DHCP (Dynamic Host Configuration Protocol):

- DHCP is an abbreviation for Dynamic Host Configuration Protocol.
- Cisco IOS features known as Easy IP Lease which is full-featured DHCP server.
- DHCP is a client server protocol that automatically provides an IP to hosts.
- DHCP also provide IP, subnet mask, default gateway, DNS server & other config.
- DHCP allows a network device to dynamically receive IP address parameters.
- DHCP process follows DORA process, Discover, Offer, Request & Acknowledgement.
- DHCP is app layer protocol used by hosts for obtaining network setup information.
- DHCP Server dynamically configures a host or Network device in a network.
- DHCP is Client server protocol, which uses User Datagram Protocol services.
- DHCP port number for server is UDP port 67 and for the client is UDP port 68.
- DHCP assigned Internet Protocol (IP) address from a pool (range) of addresses.
- Dynamic Host Configuration Protocol (DHCP) is an application layer protocol.

Dynamic	Automatically
Host	Any computer that is connected to the network
Configuration	To configure a host means to provide network information
Protocol	Set of rules and regulation

Advantages of DHCP:

- Primary advantage of DHCP is easier management of IP addresses.
- Centralized network client configuration.
- DHCP greatly reduce the time required to configure & reconfigure computers.
- DHCP Server assigning IP addresses automatically avoid configuration errors.
- Ease of adding new clients to a network.
- Reuse of IP addresses reducing the total number of IP addresses.
- No need to reconfigure each client separately.
- Configure the network from a centralized area.
- Easy handling of new users and reuse of IP address can be achieved.

IOS DHCP Server:

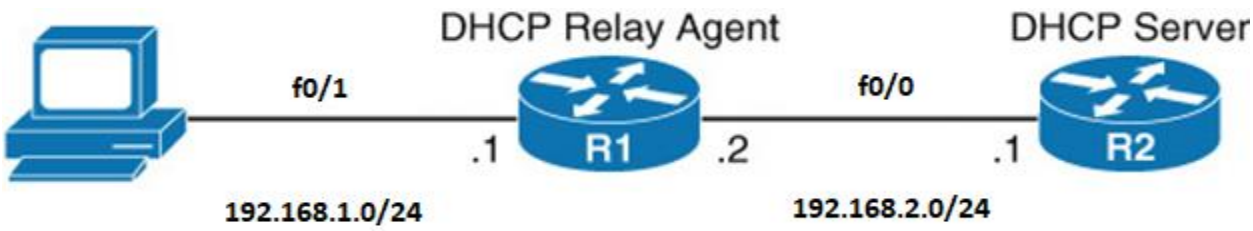
- Cisco devices running Cisco software include DHCP server.
- Cisco router can be used as a DHCP server and the various options available.
- Cisco IOS routers and layer 3 switches can be configured as DHCP server.
- The Cisco IOS DHCP server is a full DHCP server implementation.
- Cisco IOS DHCP assigns and manages IP addresses from specified address pools.
- Cisco IOS DHCP server can be configured to assign additional parameters as well.
- DHCP server is the one responsible for handing out IPs to the clients.

DHCP Client:

- DHCP client is a host using DHCP to obtain configuration parameters.
- The endpoint that receives configuration information from a DHCP server.
- DHCP client is anything needing an IP address that is not configured as a static.
- Cisco routers can be configure as both DHCP servers and DHCP clients.
- DHCP clients use UDP broadcasts to send their initial DHCPDISCOVER messages.
- DHCP Client uses UDP port 67 to send messages to the server.

DHCP Relay:

- DHCP relay agent is any host that forwards DHCP packets between clients and servers.
- DHCP Relay allows clients to obtain DHCP info from a server on a different subnet.
- Relay agents are used to forward requests and replies between clients and servers.
- Relay agents are used to forward request when they are not on the same physical subnet.
- The devices that do the forwarding are referred to as DHCP relay agents.
- Relay agents forward packets differently than normal IP forwarding.
- Relay agents receive a DHCP message & generate a new message out another interface.
- DHCP relay agent adds a GIADDR (Gateway Address of Packet) field.
- DHCP relay also add the Relay agent information option 82 if enabled.



DHCP Operation:

- DHCP important messages exchanged between a DHCP client & DHCP Server.
- Four basic phases are required in DHCP operations between a DHCP server and DHCP client.
- DHCP operation process for IPv4 called DORA process.

DHCP Discover Message:

- First message generated in the communication process between server and client.
- Client host generated this message to discover DHCP server in a network.
- This message is broadcasted to all devices present in a network to find DHCP server.
- Incase no respond from a DHCP server, windows client assigns itself, an APIPA.
- DHCP Discover message use broadcast IP address and broadcast MAC address.
- This message is 342 or 576 bytes long & Destination MAC address is FFFFFFFFFFFF.
- Source IP address is 0.0.0.0 because DHCP client has no IP address until now.
- Destination IP address is broadcast 255.255.255.255.

DHCP Offer Message:

- DHCP servers receive a DHCP Discover message respond with a DHCP Offer message.
- DHCP Server response to client and offers the client an IPv4 address lease.
- DHCP Offer message is broadcasted by server.
- DHCP Offer size of message is 342 bytes.
- If more than, one DHCP servers then client will accept the first DHCP OFFER message.
- Server ID is specified in the packet in order to identify the server.
- The DHCP Offer message is broadcast by the DHCP server.
- The destination IP address is broadcast IP address.
- The destination MAC address is FFFFFFFFFFFF.
- The source IP address is server IP address & MAC address is server MAC address.

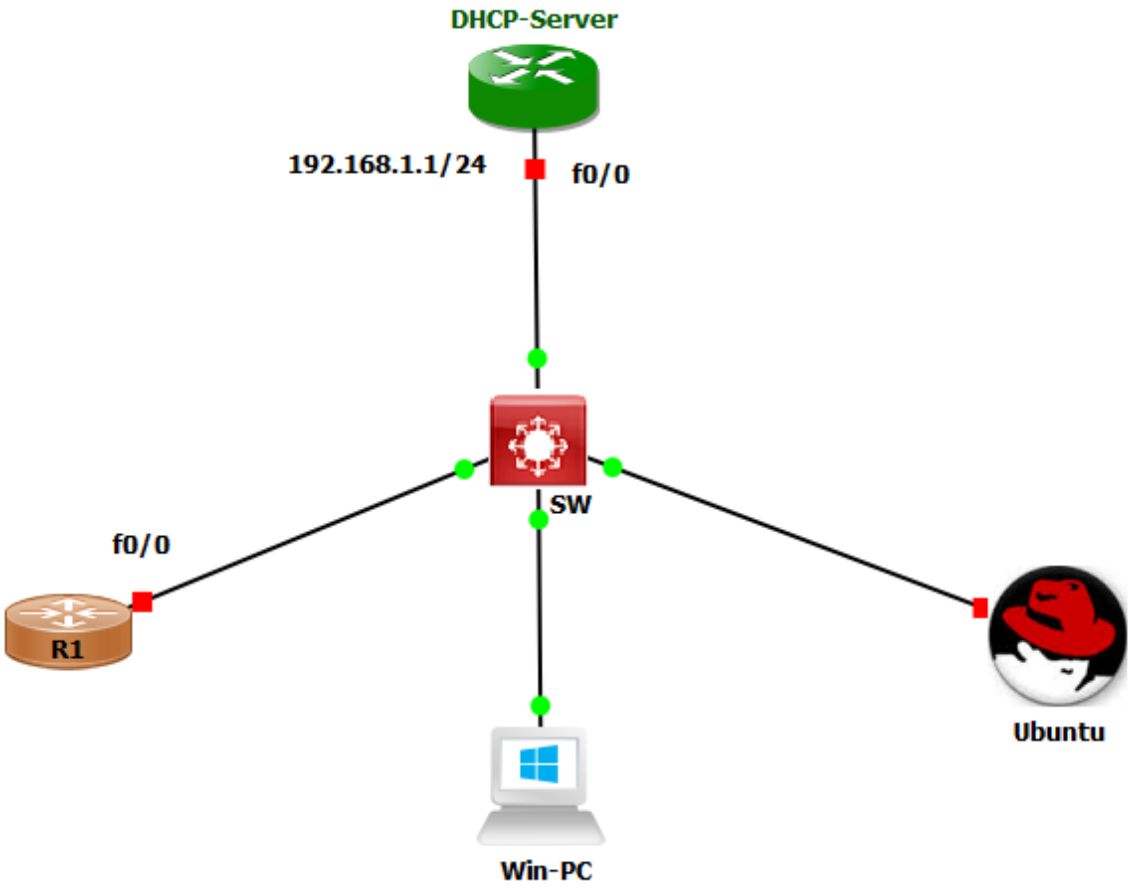
DHCP Request Message:

- Clients accept first offer received by broadcasting a DHCP Request message.
- Client receives an offer message & responds by broadcasting a DHCP request message.
- Client produce a gratuitous ARP to find any other host in network with same IP address.
- If there is no reply by other host, then there is no host with same TCP configuration.
- Broadcast message is send to server showing the acceptance of IP address.
- Source IP address is 0.0.0.0, as the client has no IP right now.
- Destination IP address is 255.255.255.255 broadcast IP address.
- Source MAC address is client MAC address & destination MAC address is FFFFFFFFFFFF.

DHCP Acknowledgment Message:

- Server accepts the client request and DHCP Acknowledgment message send.
- Server make entry with specified client ID & bind the IP address offered with lease time.
- Finally, client have the IP address provided by DHCP server.
- Server will not provide this IP address to any other host.

DHCP Discover		Hello, any DHCP server available out there.
DHCP Offer		I am DHCP Server and I can give you the IP Address.
DHCP Request		Thank you for your response. Please allocate lease IP address to me.
DHCP Ack		Sure, here is your IP information



DHCP Server Configuration
DHCP-Server(config)#ip dhcp excluded-address 192.168.1.1 DHCP-Server(config)#ip dhcp pool MYPOOL DHCP-Server(dhcp-config)#network 192.168.1.0 /24 DHCP-Server(dhcp-config)#default-router 192.168.1.1 DHCP-Server(dhcp-config)#dns-server 8.8.8.8 DHCP-Server(dhcp-config)#domain-name test.com DHCP-Server(dhcp-config)#lease 1 1 1
DHCP-Server# show ip dhcp binding

DHCP Server Show Commands	
DHCP-Server# show ip dhcp binding	DHCP-Server# show ip dhcp pool
DHCP-Server# show ip dhcp database	DHCP-Server# show ip dhcp conflict
DHCP-Server# show ip dhcp server statistics	

DHCP release & Renew	
C:\Users\Ahmad>ipconfig /release C:\Users\Ahmad>ipconfig /renew	R1#renew dhcp FastEthernet 0/0
R1(config)#interface f0/0 R1(config-if)#shutdown R1(config-if)#no shutdown	$ sudo dhclient -r eth0 $ sudo dhclient eth0

```
DHCP-Server#show ip dhcp binding
Bindings from all pools not associated with VRF:
IP address          Client-ID/                Lease expiration        Type
                    Hardware address/
                    User name
192.168.1.2         01be.0fbe.dd63.0e         Mar 02 2002 01:02 AM    Automatic
192.168.1.3         0063.6973.636f.2d63.      Mar 02 2002 01:02 AM    Automatic
                    3230.322e.3130.3563.
                    2e30.3030.302d.4661.
                    302f.30
```

bootp

No.	Time	Source	Destination	Protocol	Length	Info
62	84.039945	192.168.1.3	192.168.1.1	DHCP	618	DHCP Release - Transaction ID 0x924
63	89.639724	192.168.1.3	192.168.1.1	DHCP	618	DHCP Release - Transaction ID 0x924
65	95.474261	192.168.1.3	192.168.1.1	DHCP	618	DHCP Release - Transaction ID 0x924
72	111.854469	0.0.0.0	255.255.255.255	DHCP	618	DHCP Discover - Transaction ID 0x12b7
74	114.197555	192.168.1.1	255.255.255.255	DHCP	344	DHCP Offer - Transaction ID 0x12b7
75	114.214619	0.0.0.0	255.255.255.255	DHCP	618	DHCP Request - Transaction ID 0x12b7
76	114.234551	192.168.1.1	255.255.255.255	DHCP	357	DHCP ACK - Transaction ID 0x12b7

DHCP Server Configuration
DHCP-Server(config)#ip dhcp pool test DHCP-Server(dhcp-config)#network 192.168.1.0 /24 DHCP-Server# debug ip dhcp server packet
DHCP Relay Configuration
Relay(config)#interface f0/1 Relay(config-if)#ip helper-address 192.168.2.1 Relay# debug ip dhcp server packet
DHCP Client Configuration
Client(config)#no ip routing Client(config)#interface f0/1 Client(config-if)#ip add dhcp Client(config-if)#no shutdown Client# show ip int br

```
DHCP-Server#show ip dhcp binding
Bindings from all pools not associated with VRF:
IP address          Client-ID/              Lease expiration        Type
                    Hardware address/
                    User name
192.168.1.1         0063.6973.636f.2d63.    Mar 02 2002 12:02 AM    Automatic
                    3230.312e.3066.3363.
                    2e30.3030.312d.4661.
                    302f.31
```

```
Client#show ip int br
Interface                  IP-Address      OK? Method Status                Prot
ocol
FastEthernet0/0            unassigned      YES NVRAM  administratively down down
FastEthernet0/1            192.168.1.1     YES DHCP   up                    up
```

```
Relay#show running-config interface f0/1
Building configuration...

Current configuration : 127 bytes
!
interface FastEthernet0/1
 ip address 192.168.1.2 255.255.255.0
 ip helper-address 192.168.2.1
```