

Network Technology lab Final Project

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Network design for office, connected with multiple subnets

1. Project Implementation Area

My project title is "Network design for office, connected with multiple subnets". I will focus on two routers and four switches configuration. These devices are designed to operate in a subnet structure that divides the network into four parts. The various IP Address ranges are given below - 192.168.33.0/24, 192.168.34.0/24, 192.168.35.0/24 and 192.168.36.0/24. Furthermore, the network has a DHCP server for automatic IP addressing fixed in one of the parts.

2. Network address plan

Number of network	IP network	Mask	Computer addresses	Gateway	Broadcast address
N1	192.168.33.0/24	255.255.255.0	192.168.33.2 - 192.168.33.254 (253)	192.168.33.1	192.168.33.255
N2	192.168.34.0/24	255.255.255.0	192.168.34.2 - 192.168.34.254 (253)	192.168.34.1	192.168.34.255
N3	192.168.35.0/24	255.255.255.0	192.168.35.2 - 192.168.35.254 (253)	192.168.35.1	192.168.35.255
N4	192.168.36.0/24	255.255.255.0	192.168.36.2 - 192.168.36.254 (253)	192.168.36.1	192.168.36.255
N5	192.168.1.0/30	255.255.255.252	192.168.1.1 - 192.168.1.2 (2)	-	192.168.1.3

3. List of devices used

I used these devices:

Router-2911

Switch- 2950-24

PC

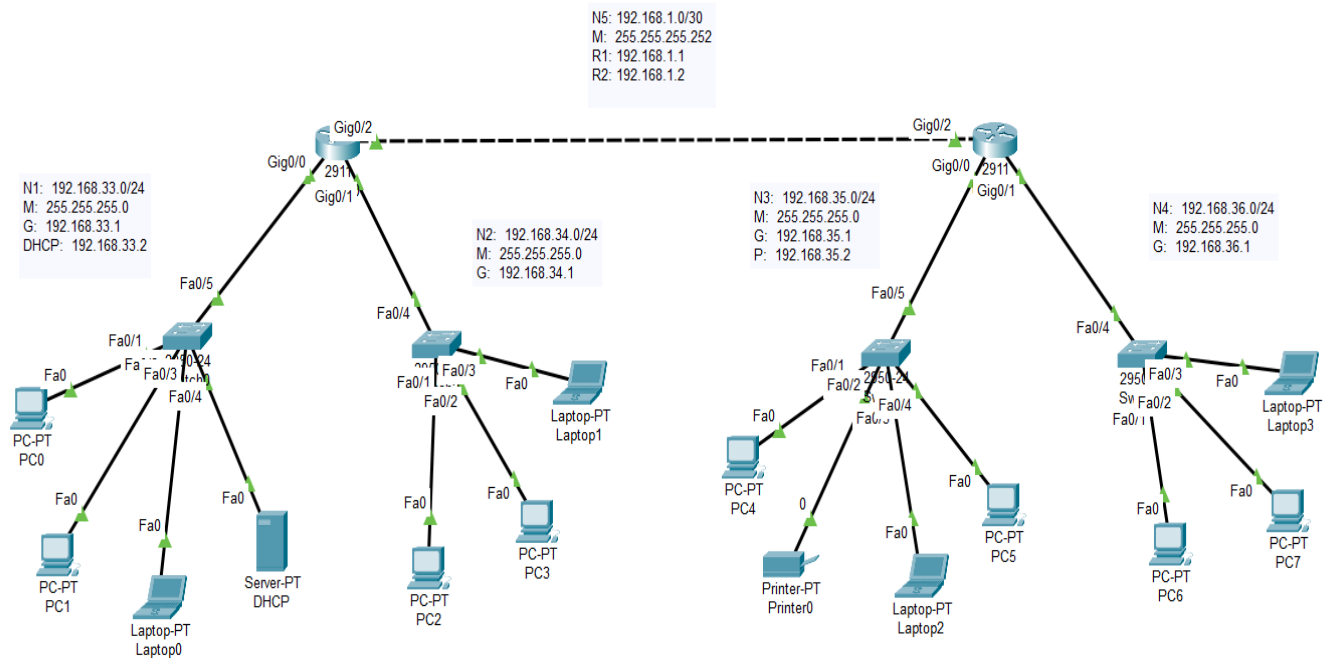
Server

Laptop

Printer

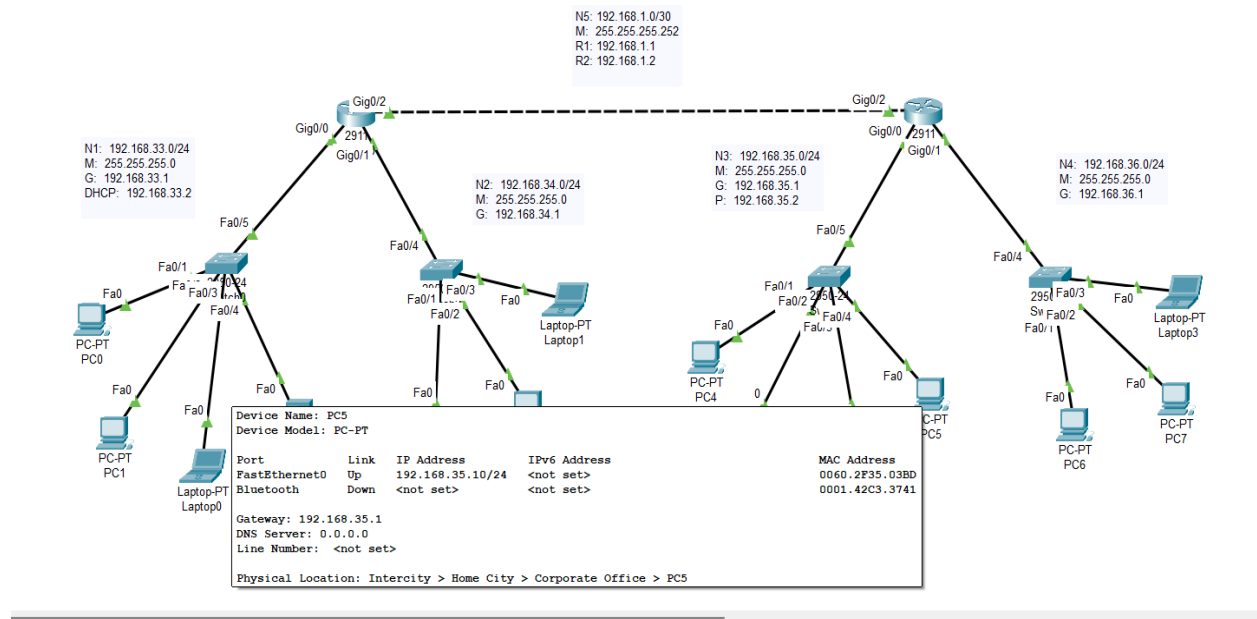
DHCP

4. Logical diagram of the constructed network

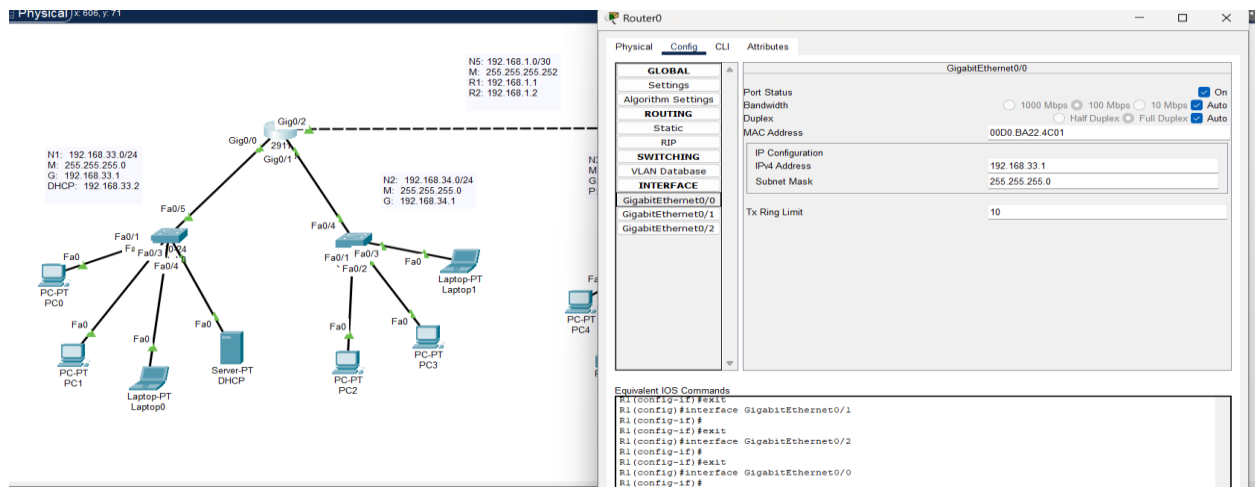


5. Text description of device configuration with basic network components

I designed this network structure using the IP ranges 192.168.33.0/24, 192.168.34.0/24, 192.168.35.0/24, and 192.168.36.0/24, distributed across four subnets. The network includes two routers, each connected to two switches. Router 1 connects to Switch 1 and Switch 2, while Router 2 connects to its Switch 1 and Switch 2. Each switch has multiple devices connected: PCs, laptops, a DHCP server, and a printer. The DHCP server dynamically provides IP addresses from the 192.168.33.0/24 subnet. Device communication across all subnets is enabled by correct IP addressing and routing configurations.



After physical configuration, I entered ethernet IP and Mask numbers to routers.

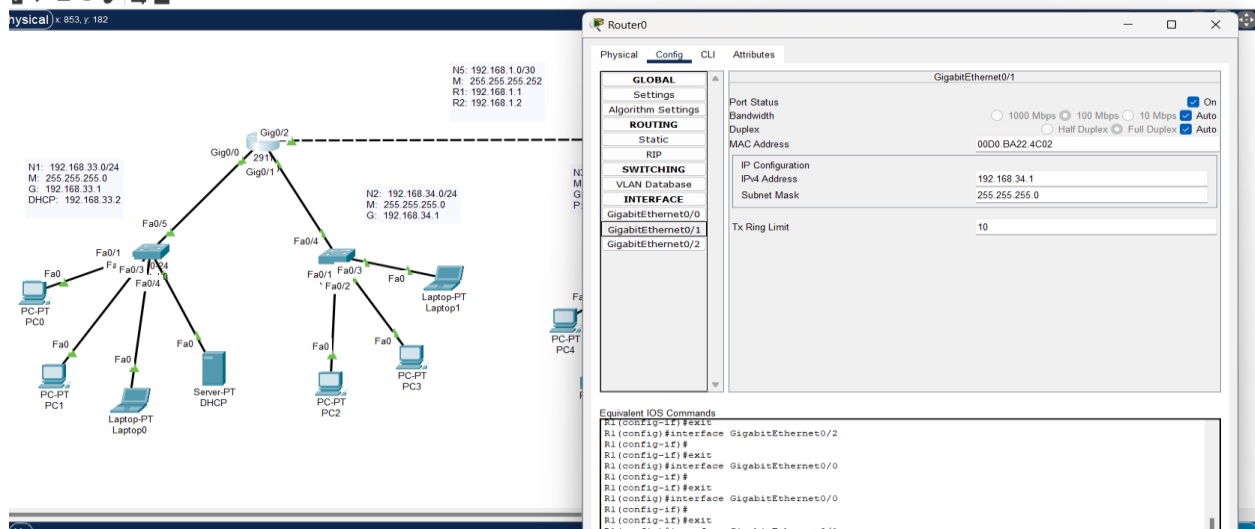


The network diagram shows a central router (R1) connected to two switches (S1 and S2). R1 has interfaces GigabitEthernet0/0, GigabitEthernet0/1, and GigabitEthernet0/2. S1 has interfaces Fa0/1, Fa0/2, Fa0/3, Fa0/4, and Fa0/5. S2 has interfaces Fa0/1, Fa0/2, Fa0/3, and Fa0/4. Various PCs and laptops are connected to these interfaces. The IP addresses for the routers are: N1: 192.168.33.0/24, M: 255.255.255.0, G: 192.168.33.1, DHCP: 192.168.33.2; N2: 192.168.34.0/24, M: 255.255.255.0, G: 192.168.34.1.

The Router0 configuration window shows the configuration for GigabitEthernet0/0. The IP address is 192.168.33.1 and the subnet mask is 255.255.255.0. The configuration is as follows:

```

R1(config-if)#exit
R1(config)#interface GigabitEthernet0/1
R1(config-if)#
R1(config-if)#exit
R1(config)#interface GigabitEthernet0/2
R1(config-if)#
R1(config-if)#exit
R1(config)#interface GigabitEthernet0/0
R1(config-if)#
  
```

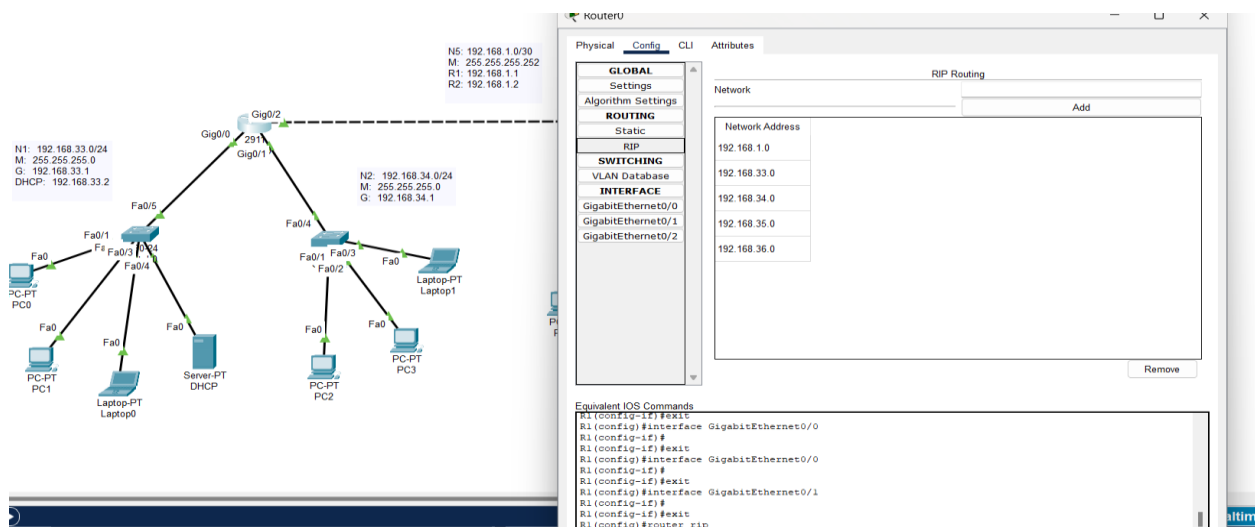


The network diagram is the same as the previous one. The Router0 configuration window shows the configuration for GigabitEthernet0/1. The IP address is 192.168.34.1 and the subnet mask is 255.255.255.0. The configuration is as follows:

```

R1(config-if)#exit
R1(config)#interface GigabitEthernet0/2
R1(config-if)#
R1(config-if)#exit
R1(config)#interface GigabitEthernet0/0
R1(config-if)#
R1(config-if)#exit
R1(config)#interface GigabitEthernet0/0
R1(config-if)#
R1(config-if)#exit
R1(config)#interface GigabitEthernet0/1
R1(config-if)#
  
```

Then I enabled RIP and added all devices IPs.



The network diagram is the same as the previous ones. The Router0 configuration window shows the configuration for RIP. The configuration is as follows:

```

R1(config-if)#exit
R1(config)#interface GigabitEthernet0/0
R1(config-if)#
R1(config-if)#exit
R1(config)#interface GigabitEthernet0/1
R1(config-if)#
R1(config-if)#exit
R1(config)#interface GigabitEthernet0/2
R1(config-if)#
R1(config-if)#exit
R1(config)#router rip
  
```

The RIP configuration window shows the following network addresses:

Network Address
192.168.1.0
192.168.33.0
192.168.34.0
192.168.35.0
192.168.36.0

I connected the DHCP I created to this server to other ethernet.

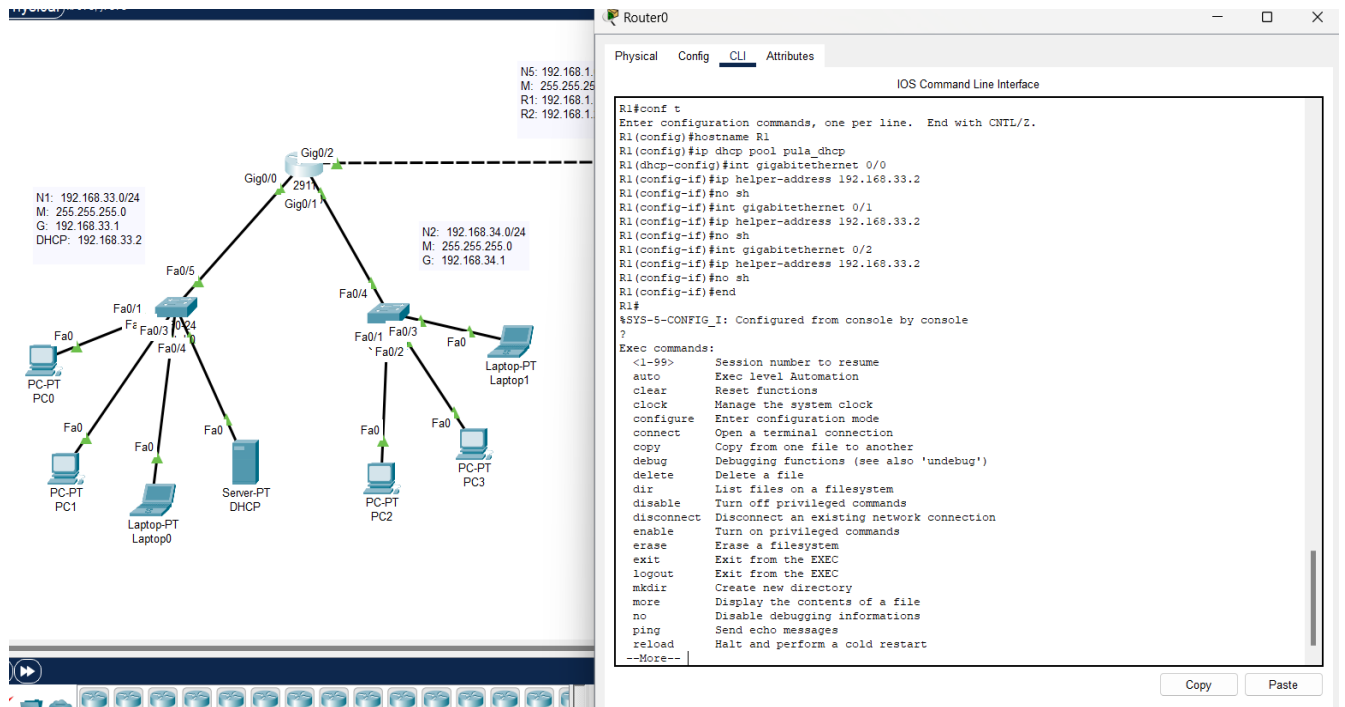
The screenshot displays a network simulation environment. On the left, a topology diagram shows two routers connected via their GigabitEthernet0/0/24 and GigabitEthernet0/0/24 interfaces. The left router has interfaces Fa0/1, Fa0/24, Fa0/4, Fa0/5, and Fa0/3. It is connected to PC-PT PC0, PC-PT PC1, Laptop-PT Laptop0, and a Server-PT DHCP. The right router has interfaces Fa0/1, Fa0/2, Fa0/3, and Fa0/4, connected to PC-PT PC2 and PC-PT PC3. A text box on the left provides IP addresses: N1: 192.168.33.0/24, M: 255.255.255.0, G: 192.168.33.1, DHCP: 192.168.33.2. On the right, the DHCP configuration window is open, showing the 'Services' tab. The DHCP service is enabled for the FastEthernet0 interface. The configuration includes a pool named 'serverPool' with a default gateway of 192.168.33.1 and a DNS server of 0.0.0.0. The start IP address is 192.168.33.10, and the subnet mask is 255.255.255.0. The maximum number of users is 246. The TFTP server and WLC address are both 0.0.0.0. Below the configuration fields, a table lists the DHCP pools:

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
serverPool3	192.168.36.1	0.0.0.0	192.168.3...	255.255.2...	246	0.0.0.0	0.0.0.0
serverPool2	192.168.35.1	0.0.0.0	192.168.3...	255.255.2...	246	0.0.0.0	0.0.0.0
serverPool1	192.168.34.1	0.0.0.0	192.168.3...	255.255.2...	246	0.0.0.0	0.0.0.0
serverPool	192.168.33.1	0.0.0.0	192.168.3...	255.255.2...	246	0.0.0.0	0.0.0.0

Then I configured DHCP server and added IP address with Mask.

The screenshot displays the same network simulation environment as the previous image. The topology diagram and text box are identical. On the right, the IP configuration window is open, showing the 'Desktop' tab. The IP configuration is set to 'Static' for the IPv4 address. The IPv4 address is 192.168.33.2, the subnet mask is 255.255.255.0, and the default gateway is 192.168.33.1. The DNS server is 0.0.0.0. The IPv6 configuration is set to 'Static'. The IPv6 address is empty, the link local address is FE80::260:70FF:FE54:D078, and the default gateway and DNS server are empty. The 802.1X configuration is also shown, with 'Use 802.1X Security' checked, authentication set to MD5, and fields for username and password.

After that, I also configured the Command Line Interface for both routers to connect all devices between each other.

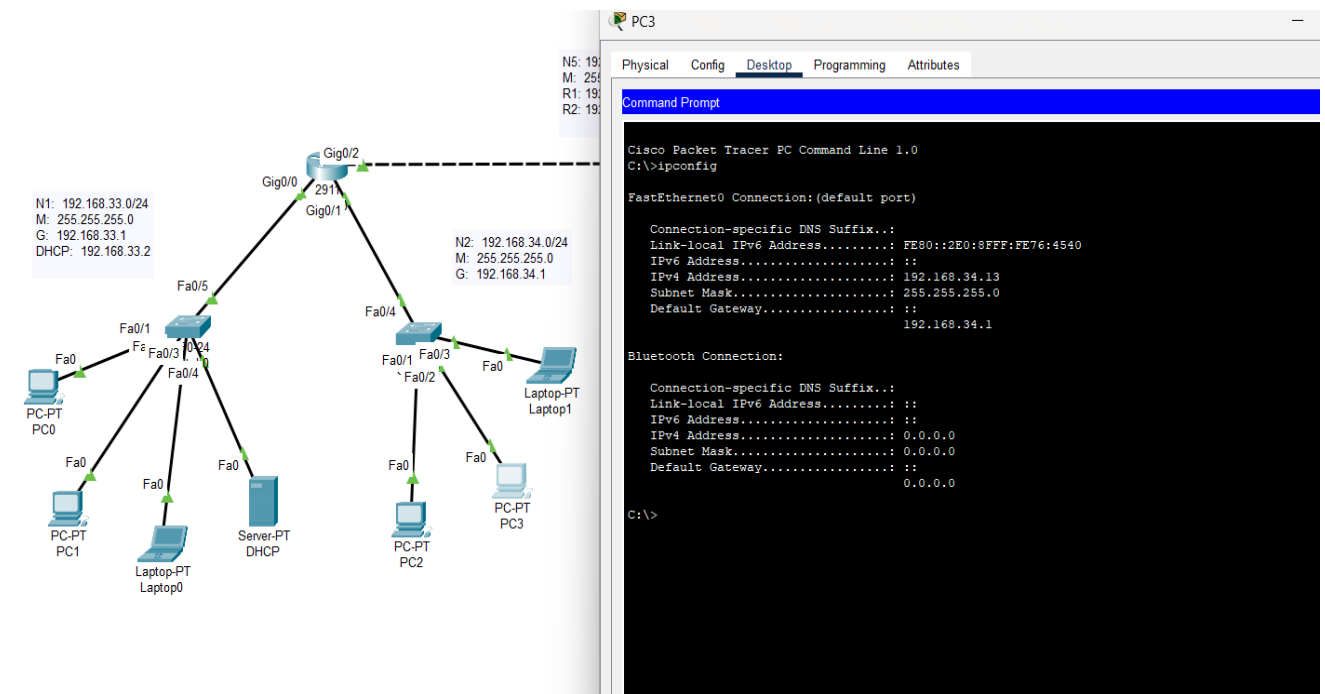


The network diagram shows a central router (R1) connected to two switches (S1 and S2). R1 has interfaces Gig0/0, Gig0/1, and Gig0/2. S1 has interfaces Fa0/1, Fa0/2, Fa0/3, Fa0/4, and Fa0/5. S2 has interfaces Fa0/1, Fa0/2, Fa0/3, and Fa0/4. Various PCs and laptops are connected to the switches. The CLI window shows the configuration for R1, including DHCP pools and interface settings.

```

R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#hostname R1
R1(config)#ip dhcp pool pula_dhcp
R1(dhcp-config)#int gigabitEthernet 0/0
R1(config-if)#ip helper-address 192.168.33.2
R1(config-if)#no sh
R1(config-if)#int gigabitEthernet 0/1
R1(config-if)#ip helper-address 192.168.33.2
R1(config-if)#no sh
R1(config-if)#int gigabitEthernet 0/2
R1(config-if)#ip helper-address 192.168.33.2
R1(config-if)#no sh
R1(config-if)#end
R1#
%SYS-5-CONFIG_I: Configured from console by console
?
Exec commands:
<l-S>
auto          Exec level Automation
clear         Reset functions
clock         Manage the system clock
configure     Enter configuration mode
connect       Open a terminal connection
copy          Copy from one file to another
delete        Delete a file
dir           List files on a filesystem
disable       Turn off privileged commands
disconnect    Disconnect an existing network connection
enable        Turn on privileged commands
erase         Erase a filesystem
exit          Exit from the EXEC
logout        Exit from the EXEC
mkdir         Create new directory
more          Display the contents of a file
no            Disable debugging informations
ping          Send echo messages
reload        Halt and perform a cold restart
--More--
  
```

6. Test of designed network. Confirmation of the results obtained.



The network diagram is identical to the one above. The Command Prompt window shows the output of the 'ipconfig' command on PC3, displaying network configuration details for both FastEthernet0 and Bluetooth connections.

```

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

FastEthernet0 Connection:(default port)

Connection-specific DNS Suffix...:
Link-local IPv6 Address...: FE80::2E0:8FFF:FE76:4540
IPv6 Address...: ::
IPv4 Address...: 192.168.34.13
Subnet Mask...: 255.255.255.0
Default Gateway...: ::
192.168.34.1

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:\>
  
```

N1: 192.168.33.0/24
M: 255.255.255.0
G: 192.168.33.1
DHCP: 192.168.33.2

N2: 192.168.34.0/24
M: 255.255.255.0
G: 192.168.34.1

Physical Config Desktop Programming Attributes

Command Prompt

```

C:\>ipconfig /all

FastEthernet0 Connection: (default port)

    Connection-specific DNS Suffix...: 
    Link-local IPv6 Address...: FE80::2E0:8FFF:FE76:4540
    IPv6 Address...: 
    IPv4 Address...: 192.168.34.13
    Subnet Mask...: 255.255.255.0
    Default Gateway...: 192.168.34.1

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:\>ipconfig /all

FastEthernet0 Connection: (default port)

    Connection-specific DNS Suffix...: 
    Physical Address...: 00E0.8F76.4540
    Link-local IPv6 Address...: FE80::2E0:8FFF:FE76:4540
    IPv6 Address...: 
    IPv4 Address...: 192.168.34.13
    Subnet Mask...: 255.255.255.0
    Default Gateway...: 192.168.34.1

    DHCP Servers...: 192.168.33.2
    DHCPv6 IAID...: 
    DHCPv6 Client DUID...: 00-01-00-01-B7-AC-3B-31-00-E0-8F-76-45-40
    DNS Servers...: 0.0.0.0

Bluetooth Connection:

    Connection-specific DNS Suffix...: 
    Physical Address...: 0009.7CD0.7336
    Link-local IPv6 Address...: 
    IPv6 Address...: 
    IPv4 Address...: 0.0.0.0
    Subnet Mask...: 0.0.0.0
    Default Gateway...: 0.0.0.0
          
```

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Laptop0	PC2	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC0	PC3	ICMP		0.000	N	1	(edit)	(delete)
	Successful	PC3	PC0	ICMP		0.000	N	2	(edit)	(delete)
	Successful	PC4	Printer0	ICMP		0.000	N	3	(edit)	(delete)

7. Final remarks

It worked. At the beginning of the project, four subnets (switches) were created from an IP range of 192.168.33.0 to 192.168.36.255. The network consisted of two routers interconnected with each other via two interconnecting switches, and a few devices, including PCs, laptops, printers, and a DHCP server. I created a separate subnet (192.168.1.0/30) to connect the two routers and assigned IP addresses and masks to their serial interfaces.

I set up a DHCP server to dynamically allocate IP addresses to devices in that network. Other subnet IP addresses were allocated using manually configured static IP addresses for the gateway and connected devices. I ensured proper communication by configuring the routers with static routes between subnets. Additionally, I used the "IP helper-address" command to enable DHCP communication across different subnets.

Once I configured all devices and addresses, I was able to check the network for operability. Using ping and ipconfig commands, I tested connectivity between devices in the same subnet and across subnets. All devices operated successfully, and the network works as intended.