📘 Lecture 7- Class A Subnetting,Subnet Mask & VLSM

🌐 1. What is a Class A IP Address?

A **Class A IP address** is designed for **very large networks** 🌍.

📌 Class A Basics

- Range: **1.0.0.0 – 126.255.255.255**
- **1st Octet** → Network portion
- **Last 3 Octets** → Host portion
- Default CIDR: **/8**

🧠 Daily Life Example:

- A multinational company 🌐 with offices across countries
- One main network with thousands of devices

🧮 2. Class A Subnetting Rules

🔹 Finding Number of Networks

- Count how many **bits are borrowed** from host part

Formula:

Number of Networks = 2^n

(n = borrowed bits)

🔹 Finding IP Addresses per Network

- Count **remaining host bits**

Formula:

Total IPs per Network = 2^n

🔹 **Finding Usable Hosts**

Usable Hosts = Total IPs − 2

❓ Why subtract 2?

- 1 Network ID
- 1 Broadcast ID

🧮 3. Class A Subnetting Example: 10.0.0.0/28

🔹 **Step 1: Identify Class**

- 10.x.x.x → Class A
- Default mask = /8

🔹 **Step 2: Borrowed Bits**

28 − 8 = 20 bits borrowed

🔹 **Step 3: Number of Networks**

2^{20} = 1,048,576 networks

🔹 **Step 4: Host Bits & Hosts**

- Host bits = 32 − 28 = **4 bits**

Total IPs = 2^4 = 16

Usable Hosts = 14

🔹 **Step 5: Subnet Mask**

/28 = 255.255.255.240

📐 4. What is a Subnet Mask?

A **Subnet Mask** is a **32-bit number** used to divide an IP address into:

- Network portion
- Host portion

📄 **Example**

- IP: 192.168.10.0
- Subnet Mask: 255.255.255.0
- CIDR: /24

👉 First 24 bits = Network
👉 Last 8 bits = Host

❓ 5. Why Subnet Mask is Used?

- Helps routers identify the correct network 🚦
- Divides large networks into smaller subnets 🧩
- Controls number of usable hosts

🧠 **Daily Life Example:**

- Big office divided into HR, IT, Sales networks 🏢

🧱 6. Default Subnet Masks

Class	Subnet Mask
Class A	255.0.0.0
Class B	255.255.0.0
Class C	255.255.255.0

🔢 7. Subnet Mask to CIDR Example

Example:

Subnet Mask: 255.255.255.248

- Binary last octet: **11111000**
- Network bits = **29**

👉 CIDR = **/29**
👉 Host bits = **5 bits used**

📊 8. Subnetting Cheat Sheet

Group Size	Subnet Mask	CIDR
128	255.255.255.128	/25
64	255.255.255.192	/26
32	255.255.255.224	/27
16	255.255.255.240	/28
8	255.255.255.248	/29
4	255.255.255.252	/30
2	255.255.255.254	/31
1	255.255.255.255	/32

❓ 9. /30 Subnet Mask

/30 = 255.255.255.252

👉 Commonly used for **router-to-router links** 🔗

💻 10. Checking IP Address Using CMD

- Use command:

ipconfig

👉 Shows:

- Private IP Address
- Subnet Mask
- Default Gateway

🌐 11. What is VLSM (Variable Length Subnet Mask)?

VLSM allows **different subnet masks** for different networks 🎯.

📌 Why VLSM?

- Saves IP addresses
- Efficient network design

🧮 12. VLSM Example Scenario

📌 Given Network

192.168.10.0/26

Total IPs = 64
Usable = 62

📌 Requirements

Team	Hosts Needed
Team A	60
Team B	30
Team C	12

Team	Hosts Needed
Team D	6

🔢 13. Power of 2 Table (2^7 to 2^0)

Power	Value
2^7	128
2^6	64
2^5	32
2^4	16
2^3	8
2^2	4
2^1	2
2^0	1

🧮 14. Step 1: Arrange Requirements (Largest to Smallest)

60 → 30 → 12 → 6

🧮 15. Step 2: Find Required Subnet Mask

Hosts Needed	Nearest Power of 2	Total IPs	Subnet Mask	CIDR
60	64	64	255.255.255.192	/26
30	32	32	255.255.255.224	/27
12	16	16	255.255.255.240	/28
6	8	8	255.255.255.248	/29

🧮 16. Step 3: Assign Networks (Largest to Smallest)

🔹 **Base Network: 192.168.10.0**

Team	Network ID	IP Range	Broadcast
Team A (60)	192.168.10.0/26	.1 – .62	.63
Team B (30)	192.168.10.64/27	.65 – .94	.95
Team C (12)	192.168.10.96/28	.97 – .110	.111
Team D (6)	192.168.10.112/29	.113 – .118	.119

🎯 Key Takeaways

- Class A default mask = /8
- Subnet mask defines network & host bits
- VLSM saves IP addresses
- Always allocate largest network first

🔹 1️⃣ Chapter Summary

This chapter explains **advanced subnetting concepts** used in **very large enterprise networks** 🌍.

You learned:

- What a **Class A IP address** is and where it is used
- How **Class A subnetting** works using CIDR
- What a **Subnet Mask** is and why it is important
- Default subnet masks of Class A, B, and C
- Conversion between **Subnet Mask and CIDR**
- Practical use of **/30 subnet** for router links
- How to check IP details using **CMD (ipconfig)**
- Most importantly, **VLSM (Variable Length Subnet Mask)** for efficient IP utilization

👉 This chapter moves you from **basic subnetting** to **real-world network design** 💼🌐

🔹 2️⃣ Chapter Conclusion 🎯

Class A subnetting and VLSM are **core skills for network engineers** working with:

- Large enterprises 🏢
- ISPs 🌐
- Data centers 🖥️

Key understanding from this chapter:

- **Subnet Mask** decides how a network is divided
- **CIDR** removes class limitations
- **VLSM** prevents IP wastage and optimizes networks

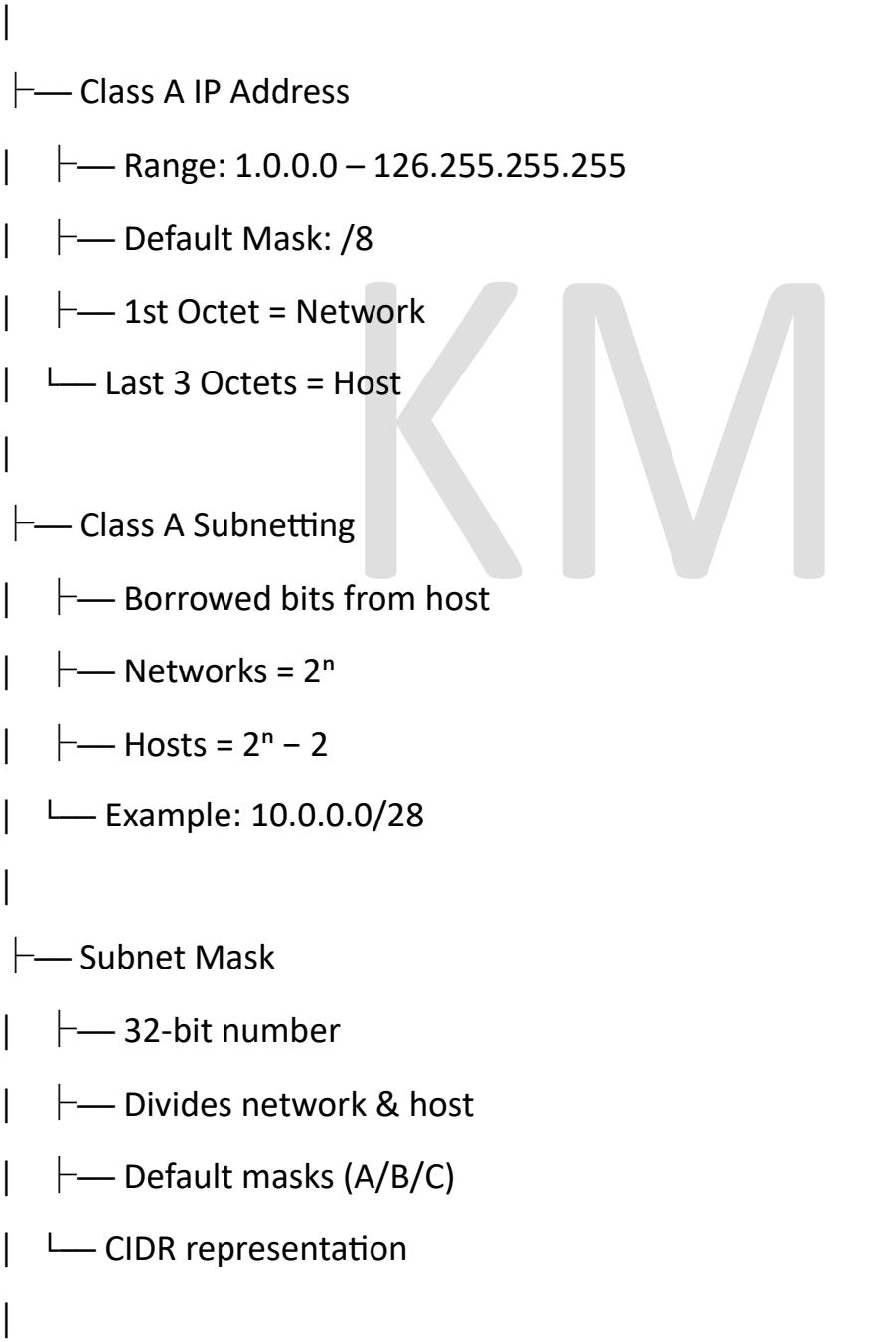
- Always assign **largest subnet first** in VLSM

💡 If you can explain VLSM confidently, an interviewer instantly knows:

"This candidate understands real network planning." 🔥😎

🔹 3️⃣ Detailed Mind Map

Lecture 7: Class A Subnetting, Subnet Mask & VLSM



- Subnet Mask ↔ CIDR
  - Binary conversion
  - Count network bits
  - Example: 255.255.255.248 → /29
- Special Subnets
  - /30 for router links
  - /32 for single host
- CMD Networking
  - ipconfig
  - IP address
  - Subnet mask
  - Default gateway
- VLSM
  - Variable subnet sizes
  - Efficient IP usage
  - Largest-first allocation
  - Real-world design
- VLSM Example
  - Requirement analysis
  - Power of 2 selection
  - CIDR assignment
  - Network allocation

🔹 4️⃣ Q & A

❓ Q1. What is a Class A IP address?

Answer:
A Class A IP address is designed for **very large networks**.
Its range is **1.0.0.0 to 126.255.255.255**, and its default subnet mask is **/8**.

❓ Q2. How many network and host bits are there in Class A?

Answer:

- Network bits: 8
- Host bits: 24

This allows **millions of hosts** in a single network 🌍.

❓ Q3. What is the default CIDR of Class A?

Answer:
The default CIDR of Class A is **/8**.

❓ Q4. Explain Class A subnetting in simple terms.

Answer:
Class A subnetting means **borrowing bits from the host portion** to create multiple smaller networks while reducing hosts per network.

❓ Q5. In 10.0.0.0/28, how many bits are borrowed?

Answer:
Borrowed bits = 28 − 8 = **20 bits**

❓ Q6. How many networks are created in 10.0.0.0/28?

Answer:
Networks = 2^{20} = **1,048,576 networks**

❓ Q7. How many usable hosts are in /28?

Answer:
Host bits = 4
Total IPs = 16
Usable hosts = **14**

❓ Q8. What is a Subnet Mask?

Answer:
A subnet mask is a **32-bit number** used to separate:

- Network portion
- Host portion

It helps routers decide where to send packets 🚦.

❓ Q9. Why is subnet mask important?

Answer:
Subnet mask:

- Divides large networks
- Improves security 🔐
- Reduces traffic 🚦
- Controls number of hosts

❓ Q10. What are default subnet masks of Class A, B, and C?

Answer:

- Class A → 255.0.0.0
- Class B → 255.255.0.0
- Class C → 255.255.255.0

❓ Q11. How do you convert subnet mask to CIDR?

Answer:
Convert subnet mask to binary and **count the number of 1s**.

Example:
255.255.255.248 → 11111000 → **/29**

❓ Q12. Why is /30 subnet commonly used?

Answer:
/30 provides **2 usable IPs**, which is perfect for **router-to-router point-to-point links** 🔗 .

❓ Q13. What command is used to check IP details in Windows?

Answer:
The command is:

ipconfig

It shows IP address, subnet mask, and default gateway 💻 .

❓ Q14. What is VLSM?

Answer:
VLSM (Variable Length Subnet Mask) allows **different subnet sizes** within the same network to **save IP addresses** 🎯 .

❓ Q15. Why is VLSM better than FLSM?

Answer:
Because VLSM:

- Avoids IP wastage
- Allocates IPs based on actual requirement
- Is used in real-world networks 🌐

❓ Q16. What is the first step in VLSM?

Answer:
Arrange host requirements from **largest to smallest** 📊.

❓ Q17. Why do we assign the largest subnet first in VLSM?

Answer:
Because large networks need continuous IP ranges.
If assigned later, IP fragmentation can occur ❌.

❓ Q18. Explain the VLSM example in brief.

Answer:
From 192.168.10.0/26:

- Team A → /26
- Team B → /27
- Team C → /28
- Team D → /29

This ensures **zero IP wastage** ✔️.

❓ Q19. What happens if VLSM is not used?

Answer:
Without VLSM:

- IP addresses are wasted
- Network design becomes inefficient
- Scaling becomes difficult 🚨

❓ Q20. Real-life analogy of VLSM?

Answer:
Different departments in a company get **different-sized office spaces** based on team size 🏢.