DHCP – Dynamic Host Configuration Protocol

- **Auto-IP Assignment:** DHCP clients reserve or get auto-assignment of the IP address to a system, which decreases the manual configuration of the IP address and avoids address conflicts.
- **Centralized Management:** Network settings and IP address assignments are configured on a central DHCP server managed by the network administrators.
- **Dynamic IP Allocation:** DHCP can dynamically allocate and reclaim IP addresses depending on demand, optimizing IP address usage and accommodates devices which frequently join and leave the network.
- **Configuration Flexibility:** DHCP supports a whole series of configuration options for the network, like subnet masks, default gateways, DNS servers, many more. Hence, the protocol is adaptable to different network configurations.

Working of DHCP:

1. A DHCP server dynamically assigns an IP address and other network configuration parameters to each device on a network so they can communicate with other IP networks. DHCP is an enhancement of an older protocol called BOOTP.
2. With respect to the DHCP protocol, the DHCP server goes through an initializing, selecting, requesting, binding, renewal, rebinding, and expiration cycle when negotiating for an IP address, as shown in the below diagram. The process is basically as follows:

3. The client just added or relocated on the network requests an IP address by broadcasting a DHCPDISCOVER message to the local subnet over the well-known BOOTP server port. (The client can also go through a BOOTP router or relay agent to forward the DHCPDISCOVER to additional remote DHCP servers.) This is the *initializing* state.

4. The participating DHCP servers respond with a DHCPOFFER message if they have a valid configuration for the client. The client may get many of these messages, which contain the IP address and configuration data. (The servers make sure to reserve the addresses so as not to accidentally offer them to another client.) At this point the client enters the *selecting* state.

5. After selecting an address, the client broadcasts the selected address and name of the "winning" server (Server 1) using a DHCPREQUEST message. This is the *requesting* state. All the other servers can now safely unreserve their addresses.

6. Server 1 sends the client a DHCPACK (acknowledgment) message with the negotiated IP address, the lease, and the network configuration parameters. The client now enters the *binding* state and can fully use the assigned IP address.

7. About halfway through the lease, the client sends Server 1 another DHCPREQUEST for a lease renewal and enters the *renewal* state. If the server deems the lease renewable, it sends back another DHCPACK to update the lease (including any new parameters). The client now returns to the *binding* state, as in Step 4.

8. If the client cannot renew the lease (such as if Server 1 is down), the client waits until about 87.5% of the way through the lease and broadcasts another DHCPREQUEST to all DHCP servers. Any server can now return a DHCPACK containing the extended lease and updated parameters. This is the *rebinding* state.

9. When the lease reaches 100% expired, or a server sends back a DHCPNAK negative acknowledgment message, the client must give up the IP address. It then returns to the *initializing* state and must start the address negotiation over again.

Two DHCP servers are recommended for a network. The benefit of having more than one server is if one fails another is available to continue processing requests, ensuring that all hosts (old and new) are serviced continuously.