5.6.8 IPv6 Address Assignment Facts

You can configure an IPv6 address with any of the methods in the following table.

IPv6 Configuration Methods

Method	Description
Static Full Assignment	The entire 128-bit address and all other configuration information is statically assigned to the host.
Static Partial Assignment	The prefix is statically assigned. The interface ID is derived from the MAC address.
Stateless Autoconfiguration	Clients automatically generate the interface ID and learn the subnet prefix and default gateway through the Neighbor Discovery Protocol (NDP). NDP uses the following messages for autoconfiguration: ▪ A *Router solicitation* (RS) is a message the client sends to request router response. ▪ A *Router advertisement* (RA) is a message the router sends at two times: in response to RS messages and to inform clients of the IPv6 subnet prefix and default gateway address. Hosts also use NDP to discover the addresses of other interfaces on the network, removing the need for the Address Resolution Protocol (ARP). NDP provides enough information for to address the client and for clients to learn the addresses of other clients on the network. However, it does not provide the client with DNS server information or any other IP configuration information besides the IP address and the default gateway.
DHCPv6	IPv6 uses an updated version of DHCP, DHCPv6. It operates in one of two modes: ▪ *Stateful* DHCPv6 is when the DHCP server provides each client an IP address, default gateway, and other IP configuration information (such as the DNS server IP address). The DHCP server tracks the status (or state) of the client. ▪ *Stateless* DHCPv6 does not provide the client an IP address or track the status of each client. It supplies the client with the DNS server IP address. Stateless DHCPv6 is most useful when used in conjunction with stateless autoconfiguration.

IPv6 Configuration Process

When a host starts up, it uses the following process to configure the IPv6 address for each interface:

1. The host generates an IPv6 address using the link-local prefix (FE80::/10) and modifies the MAC address to get the interface ID. For example, if the MAC address is 20-0C-FB-BC-A0-07, the link-local address for the interface is FE80::220C:FBFF:FEBC:A007.
2. The host sends a neighbor solicitation (NS) message addressed to its own link-local address to see if the address it has chosen is already in use:
   - If the address is in use, the other network host responds with a neighbor advertisement (NA) message. The process stops, and you must configure the host manually.
   - If the address is not in use (no NA message is received), the process continues.
3. The host waits for an RA message from a router to learn the prefix:
   - If an RA message is not received, the host uses the multicast address FF02::2 to send an RS message addressed to all routers on the subnet.
   - The router sends an RA message addressed to all interfaces on the subnet using the multicast address FF02::1.
   - If no routers respond, the host attempts to use stateful DHCPv6 to receive configuration information.
4. The RA message contains information that identifies how the IPv6 address and other information should be configured. The following table shows possible combinations:

Configuration Method	Description
Stateful Autoconfiguration	Obtains the interface ID, subnet prefix, default gateway, and other configuration information from a DHCPv6 server. The host sends a REQUEST message addressed to the multicast address FF02::1:2, requesting this information from the DHCPv6 server.
Stateless Autoconfiguration	Sets the interface ID automatically. Obtains the subnet prefix and default gateway from the RA message. Obtains DNS and other configuration information from a DHCPv6 server.

	The host sends out an INFORMATION-REQUEST message addressed to the multicast address FF02::1:2, requesting this information from the DHCPv6 server.

5. If a manual address or stateful autoconfiguration is used, the host sends an NS message to make sure the address is not already in use. If stateless autoconfiguration is used, the NS message is unnecessary because the interface ID was verified in step 2.

IPv6 Address Management

A good way to manage IP addresses is to use IP address management (IPAM). IPAM allows you to plan, track, and manage IP addresses using integrated DHCP and DNS information. This allows administrators to keep a pool of assignable IP addresses up-to-date. IPAM tools are becoming more important for managing IPv6 networks because IPv6 networks have larger address pools, different subnetting techniques, and more complex 128-bit hexadecimal numbers.

IPAM can manage the following information:

- IP addresses in use
- The user an IP address is assigned to
- Free IP address space
- The size of subnets, who uses them, and how many subnets are in use
- IP address status (permanent vs. temporary)
- Default routers that the various network devices use
- The host name associated with each IP address
- The hardware associated with each IP address