Networking Sub-capstone using Cisco PT - wsnamu

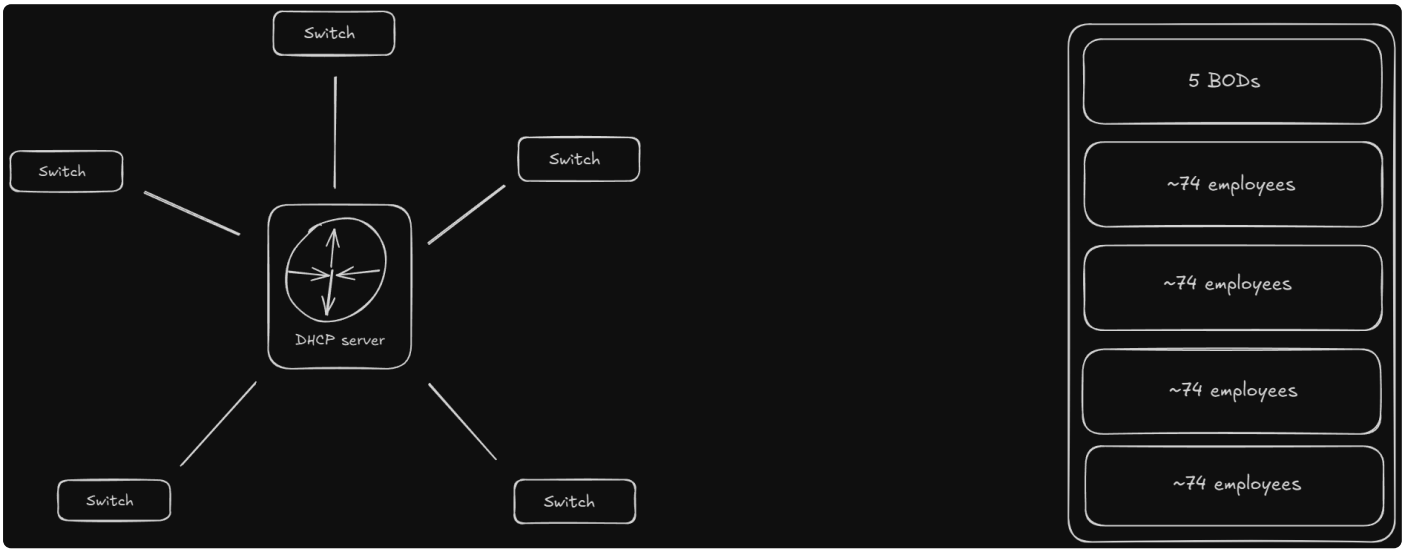
Scenario: Network setup for XYZ Corp

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:

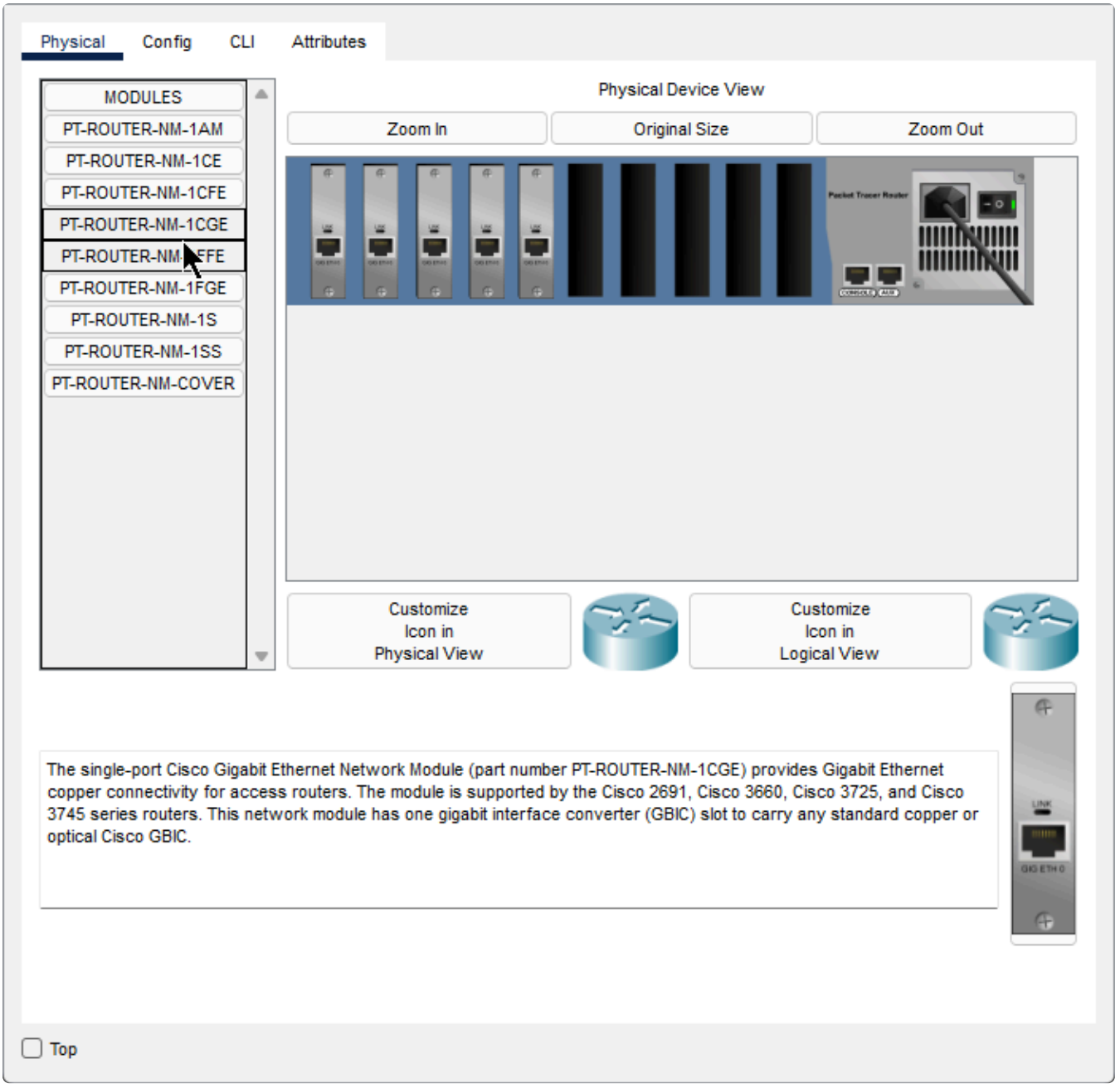
- **Correctness of the Network Setup** (30%)
- **Proper Subnetting and IP Allocation** (20%)
- **Successful DHCP Configuration** (20%)
- **Documentation Quality** (20%)
- **Presentation and Clarity** (10%)

Solution

Part 1: Network Design in Cisco Packet Tracer

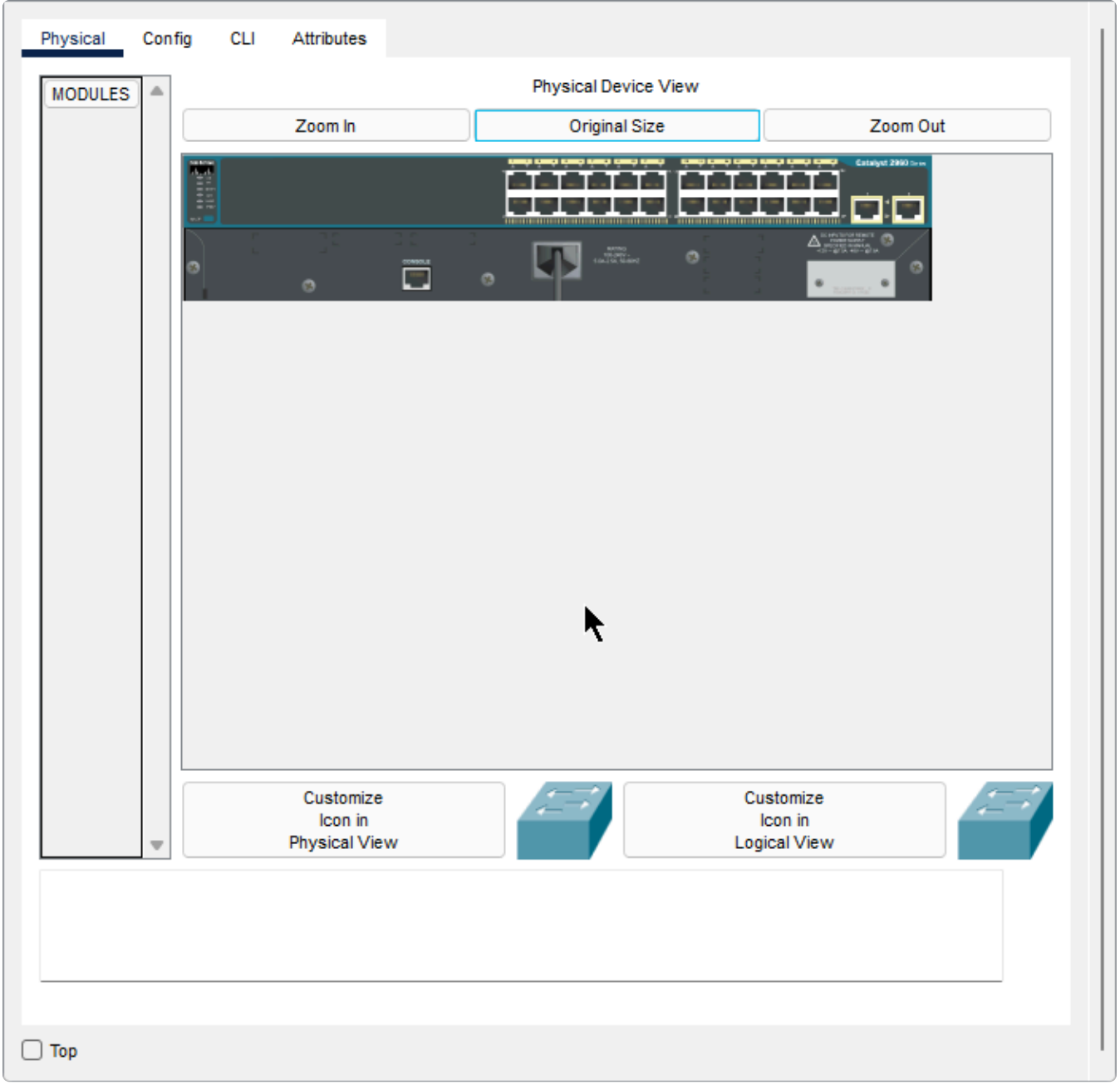
1. **Setup the Devices:**
   Created a empty router with empty slots for inserting modular components which is more customizable to be used as a central DHCP

server

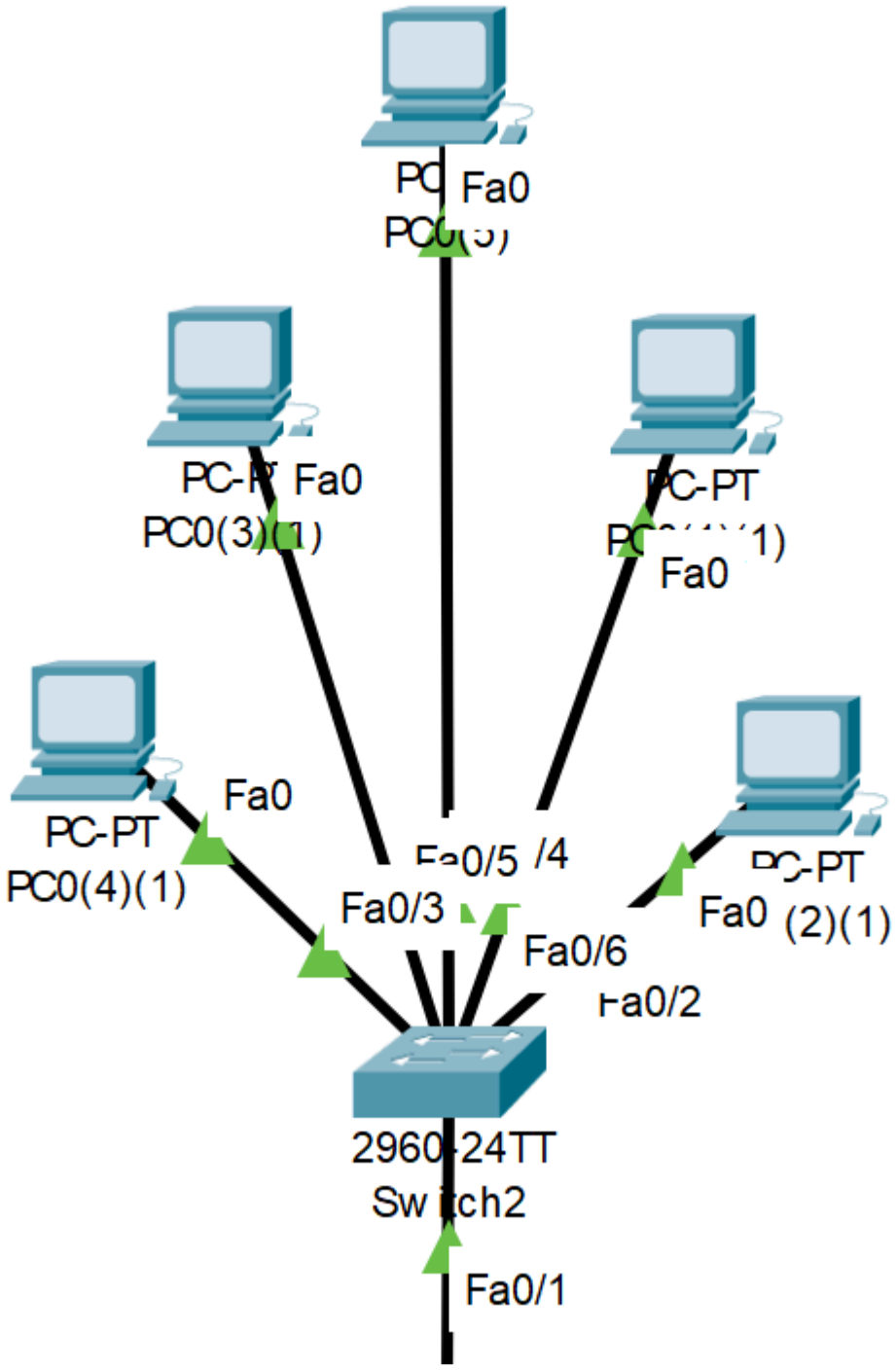


Also the module inserted were `PT-Router-NM-1-CGE` x5 which were my go-to modules

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

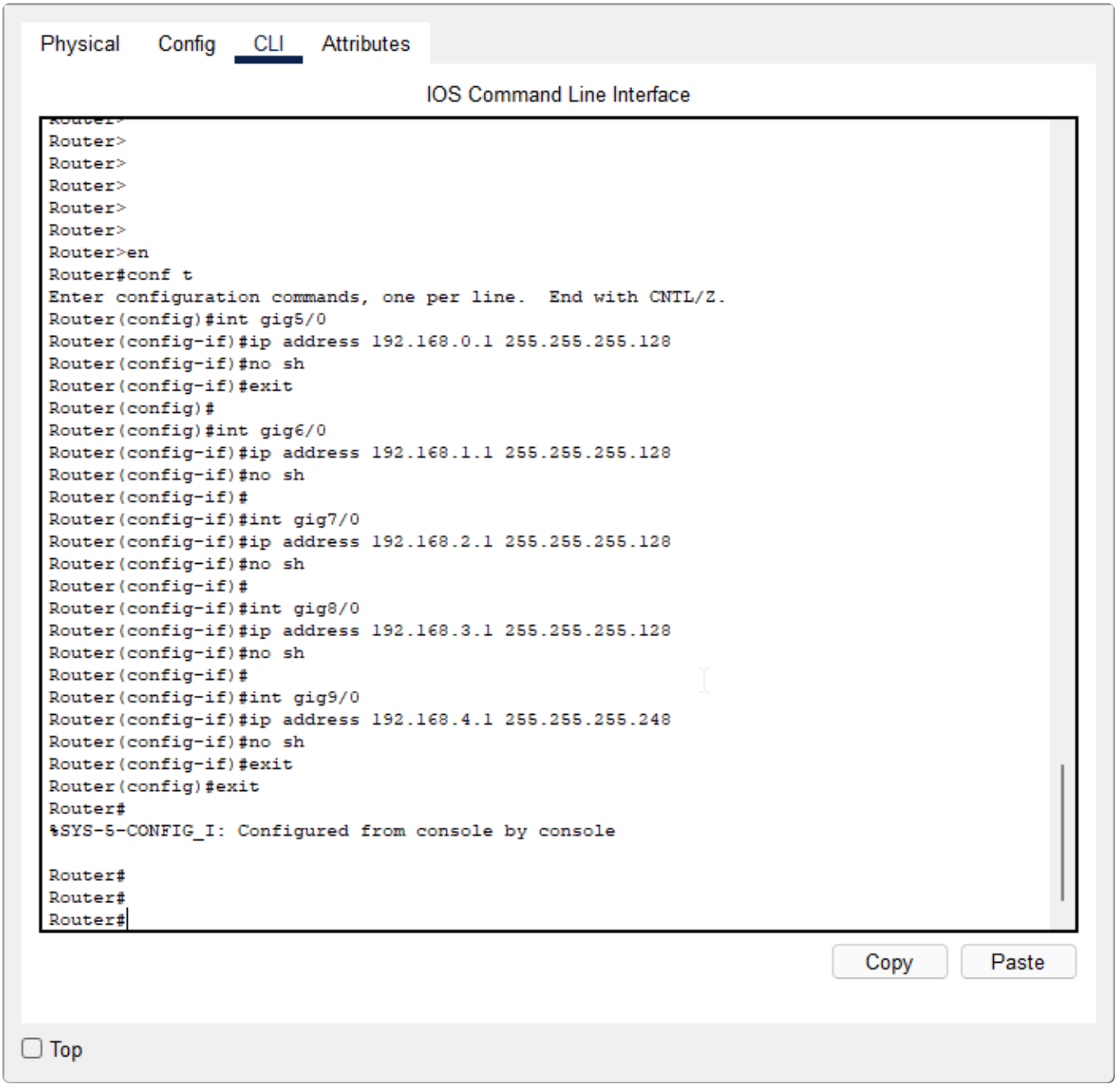


Then I connected the end devices to each switch so that data can be transferred

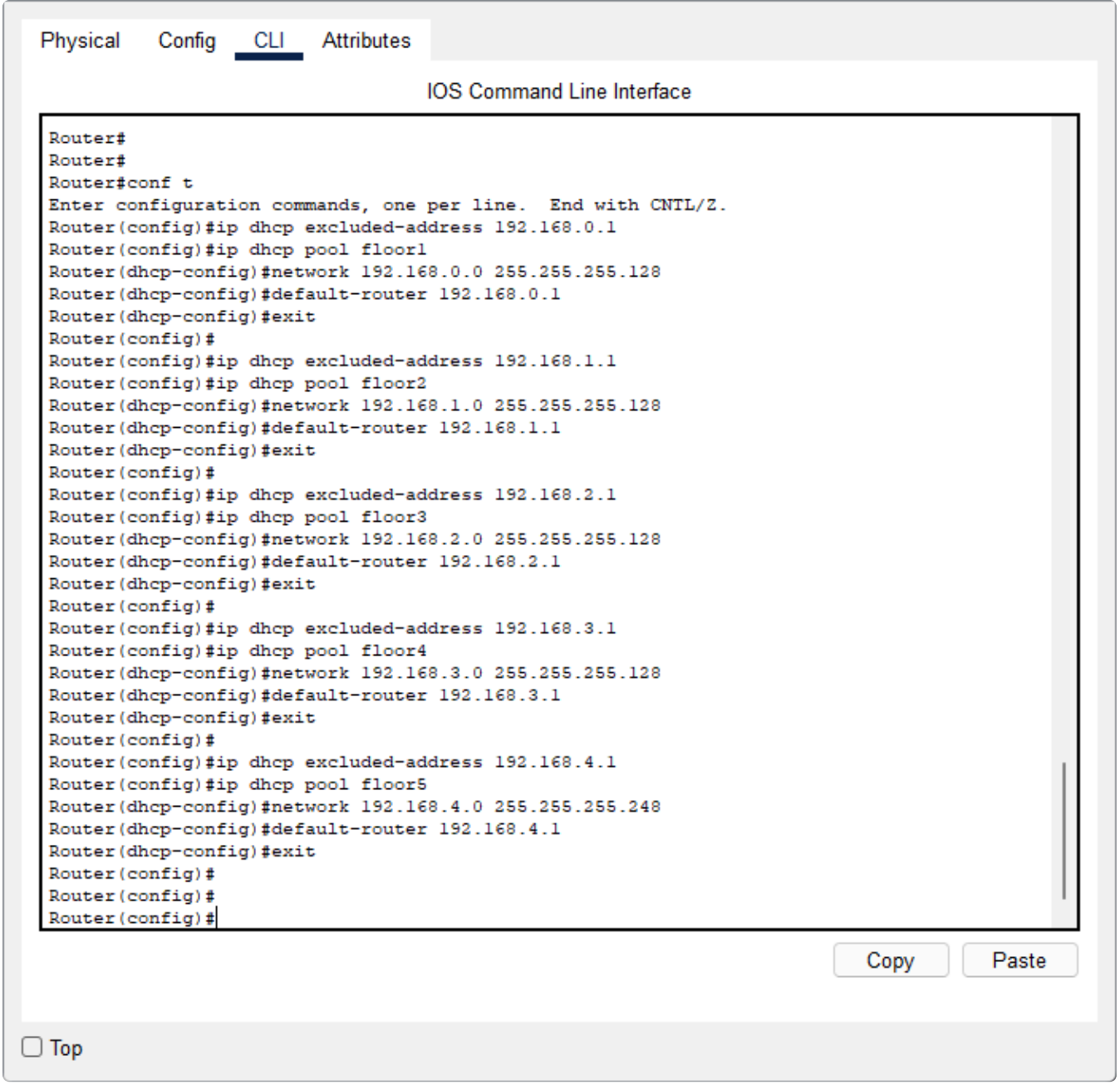


2. **Configure the Router:**
   Then I assigned IP addresses to each router interfaces using the

following commands



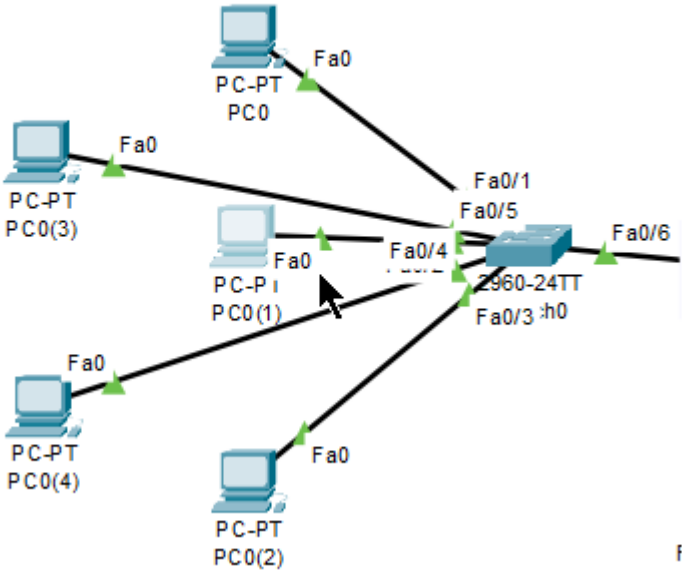
Then I enabled DHCP on the router and configured seperate DHCP pool for each subnet.

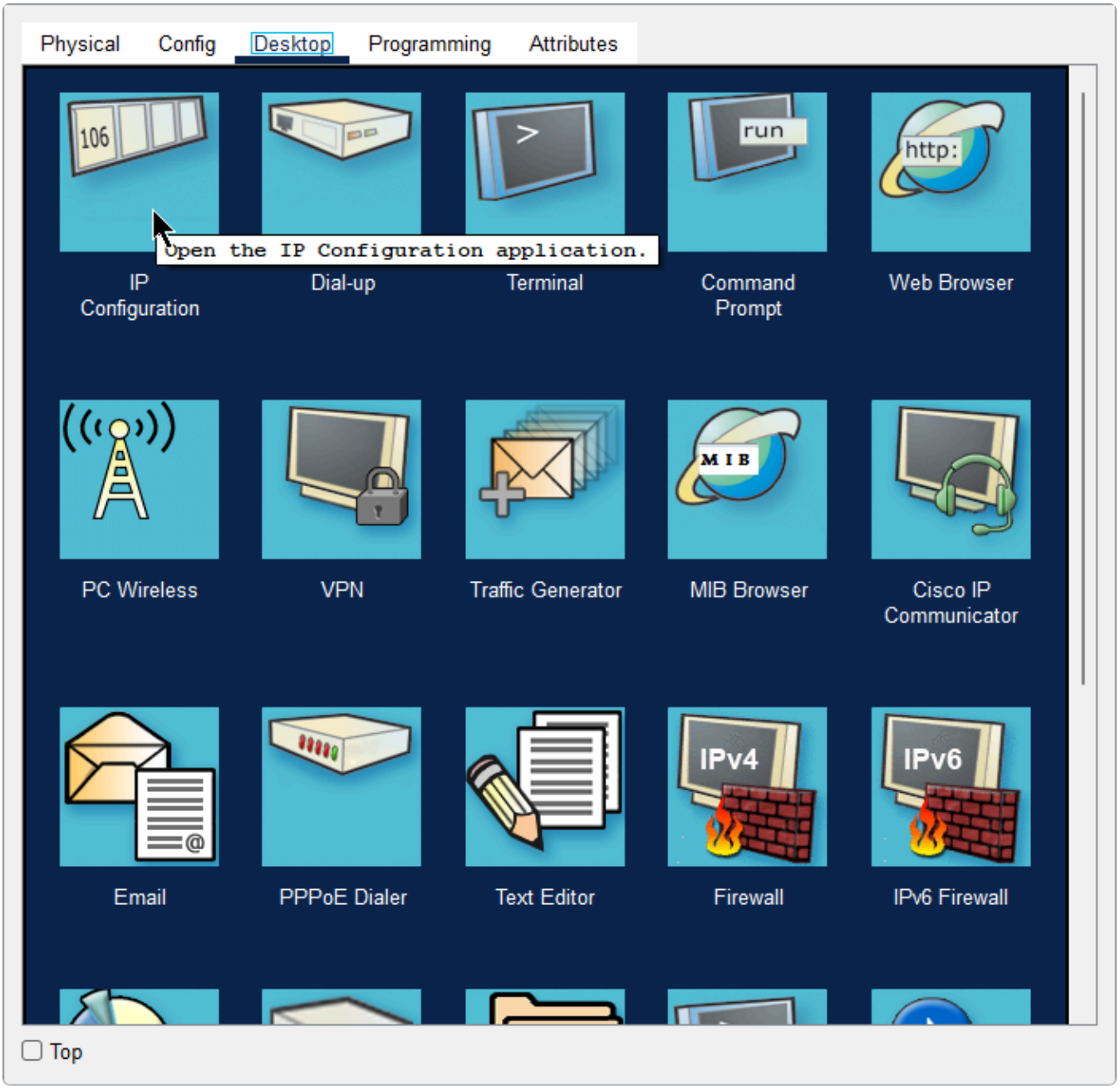


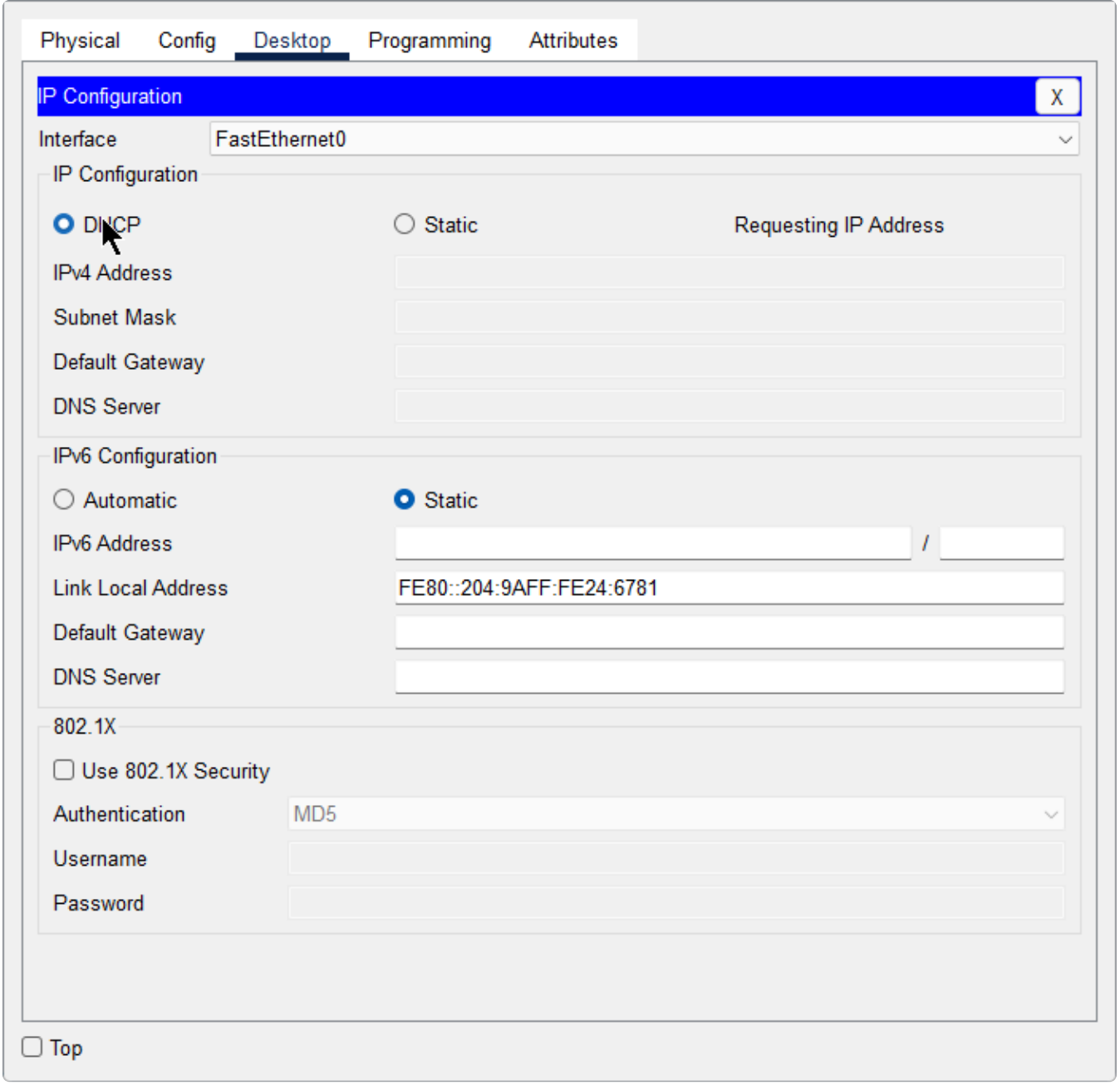
We also ensured correct subnet mask and gateway for each floor as we had already calculated beforehand

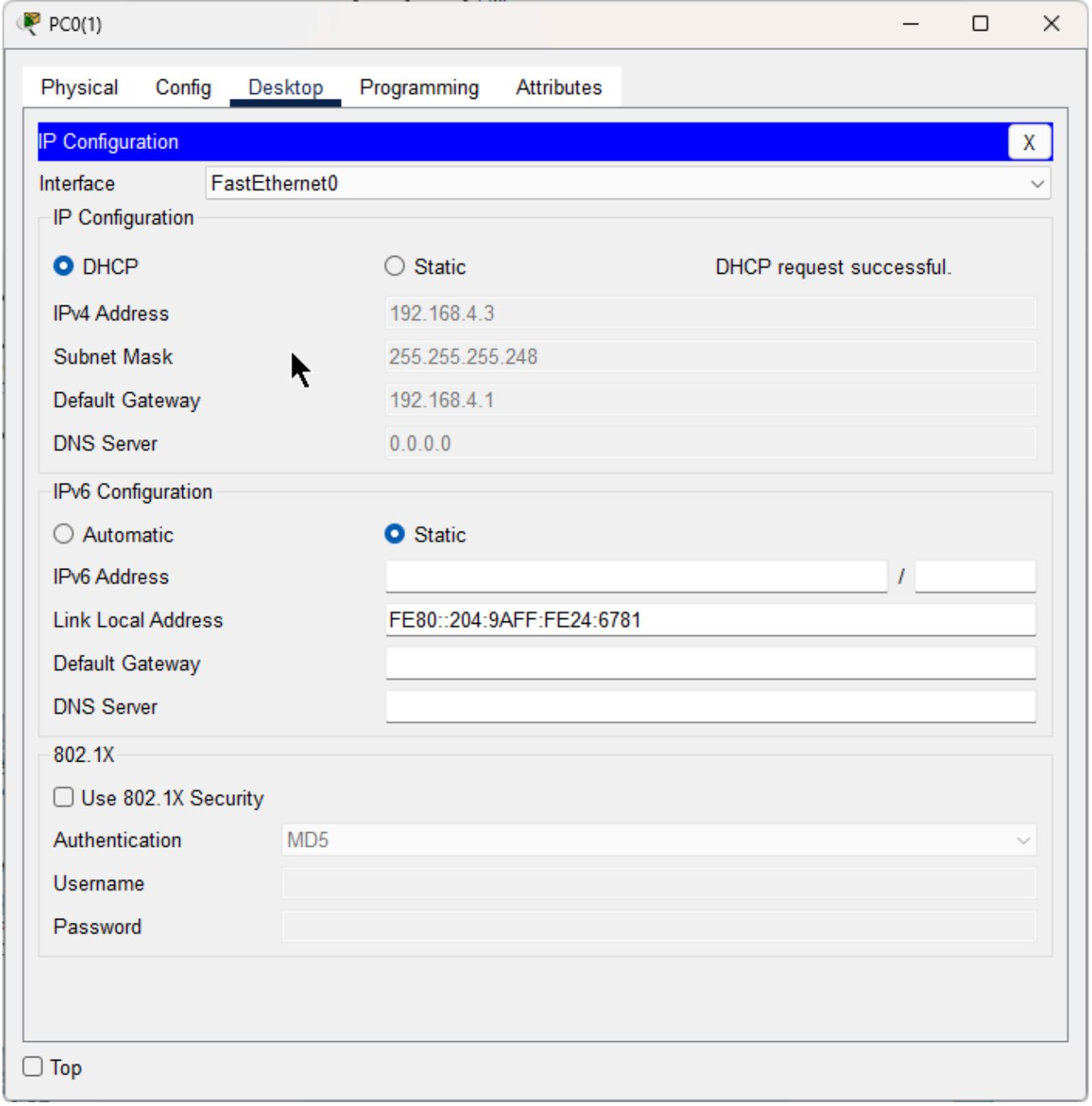
3. **Configure the Switches:**
   First of all **Config the end-devices**

Process is fairly simple

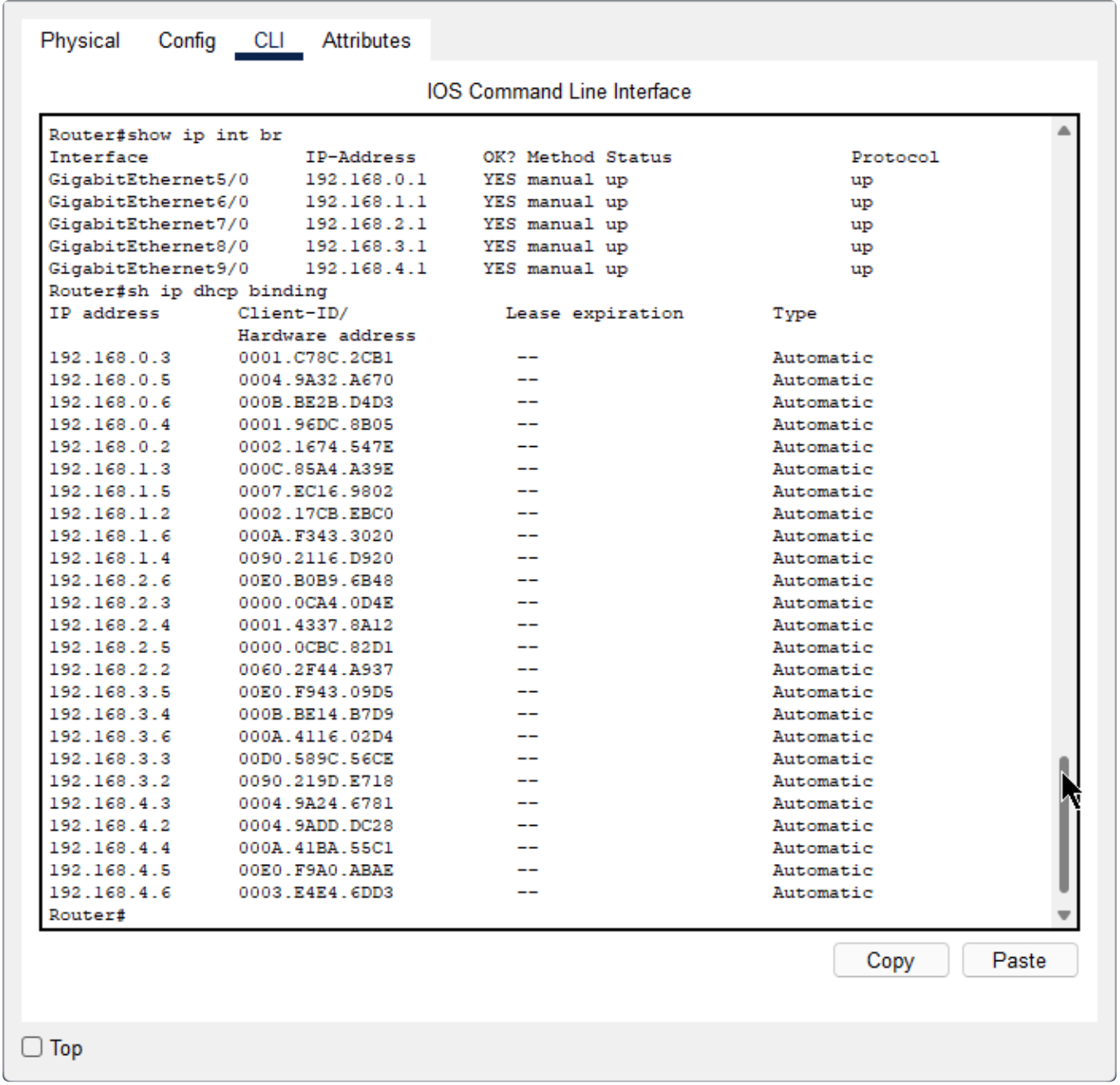





Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
Requesting IP Address
IPv4 Address
Subnet Mask
Default Gateway
DNS Server
IPv6 Configuration
Automatic
Static
IPv6 Address
/
Link Local Address
FE80::204:9AFF:FE24:6781
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Username
Password
Top



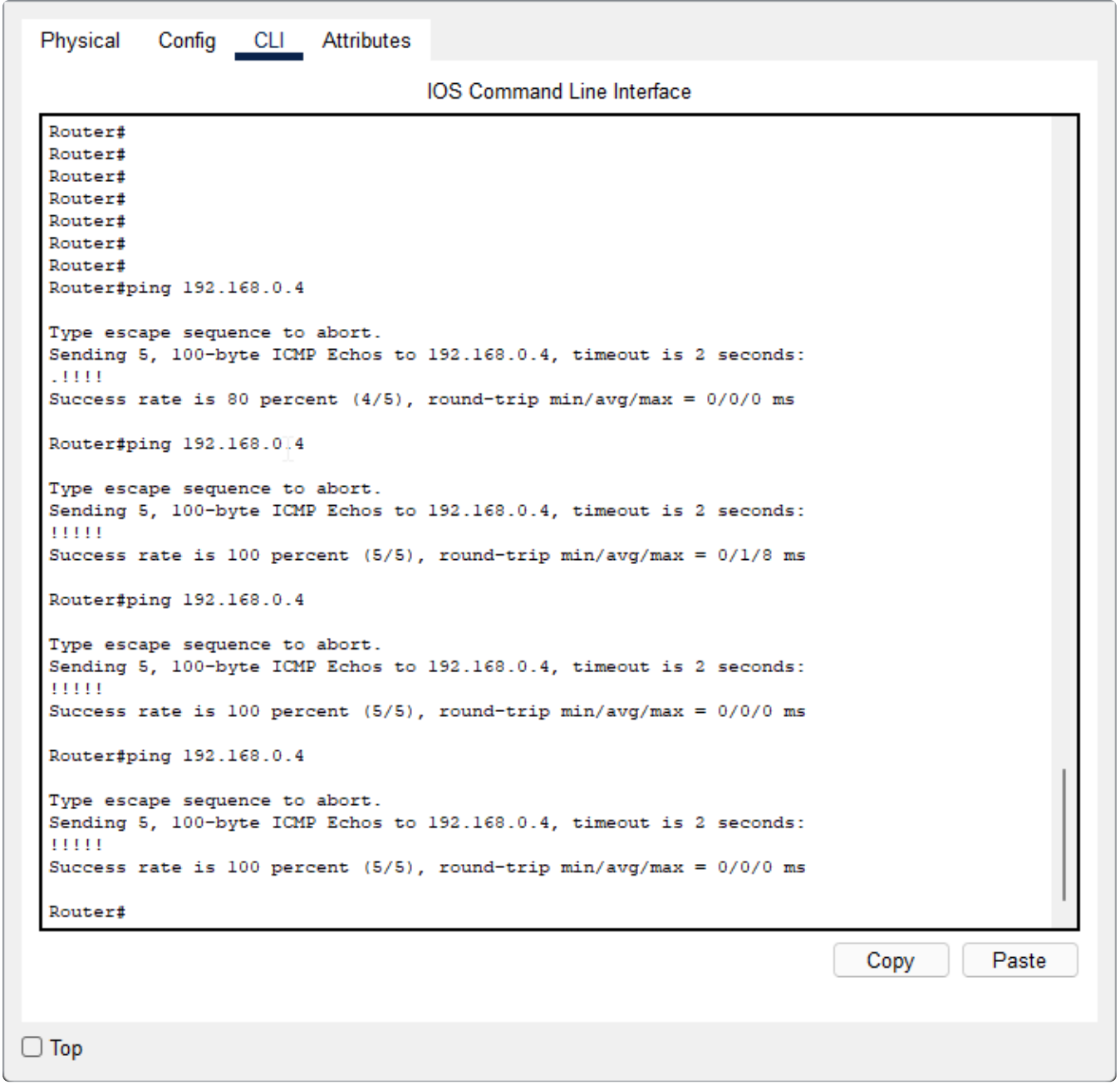
After that we check DHCP binding and also interface values



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.



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
```

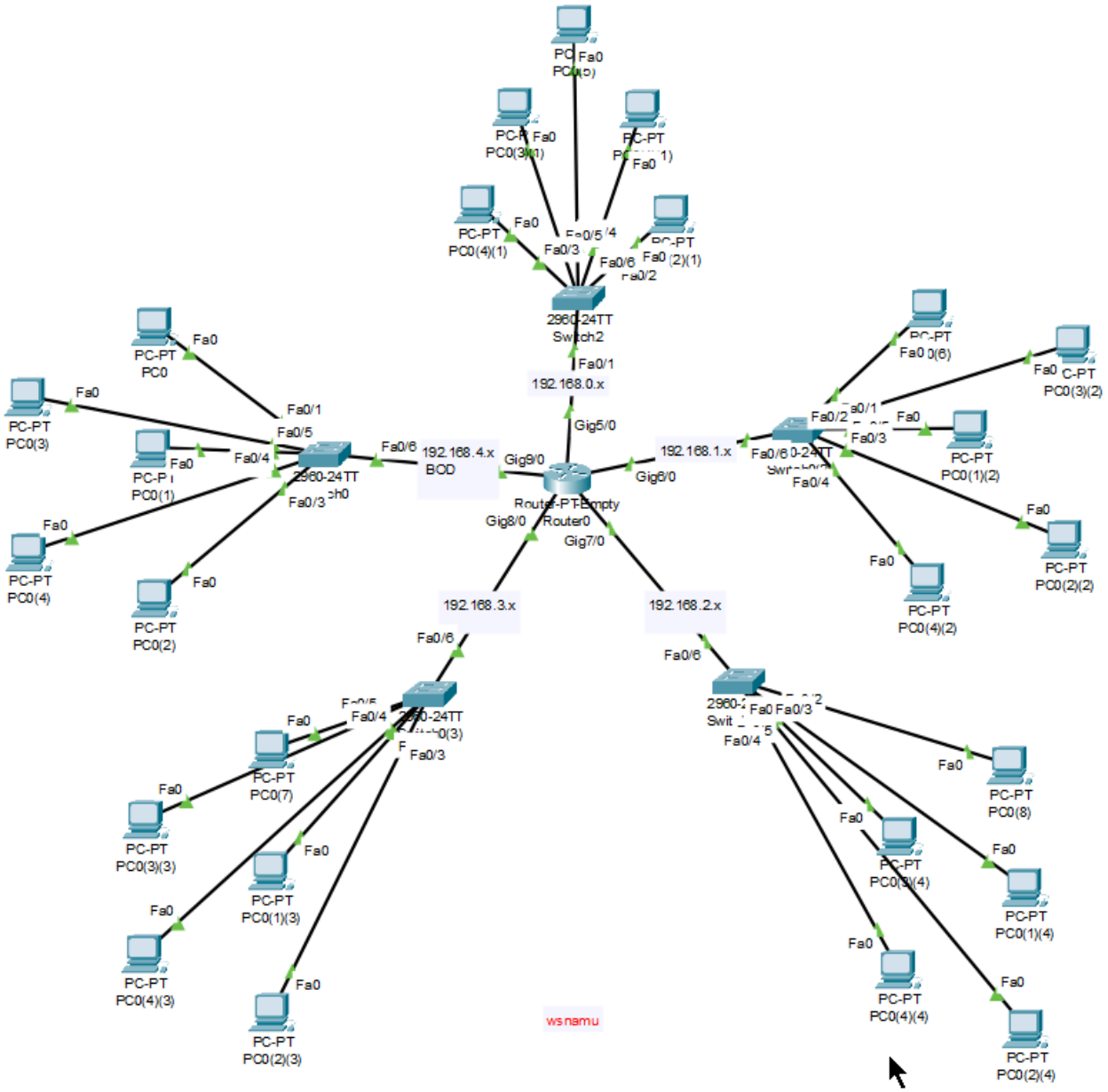
Some random pings to default router and another device to check again

```
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<1ms TTL=127
Reply from 192.168.0.2: bytes=32 time<1ms TTL=127
Reply from 192.168.0.2: bytes=32 time<1ms 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<1ms TTL=127
Reply from 192.168.0.2: bytes=32 time<1ms TTL=127
Reply from 192.168.0.2: bytes=32 time<1ms TTL=127
Reply from 192.168.0.2: bytes=32 time<1ms 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<1ms TTL=255
Reply from 192.168.4.1: bytes=32 time<1ms TTL=255
Reply from 192.168.4.1: bytes=32 time<1ms TTL=255
Reply from 192.168.4.1: bytes=32 time<1ms 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