Lab 9 - Implement DHCPv4

**Name/ID: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

# Topology

**VLAN 1**

**VLAN 100**

**Trunk**



**Subnet C: R2Clients**

**Subnet A: R1Clients**

# Addressing Table

| Device | Interface | IP Address | Subnet Mask | Default Gateway |
| --- | --- | --- | --- | --- |
| R1 | G0/0/0 | 10.0.0.1 | 255.255.255.252 | N/A |
| R1 | G0/0/1 | N/A | N/A | N/A |
| R1 | G0/0/1.100 | 192.168.1.1 | 255.255.255.192 | N/A |
| R1 | G0/0/1.200 | 192.168.1.65 | 255.255.255.224 | N/A |
| R1 | G0/0/1.1000 | N/A | N/A | N/A |
| R2 | G0/0/0 | 10.0.0.2 | 255.255.255.252 | N/A |
| R2 | G0/0/1 | 192.168.1.97 | 255.255.255.240 |  |
| S1 | VLAN 200 | 192.168.1.66 | 255.255.255.224 | 192.168.1.65 |
| S2 | VLAN 1 | 192.168.1.98 | 255.255.255.240 | 192.168.1.97 |
| PC-A | NIC | DHCP | DHCP | DHCP |
| PC-B | NIC | DHCP | DHCP | DHCP |

# VLAN Table

| Device | VLAN | Name | Subnet | Required Hosts | Interface Assigned |
| --- | --- | --- | --- | --- | --- |
| S1 | 100 | R1Clients | A | 58 | S1: F0/6 |
| S1 | 200 | Management | B | 28 | S1: VLAN 200 |
| S1 | 999 | Parking\_Lot |  |  | S1: F0/1-4, F0/7-24, G0/1-2 |
| S1 | 1000 | Native |  |  | N/A |
| S2 | 1 | VLAN 1 | C | 12 | S2: F0/18 |

# Objectives

Part 1: Build the Network and Configure Basic Device Settings

Part 2: Configure and verify two DHCPv4 Servers on R1

Part 3: Configure and verify a DHCP Relay on R2

Lab Report General Instructions

1. Lab report should include your names and IDs.
2. Lab report should include answers to all questions highlighted in grey.
3. Lab report should include all required screenshots.
4. Screenshots should include your names at the command prompt.
5. Lab report should include answers to all reflection questions. Pls use your own words to answer the questions. Copy answers will receive zero.
6. Reflection questions should be answered clearly with enough elaboration.

# Background / Scenario

The Dynamic Host Configuration Protocol (DHCP) is a network protocol that lets network administrators manage and automate the assignment of IP addresses. Without DHCP for IPv4, the administrator must manually assign and configure IP addresses, preferred DNS servers, and default gateways. As the network grows in size, this becomes an administrative problem when devices are moved from one internal network to another.

In this scenario, the company has grown in size, and the network administrators can no longer assign IP addresses to devices manually. Your job is to configure the R1 router to assign IPv4 addresses on two different subnets.

**Note**: The routers used with CCNA hands-on labs are Cisco 4221 with Cisco IOS XE Release 16.9.4 (universalk9 image). The switches used in the labs are Cisco Catalyst 2960s with Cisco IOS Release 15.2(2) (lanbasek9 image). Other routers, switches, and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and the output produced might vary from what is shown in the labs. Refer to the Router Interface Summary Table at the end of the lab for the correct interface identifiers.

**Note**: Ensure that the routers and switches have been erased and have no startup configurations. If you are unsure contact your instructor.

# Required Resources

* 2 Routers (Cisco 4221 with Cisco IOS XE Release 16.9.4 universal image or comparable)
* 2 Switches (Cisco 2960 with Cisco IOS Release 15.2(2) lanbasek9 image or comparable)
* 2 PCs (Windows with a terminal emulation program, such as Tera Term)
* Console cables to configure the Cisco IOS devices via the console ports
* Ethernet cables as shown in the topology
* VLSM/CIDR Calculator

# Instructions

## Build the Network and Configure Basic Device Settings

In Part 1, you will set up the network topology and configure basic settings on the PC hosts and switches.

### Establish an addressing scheme

Subnet the network 192.168.1.0/24 to meet the following requirements. You may use an online VLSM/CIDR calculator to complete this step.

Provide all subnets details in the table below:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Subnet Name** | **Needed Hosts** | **Allocated Subnet Size** | **Subnet Address** | **Prefix** | **Subnet Mask** | **Usable Range** | **Broadcast** |
| **A (on R1)**  VLAN ID=100  VLAN name = R1Clients | 58 | 62 | 192.168.1.0 | /26 | 255.255.255.192 | 192.168.1.1  To  192.168.1.62 | 192.168.1.63 |
| **B (on R1)**  VLAN ID=200  VLAN name = Management | 28 | 30 | 192.168.1.64 | /27 | 255.255.255.224 | 192.168.1.65  To  192.168.1.94 | 192.168.1.95 |
| **C (on R2)**  R2Clients (default VLAN 1) | 12 | 14 | 192.168.1.96 | /28 | 255.255.255.240 | 192.168.1.97  To  192.168.1.110 | 192.168.1.111 |

* + - 1. One subnet, “Subnet A”, supporting 58 hosts (the R1Clients VLAN at R1).

**Subnet A:** 192.168.1.0/26 (.1 -.62)

* + - 1. One subnet, “Subnet B”, supporting 28 hosts (the Management VLAN at R1).

**Subnet B:** 192.168.1.64/27 (.65-.94)

* + - 1. One subnet, “Subnet C”, supporting 12 hosts (the R2Clients subnet at R2).

**Subnet C:** 192.168.1.96/28 (.97-.110)

### Cable the network as shown in the topology.

The network is built as shown in the topology.

### Configure basic settings for both routers R1 and R2.

* + - 1. Assign a device name to the router.

Open configuration window

* + - 1. Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names.
      2. Save the running configuration to the startup configuration file.

### Configure Inter-VLAN Routing on R1

* + - 1. Configure sub-interfaces for each VLAN as required by the IP addressing table. All sub-interfaces use 802.1Q encapsulation and are assigned the first usable address from the IP address pool you have calculated. Include a description for each sub-interface. Ensure the sub-interface for the native VLAN does not have an IP address assigned.

R1(config)# **interface g0/0/1.100**

R1(config-subif)# **description R1Clients Network**

R1(config-subif)# **encapsulation dot1q 100**

R1(config-subif)# **ip address 192.168.1.1 255.255.255.192**

R1(config-subif)# **interface g0/0/1.200**

R1(config-subif)# **description Management Network**

R1(config-subif)# **encapsulation dot1q 200**

R1(config-subif)# **ip address 192.168.1.65 255.255.255.224**

R1(config-subif)# **interface g0/0/1.1000**

R1(config-subif)# **description Native VLAN**

R1(config-subif)# **encapsulation dot1q 1000 native**

R1(config-subif)# **exit**

* + - 1. Activate interface G0/0/1 on the router R1.

R1(config)# **interface g0/0/1**

R1(config-if)# **no shutdown**

R1(config-if)# **exit**

* + - 1. Use the command **show ip interface brief** to verify the sub-interfaces are operational.

# Screenshot the command output and paste it here. Add your name and ID at the command prompt.

### Step 5: Configure G0/0/1 on R2, then G0/0/0 and static routing for both routers

* + - 1. Configure G0/0/1 on R2 with the first IP address of Subnet C you calculated earlier.

R2(config)# **interface g0/0/1**

R2(config-if)# **ip address 192.168.1.97 255.255.255.240**

R2(config-if)# **no shutdown**

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

* + - 1. Configure interface G0/0/0 for each router based on the IP Addressing table above.

R1(config)# **interface g0/0/0**

R1(config-if)# **ip address 10.0.0.1 255.255.255.252**

R1(config-if)# **no shutdown**

R2(config)# **interface g0/0/0**

R2(config-if)# **ip address 10.0.0.2 255.255.255.252**

R2(config-if)# **no shutdown**

* + - 1. Configure a default route on each router pointed to the IP address of G0/0/0 on the other router.

R1(config)# **ip route 0.0.0.0 0.0.0.0 10.0.0.2**

R2(config)# **ip route 0.0.0.0 0.0.0.0 10.0.0.1**

* + - 1. Verify static routing is working by pinging R2’s G0/0/1 address from R1.

# Screenshot the ping result and paste it here. Add your name and ID at the command prompt.

* + - 1. Save the running configuration to the startup configuration file.

Close configuration window

### Step 6: Configure basic settings for each switch.

* + - 1. Assign a device name to the switch.

Open configuration window

* + - 1. Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names.
      2. Save the running configuration to the startup configuration file.

### Step 7: Create VLANs on S1.

**Note**: S2 is only configured with basic settings.

* + - 1. Create and name the required VLANs on switch 1 from the table above.

S1(config)# **vlan 100**

S1(config-vlan)# **name R1Clients**

S1(config-vlan)# **vlan 200**

S1(config-vlan)# **name Management**

S1(config-vlan)# **vlan 999**

S1(config-vlan)# **name Parking\_Lot**

S1(config-vlan)# **vlan 1000**

S1(config-vlan)# **name Native**

S1(config-vlan)# **exit**

* + - 1. Configure and activate the management interface on S1 (VLAN 200) using the second IP address from the subnet calculated earlier. Additionally, set the default gateway on S1.

S1(config)# **interface vlan 200**

S1(config-if)# **ip address 192.168.1.66 255.255.255.224**

S1(config-if)# **no shutdown**

S1(config-if)# **exit**

S1(config)# **ip default-gateway 192.168.1.65**

* + - 1. Shutdown all unused ports on S1. First, configure all unused ports for static access mode, then assign them to the ParkingLot VLAN, and administratively deactivate them.

**Note**: The interface range command is helpful to accomplish this task with as few commands as necessary.

S1(config)# **interface range f0/1 - 4, f0/7 - 24, g0/1 - 2**

S1(config-if-range)# **switchport mode access**

S1(config-if-range)# **switchport access vlan 999**

S1(config-if-range)# **shutdown**

S1(config-if-range)# **exit**

### Step 8: Assign VLANs to the correct switch interfaces on S1.

* + - 1. Assign used ports to the appropriate VLAN (specified in the VLAN table above) and configure them for static access mode.

S1(config)# **interface f0/6**

S1(config-if)# **switchport mode access**

S1(config-if)# **switchport access vlan 100**

Open configuration window

* + - 1. Use the command **show vlan brief** to verify that the VLANs are assigned to the correct interfaces.

# Screenshot the command output and paste it here. Add your name and ID at the command prompt.

#### Question:

**Why is interface F0/5 listed under VLAN 1?**

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### Step 9: Configure S2.

* + - 1. Configure and activate the management interface on S2 (VLAN 1) using the second IP address from the subnet calculated earlier. Additionally, set the default gateway on S2.

S2(config)# **interface vlan 1**

S2(config-if)# **ip address 192.168.1.98 255.255.255.240**

S2(config-if)# **no shutdown**

S2(config-if)# **exit**

S2(config)# **ip default-gateway 192.168.1.97**

* + - 1. Shutdown all unused ports on S2. First, configure all unused ports for static access mode, then administratively deactivate them.

**Note**: The interface range command is helpful to accomplish this task with as few commands as necessary.

S2(config)# **interface range f0/1 - 4, f0/6 - 17, f0/19 - 24, g0/1 - 2**

S2(config-if-range)# **switchport mode access**

S2(config-if-range)# **shutdown**

S2(config-if-range)# **exit**

### Step 10: Manually configure S1’s interface F0/5 as an 802.1Q trunk.

* + - 1. Change the switchport mode on the F0/5 interface to force trunking.

S1(config)# **interface f0/5**

S1(config-if)# **switchport mode trunk**

* + - 1. As a part of the trunk configuration, set the native VLAN to 1000.

S1(config-if)# **switchport trunk native vlan 1000**

* + - 1. As another part of trunk configuration, specify that VLANs 100, 200, and 1000 are allowed to cross the trunk.

S1(config-if)# **switchport trunk allowed vlan 100,200,1000**

* + - 1. Save the running configuration to the startup configuration file.
      2. Use the command **show interfaces trunk** to verify trunking status.

#### Question:

**At this point, what IP address would the PC’s have if they were connected to the network using DHCP? Which command will verify the IP address configuration? Explain the results.**

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Close configuration window

## Configure and verify two DHCPv4 Servers on R1

In Part 2, you will configure and verify a DHCPv4 Server on R1. The DHCPv4 server will service two subnets, Subnet A (R1Clients VLAN at R1) and Subnet C (R2Clients subnet at R2).

### Configure R1 with DHCPv4 pools for the two supported subnets.

### Use the below DHCPv4 Pool parameters for Subnet A (R1Clients VLAN at R1):

* + - 1. Exclude the first five useable addresses from each address pool.

1. R1(config)# **ip dhcp excluded-address 192.168.1.1 192.168.1.5**
   * + 1. Create the DHCP pool (Use the name R1\_Clients\_Subnet for the pool).
2. R1(config)# **ip dhcp pool R1\_Clients\_Subnet**
   * + 1. Specify the network that this DHCP server is supporting.
3. R1(dhcp-config) # **network 192.168.1.0 255.255.255.192**
   * + 1. Configure the domain name as ccna-lab.com
4. R1(dhcp-config) # **domain-name ccna-lab.com**
   * + 1. Configure the appropriate default gateway for each DHCP pool.
5. R1(dhcp-config) # **default-router 192.168.1.1**
   * + 1. Exit DHCP configuration
6. R1(dhcp-config) # **exit**

**Next, configure the second DHCPv4 Pool for Subnet C (R2Clients subnet at R2):**

* + - 1. Exclude the first five useable addresses from each address pool.

1. R1(config)# **ip dhcp excluded-address 192.168.1.97 192.168.1.101**
   * + 1. Create the DHCP pool (Use the name R2\_Clients\_Subnet for the pool).
2. R1(config)# **ip dhcp pool R2\_Clients\_Subnet**
   * + 1. Specify the network that this DHCP server is supporting.
3. R1(dhcp-config)# **network 192.168.1.96 255.255.255.240**
   * + 1. Configure the domain name as ccna-lab.com
4. R1(dhcp-config)# **domain-name ccna-lab.com**
   * + 1. Configure the appropriate default gateway for each DHCP pool.
5. R1(dhcp-config)# **default-router 192.168.1.97**
   * + 1. Exit DHCP configuration
6. R1(dhcp-config) # **exit**

### Save your configuration

Save the running configuration to the startup configuration file.

Close configuration window

### Verify the DHCPv4 Server configuration

* + - 1. Issue the command **show ip dhcp pool** to examine the pool details.
      2. Issue the command **show ip dhcp binding** to examine established DHCP address assignments.

**Screenshot the results of steps a and b and paste them here. Add your name and ID** **at the command prompt.**

### Attempt to acquire an IP address from DHCP on PC-A

* + - 1. Open a command prompt on PC-A and issue the command **ipconfig /renew**.
      2. Once the renewal process is complete, issue the command **ipconfig** to view the new IP information.

**Were PC-A able to obtain an IP address from the DHCPv4 Server on R1?** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**PC-A IP address:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + - 1. Test connectivity by pinging PC-A gateway IP address on R1 from PC-A.

**Was the ping successful?** \_\_\_\_\_\_\_\_\_

**Screenshot the results of step 4.b and 4.c and paste them here. Add your name and ID** **at the command prompt.**

### Attempt to acquire an IP address from DHCP on PC-B

* + - 1. Open a command prompt on PC-B and issue the command **ipconfig /renew** to view the IP information.

**Were PC-B able to obtain an IP address from the DHCPv4 Server on R1? Explain the output.**

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**PC-B IP address:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Configure and verify a DHCP Relay on R2

In Part 3, you will configure R2 to relay DHCP requests from the local area network on interface G0/0/1 to the DHCP server (R1).

### Configure R2 as a DHCP relay agent for the R2Clients LAN on G0/0/1

* + - 1. Configure the **ip helper-address** command on G0/0/1 specifying R1’s G0/0/0 IP address.

1. R2(config)# **interface g0/0/1**
2. R2(config-if)# **ip helper-address 10.0.0.1**
   * + 1. Save your configuration.

Close configuration window

### Attempt to acquire an IP address from DHCP on PC-B

* + - 1. Open a command prompt on PC-B and issue the command **ipconfig /renew**.
      2. Once the renewal process is complete, issue the command **ipconfig** to view the new IP information.

**Were PC-B able to obtain an IP address from the DHCPv4 Server on R1? Explain what happened?**

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**PC-B IP address:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + - 1. Test connectivity by pinging PC-A IP address from PC-B.

**Was the ping successful?** \_\_\_\_\_\_\_\_\_\_\_

**Screenshot the results of step 2.b and 2.c and paste them here. Add your name and ID at the command prompt.**

* + - 1. Issue the **show ip dhcp binding** on R1 to verify DHCP bindings.

**Screenshot the command output and paste it here. Add your name and** **ID at the command prompt.**