could access server if this server not required to response for this device.

So, we need to perform something called Access-List as it can differentiate IP traffic.

Syntax of our Access-list:

Router(config)# access-list "ID Process" Deny "Required to Deny" "Netmask"
Router(config)# access-list "ID Process" Permit Any
Router(config)# int needed Serial.
Router(config-if)# ip access-group "Same ID Process"

Last Thing, Main Final Topology!



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6.Additional Points

Work Done :

1. **NTP (Network Time Protocol) :-**
   - A protocol that allows the synchronization of system clocks.
   - Server→NTP→Adjust time.
2. **DNS (Domain Name System) :-**
   - Access the IP through domain names.
   - Changes internal IP into domain name
3. **FTP (File Transfer Protocol) :-**
   - Used for the transfer of files from one host to another over a TCP-based network.
   - Server→FTP→Enable authentication→Apply username, pass and permissions.
4. **SSH (Secure Socket Shell)**
   - Gives users, particularly system administrators, a secure way to access a computer over an unsecured network.
     - ❖ Configuration code for the SSH: -
       1. Set the IP domain name to "SSH1" and hostname to "Department name."
       2. Initiated RSA key generation with a modulus of 1024 bits.
       3. Configured lines 0 to 15 for SSH access with local login and set the SSH protocol to v2.
       4. And finally added a local user with full privileges.
5. **Telnet(Teletype Network)**
   - Provides access to virtual terminals of remote systems on local area networks or the Internet.
     - ❖ Configuration code for the Telnet : -
       1. Assign the Router IP address alongside it's subnet mask to internal interface.
       2. Configured lines 0 to 5 for Telnet access, set login with a specified password.
6. **Password**
   - We applied passwords for each router to increase the security.
7. **Web server**
   - We've built up a simple website simulation for each of our departments (General, Special).