

Lecture 11- DHCP (Dynamic Host Configuration Protocol)

What is DHCP?

DHCP (Dynamic Host Configuration Protocol) is a network protocol used to automatically assign network settings to devices.

DHCP Automatically Provides:

-  IP Address
-  Subnet Mask
-  Default Gateway
-  DNS Server
-  Lease Duration

 Without DHCP, every device would need **manual IP configuration**, which is slow and error-prone.



Why is DHCP Used?

- ✓ Reduces manual configuration work
- ✓ Prevents wrong IP & duplicate IP issues
- ✓ Automatically reassigns unused IPs
- ✓ Used in almost **all Wi-Fi networks**

Daily Life Example

When you connect your phone or laptop to Wi-Fi:

- You don't type IP address
- You don't type DNS
- Everything works automatically

 This is DHCP working in the background 



DHCP Working Process – DORA

DHCP uses a **4-step process** called **DORA**.

Step Name	Sent By	Type	Purpose	
1	Discover	Client	Broadcast	Find DHCP server
2	Offer	Server	Unicast/Broadcast	Offer IP address
3	Request	Client	Broadcast	Accept IP
4	ACK	Server	Unicast/Broadcast	Confirm IP



DORA Process Explained (Easy)

1 DHCP Discover

- Sent by: **Client**
- Type: **Broadcast (255.255.255.255)**
- Meaning: “Is any DHCP server available?”



2 DHCP Offer

- Sent by: **DHCP Server**
- Includes:
 - IP address
 - Subnet mask
 - Default gateway
 - DNS server
 - Lease time
- Meaning: “I can give you this IP.”

DHCP Request

- Sent by: **Client**
- Meaning: “I accept this IP from this server.”

DHCP ACK (Acknowledgement)

- Sent by: **DHCP Server**
- Meaning: “This IP is officially yours.” 

What DHCP Provides to Clients

- IP Address
- Subnet Mask
- Default Gateway
- DNS Server
- Lease Duration
- Optional info (Domain name, NTP server)

DHCP Lease Concept

- ◆ **Lease** = Time for which IP is assigned
- ◆ Client renews lease before expiry
- Example:

Laptop connects in office → gets IP for 8 hours → renews automatically

Important DHCP Terms

Term	Meaning
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Dynamic IP Automatically assigned IP

Static IP Manually assigned IP

Term	Meaning
Lease Time	IP validity duration
DHCP Server	Assigns IP (Router)
DHCP Client	Receives IP (PC)

⚠️ APIPA (Automatic Private IP Addressing)

If **DHCP fails**, the device assigns itself an IP automatically.

🔴 APIPA Range:

169.254.0.1 – 169.254.255.254 (/16)

📍 Meaning:

- DHCP server not reachable
- No internet access
- Only local communication (limited)

🛠️ How to Fix APIPA Issue

✓ Check router is ON

✓ Check DHCP service is enabled

✓ Check cable connections

✓ Renew IP address

✓ Restart router / PC

📍 If IP starts with **169.254.x.x** → DHCP failed ✗

DHCP Lab Topology

- 1 Router (DHCP Server)
- 1 Switch
- 4 PCs

Network: **192.168.10.0/24**

Router Interface IP: **192.168.10.1**

Router DHCP Configuration (Step-by-Step)

◆ Step 1: Configure Router Interface

Router> enable

Router# configure terminal

Router(config)# interface g0/0

Router(config-if)# ip address 192.168.10.1 255.255.255.0

Router(config-if)# no shutdown

 Purpose:

Assign IP to router and activate interface.

◆ Step 2: Set Router Hostname

Router(config)# hostname DHCP_Server

 Helps identify router in network.

◆ Step 3: Create DHCP Pool

DHCP_Server(config)# ip dhcp pool CodingSeekho_Pune

 Pool = IP address group

◆ Step 4: Define Network Range

```
DHCP_Server(dhcp-config)# network 192.168.10.0 255.255.255.0
```

- Defines which IP range DHCP will assign.
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◆ Step 5: Exclude IP Address

```
DHCP_Server(config)# ip dhcp excluded-address 192.168.10.10
```

- Prevents DHCP from assigning reserved IPs.
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◆ Step 6: Define Default Gateway

```
DHCP_Server(dhcp-config)# default-router 192.168.10.1
```

- Tells PCs where to send traffic outside network.
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◆ Step 7: Define DNS Server

```
DHCP_Server(dhcp-config)# dns-server 8.8.8.8
```

- Converts domain names into IPs.
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◆ Step 8: Save Configuration

```
DHCP_Server# do write
```

- Saves config to NVRAM.
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PC Side Configuration

- Go to PC → Desktop → IP Configuration
 - Select **DHCP** instead of Static
 - PC will receive IP automatically 
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Verify DHCP on Router

show ip dhcp binding

• Shows:

- MAC address
 - Assigned IPs
 - Lease details
-

Real Life DHCP Example

In offices, hotels, airports:

- Hundreds of users connect daily
 - DHCP automatically manages IPs
 - No manual work needed
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Summary

- DHCP automates IP assignment
 - Uses **DORA process**
 - APIPA means DHCP failed
 - Router can act as DHCP Server
 - DHCP lab is VERY IMPORTANT for CCNA
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DETAILED SUMMARY



DHCP (Dynamic Host Configuration Protocol) is a **Layer 7 application-layer protocol** that automatically assigns network configuration details to devices when they join a network .

Instead of manually assigning:

- IP Address
- Subnet Mask
- Default Gateway
- DNS Server

DHCP does all this **automatically**, saving time and preventing errors .

DHCP works using a **4-step process called DORA**:

- 1 Discover
- 2 Offer
- 3 Request
- 4 Acknowledgement

If DHCP fails, devices assign themselves an **APIPA address (169.254.x.x)**, which means **no internet access** .

In real networks (offices, hotels, Wi-Fi, enterprises), DHCP is **mandatory** for scalable and error-free networking.



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CONCLUSION



DHCP is the **backbone of modern networking**.

Without DHCP, managing IP addresses in large networks would be **slow, manual, and error-prone** .

This chapter proves that the candidate:

- ✓ Understands automation in networking
- ✓ Knows real-world IP management
- ✓ Can configure DHCP on routers
- ✓ Can troubleshoot APIPA & IP issues

👉 Anyone who understands DHCP clearly is **ready for CCNA exams and real enterprise networks** 🚀

3 MIND MAP

DHCP

- |
 - |— What is DHCP
 - |— Automatic IP Assignment
 - |— Reduces Manual Work
 - |
 - |— What DHCP Provides
 - |— IP Address
 - |— Subnet Mask
 - |— Default Gateway
 - |— DNS Server
 - |— Lease Time
 - |
 - |— DORA Process
 - |— Discover (Client → Broadcast)
 - |— Offer (Server → Client)
 - |— Request (Client → Server)
 - |— ACK (Server → Client)
 - |
 - |— Lease Concept
 - |— Temporary IP
 - |— Auto Renewal



```
|  
|   └── APIPA  
|       |   └── 169.254.x.x  
|       └── DHCP Failure  
|           └── No Internet  
|  
|   └── DHCP Router Configuration  
|       |   └── Interface IP  
|       └── DHCP Pool  
|           └── Network Range  
|               └── Excluded IPs  
|               └── Default Gateway  
|           └── DNS Server  
|  
└── Verification  
    └── show ip dhcp binding
```



Q & A

◆ Q1. What is DHCP?

Answer:

DHCP is a protocol that **automatically assigns IP addresses and other network settings** to devices when they connect to a network.

👉 It removes the need for manual configuration.

◆ Q2. Why is DHCP important?

Answer:

DHCP is important because it:

- ✓ Saves time
 - ✓ Prevents duplicate IPs
 - ✓ Reduces configuration errors
 - ✓ Automatically reuses unused IPs
-

◆ Q3. What information does DHCP provide?

Answer:

DHCP provides:

- IP Address
 - Subnet Mask
 - Default Gateway
 - DNS Server
 - Lease Time
-

◆ Q4. Explain the DORA process 

Answer:

Step Name Description

- 1 Discover Client searches for DHCP server
- 2 Offer Server offers IP configuration
- 3 Request Client accepts offered IP
- 4 ACK Server confirms assignment

 This ensures secure and proper IP allocation.

◆ Q5. Why is DHCP Discover sent as broadcast? 

Answer:

Because the client **does not know the DHCP server's IP address**, so it broadcasts to all devices.

◆ Q6. What is DHCP lease time? 

Answer:

Lease time is the **duration for which an IP address is assigned** to a client.

 After expiry, the client renews it automatically.

◆ Q7. Difference between Static IP and Dynamic IP? 

Static IP Dynamic IP

Manually assigned Automatically assigned

Fixed Changes

Used for servers Used for clients

◆ Q8. What is APIPA? 

Answer:

APIPA (Automatic Private IP Addressing) is used when **DHCP fails**.

 Range:

169.254.0.1 – 169.254.255.254 (/16)

 Indicates no DHCP server available.

◆ Q9. How do you identify a DHCP failure? 

Answer:

If a device gets an IP starting with **169.254.x.x**, DHCP has failed.

◆ Q10. How do you fix APIPA issues? 

Answer:

- ✓ Check router is ON
 - ✓ Check DHCP service
 - ✓ Check cable
 - ✓ Renew IP
 - ✓ Restart devices
-



◆ Q11. Can a router act as a DHCP server? 

Answer:

Yes 

Cisco routers can act as **DHCP servers** and assign IPs to clients.

◆ Q12. Why do we exclude IP addresses in DHCP? 

Answer:

Excluded IPs prevent DHCP from assigning:

- ✓ Router IPs

- ✓ Server IPs
 - ✓ Reserved devices
-

◆ **Q13. What is a DHCP pool?** 

Answer:

A DHCP pool is a **group of IP addresses** defined for automatic assignment.

◆ **Q14. Command to verify DHCP assignments?** 

Answer:

show ip dhcp binding

👉 Shows MAC address, IP, and lease details.

◆ **Q15. Real-life use of DHCP?** 

Answer:

DHCP is used in:

- ✓ Offices
 - ✓ Homes
 - ✓ Hotels
 - ✓ Airports
 - ✓ Wi-Fi networks
-

⭐ **GOLDEN ANSWER** 🔥

“Explain DHCP in short”, say:

“DHCP is an application-layer protocol that automatically assigns IP addresses, subnet mask, gateway, DNS, and lease time to clients using the DORA process. It reduces manual work, prevents IP conflicts, and is essential for modern networks.”
