DHCP: (Dynamic Host Configuation Protocol)

- Provides automatic IP addressing services to clients from an address pool

- Client sends messages to server on port 67, server to client on port 68 (both on UDP)

- Methods of address allocation:

- Manual allocation -- administrator manually assigns permanent IP to a device

- Automatic allocation -- DHCP assigns a random permanent static IP to a device

- Dynamic allocation -- DHCP leases random IP to device for a period of time

- Process of connecting to the DHCP server:

- Client sends a DHCPDISCOVER broadcast to find a DHCP server on network

- Source IP is 0.0.0.0 and destination IP is 255.255.255.255

- Server responds with DHCPOFFER unicast with leased IP address to client

- Client sends DHCPREQUEST broadcast to accept the DHCP offer

- Broadcast is used in case there are multiple DHCP servers on a network

- Used for both first-time leases and also lease renewals

- Server responds with a DHCPACK unicast to confirm the DHCP lease

- Same as DHCPOFFER but with a different message type field

- Client performs an ARP lookup for its leased IP address to make sure that it is the only device with that IP address (which means that if no device responds to the ARP broadcast, then the IP address is valid)

- Bootstrap Protocol (BOOTP):

- Used before DHCP was created to assign IP addresses to devices

- Administrator manually configures permanent static IP mappings

- Only supports up to four configuration options, while DHCP supports over 20

- DHCP Relay:

- Sometimes another device runs the DHCP server instead of the gateway router

- Solution: configure the router as a DHCP relay agent through a helper address

- Router forwards all broadcasts on local interface to helper address and back

NAT: (Network Address Translation)

- Translates private addresses on the LAN into public addresses on the Internet

- Required when there are multiple devices on the LAN on a router to use the Internet

- IP addresses involved in NAT translation:

- Inside local address -- private IP address of the client on the LAN

- Outside local address -- public IP address given to client after exiting NAT router

- Outside global address -- public IP address of the client on the Internet

- Inside global address -- same as the outside global address

- Dynamic NAT vs. static NAT (pool of addresses vs. manual one-to-one mappings)

- NAT overloading: (aka PAT)

- Router maps multiple private addresses to one public address

- Uses the port to determine which private address is being used

- Different from regular NAT since it maps many to 1 instead of 1 to 1

- Port forwarding:

- Allowing external users access to a specific port for a specific private IP

- Works because of NAT translation services on the router

IOS Commands:

- ip dhcp excluded-address [[[LOW] [HIGH]] | IP] -- excludes an IP or range of IPs

- ip dhcp pool [NAME] -- creates a new DHCP pool with a given name

- network [NID] [MASK | /PREFIX] -- defines the DHCP address pool (dhcp-config)

- default-router [IP] -- specifies the IP address of the default router in (dhcp-config)

- dns-server [HOSTNAME | IP] -- specifies the DNS server in (dhcp-config)

- domain-name [DOMAIN] -- specifies the domain name for the network in (dhcp-config)

- lease [[DAYS] [HOURS] [MINUTES] | infinite] -- specifies the lease duration

- service dhcp -- turns on the DHCP service in global configuration

- no service dhcp -- turns off the DHCP service in global configuration

- show ip dhcp [...] -- shows the DHCP information or statistics, etc.

- ip helper-address [IP] -- configures the helper address for an interface

- ip nat inside source static [LOCALIP] [GLOBALIP] -- sets up static NAT translation

- ip nat inside -- configures the interface as an inside NAT interface (before-translation)

- ip nat outside -- sets the interface as an outside NAT interface (after-translation)

- ip nat pool [NAME] [STARTIP] [ENDIP] netmask [MASK] -- setup dynamic NAT pool

- ip nat inside source list [ACLID] pool [POOLID] -- binds NAT pool to private addr. list

- ip nat inside source list [ACLID] interface [INTID] overlord -- setup NAT overloading (1)

- ip nat inside source list [ACLID] pool [POOLID] overlord -- setup NAT overlording (2+)

- show ip nat translations -- shows all NAT translations on the router

- clear ip nat translation -- clears the entire NAT translation table

- debug ip nat -- debugs NAT translations for the router