

Networking



Networking Fundamentals

1.6.1 - DHCP

What is a DHCP server and how does it help devices when they connect to a network?

Overview

The student will explain the use and purpose of network services.

Grade Level(s)

10, 11, 12

Cyber Connections

- Threats & Vulnerabilities
- Networks & Internet
- Hardware & Software

This content is based upon work supported by the US Department of Homeland Security's Cybersecurity & Infrastructure Security Agency under the Cybersecurity Education Training and Assistance Program (CETAP).

Teacher Notes:

CompTIA N10-008 Network+ Objectives

Objective 1.6

- Explain the use and purpose of network services.
 - Scope
 - Exclusion ranges
 - Reservation
 - Dynamic assignment
 - Static assignment
 - Lease time
 - Scope options
 - Available leases
 - DHCP relay
 - IP helper/UDP forwarding

What is a DHCP service?

When a device connects to a network, it must get an IP Address so it can talk with the other devices on a network, like how a house must get an address when built to be able to send mail to/from other places. *DHCP*, or dynamic host configuration protocol, is a service that assigns these IP addresses to devices that connect to a network. DHCP servers can be found in many different devices, one common example is a router in a single-family home. When a device connects to the house's network, the DHCP server inside of the router will assign that device an IP for that network. If that device is to go to a friend's home and wants to connect to their network, they will be assigned a new IP address by their friend's DHCP service in their router.

How does DHCP service work? When a device connects to a network, it sends out a message (using UDP) that is broadcasted to the entire network, this is called the DHCPDISCOVER message, and it contains some information about the device (usually the MAC address). If the DHCP server will accept the device, it will respond with a DHCPOFFER that will contain all the necessary configuration information as well as an available IP address for the device. Then, the device will send back a DHCPREQUEST that accepts the offer and selects different settings that it would like. Finally, the server sends a DHCPACK message that leases the IP address as well as any other configuration information, the device is on the network.

Teacher Notes:

When a device wants to disconnect from a network, it can send a DHCPRELEASE message that will return the IP address back to the available pool on the DHCP server. The configuration settings that are sent back and forth include the IP address, default gateways, the DNS server, subnet masks, and other settings.

DHCP Terms

Port – The DHCP service runs on port 67. When the device sends out the DHCPDISCOVER message, this is sent to port 67.

Scope and Scope Options

This is the IP configuration options for the network (or a specific subnet). Some options that can be set are the DNS server, TTL server, and more.

Exclusion ranges

In the pool of IP addresses that can be assigned by the DHCP, the network administrator can block off some of these IP addresses, these are known as the exclusion range. These IP addresses can not be assigned to any device that connects to the network. Typically, these are because they are reserved for specific devices, like the router or a printer on the network.

Reservation

The IP addresses that are assigned to a specific device and can't be handed out to other devices that connect to the network. These are reserved, devices like a printer, projector, router, etc...

Dynamic assignment

How a DHCP device assigns IP addresses, it is temporary and can change depending on when the device connects to the network.

Static assignment

Devices that keep the same IP address on a network. The IP address is permanent on that network and never changes.

Teacher Notes:

Lease time

The amount of time the DHCP leases/gives a device an IP address on the network. Most default time are between 24-48 hours, but this can be changed. Once the lease time is up, the device must ask to rejoin the network again to get an IP address.

Available leases

Available IP Addresses on the network that are auto-assigned when a device connects to the network.

DHCP relay

If a device not directly connected to the network need an IP address on that network, the devices in the middle can send a relay DHCP message to assign an IP to that device.

IP helper/UDP forwarding

These help set-up the DHCP relay that helps pass along/relay the DHCP requests between the DHCP server and another device.