

DHCP (Dynamic Host Configuration Protocol):

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

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

IOS DHCP Server:

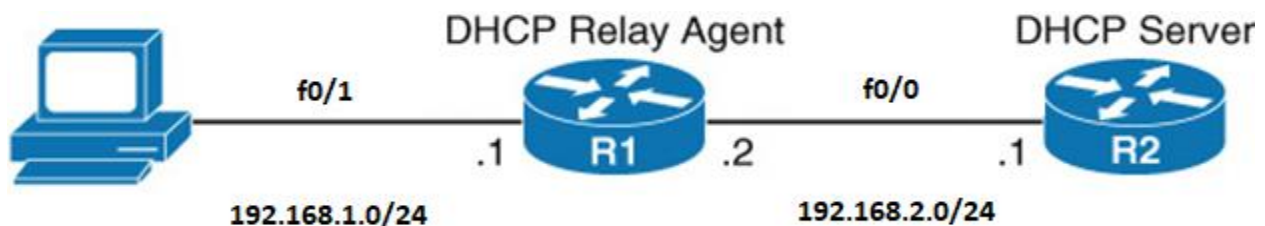
- o Cisco devices running Cisco software include DHCP server.
 - o Cisco router can be used as a DHCP server and the various options available.
 - o Cisco IOS routers and layer 3 switches can be configured as DHCP server.
 - o The Cisco IOS DHCP server is a full DHCP server implementation.
 - o Cisco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

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

DHCP Relay:

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



DHCP Operation:

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

DHCP Discover Message:

- o First message generated in the communication process between server and client.
 - o Client host generated this message to discover DHCP server in a network.
 - o This message is broadcasted to all devices present in a network to find DHCP server.
 - o In case no response from a DHCP server, Windows client assigns itself an APIPA.
 - o DHCP Discover message uses broadcast IP address and broadcast MAC address.
 - o This message is 342 or 576 bytes long & Destination MAC address is FFFFFFFF.
 - o Source IP address is 0.0.0.0 because DHCP client has no IP address until now.
 - o Destination IP address is broadcast 255.255.255.255.
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DHCP Offer Message:

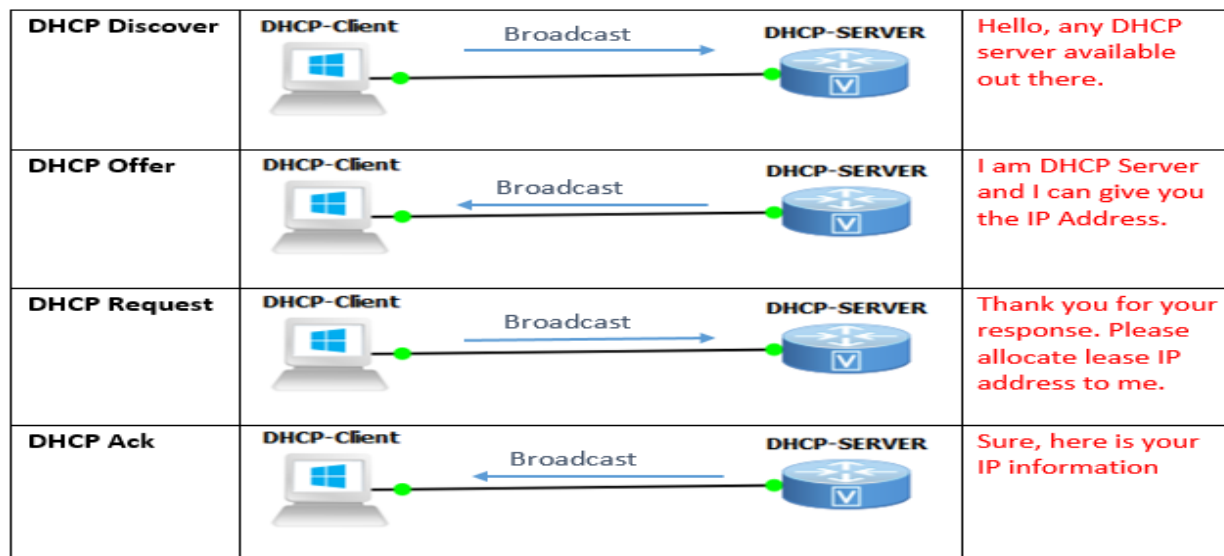
- o DHCP servers receive a DHCP Discover message respond with a DHCP Offer message.
- o DHCP Server response to client and offers the client an IPv4 address lease.
- o DHCP Offer message is broadcasted by server.
- o DHCP Offer size of message is 342 bytes.
- o If more than, one DHCP servers then client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

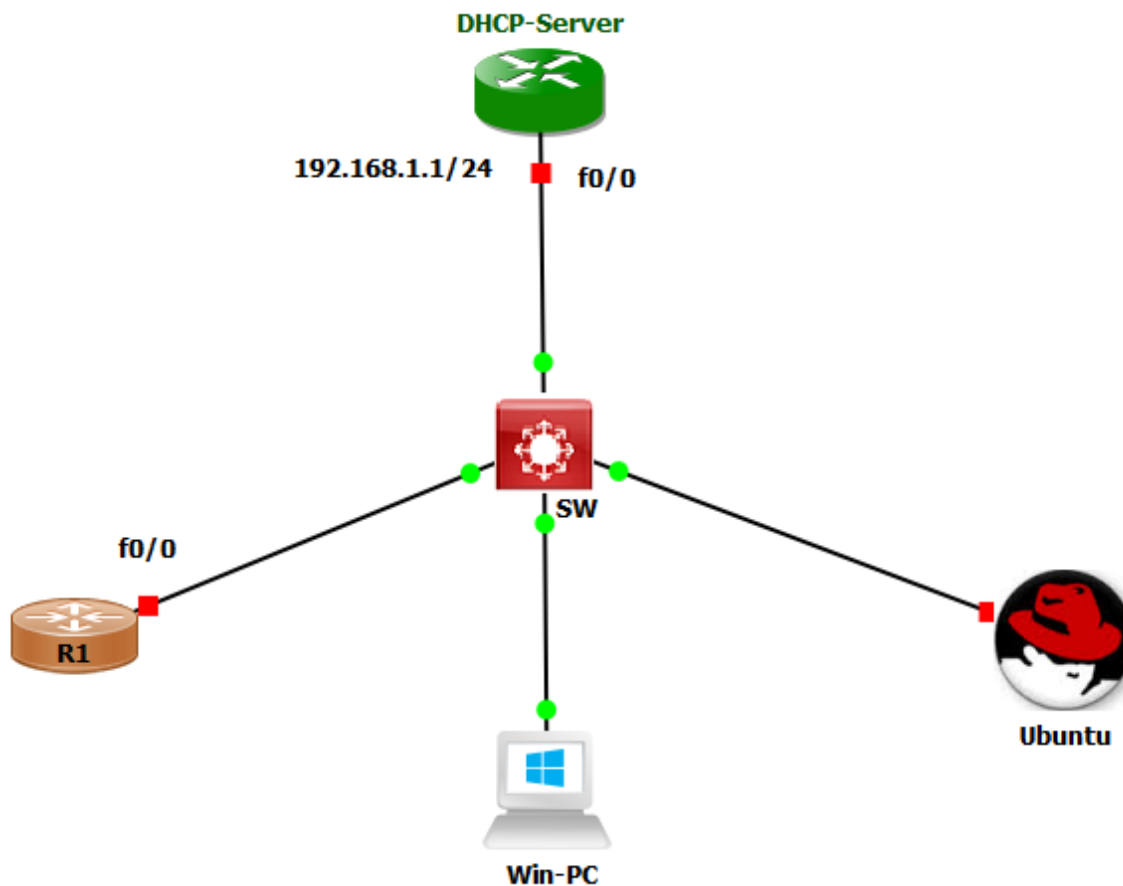
DHCP Request Message:

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

DHCP Acknowledgment Message:

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





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/
                    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
```