📘 Lecture 6- Class B Subnetting

🌐 1. What is a Class B IP Address?

A **Class B IP address** is used for **medium to large-sized networks** 🏢🏫.

📌 **Class B Range**

- **128.0.0.0 to 191.255.255.255**

📐 **Default Subnet Mask**

- **/16**
- First **16 bits** → Network part
- Last **16 bits** → Host part

🧠 **Daily Life Example:**

- Think of a university campus 🎓 where each department has many computers.
- Class B allows many sub-networks with many hosts.

📜 2. Understanding the Given IP

🔹 **IP Address:**

172.168.10.0/22

- 172.x.x.x → **Class B**
- Default Class B mask = **/16**
- Given mask = **/22**

🔍 3. What Does /22 Mean?

- Total bits in IPv4 = **32**
- Network bits = **22**
- Host bits = **32 – 22 = 10**

👉 Extra bits added to network = **Borrowed bits**

🧮 4. Borrowed Bits Calculation

- Default mask = /16
- Given mask = /22

📌 Borrowed Bits

22 − 16 = 6 bits

👉 These 6 bits are borrowed from the **host portion** and added to the **network portion** 🔁

🧮 5. How Many Subnets?

📐 Formula

Number of Subnets = 2^n

- n = borrowed bits = 6

✅ Result

2^6 = 64 subnets

🧠 Why needed?

- To divide one big organization network into multiple departments 🏢

🧮 6. IP Addresses per Subnet

🔹 Remaining Host Bits

32 − 22 = 10 bits

📐 Formula

Total IPs per Subnet = 2^{10} = 1024

✅ Usable Hosts

1024 − 2 = 1022

❓ Why Subtract 2?

- First IP → **Network Address** 🆔
- Last IP → **Broadcast Address** 📢

🧱 7. Finding Network ID Range (Very Important 🔥)

📌 Key Rule

- Check **which octet is affected by subnetting**
- In **/22**, subnetting happens in the **3rd octet**

🔢 Block Size Calculation

- Borrowed bits in 3rd octet = **2 bits**
- Block size = **2^2 = 4**

📜 8. Network Ranges for 172.168.10.0/22

Each subnet increases by **4** in the 3rd octet 👇

🔹 **First Few Subnets**

Subnet No.	Network ID	Broadcast Address
1	172.168.0.0	172.168.3.255
2	172.168.4.0	172.168.7.255
3	172.168.8.0	172.168.11.255
4	172.168.12.0	172.168.15.255
...	...	...
64	172.168.252.0	172.168.255.255

👉 Total **64 networks** will be created ✔️

🧠 **Daily Life Analogy**

- Each **subnet** = one department 🏢
- Network ID = department name board
- Broadcast = office announcement system 📣

🧮 9. Example 2: Class B Subnetting – 172.168.0.0/21

🔹 **Step 1: Identify Class**

- 172.x.x.x → Class B
- Default mask = /16

🔹 **Step 2: Borrowed Bits**

21 − 16 = 5 bits

🔹 **Step 3: Number of Subnets**

2^5 = 32 subnets

🔹 **Step 4: Host Bits & Hosts**

- Host bits = 32 − 21 = **11 bits**

Total IPs = 2^{11} = 2048

Usable Hosts = 2046

🔹 **Step 5: Block Size & Network Range**

- Subnetting octet = **3rd octet**
- Borrowed bits in 3rd octet = **3 bits**

Block size = 2^3 = 8

🔹 **Network Ranges**

Subnet	Network ID	Broadcast
1	172.168.0.0	172.168.7.255
2	172.168.8.0	172.168.15.255

Subnet	Network ID	Broadcast
3	172.168.16.0	172.168.23.255
...	...	...
32	172.168.248.0	172.168.255.255

🎯 Key Points to Remember

- Class B default mask = /16
- Borrowed bits decide number of subnets
- Block size helps find network ID
- Always subtract 2 for usable hosts

🔹 1️⃣ Chapter Summary

Class B subnetting is used to divide **medium to large networks** into multiple smaller and manageable sub-networks 🏢🏠.

A **Class B IP address**:

- Ranges from **128.0.0.0 – 191.255.255.255**
- Has a **default subnet mask /16**
- First **16 bits = Network**
- Last **16 bits = Host**

By using **CIDR notation** like /22 or /21, we:

- Borrow bits from the host portion
- Increase the number of networks (subnets)
- Control the number of hosts per subnet

Key concepts include:

- **Borrowed bits**
- **Number of subnets = 2^n**
- **Hosts per subnet = $2^n - 2$**
- **Block size** to find network ranges

👉 This chapter explains **how large organizations logically divide their networks** for efficiency, security, and scalability 🌐🔐

🔹 2️⃣ Chapter Conclusion 🎯

Class B subnetting is essential for **real-world enterprise networks** like:

- Universities 🎓
- Corporate offices 🏢
- Data centers 🖥️

By mastering this chapter, you learn:

- How to divide a big IP block into departments
- How CIDR gives flexibility beyond classful limits
- How to calculate subnets, hosts, and ranges confidently

💡 An interviewer can clearly see that:

You understand **both theory and practical subnet planning**

👉 Strong Class B subnetting = Strong networking fundamentals 💪🌍

🔹 3 Detailed Mind Map

Class B Subnetting

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├── Class B Overview

| ├── Range: 128.0.0.0 – 191.255.255.255

| ├── Default Mask: /16

| ├── 16 Network Bits

| └── 16 Host Bits

|

├── CIDR Concept

| ├── /21, /22, etc.

| ├── Flexible subnetting

| └── Borrowing host bits

|

├── Borrowed Bits

| ├── Given mask – Default mask

| └── Decide number of subnets

|

├── Calculations

| ├── Subnets = 2^n

| ├── Hosts = $2^n - 2$

| └── Block size

|

├── Block Size Logic

```
|   ├── Identify subnetting octet
|   ├── Use borrowed bits
|   └── Increment network IDs
|
├── Example /22
|   ├── 64 subnets
|   ├── 1022 hosts each
|   └── Jump = 4 (3rd octet)
|
├── Example /21
|   ├── 32 subnets
|   ├── 2046 hosts each
|   └── Jump = 8 (3rd octet)
|
└── Key Rules
    ├── Always subtract 2
    ├── Network & Broadcast reserved
    └── CIDR removes class limitations
```

🔹 4️⃣ Q & A

❓ Q1. What is a Class B IP address?

Answer:
A Class B IP address is used for **medium to large networks** and ranges from **128.0.0.0 to 191.255.255.255**.
It has a default subnet mask of **/16**.

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

Answer:

- Network bits = 16
- Host bits = 16

This allows many subnets and many hosts per subnet 🧠.

❓ Q3. What is the default subnet mask of Class B?

Answer:
The default subnet mask of Class B is **255.255.0.0** or **/16**.

❓ Q4. What does CIDR /22 mean?

Answer:
/22 means:

- 22 bits are used for the network
- 10 bits are used for hosts
  It allows flexible subnetting beyond default class limits 🎯.

❓ Q5. How do you calculate borrowed bits?

Answer:
Borrowed bits =
👉 **Given mask − Default mask**

Example:
/22 − /16 = **6 borrowed bits**

❓ Q6. How many subnets are created in /22?

Answer:
Formula:
👉 Subnets = 2^n

Where n = borrowed bits = 6
So, **2^6 = 64 subnets**

❓ Q7. How many hosts per subnet in /22?

Answer:
Host bits = 32 − 22 = 10
Total IPs = 2^{10} = 1024
Usable hosts = **1022**

❓ Q8. Why do we subtract 2 from total IPs?

Answer:
Because:

- 1 IP is reserved for **Network ID**
- 1 IP is reserved for **Broadcast ID**

These cannot be assigned to devices ❌.

❓ Q9. What is block size in subnetting?

Answer:
Block size is the **jump value** between network IDs.
It helps find subnet ranges quickly ⚡.

❓ Q10. In /22, which octet is used for subnetting?

Answer:
In /22, subnetting occurs in the **3rd octet**.

❓ Q11. What is the block size for /22?

Answer:
Borrowed bits in 3rd octet = 2
Block size = 2^2 = **4**

❓ Q12. Explain subnet ranges for 172.168.10.0/22

Answer:
Networks increase by **4 in the 3rd octet**:

- 172.168.0.0 – 172.168.3.255
- 172.168.4.0 – 172.168.7.255
- 172.168.8.0 – 172.168.11.255
  Total **64 subnets** ✔

❓ Q13. Explain subnetting of 172.168.0.0/21

Answer:

- Borrowed bits = 5
- Subnets = 32
- Host bits = 11

- Usable hosts = 2046
- Block size = 8 (3rd octet)

❓ Q14. Why is Class B suitable for large organizations?

Answer:
Because it:

- Supports many subnets
- Supports thousands of hosts
- Is scalable and efficient for enterprises 🏢🌍

❓ Q15. What happens if subnetting is not used?

Answer:
Without subnetting:

- Network traffic increases 🚦
- Security decreases 🔓
- Network becomes slow and unmanageable 🚨

❓ Q16. How do you quickly identify Class B?

Answer:
If the **first octet is between 128 and 191**, it is **Class B**.

❓ Q17. What is the real-life analogy of Class B subnetting?

Answer:
A **university campus**:

- Campus = Network
- Departments = Subnets
- Students/PCs = Hosts 🎓🖥️