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## WEEK 1 – NETWORKING FOUNDATIONS

### DAY 4 – SUBNETTING (DEEP)

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#### 1. Why Subnetting Exists

Subnetting divides a **large IP network** into **smaller, manageable networks**.

##### Benefits:

- Reduces **IP wastage**
- Organizes networks logically
- Improves **routing efficiency**
- Enhances **security via segmentation**

Think of it like:

Dividing a city into neighborhoods to manage deliveries better.

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#### 2. VLSM (Variable Length Subnet Mask)

##### What is VLSM?

- Not all subnets need the **same number of hosts**
- VLSM allows **different subnet sizes in the same network**
- More flexible than “fixed-length” subnetting

##### Example:

Suppose we have **192.168.1.0/24** and need:

- Subnet A → 50 hosts
- Subnet B → 20 hosts
- Subnet C → 10 hosts

Using VLSM:

1. Allocate largest subnet first
  2. Then allocate smaller subnets to remaining IPs
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#### Step 1: Convert Host Requirement to Bits

Hosts needed → # host bits

Subnet A: 50 hosts →  $2^6 - 2 = 62$  hosts → /26

Subnet B: 20 hosts →  $2^5 - 2 = 30$  hosts → /27

Subnet C: 10 hosts →  $2^4 - 2 = 14$  hosts → /28

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## Step 2: Assign Subnet Ranges

	Subnet	Network Address	Subnet Mask	Broadcast	Usable Hosts
A	192.168.1.0	/26 → 255.255.255.192	192.168.1.63	.1 – .62	
B	192.168.1.64	/27 → 255.255.255.224	192.168.1.95	.65 – .94	
C	192.168.1.96	/28 → 255.255.255.240	192.168.1.111	.97 – .110	

Note: Always allocate **largest subnets first** to avoid overlap.

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## 3. Subnet Calculation Tricks (Interview Tips)

### 1. Binary Shortcut

- Last octet determines subnet/block size
- Example: /26 →  $256 - 192 = 64$  → increment by 64

### 2. Usable Hosts Formula

Hosts =  $2^{(32 - \text{prefix})} - 2$

- Subtract 2 for network & broadcast

### 3. Block Size Rule

- Block size =  $2^{(\text{number of host bits})}$

### 4. Subnet Allocation Rule

- Always assign **largest subnet first**
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## Quick Subnet Reference Table

### CIDR Block Size Usable Hosts

/24	256	254
/25	128	126
/26	64	62
/27	32	30
/28	16	14

CIDR Block Size Usable Hosts

/29	8	6
/30	4	2

4. Real-World Subnet Design (Practical Example)

Scenario: Company network 192.168.10.0/24

Departments:

- HR → 50 devices
- IT → 30 devices
- Guest Wi-Fi → 10 devices

Step 1: Determine required subnet sizes

- HR → /26 (62 hosts)
- IT → /27 (30 hosts)
- Guest → /28 (14 hosts)

Step 2: Assign subnets (VLSM)

Department	Network	Subnet Mask	Broadcast	Usable Hosts
HR	192.168.10.0	/26	192.168.10.63	.1 – .62
IT	192.168.10.64	/27	192.168.10.95	.65 – .94
Guest	192.168.10.96	/28	192.168.10.111	.97 – .110

Step 3: Benefits

- Efficient IP usage
- Each department isolated logically
- Simplifies routing & firewall rules

5. Security Relevance – Network Segmentation

Subnetting is **not just for IP management**, it enhances **security**:

1. **Limit broadcast traffic**
  - Smaller broadcast domains reduce potential attacks
2. **Firewall / ACL policies**
  - Apply rules per subnet

### 3. Contain threats

- Virus in one subnet cannot easily spread

### 4. Guest networks isolation

- Keep visitors separate from corporate resources

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#### Example Interview Answer:

“Subnetting allows dividing a large network into smaller logical networks, improving IP utilization and security. VLSM helps allocate IPs according to host requirements, and segmentation allows firewalls and ACLs to protect each subnet independently.”

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## 6. Hands-On Practice (Must Do)

**Task:** Calculate usable hosts and subnet ranges

Example:

IP: 10.0.0.0/22

Requirement:

- Dept A → 100 hosts
- Dept B → 50 hosts
- Dept C → 20 hosts

**Step 1:** Determine subnet bits

- Dept A →  $2^7 - 2 = 126 \rightarrow /25$
- Dept B →  $2^6 - 2 = 62 \rightarrow /26$
- Dept C →  $2^5 - 2 = 30 \rightarrow /27$

**Step 2:** Assign ranges

- Dept A: 10.0.0.0/25
- Dept B: 10.0.0.128/26
- Dept C: 10.0.0.192/27

Check for **overlap & total IP coverage**.

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## 7. Key Takeaways – Day 4

1. Subnetting divides networks into smaller, manageable pieces
2. **VLSM** allows variable-length subnet masks
3. Calculate subnets using:

- Host bits
  - Block size
  - Increment by block size
4. Real-world design prioritizes **largest subnets first**
  5. Subnetting improves **security via network segmentation**
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## 8. Interview Tips (Day 4)

**Q1:** Why VLSM is used?

“VLSM allows different subnets to have different sizes, preventing IP wastage.”

**Q2:** How does subnetting improve security?

“By segmenting networks, we reduce broadcast domains, isolate departments, and apply subnet-level firewall rules.”

**Q3:** How to quickly calculate hosts for any CIDR?

“Hosts =  $2^{(32 - \text{prefix})} - 2$ ”