

Networking Sub-capstone using Cisco PT - wsnamu

Scenario: Network setup for XYZ Corp

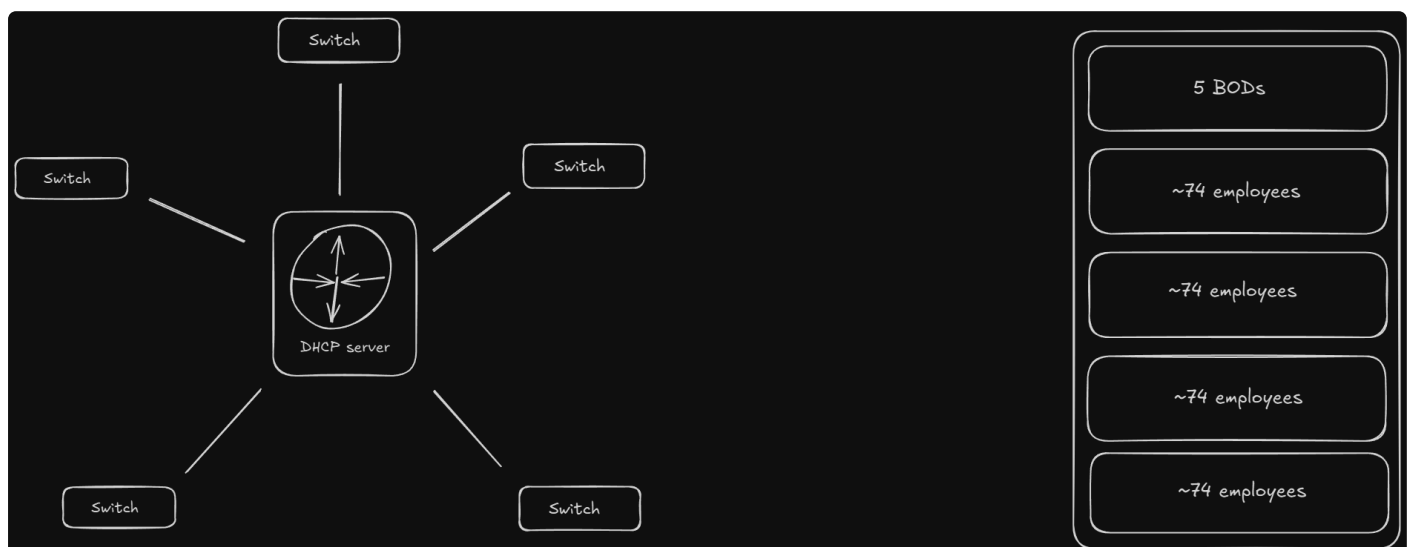
XYZ Corp has hired you to design a simple yet efficient network infrastructure for their office building. The building consists of five floors, each requiring a separate subnet for efficient traffic management. The specific requirements are as follows:

Requirements:

- Each floor (except the top floor) has approximately 74 employees who need network access.
- The top floor is reserved for the Board of Directors (BOD) and has only 5 members.
- Each floor must have its own subnet.
- A router will act as the central DHCP server, assigning IP addresses dynamically.
- A switch will be used to connect devices on each floor.
- Use a Class C private IP address (192.168.X.0/24) and subnet accordingly.

Network IP Plan:

Since we need a proper subnet for the network



The above is the initial concept of the network

For the normal floors the followings were the subnet calculations:
We needed 74 employees which is fulfilled by 2^7 Subnets

So the reqd. subnet is as follows:

IP Address:	192.168.0.0
Network Address:	192.168.0.0
Usable Host IP Range:	192.168.0.1 - 192.168.0.126
Broadcast Address:	192.168.0.127
Total Number of Hosts:	128
Number of Usable Hosts:	126
Subnet Mask:	255.255.255.128
Wildcard Mask:	0.0.0.127
Binary Subnet Mask:	11111111.11111111.11111111.10000000
IP Class:	C
CIDR Notation:	/25
IP Type:	Private
Short:	192.168.0.0 /25
Binary ID:	11000000101010000000000000000000
Integer ID:	3232235520
Hex ID:	0xc0a80000
in-addr.arpa:	0.0.168.192.in-addr.arpa
IPv4 Mapped Address:	::ffff:c0a8.00
6to4 Prefix:	2002:c0a8.00::/48

All 2 of the Possible /25 Networks for 192.168.0.*

Network Address	Usable Host Range	Broadcast Address:
192.168.0.0	192.168.0.1 - 192.168.0.126	192.168.0.127
192.168.0.128	192.168.0.129 - 192.168.0.254	192.168.0.255

The above is just a general calculation for the normal floors and not constrained to all of them

And for the BOD floor:

So, as per requirement, the Subnet is 2^3 which is sufficient

IP Address:	192.168.0.0
Network Address:	192.168.0.0
Usable Host IP Range:	192.168.0.1 - 192.168.0.6
Broadcast Address:	192.168.0.7
Total Number of Hosts:	8
Number of Usable Hosts:	6
Subnet Mask:	255.255.255.248
Wildcard Mask:	0.0.0.7
Binary Subnet Mask:	11111111.11111111.11111111.11111000
IP Class:	C
CIDR Notation:	/29
IP Type:	Private
Short:	192.168.0.0 /29
Binary ID:	11000000101010000000000000000000
Integer ID:	3232235520
Hex ID:	0xc0a80000
in-addr.arpa:	0.0.168.192.in-addr.arpa
IPv4 Mapped Address:	::ffff:c0a8.00
6to4 Prefix:	2002:c0a8.00::/48

Part 1: Network Design in Cisco Packet Tracer

1. Setup the Devices:

- Add a router to act as the DHCP server.
- Add five switches, one for each floor.
- Connect end devices (PCs) to each switch.

2. Configure the Router:

- Assign IP addresses to router interfaces.
- Enable DHCP on the router and configure separate DHCP pools for each subnet.
- Ensure correct subnet mask and gateway assignments.

3. Configure the Switches:

- Assign management IPs to the switches (*optional*).
- Ensure proper connectivity between the router and switches.

4. Test the Network:

- Verify that each device receives the correct IP from the DHCP pool.
- Ensure inter-floor communication is possible if required.

Part 2: Documentation Submission

- Document your setup process in detail, including:
 - Device configurations (router, switches, PCs).
 - IP addressing and subnet calculations.
 - Screenshots of successful DHCP assignment.
- Write the documentation using one of the following methods:
 - MS Word and export as PDF.
 - Obsidian or Notion and export as PDF.
 - Publish on Medium.com.
 - Personal blog/writeup website (acceptable).

Part 3: Submission Guidelines

- Submit your Packet Tracer (.pkt) file.
- Submit a PDF report covering your network design and configurations.
- Ensure all configurations are functional before submission.

Your submission will be evaluated based on the following:

- Correctness of the Network Setup (30%)
 - Proper Subnetting and IP Allocation (20%)
 - Successful DHCP Configuration (20%)
 - Documentation Quality (20%)
 - Presentation and Clarity (10%)
-

Solution

Part 1: Network Design in Cisco Packet Tracer

1. Setup the Devices:

Created a empty router with empty slots for inserting modular components which is more customizable to be used as a central DHCP

server

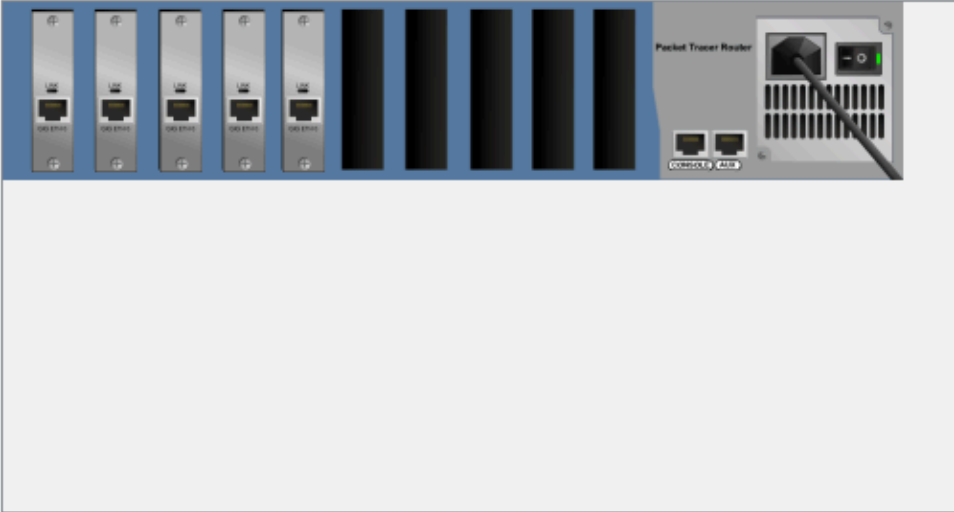
Physical Config CLI Attributes

MODULES

- PT-ROUTER-NM-1AM
- PT-ROUTER-NM-1CE
- PT-ROUTER-NM-1CFE
- PT-ROUTER-NM-1CGE
- PT-ROUTER-NM-1EFE
- PT-ROUTER-NM-1FGE
- PT-ROUTER-NM-1S
- PT-ROUTER-NM-1SS
- PT-ROUTER-NM-COVER

Physical Device View

Zoom In Original Size Zoom Out



Customize Icon in Physical View

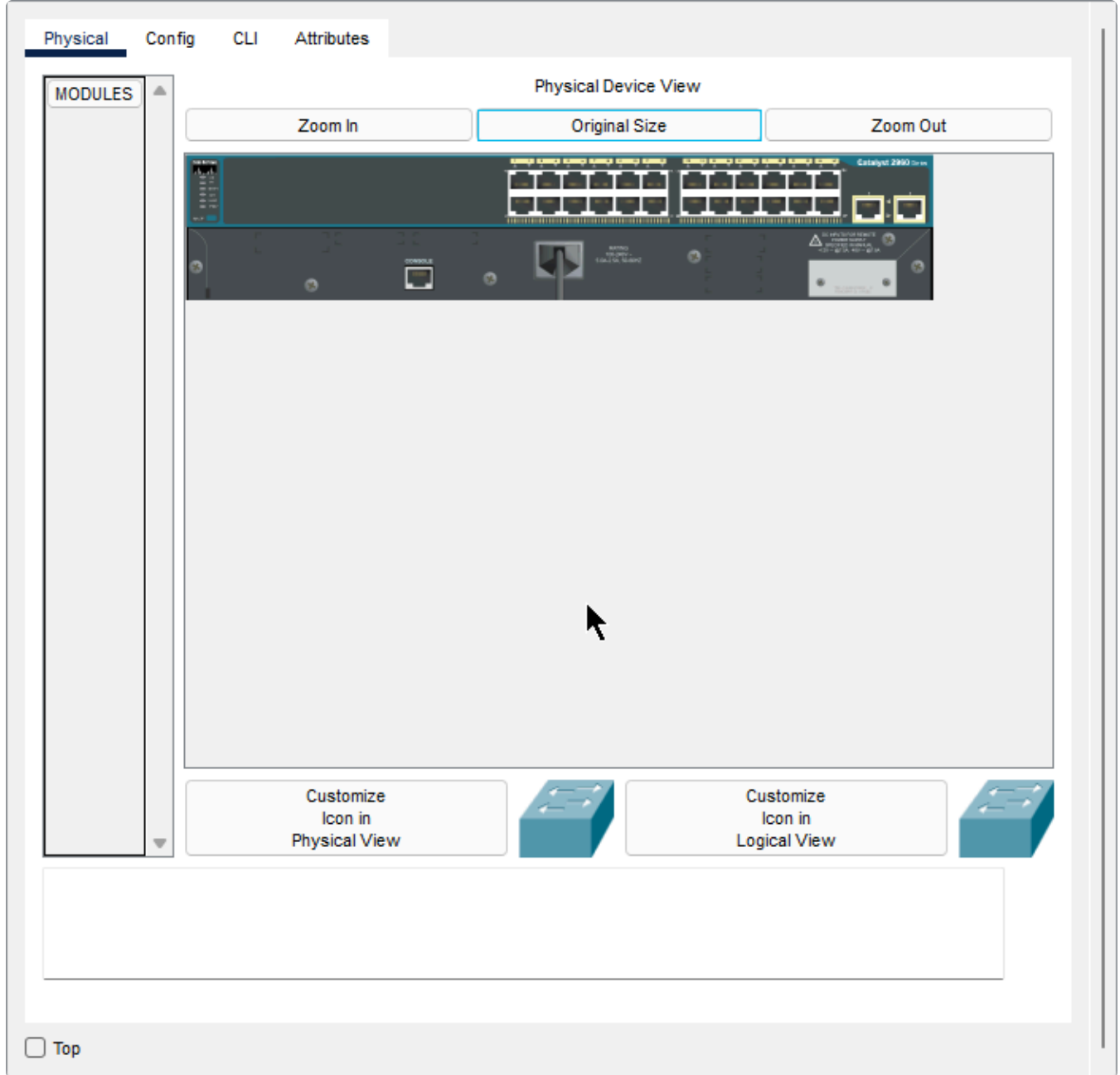
Customize Icon in Logical View

The single-port Cisco Gigabit Ethernet Network Module (part number PT-ROUTER-NM-1CGE) provides Gigabit Ethernet copper connectivity for access routers. The module is supported by the Cisco 2691, Cisco 3660, Cisco 3725, and Cisco 3745 series routers. This network module has one gigabit interface converter (GBIC) slot to carry any standard copper or optical Cisco GBIC.

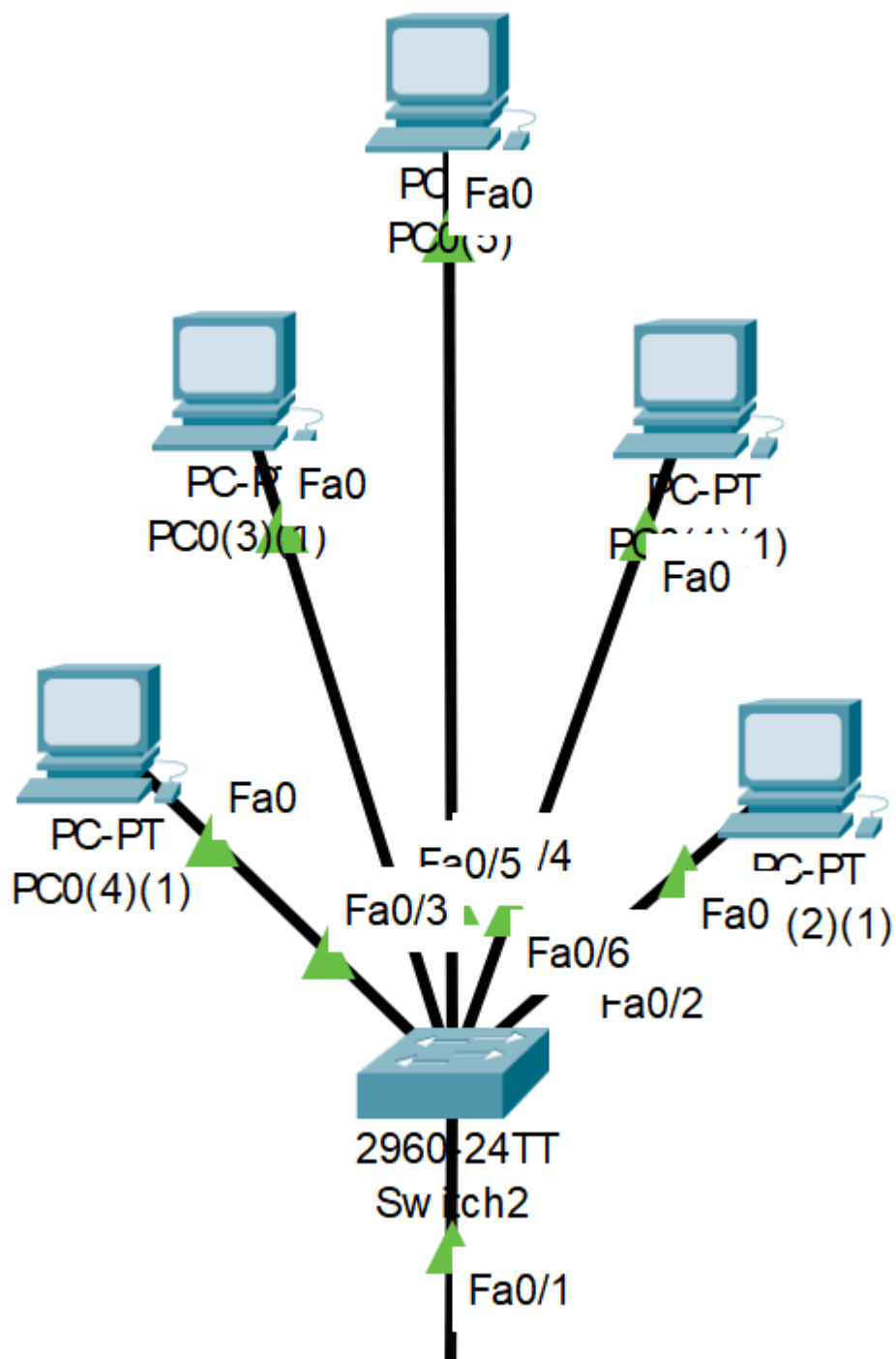
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Also the module inserted were PT-Router-NM-1-CGE x5 which were my go-to modules

Then I created 5 switches 2960-24-TT x5 switches for each floor just as I planned



Then I connected the end devices to each switch so that data can be transferred



2. Configure the Router:

Then I assigned IP addresses to each router interfaces using the

following commands

PhysicalConfigCLIAttributes

IOS Command Line Interface

```
Router>
Router>
Router>
Router>
Router>
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int gig5/0
Router(config-if)#ip address 192.168.0.1 255.255.255.128
Router(config-if)#no sh
Router(config-if)#exit
Router(config)#
Router(config)#int gig6/0
Router(config-if)#ip address 192.168.1.1 255.255.255.128
Router(config-if)#no sh
Router(config-if)#
Router(config-if)#int gig7/0
Router(config-if)#ip address 192.168.2.1 255.255.255.128
Router(config-if)#no sh
Router(config-if)#
Router(config-if)#int gig8/0
Router(config-if)#ip address 192.168.3.1 255.255.255.128
Router(config-if)#no sh
Router(config-if)#
Router(config-if)#int gig9/0
Router(config-if)#ip address 192.168.4.1 255.255.255.248
Router(config-if)#no sh
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
Router#
Router#
```

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Then I enabled DHCP on the router and configured separate DHCP pool for each subnet.

IOS Command Line Interface

```
Router#
Router#
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip dhcp excluded-address 192.168.0.1
Router(config)#ip dhcp pool floor1
Router(dhcp-config)#network 192.168.0.0 255.255.255.128
Router(dhcp-config)#default-router 192.168.0.1
Router(dhcp-config)#exit
Router(config)#
Router(config)#ip dhcp excluded-address 192.168.1.1
Router(config)#ip dhcp pool floor2
Router(dhcp-config)#network 192.168.1.0 255.255.255.128
Router(dhcp-config)#default-router 192.168.1.1
Router(dhcp-config)#exit
Router(config)#
Router(config)#ip dhcp excluded-address 192.168.2.1
Router(config)#ip dhcp pool floor3
Router(dhcp-config)#network 192.168.2.0 255.255.255.128
Router(dhcp-config)#default-router 192.168.2.1
Router(dhcp-config)#exit
Router(config)#
Router(config)#ip dhcp excluded-address 192.168.3.1
Router(config)#ip dhcp pool floor4
Router(dhcp-config)#network 192.168.3.0 255.255.255.128
Router(dhcp-config)#default-router 192.168.3.1
Router(dhcp-config)#exit
Router(config)#
Router(config)#ip dhcp excluded-address 192.168.4.1
Router(config)#ip dhcp pool floor5
Router(dhcp-config)#network 192.168.4.0 255.255.255.248
Router(dhcp-config)#default-router 192.168.4.1
Router(dhcp-config)#exit
Router(config)#
Router(config)#
Router(config)#
```

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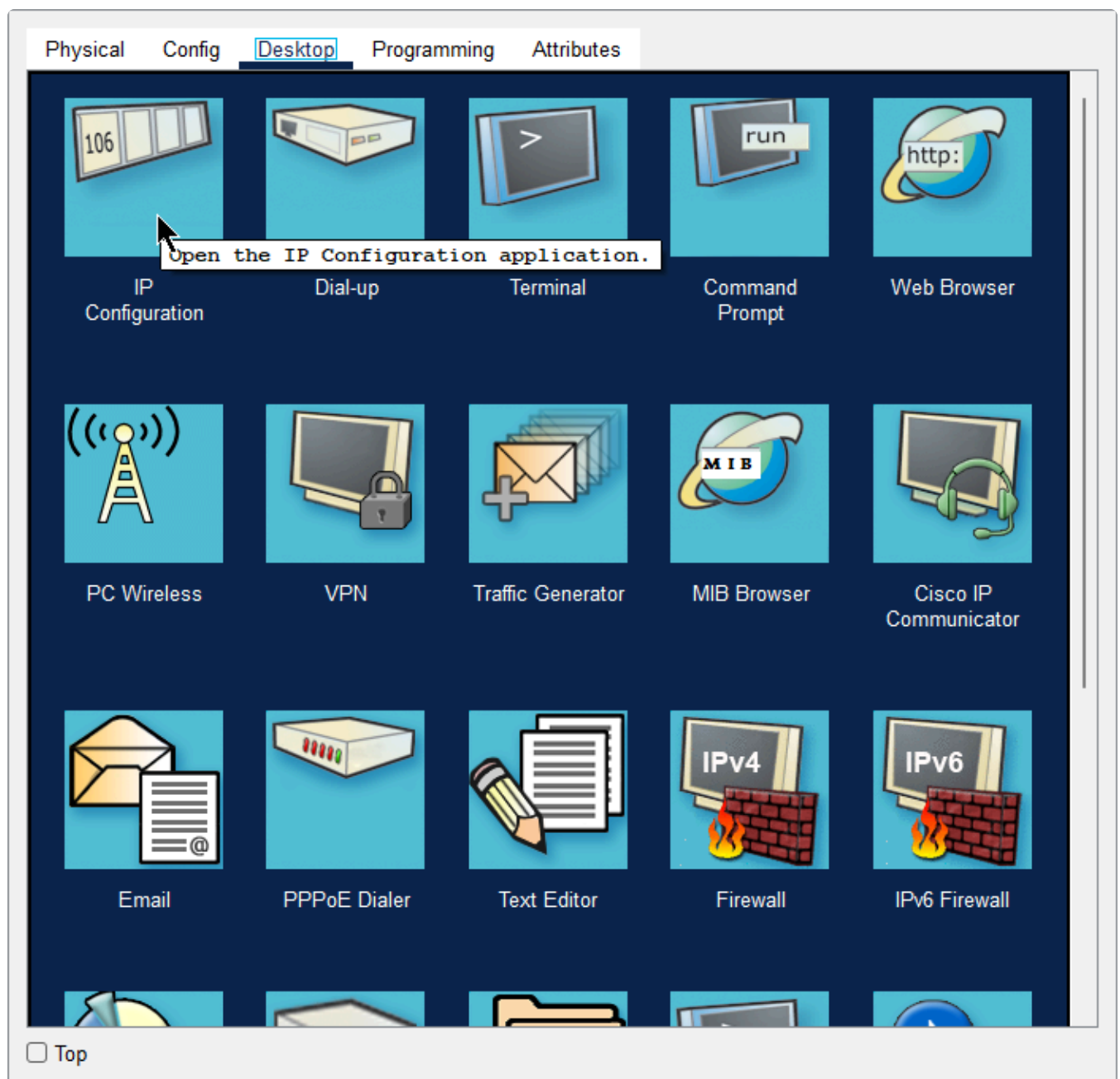
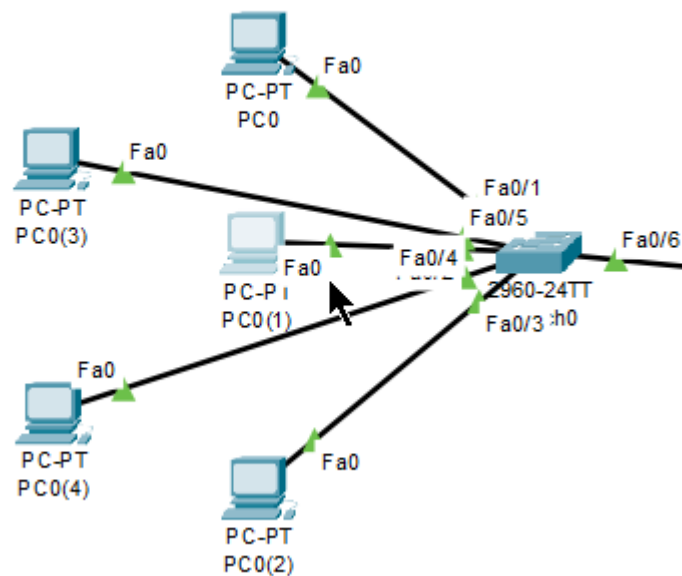
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We also ensured correct subnet mask and gateway for each floor as we had already calculated beforehand

3. Configure the Switches:

First of all Config the end-devices

Process is fairly simple



IP Configuration

X

Interface FastEthernet0

IP Configuration

☒ DHCP

☐ Static

Requesting IP Address

IPv4 Address

Subnet Mask

Default Gateway

DNS Server

IPv6 Configuration

☐ Automatic

☒ Static

IPv6 Address

Link Local Address

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication

MD5

Username

Password

☐ Top

PC0(1)

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☒ DHCP ☐ Static DHCP request successful.

IPv4 Address 192.168.4.3

Subnet Mask 255.255.255.248

Default Gateway 192.168.4.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::204:9AFF:FE24:6781

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication MD5

Username

Password

☐ Top

After that we check DHCP binding and also interface values

IOS Command Line Interface

```
Router#show ip int br
Interface                IP-Address      OK? Method Status      Protocol
GigabitEthernet5/0       192.168.0.1     YES manual up          up
GigabitEthernet6/0       192.168.1.1     YES manual up          up
GigabitEthernet7/0       192.168.2.1     YES manual up          up
GigabitEthernet8/0       192.168.3.1     YES manual up          up
GigabitEthernet9/0       192.168.4.1     YES manual up          up
Router#sh ip dhcp binding
IP address                Client-ID/      Lease expiration   Type
                          Hardware address
192.168.0.3                0001.C78C.2CB1   --                 Automatic
192.168.0.5                0004.9A32.A670   --                 Automatic
192.168.0.6                000B.BE2B.D4D3   --                 Automatic
192.168.0.4                0001.96DC.8B05   --                 Automatic
192.168.0.2                0002.1674.547E   --                 Automatic
192.168.1.3                000C.85A4.A39E   --                 Automatic
192.168.1.5                0007.EC16.9802   --                 Automatic
192.168.1.2                0002.17CB.EBC0   --                 Automatic
192.168.1.6                000A.F343.3020   --                 Automatic
192.168.1.4                0090.2116.D920   --                 Automatic
192.168.2.6                00E0.B0B9.6B48   --                 Automatic
192.168.2.3                0000.0CA4.0D4E   --                 Automatic
192.168.2.4                0001.4337.8A12   --                 Automatic
192.168.2.5                0000.0CBC.82D1   --                 Automatic
192.168.2.2                0060.2F44.A937   --                 Automatic
192.168.3.5                00E0.F943.09D5   --                 Automatic
192.168.3.4                000B.BE14.B7D9   --                 Automatic
192.168.3.6                000A.4116.02D4   --                 Automatic
192.168.3.3                00D0.589C.56CE   --                 Automatic
192.168.3.2                0090.219D.E718   --                 Automatic
192.168.4.3                0004.9A24.6781   --                 Automatic
192.168.4.2                0004.9ADD.DC28   --                 Automatic
192.168.4.4                000A.41BA.55C1   --                 Automatic
192.168.4.5                00E0.F9A0.ABAE   --                 Automatic
192.168.4.6                0003.E4E4.6DD3   --                 Automatic
Router#
```

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We ensured that the routers and the switches were properly configured and addresses were given via DHCP-server as expected

```
Router#  
Router#sh ip dhcp pool
```

```
Pool floor1 :  
Utilization mark (high/low)      : 100 / 0  
Subnet size (first/next)         : 0 / 0  
Total addresses                   : 126  
Leased addresses                  : 5  
Excluded addresses                : 5  
Pending event                     : none  
  
1 subnet is currently in the pool  
Current index      IP address range      Leased/Excluded/Total  
192.168.0.1        192.168.0.1 - 192.168.0.126  5 / 5 / 126
```

```
Pool floor2 :  
Utilization mark (high/low)      : 100 / 0  
Subnet size (first/next)         : 0 / 0  
Total addresses                   : 126  
Leased addresses                  : 5  
Excluded addresses                : 5  
Pending event                     : none  
  
1 subnet is currently in the pool  
Current index      IP address range      Leased/Excluded/Total  
192.168.1.1        192.168.1.1 - 192.168.1.126  5 / 5 / 126
```

```
Pool floor3 :  
Utilization mark (high/low)      : 100 / 0  
Subnet size (first/next)         : 0 / 0  
Total addresses                   : 126  
Leased addresses                  : 5  
Excluded addresses                : 5  
Pending event                     : none  
  
1 subnet is currently in the pool  
Current index      IP address range      Leased/Excluded/Total  
192.168.2.1        192.168.2.1 - 192.168.2.126  5 / 5 / 126
```

```
Pool floor4 :  
Utilization mark (high/low)      : 100 / 0  
Subnet size (first/next)         : 0 / 0  
Total addresses                   : 126  
Leased addresses                  : 5  
Excluded addresses                : 5  
Pending event                     : none  
  
1 subnet is currently in the pool  
Current index      IP address range      Leased/Excluded/Total  
192.168.3.1        192.168.3.1 - 192.168.3.126  5 / 5 / 126
```

```
Pool floor5 :  
Utilization mark (high/low)      : 100 / 0  
Subnet size (first/next)         : 0 / 0  
Total addresses                   : 6  
Leased addresses                  : 5  
Excluded addresses                : 5  
Pending event                     : none  
  
1 subnet is currently in the pool  
Current index      IP address range      Leased/Excluded/Total  
192.168.4.1        192.168.4.1 - 192.168.4.6    5 / 5 / 6
```

```
Router#  
Router#
```

4. Test the Network:

After ensuring proper config, we proceeded to ping devices for further exam.

IOS Command Line Interface

```
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#ping 192.168.0.4

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.4, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/0/0 ms

Router#ping 192.168.0.4

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/1/8 ms

Router#ping 192.168.0.4

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms

Router#ping 192.168.0.4

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms

Router#
```

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Pinging from router to a device on floor1 with 192.168.0.4

Another observation was that on 1st ping a packet is lost most likely due to the fact that by time of the ARP process is completed, the first ping packet has already timed out

```
Router#
Router#ping 192.168.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/2/6 ms

Router#ping 192.168.1.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.3, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/0/0 ms

Router#ping 192.168.1.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/1 ms
```

Some random pings to default router and another device to check again


```

Cisco Packet Tracer PC Command Line 1.0
C:\>
C:\>ipconfig

FastEthernet0 Connection:(default port)

    Connection-specific DNS Suffix...:
    Link-local IPv6 Address.....: FE80::290:21FF:FE16:D920
    IPv6 Address.....: ::
    IPv4 Address.....: 192.168.1.4
    Subnet Mask.....: 255.255.255.128
    Default Gateway.....: ::
                        192.168.1.1

Bluetooth Connection:

    Connection-specific DNS Suffix...:
    Link-local IPv6 Address.....: ::
    IPv6 Address.....: ::
    IPv4 Address.....: 0.0.0.0
    Subnet Mask.....: 0.0.0.0
    Default Gateway.....: ::
                        0.0.0.0

C:\>
C:\>ping 192.168.0.2

Pinging 192.168.0.2 with 32 bytes of data:

Request timed out.
Reply from 192.168.0.2: bytes=32 time<lms TTL=127
Reply from 192.168.0.2: bytes=32 time<lms TTL=127
Reply from 192.168.0.2: bytes=32 time<lms TTL=127

Ping statistics for 192.168.0.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.0.2

Pinging 192.168.0.2 with 32 bytes of data:

Reply from 192.168.0.2: bytes=32 time<lms TTL=127
Reply from 192.168.0.2: bytes=32 time<lms TTL=127
Reply from 192.168.0.2: bytes=32 time<lms TTL=127
Reply from 192.168.0.2: bytes=32 time<lms TTL=127

Ping statistics for 192.168.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.4.1

Pinging 192.168.4.1 with 32 bytes of data:

Reply from 192.168.4.1: bytes=32 time<lms TTL=255
Reply from 192.168.4.1: bytes=32 time<lms TTL=255
Reply from 192.168.4.1: bytes=32 time<lms TTL=255
Reply from 192.168.4.1: bytes=32 time<lms TTL=255

Ping statistics for 192.168.4.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>

```

Ensuring that inter-floor comms is possible
Same case as above

Final Network topology



Conclusion

The network for XYZ Corp was set up smoothly, ensuring all floors could communicate without issues. With subnetting and a router handling DHCP, devices got their IP addresses automatically. Testing in Cisco Packet Tracer showed everything was working, with successful connections between floors.

This setup keeps things simple, efficient, and ready for future growth.

Thanks for reading!

-whoisnamu