DHCP & DNS

1. **3 way- handshakes**

The **3-way handshake** is a fundamental process in the **TCP (Transmission Control Protocol)** used to establish a reliable connection between a client and a server. This handshake ensures that both parties are ready to send and receive data before the communication starts.

1. SYN (Synchronize)
The client initiates the connection by sending a SYN (synchronize) packet to the server.
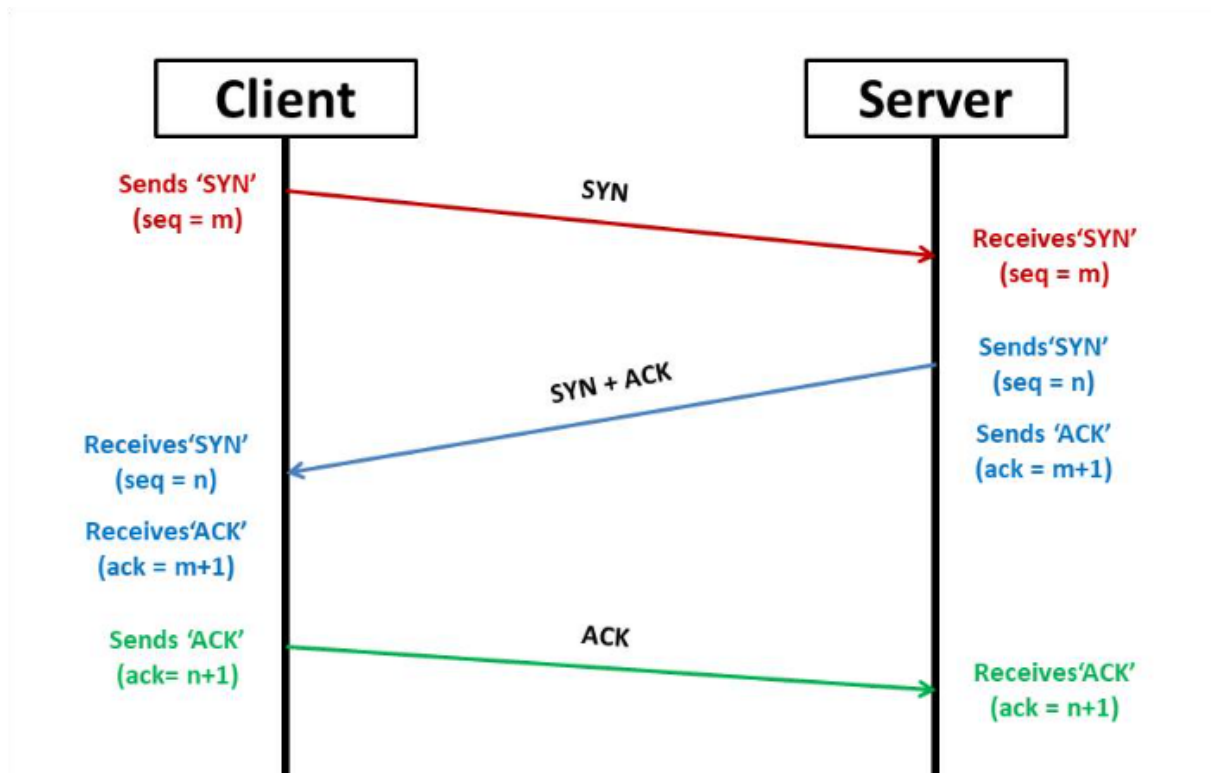
2. SYN-ACK (Synchronize-Acknowledge)

The server responds to the client with a **SYN-ACK** packet:

3. ACK (Acknowledge)

The client sends an **ACK** packet back to the server:

```
Client                                Server
  |---- SYN Seq=X ------------------->|
  |<--- SYN-ACK Seq=Y Ack=X+1 --------|
  |---- ACK Seq=X+1 Ack=Y+1 --------->|
```

3-Way Handshaking(for establishing connection)

three steps to establish the connection in 3-way handshakes:

1. Client sends SYN.

2. Server responds with SYN-ACK.

3. Client confirms with ACK.

2. **DHCP (Dynamic Host Configuration Protocol)—**

Assigns automatically IP Addresses in the network.

DHCP is a **client-server protocol** that automates the assignment of:

1. **IP Addresses** (from a predefined range or pool)

2. **Subnet Masks**

3. **Default Gateways**

4. **DNS Server addresses**

5. **Other optional parameters**, like domain names.

Without DHCP, these parameters would have to be manually configured, which is time-consuming and error-prone, especially for large networks.

DHCP Server-

 Windows Server/ Linux Machines / Cisco Router/Switches.

DHCP Client -

 PC/Laptop/Mobile

(IPv4 address from a **pool of addresses** for a limited period. The lease is typically from 24 hours to a week or more.)

How DHCP Works

The DHCP process involves four main steps, often referred to as **DORA**:

1. **D (Discover)** :
   - The client device (host) sends a **DHCP Discover broadcast** (255.255.255.255) to find available DHCP servers.
   - This packet is sent because the client doesn't yet have an IP address.

2. **O (Offer)**:
   - A DHCP server responds with a **DHCP Offer**, proposing an IP address and configuration settings to the client.

3. **R (Request)**:
   - The client sends a **DHCP Request** to the server, indicating acceptance of the offered IP address and configurations.

4. **A (Acknowledge)**:
   - The server sends a **DHCP Acknowledgment**, finalizing the lease of the IP address and other configurations to the client.
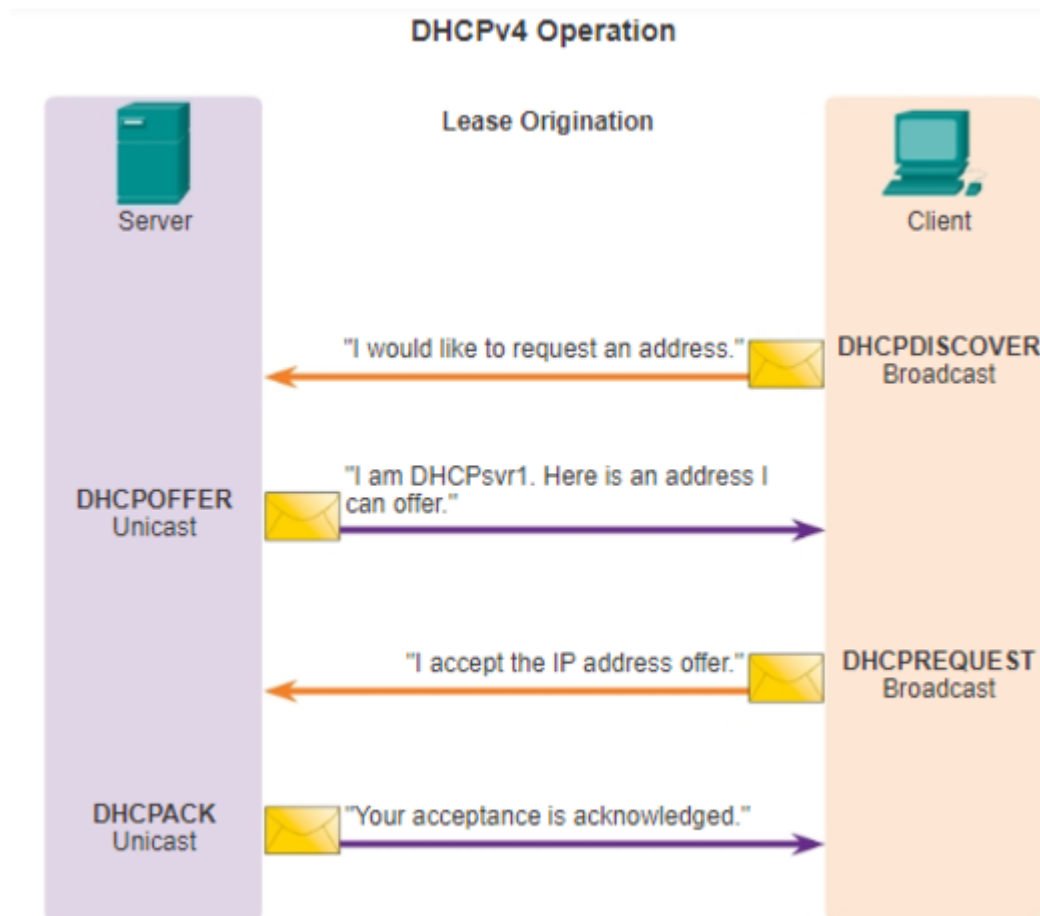
   ###########

   APIPA

   Automatic Private IP addressing with this, A DHCP client can automatically configure an IP address & subnet mask when no DHCP server is available.

   It was a random address ranging from Class B from 169.254.0.1 to 169.254.255.254. default subnet mask of 255.255.0.0

   ###########

DHCPv4 Operation

Lease Origination

Unicast:

It is a one-to-one communication technique where communication occurs between a single client and a single recipient in a network.

**For Example:** Browsing any website

Multicast:

Multicast is a group type of communication where one or more senders transfer data to receivers. It uses the IGMP (Internet Group Management Protocol) to determine the receiver group.

For Example: Sending an Email to a particular group

Broadcast:

Broadcast is a one-to-many type of communication where data communication occurs between all the devices in the network. In broadcast, data is sent by one sender once and a copy of that data is available to all the devices in that network.

For Example: Television
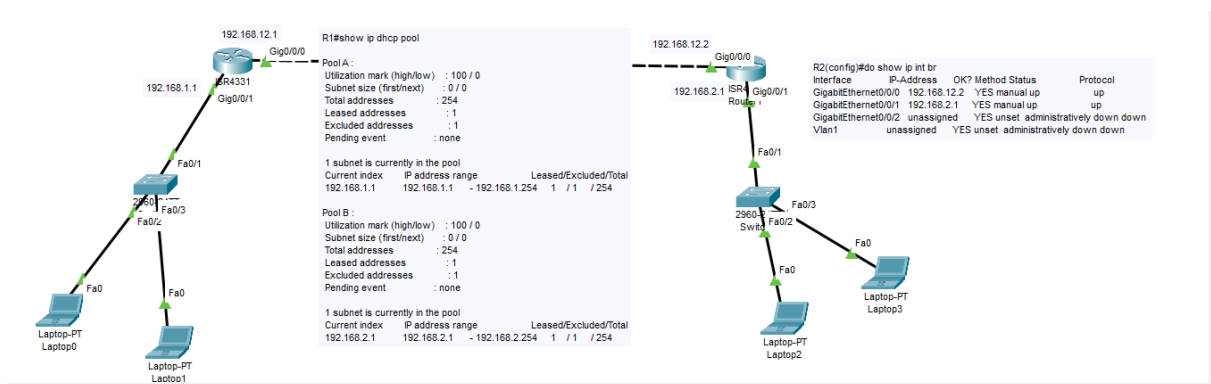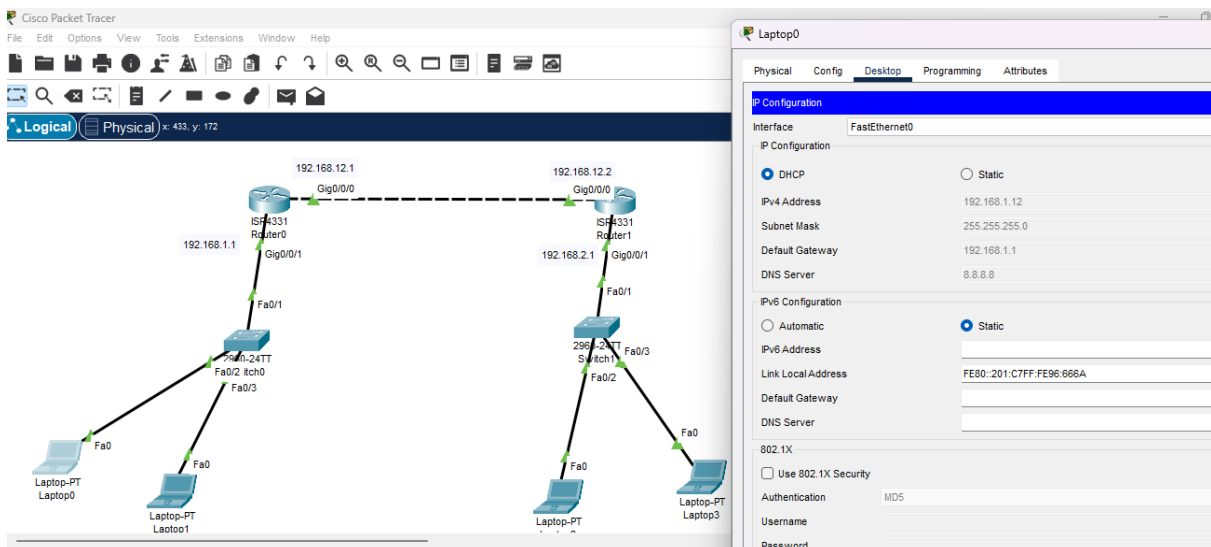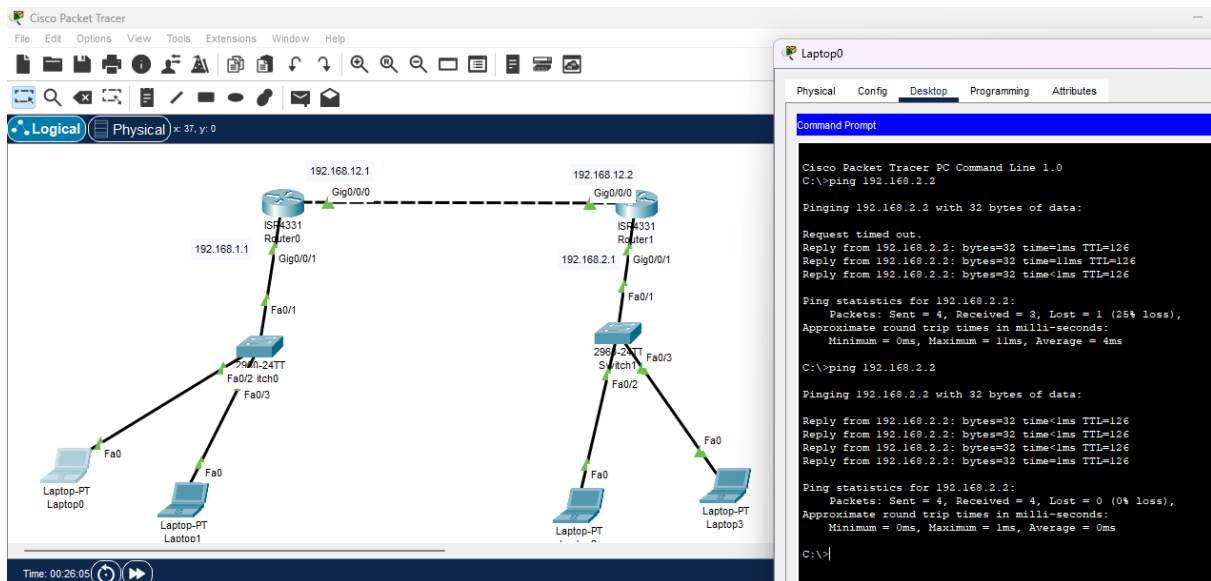
######## R1 ########

enable

```
conf t
hostname R1
int gig0/0/1
ip add 192.168.1.1 255.255.255.0
no sh

int gig0/0/0
ip add 192.168.12.1 255.255.255.0
no shutdown

ip route 192.168.2.0 255.255.255.0 192.168.12.2

ip dhcp pool A
network 192.168.1.0 255.255.255.0
default-router 192.168.1.1
dns-server 8.8.8.8

ip dhcp pool B
network 192.168.2.0 255.255.255.0
default-router 192.168.2.1
dns-server 8.8.8.8


ip dhcp excluded-address 192.168.1.1 192.168.1.10


######## R2 ########

enable
conf t
hostname R2
int gig0/0/0
ip add 192.168.12.2 255.255.255.0
no sh

int gig0/0/1
ip add 192.168.2.1 255.255.255.0
no shutdown
```

```
ip route 192.168.1.0 255.255.255.0 192.168.12.1

int gig0/0/1
ip helper-address 192.168.12.1
ip helper-address 192.168.13.1
```

3. **DNS (Domain Name System):—-**

DNS is known as the phonebook that helps in translating the domain into a computer-readable IP address. DNS allows users to access websites without having to memorize long strings of numbers.

It acts as a directory for the internet, allowing devices to locate and connect to websites or services without needing to remember complex IP addresses.
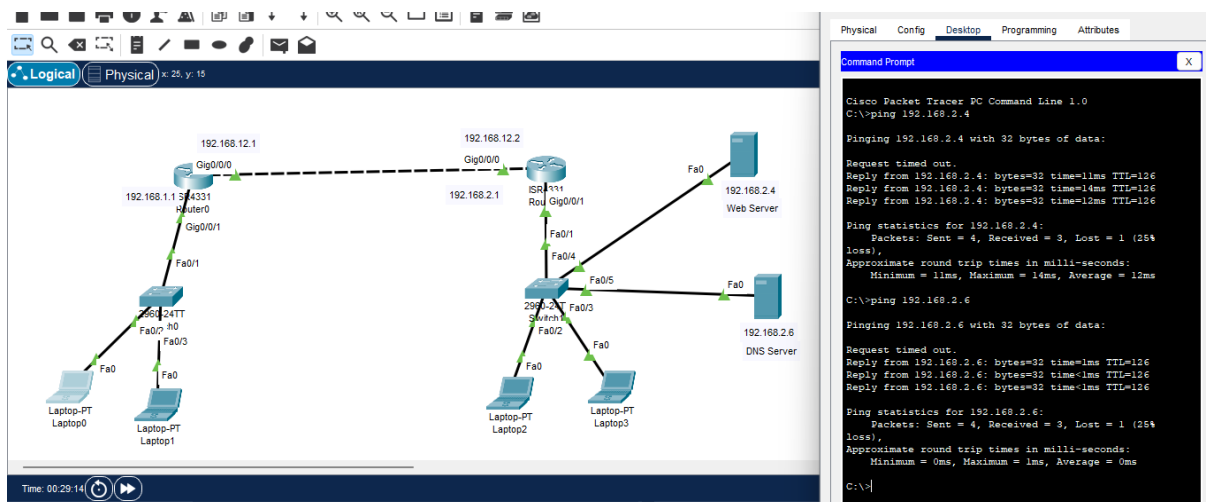
Key Components of DNS

1. **DNS Servers**: These are specialized servers that store mappings of domain names to IP addresses.

   - **Authoritative DNS Servers**: Provide the definitive IP address for a domain.

   - **Recursive DNS Servers**: Handle client queries by contacting other DNS servers if needed.

2. **DNS Records**: Various record types are stored in DNS servers, such as:

- **A Record**: Maps a domain to an IPv4 address.

- **AAAA Record**: Maps a domain to an IPv6 address.

- **MX Record**: Identifies mail servers for a domain.

- **CNAME Record**: Maps a domain to another domain (alias).

3. **DNS Resolver**: The client device or software (e.g., a router or computer) that initiates the DNS query.

4. **DNS Query Types**:

   - **Recursive Query:** The DNS server handles the entire process of resolving the domain name.

   - **Iterative Query:** The client handles the query step-by-step by contacting multiple DNS servers.