# Computer Networking: Concepts Experiment 6

# PART 1 — FIXED-LENGTH SUBNETTING

Given Network: **172.16.0.0/24**

Required Subnets:

- Subnet A: 40 hosts
- Subnet B: 20 hosts
- Subnet C: 10 hosts
- Subnet D: 5 hosts

❗ ***Fixed-length subnetting means all subnets must be of equal size.***

# Step 1 — Determine Subnet Size

We need the largest host requirement → **40 hosts**.

Formula:

```
Hosts = 2^h − 2  ≥ 40
2^6 − 2 = 62  → OK
```

So we need **6 host bits**, leaving:

```
Prefix = 32 − 6 = /26
Subnet mask = 255.255.255.192
```

Each subnet size = $2^6$ = **64 addresses per subnet**

# Step 2 — Create Subnets of /26

| Subnet | Network Address | First Host | Last Host | Broadcast |
|---|---|---|---|---|
| **A** | 172.16.0.0/26 | 172.16.0.1 | 172.16.0.62 | 172.16.0.63 |
| **B** | 172.16.0.64/26 | 172.16.0.65 | 172.16.0.126 | 172.16.0.127 |
| **C** | 172.16.0.128/26 | 172.16.0.129 | 172.16.0.190 | 172.16.0.191 |
| **D** | 172.16.0.192/26 | 172.16.0.193 | 172.16.0.254 | 172.16.0.255 |

# Step 3 — Packet Tracer Topology

Use:

- 1 Router
- 4 Switches
- Multiple PCs in each subnet

## *To add new interfaces (Extra Ports)*

***Drag the Router to the Workspace***

- *From **Devices → Routers***
- *Choose **Cisco 2911***
- *Drag onto the workspace.*

***Power OFF the Router***

*You cannot insert modules while powered on.*

- *Click the router*
- *Go to the **Physical** tab*
- *Find the **Power button** (left side → switch)*
- *Click it → It turns **red (OFF)***

***Choose a Module to Add***

*Common modules for extra ports:*

| ***Module Name*** | ***Ports Added*** | ***Purpose*** |
|---|---|---|
| ***HWIC-2T*** | *2 Serial ports* | *WAN/Serial links* |

| *Module Name* | *Ports Added* | *Purpose* |
|---|---|---|
| ***HWIC-4ESW*** | *4 FastEthernet switch ports* | *LAN expansion* |
| ***HWIC-1GE-SFP*** | *1 GigE* | *High-speed port* |
| ***NIM-ES2-4*** | *4 Ethernet ports* | *Newer PT versions* |

*For subnetting labs, the **HWIC-4ESW** is the easiest and most used.*

***Insert the Module***

- *In the router's Physical tab, you'll see **empty HWIC slots**.*
- *Drag the module (e.g., **HWIC-4ESW**) from the left panel*
- *Drop it into an empty slot.*

*You will see the module appear with new ports like:*

```
Fa0/0
Fa0/1
Fa0/2
Fa0/3
```

***Power ON the Router***

- *Click the same power switch*
- *It turns **green (ON)***

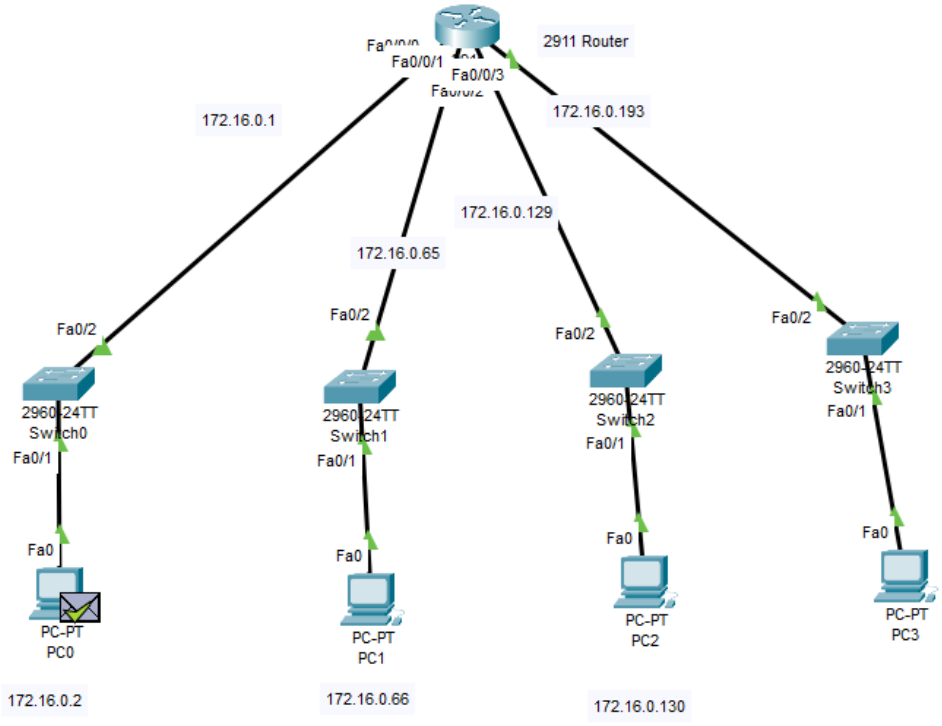
***Go to CLI and Verify Ports***

*Open CLI → type:*

```
show ip interface brief
```

*You should now see the new interfaces.*

Connect:




# Step 4 — Router Configuration

Example for Router:

```
enable
configure terminal

interface g0/0
 ip address 172.16.0.1 255.255.255.192
 no shutdown
```

```
interface g0/1
 ip address 172.16.0.65 255.255.255.192
 no shutdown

interface g0/2
 ip address 172.16.0.129 255.255.255.192
 no shutdown

interface g0/3
 ip address 172.16.0.193 255.255.255.192
 no shutdown
```

Since a single router is used, **routing is automatic** (no static routes needed).

# Step 5 — PC Configuration Example

PC in Subnet A:

```
IP: 172.16.0.10
Mask: 255.255.255.192
Gateway: 172.16.0.1
```

Repeat for all PCs.

# Step 6 — Verification

Ping across subnets:

```
PC-A → PC-B
PC-A → PC-C
PC-A → PC-D
```

All pings should succeed.

# PART 2 — VLSM

We use the same network **172.16.0.0/24**, but assign subnet sizes based on host counts.

Host requirements:

- A → 40
- B → 20
- C → 10
- D → 5

# Step 1 — Sort by host size

1. A = 40 hosts → needs /26 (62 hosts)
2. B = 20 hosts → /27 (30 hosts)
3. C = 10 hosts → /28 (14 hosts)
4. D = 5 hosts → /29 (6 hosts)

# Step 2 — Allocate Subnets (largest first)

### ✔ Subnet A (40 hosts) → /26

```
172.16.0.0/26
Range: 172.16.0.1 - 172.16.0.62
Broadcast: 172.16.0.63
```

### ✔ Subnet B (20 hosts) → /27

Next available block starts at 172.16.0.64

```
172.16.0.64/27
Range: 172.16.0.65 - 172.16.0.94
Broadcast: 172.16.0.95
```

### ✔ Subnet C (10 hosts) → /28

Next block starts at 172.16.0.96

```
172.16.0.96/28
Range: 172.16.0.97 – 172.16.0.110
Broadcast: 172.16.0.111
```

### ✔ Subnet D (5 hosts) → /29

Next block starts at 172.16.0.112

```
172.16.0.112/29
Range: 172.16.0.113 – 172.16.0.118
Broadcast: 172.16.0.119
```

# Step 3 — Router Interface Assignment

Do same as previous

# Step 4 — Configure PCs

Example for Subnet C:

```
IP: 172.16.0.100
Mask: 255.255.255.240
Gateway: 172.16.0.97
```

# Step 5 — Verify With Ping

All hosts must successfully ping across all networks.