SSN COLLEGE OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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UCS 2501 Computer Networks

Team Project

Title : Implementing DHCP on a Network with Three Routers

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PROBLEM DEFINITION:

- This project aims to implement DHCP on a network with three routers.
- DHCP is a dynamic host configuration protocol that automatically assigns IP addresses and other network configuration parameters to devices on a network.
- This makes it easier to manage and maintain networks, especially large networks with many devices.

PROJECT OVERVIEW:

1. Setup of Components in Cisco

- Connect the DHCP server (router R1) to the switch of network 0.
- Connect two PCs to the switch of network 0.
- Connect router R0 and router R2 to the switch of network 1.
- Connect router R2 and router R3 to the switch of network 2.
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2. Configuration

DHCP Server Configuration (Router R1)

- Enable DHCP service on router R1.
- Create an addressing pool for DHCP called pool1.
- Assign a range of IP addresses to the pool (192.168.4.0 255.255.255.0).
- Assign the domain name "sample.com" to the pool.
- Assign the IP address of the DNS server (192.168.4.2) to the pool.
- Assign the IP address of the default router (192.168.4.5) to the pool.
- Set the lease duration to 4 days.

DHCP Client Configuration (Routers R2 and R3)

- Enter interface configuration mode for Fast Ethernet 0/0 on routers R2 and R3.
- Issue the command "ip address dhcp" to configure the interfaces to acquire IP addresses from the DHCP server.

3. Connectivity

- Verify that routers R2 and R3 have obtained IP addresses from the DHCP server using the "show interfaces" or "show ip interface brief" command.
- Verify that the DHCP server has assigned IP addresses to routers R2 and R3 using the "show ip dhcp binding" command.

4. Testing

- Send messages from a client to the server and verify that the messages are received.

5. Documentation

- Document the configuration steps and the results of the testing.

DHCP PROTOCOL EXPLAINATION:

- DHCP (Dynamic Host Configuration Protocol) is a network protocol that automatically assigns IP addresses and other network configuration parameters to devices on a network, such as computers, smartphones, and printers.

- This eliminates the need for network administrators to manually configure each device's IP address, subnet mask, default gateway, and DNS server settings.

How DHCP Works,

DHCP operates as a client-server protocol. There are two main components in a DHCP environment: a DHCP server and DHCP clients.

DHCP Server: The DHCP server is a central computer that manages a pool of IP addresses and other network configuration parameters. It listens on UDP port 67 for requests from DHCP clients.

DHCP Clients: DHCP clients are devices that connect to the network and request IP addresses and other network configuration parameters from the DHCP server. DHCP clients typically send requests using UDP port 68.

When a DHCP client joins a network, it broadcasts a DHCPDISCOVER message to find a DHCP server. The DHCPDISCOVER message contains the client's hardware address (MAC address) and other identifying information.

Upon receiving a DHCPDISCOVER message, a DHCP server responds with a DHCPOFFER message. The DHCPOFFER message contains an IP address, subnet mask, default gateway, and DNS server settings that the client can use to communicate on the network.

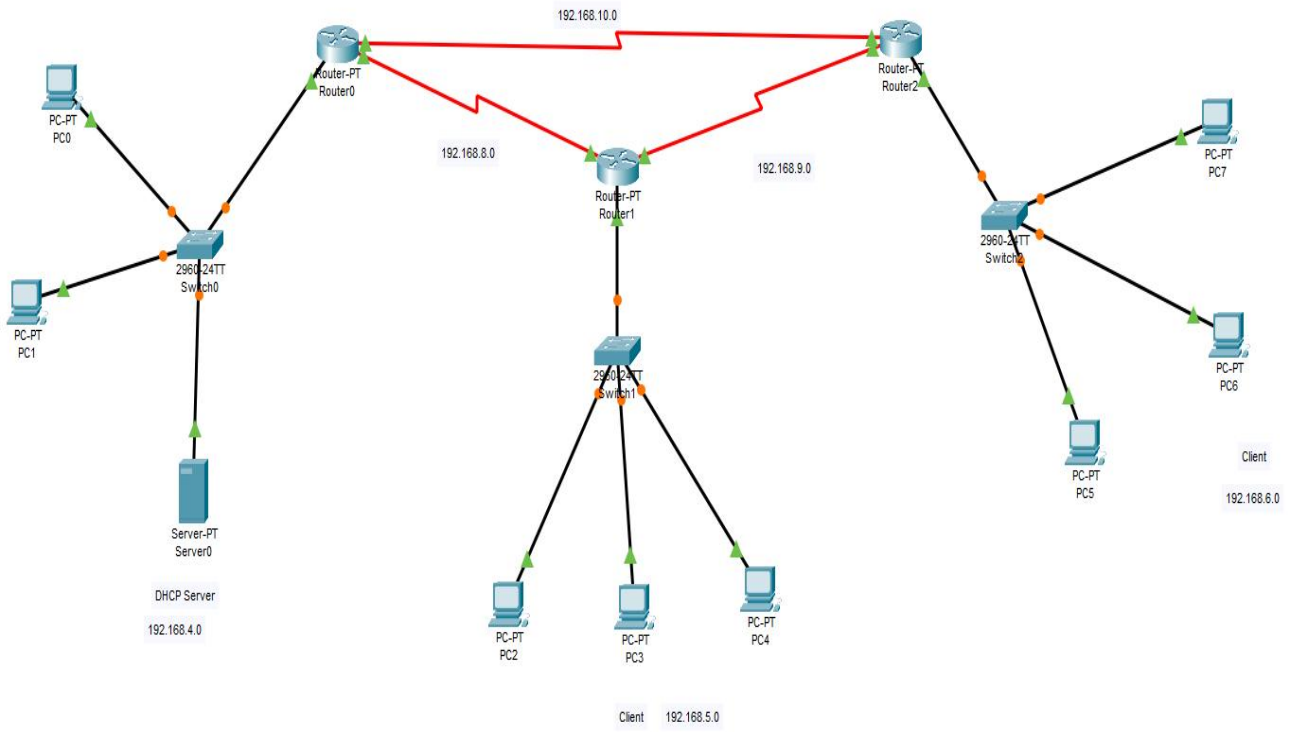
The DHCP client then sends a DHCPREQUEST message to the DHCP server to confirm its acceptance of the offered IP address and configuration parameters.

The DHCP server responds with a DHCPACK message, acknowledging the client's request and finalizing the IP address assignment.

DEVICE CONFIGURATION

Router	Configuration	Explanation
R1 (DHCP Server)	DHCP server is enabled	This means that the router will start handing out IP addresses to devices on the network that request them.
R1 (DHCP Server)	DHCP addressing pool named 'pool1' is created	This pool will be used to assign IP addresses to clients.
R1 (DHCP Server)	The range of IP addresses to be assigned to clients from the pool is specified	The pool will assign IP addresses from the range 192.168.4.0 to 192.168.4.255.
R1 (DHCP Server)	The domain name for clients is set to 'sample.com'	This means that clients will be able to use this domain name to resolve hostnames.
R1 (DHCP Server)	The IP address of the DNS server is specified to 192.168.4.2	This means that clients will use this DNS server to resolve hostnames.
R1 (DHCP Server)	The default gateway IP address is set to 192.168.4.5	This means that clients will use this IP address to route traffic to other networks.
R1 (DHCP Server)	The lease duration for IP addresses assigned to clients is defined to 4 days	This means that clients will have to renew their IP addresses every 4 days.
R1 (DHCP Server)	The Ethernet interface (e0) is configured with a static IP address of 192.168.4.1	This IP address is necessary for the router to communicate with other devices on the network.
R2 and R3 (DHCP Clients)	The Ethernet interface (e0) is configured to obtain an IP address from the DHCP server.	This means that the routers will request an IP address from the DHCP server on Router R1.

TOPOLOGY



CODE

Router R1 (DHCP Server)

1. Enter global configuration mode:

R1>configure terminal

2. Enable the DHCP server feature:

R1(config)#service dhcp

3. Create a DHCP addressing pool named 'pool1':

R1(config)#ip dhcp pool pool1

4. Specify the range of IP addresses to be assigned to clients from the pool:

R1(config-dhcp-pool)#network 192.168.4.0 255.255.255.0

5. Set the domain name for clients to "sample.com":

R1(config-dhcp-pool)#domain-name sample.com

6. Specify the IP address of the DNS server to 192.168.4.2:

R1(config-dhcp-pool)#dns-server 192.168.4.2

7. Set the default gateway IP address to 192.168.4.5:

R1(config-dhcp-pool)#default-router 192.168.4.5

8. Define the lease duration for IP addresses assigned to clients to 4 days:

R1(config-dhcp-pool)#lease 4d

9. Exit DHCP configuration mode:

R1(config-dhcp-pool)#exit

10. Configure the Ethernet interface (e0) with a static IP address:

R1(config)#interface e0
R1(config-if-e0)#ip address 192.168.4.1 255.255.255.0

Router R2 and R3 (DHCP Clients)

1. Enter global configuration mode:

R2(config)#configure terminal

2. Configure the Ethernet interface (e0) to obtain an IP address from the DHCP server:

R2(config)#interface e0
R2(config-if-e0)#ip address dhcp

3. Exit global configuration mode:

R2(config-if-e0)#exit
R2(config)#exit

Verification Commands

On Router R1 (DHCP Server)

Verify the DHCP bindings:

R1>show ip dhcp binding

On Router R2 and R3 (DHCP Clients)

Verify the obtained IP addresses: R2>show ip interface brief

LEARNING OUTCOMES:

- Understand the concept of DHCP and its role in dynamic IP address allocation.
- Configure a DHCP server on a Cisco router.
- Configure DHCP clients to obtain IP addresses from the DHCP server.
- Verify DHCP configuration and address assignments.
- Use DHCP verification commands to view IP address bindings and lease information.
- Understand how to clear DHCP bindings and unconfigure DHCP on clients.

README FILE

Software used:
CISCO Packet Tracer.

Description: This lab exercise demonstrates DHCP server configuration and DHCP client configuration on two routers and also shows the verification commands both on the server and the client.

Given Instructions:
Instructions

1. Connect the DHCP server to the switch of the network 0 where we have set up 2 PCs. Make the other two clients out of PCs and switches and routers appropriately.

2. Set the default Gateway to 192.168.4.5 and the DNS SERVER as 192.168.4.2 as per the given requirement in the problem statement, in the server0.

3. In the Fastethernet 0, set port status ON, and set the unique IPv4 address and subnet mask, where the IPv4 address here, is used for the DHCP client server communication.

4. In the services of server, in the DHCP service, set the server pools and IPv4 address for all three networks(client) in the server similarly.

5. Set the default gateway as usual in the PC 0.

6. In the fastEthernet0 , Set the port status ON. Give the IPv4 address as a unique address of class C i.e, 192.168.4.6 and set the subnet mask appropriately as per the IPv4 address.

7. Similarly do the above steps for all the PCs connected in the other two networks of the client.

8. In the router 0, Set the port status and in the fastethernet0 set the default gateway to be the IPv4 address and the appropriate mask also.

9.Similarly for all the other routers. For router 1 the IPv4 address is said to be , 192.168.5.5 and for router 2 it is 192.168.6.5.

10.Dynamic Routing is then made for the establishment of connection between the routers and the switches.

11.Now to connect the routers to each other, let us give serial connections.
R0 – R1 -> Se2/0
R1- R2 ->Se 2/0
R1 - R2 ->Se 3/0
R2- R1 -> Se 3/0
R0 – R2 ->Se 3/0
R2 – R0 – Se 2/0

12.For instance, in router0, in the serial connection 2 set the unique IPv4 address of 192.168.8.5 and the corresponding mask.

13.set the unique ipv4 addresses for all the connections ,mentioned in the serial connections.

14.In the Router0, in the Routing information protocol(RIP), add the IPV4 addresses for all the connected devices network's IP.

15. R0 is connected to two additional paths except the 192.168.4.0, which are the paths from R0 – R1 and R0-R2. Add the ip addresses in the RIP.

16.Similarly add the connected paths to the other routers namely R1, R2.

17.send messages from client to server and receive message from the client for DHCP connection in the CLI of R0.

NETWORKS:

NETWORK 0 – 192.168.4.0

NETWORK 1 - 192.168.5.0

NETWORK 2 - 192.168.6.0

Default network addresses for the three networks:

N0 R0-192.168.4.5

N1 R1 – 192.168.5.5

N2 R2 – 192.168.6.5

GITHUB LINK: https://github.com/dinesh22js/CN_Project.git