# I.   Subnetting and IP Addressing Lab

You are a network administrator at a small office that currently uses the **192.168.0.0/24** network. The company has recently expanded, and you've been tasked with **dividing this network into three smaller subnets** to separate different departments and improve network management.

You will configure IP addressing on routers and PCs according to your subnet plan, verify connectivity, and ensure efficient address usage using CIDR.

LAB TOPOLOGY
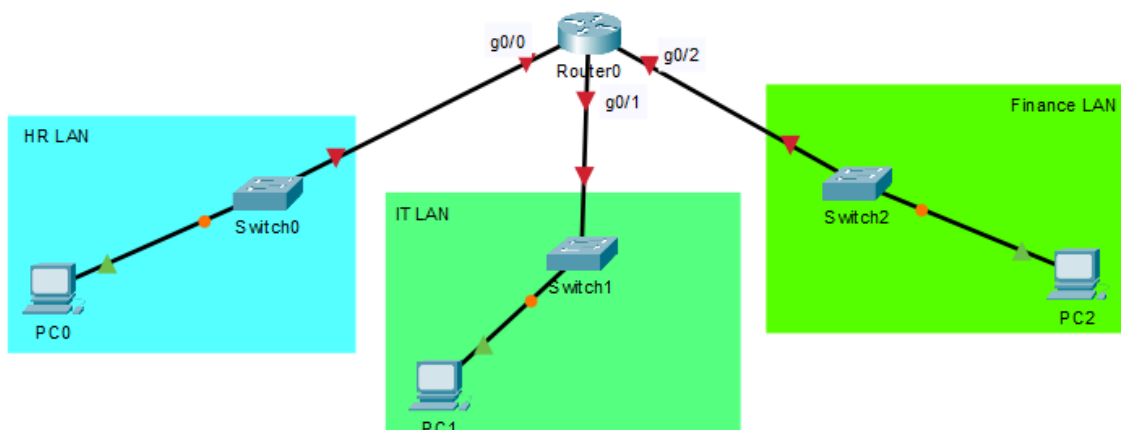
Requirements:

1. Subnet the **192.168.0.0/24** network into **three subnets** using CIDR notation.

    o   Assign enough IPs for:

    ▪   HR: 50 hosts

    ▪   IT: 30 hosts

    ▪   Finance: 20 hosts

2. Assign **the first usable IP** in each subnet to the router interface connected to that department.

3. Configure **PCs** in each department with an IP address, subnet mask, and default gateway (router IP).

4. Verify connectivity using the ping command between departments.

Subnetting and IP Addressing Lab – Answer Key

Subnetting Plan

Department	Needed Hosts	Subnet	Network Address	Subnet Mask	Usable IP Range	Broadcast
HR	50	/26	192.168.0.0	255.255.255.192	192.168.0.1 – 192.168.0.62	192.168.0.63
IT	30	/27	192.168.0.64	255.255.255.224	192.168.0.65 – 192.168.0.94	192.168.0.95
Finance	20	/27	192.168.0.96	255.255.255.224	192.168.0.97 – 192.168.0.126	192.168.0.127

1. **Assign IP addresses on R1**

R1(config)# interface g0/0

R1(config)# no shutdown

R1(config-if)# ip address 192.168.0.1 255.255.255.192

R1(config-if)# no shutdown

R1(config)# interface g0/1

R1(config)# no shutdown

R1(config-if)# ip address 192.168.0.65 255.255.255.224

R1(config-if)# no shutdown

R1(config)# interface g0/2

R1(config)# no shutdown

R1(config-if)# ip address 192.168.0.97 255.255.255.224

R1(config-if)# no shutdown

2. **Assign IP addresses to PCs**

PC Name	Department	IP Address	Subnet Mask	Default Gateway
PC1	HR	192.168.0.10	255.255.255.192	192.168.0.1
PC2	IT	192.168.0.70	255.255.255.224	192.168.0.65
PC3	Finance	192.168.0.100	255.255.255.224	192.168.0.97

3. **Verify connectivity**

- **Ping between departments:**

- **PC1> ping 192.168.0.70**

- **PC2> ping 192.168.0.100**

- **PC3> ping 192.168.0.10**

4. **Save configuration**

R1# copy running-config startup-config

# II. CIDR Troubleshooting Lab — 192.168.0.0/24

Objective:

Troubleshoot and fix incorrect subnet configurations caused by wrong CIDR masks.
All devices should be on the correct subnets under **192.168.0.0/24** (divided into smaller subnets using CIDR).

Scenario

You are the network technician at a small company.
The company was assigned the **192.168.0.0/24** network.
To organize departments, the admin subnetted it into **four smaller networks** using **CIDR /26**.

Recently, some PCs from the HR and IT departments reported they **cannot communicate with each other**, even though they are connected to the same router.

You must find and fix the subnetting problem.

Planned CIDR Subnets

DEPARTMEN	NETWORK	CIDR RANGE	DEF. GATEWAY
HR	192.168.0.0/26	192.168.0.1 – 192.168.0.62	192.168.0.1
IT	192.168.0.64/26	192.168.0.65 – 192.168.0.126	192.168.0.65
FINANCE	192.168.0.128/26	192.168.0.129 – 192.168.0.190	192.168.0.129
SALES	192.168.0.192/26	192.168.0.193 – 192.168.0.254	192.168.0.193
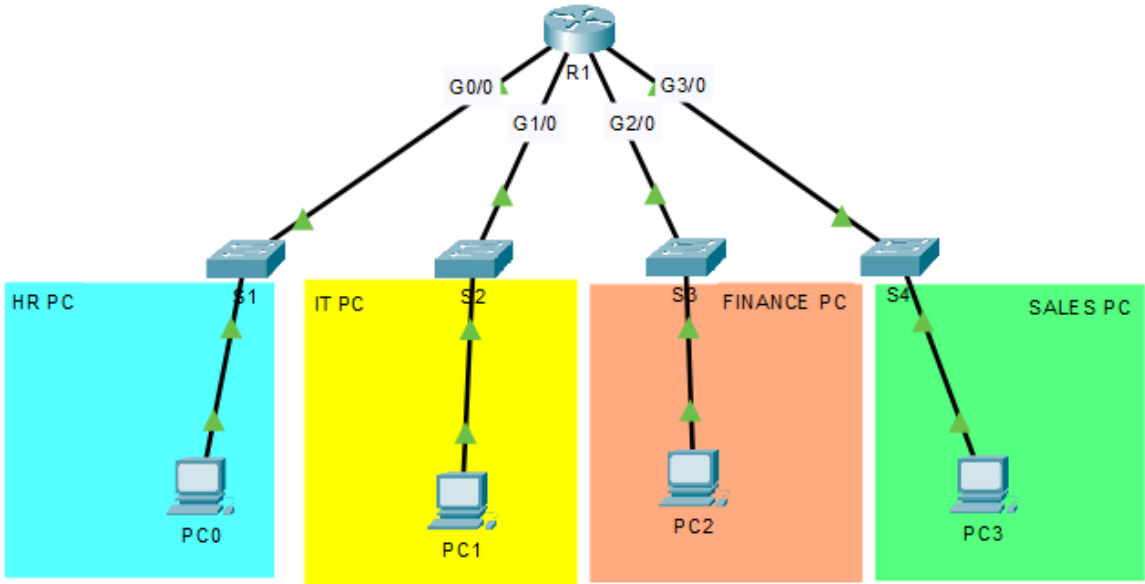
Correct Router Configuration

Interface	IP Address	Subnet Mask	Connected Dept
G0/0	192.168.0.1	255.255.255.192 (/26)	HR
G0/1	192.168.0.65	255.255.255.192 (/26)	IT
G0/2	192.168.0.129	255.255.255.192 (/26)	Finance
G0/3	192.168.0.193	255.255.255.192 (/26)	Sales

Symptoms

- PC-HR cannot ping PC-IT.

- PC-IT cannot reach its gateway.

- PC-FIN and PC-SALES are fine.

- All router interfaces show **up/up**.

Your Tasks

1. Verify IP addresses and subnet masks on each interface and PC.

2. Identify which interfaces or hosts are in the wrong subnets.

3. Correct the subnet masks so each network uses **/26 (255.255.255.192)**.

4. Confirm that all PCs can ping their gateways and each other.

CIDR Troubleshooting Lab — 192.168.0.0/24 – Answer Key

Step 1: Verify Interface Router

Command:

R1# show ip interface brief

R1# show running-config | include ip address

→ Notice Fa0/0 and Fa0/1 have incorrect masks.

Step 2: Verify PC connectivity

Command:

From PC-HR:

PC> ping 192.168.0.65

 Fails — because PC-HR's /24 mask overlaps IT's subnet.

Step 3: Correct router configuration

R1(config)# interface fa0/0

R1(config-if)# ip address 192.168.0.1 255.255.255.192

R1(config)# interface fa0/1

R1(config-if)# ip address 192.168.0.65 255.255.255.192

Step 4: Verify again

Commands:

From PC-HR:

PC> ping 192.168.0.65

Success!

From PC-IT:

PC> ping 192.168.0.1

PC> ping 192.168.0.130

III. Basic IP Addressing and Connectivity Lab

You are a new network technician assigned to set up a small office network. Your task is to configure IP addresses on two routers and two PCs, connect them, and verify end-to-end communication. This lab will help you practice basic interface configuration and connectivity testing.

LAB TOPOLOGY
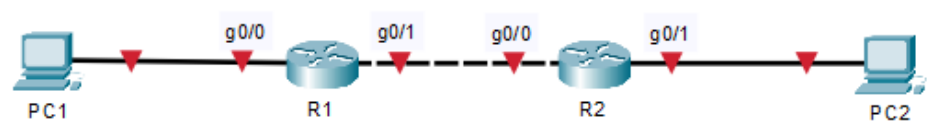
Device	Interface	IP Address	Subnet Mask	Gateway
PC1	NIC	192.168.1.2	255.255.255.0	192.168.1.1
R1	G0/0	192.168.1.1	255.255.255.0	—
R1	G0/1	10.0.0.1	255.255.255.252	—
R2	G0/0	10.0.0.2	255.255.255.252	—
R2	G0/1	192.168.2.1	255.255.255.0	—
PC2	NIC	192.168.2.2	255.255.255.0	192.168.2.1

Objectives

1. Configure IP addresses on all router interfaces and PCs according to the topology.

2. Configure static routes so PC1 and PC2 can communicate.

3. Test connectivity using the ping command.

4. Verify routing tables on both routers.

Basic IP Addressing and Connectivity Lab – Answer Key

1. Configure Router R1

R1> enable

R1# configure terminal

R1(config)# interface gigabitEthernet0/0

R1(config-if)# ip address 192.168.1.1 255.255.255.0

R1(config-if)# no shutdown

R1(config)# interface gigabitEthernet0/1

R1(config-if)# ip address 10.0.0.1 255.255.255.252

R1(config-if)# no shutdown

R1(config)# ip route 192.168.2.0 255.255.255.0 10.0.0.2

2. Configure Router R2

R2> enable

R2# configure terminal

R2(config)# interface gigabitEthernet0/0

R2(config-if)# ip address 10.0.0.2 255.255.255.252

R2(config-if)# no shutdown

R2(config)# interface gigabitEthernet0/1

R2(config-if)# ip address 192.168.2.1 255.255.255.0

R2(config-if)# no shutdown

R2(config)# ip route 192.168.1.0 255.255.255.0 10.0.0.1

3. Configure PCs

PC1:

IP Address: 192.168.1.2

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.1.1

PC2:

IP Address: 192.168.2.2

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.2.1

Verification

1. From PC1, ping R1:
2. PC1> ping 192.168.1.1
3. From PC1, ping R2's LAN interface:
4. PC1> ping 192.168.2.1
5. From PC1, ping PC2:
6. PC1> ping 192.168.2.2


View routing table:

R1# show ip route

R2# show ip route

IV. Static Routing Troubleshooting Lab

You are a junior network administrator for a small company. The network was recently configured using **static routes**, but users report that devices on one side of the network cannot reach devices on the other side. Your task is to find and correct the routing errors so that all networks can communicate.

LAB TOPOLOGY
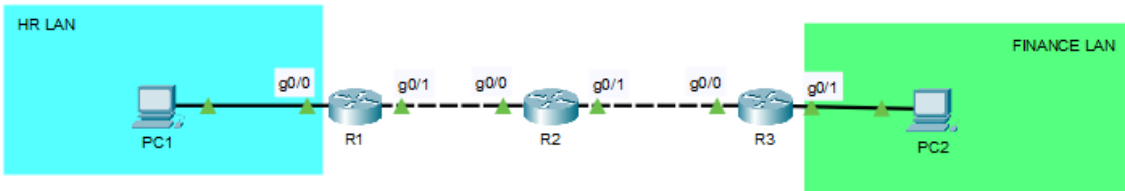
Device	Interface	IP Address	Subnet Mask	Description
PC1	NIC	192.168.1.2	255.255.255.0	HR LAN
R1	G0/0	192.168.1.1	255.255.255.0	HR LAN
R1	G0/1	10.0.0.1	255.255.255.252	Link to R2
R2	G0/0	10.0.0.2	255.255.255.252	Link to R1
R2	G0/1	10.0.0.5	255.255.255.252	Link to R3
R3	G0/0	10.0.0.6	255.255.255.252	Link to R2
R3	G0/1	192.168.3.1	255.255.255.0	Finance LAN
PC2	NIC	192.168.3.2	255.255.255.0	Finance LAN

Lab Scenario

All IP addresses have been configured correctly, but **PC1 cannot ping PC2**.
You must diagnose and fix any **static routing misconfigurations** causing this issue.

Initial Symptoms

- PC1 can ping R1's LAN interface (192.168.1.1).

- R1 and R2 can ping each other.

- R3 can ping PC2.

- But **PC1 cannot reach PC2** — and vice versa.

Troubleshooting Objectives

1. Verify interface status and connectivity.

2. Check for missing or incorrect static routes.

3. Correct routing tables on all routers.

4. Confirm end-to-end communication between PC1 and PC2.

Static Routing Troubleshooting Lab – Answer Key

Step 1: Verify Interface Status

On all routers:

R1# show ip interface brief

R2# show ip interface brief

R3# show ip interface brief

All interfaces should be **up/up**.
If not, enable with no shutdown.

Step 2: Verify Local Connectivity

From R1:

R1# ping 10.0.0.2

From R2:

R2# ping 10.0.0.5

From R3:

R3# ping 192.168.3.2

If any of these fail → check cable connections or IP address mismatches.

Step 3: Check Static Routes

Use:

R1# show ip route

R2# show ip route

R3# show ip route

You might find:

- **R1** missing a route to 192.168.3.0

- **R3** missing a route to 192.168.1.0

- **R2** configured with an incorrect next hop (e.g., 10.0.0.5 instead of 10.0.0.6)

Step 4: Fix Static Routes

On R1:

R1(config)# ip route 192.168.3.0 255.255.255.0 10.0.0.2

On R2:

R2(config)# ip route 192.168.1.0 255.255.255.0 10.0.0.1

R2(config)# ip route 192.168.3.0 255.255.255.0 10.0.0.6

On R3:

R3(config)# ip route 192.168.1.0 255.255.255.0 10.0.0.5

Step 5: Verify Routing Table Again

R1# show ip route

R2# show ip route

R3# show ip route

Each router should now have routes to both 192.168.1.0 and 192.168.3.0 networks.

Step 6: Test Connectivity

From PC1:

PC1> ping 192.168.3.2

From PC2:

PC2> ping 192.168.1.2

Both should now succeed.