Department of Computer Science and Engineering
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Laboratory Report 9

CSE 4412 : Data Communication and Networking Lab

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Title: Inter VLAN routing and configuring DHCP service.

Objective:
1. Inter VLAN routing
2. Configuration of DHCP

Devices Used in the Cisco Packet Tracers:
1. Router
2. Switch
3. PC

Theory:

Inter VLAN Routing:
Explain the procedure of routing a packet within three different user groups i.e. three different vlan situated in three different levels of an office building.

1. Configure VLANs: First, we need to configure the VLANs on the switches or routers. Each VLAN should be given a unique VLAN ID and should be associated with a specific IP subnet.
2. Assign VLANs to ports: Next, assign the VLANs to the appropriate switch ports. Devices on each VLAN should be connected to the corresponding VLAN port on the switch.
3. Configure Inter-VLAN Routing: To enable communication between different VLANs, inter-VLAN routing needs to be configured. This can be done by configuring a router or a layer-3 switch with a separate interface for each VLAN. Each interface should be assigned an IP address from the corresponding IP subnet.
4. Create VLAN interfaces: Create VLAN interfaces on the router or layer-3 switch for each VLAN. This will allow the router to communicate with devices on each VLAN.

5. Configure Routing Protocols: If dynamic routing protocols such as OSPF are being used, configure them to advertise the networks in each VLAN.
6. Configure Default Gateway: Configure the default gateway on each device to point to the IP address of the router or layer-3 switch interface for its VLAN.
7. Test Connectivity: Finally, test connectivity between devices on different VLANs by sending packets between them. If there are any issues, troubleshoot the configuration until the desired connectivity is achieved.

DHCP Service:

Network protocol known as Dynamic Host Configuration Protocol enables a server to assign IP addresses, subnet masks, default gateways, etc. automatically. Using DHCP, a centralized computer known as a DHCP server assigns IP addresses to connected devices on the network. A device sends a broadcast message asking for an IP address when it joins the network. By automating the IP address setting process, DHCP makes network administration simpler. It does away with the necessity for labor-intensive, mistake-prone manual IP address setting.

Advantage of DHCP Service:

1. Eliminates the need for manual IP configuration.
2. DHCP helps to prevent IP address conflicts
3. DHCP helps to optimize IP address utilization
4. DHCP provides centralized management of IP addresses and other network configuration parameters, making it easier to maintain and troubleshoot the network.

Disadvantage of DHCP Service:

1. Single point of failure as DHCP server fails, devices will not be able to obtain IP addresses
2. DHCP can be a security risk if not configured correctly.
3. DHCP assigns IP addresses and other network configuration parameters automatically, which can limit the control that network administrators have over the network.
4. Ip addresses must be renewed after a limited period of time.

Exclusion of Addresses in DHCP Services:

The process of reserving particular IP addresses within a DHCP scope such that they are not issued to any client devices on the network is known as exclusion of addresses in DHCP services. This is frequently done to avoid IP conflicts with statically allocated IP addresses or to reserve IP addresses for servers or network devices with fixed IP addresses.

Diagram of the experiment:
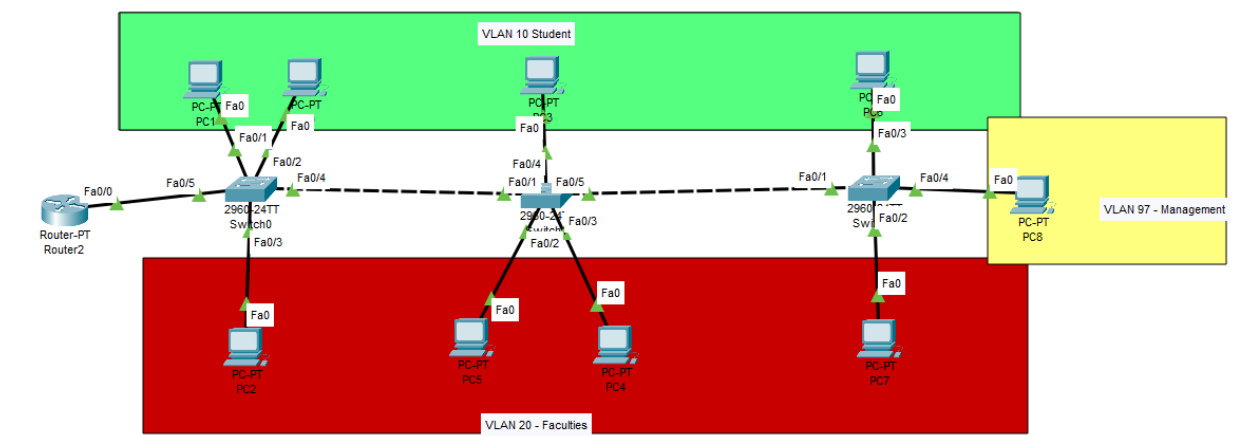
Configuration of Routers:

Commands for configuring VLAN:

Switch 0

```
Switch>en
Switch#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 20
Switch(config-vlan)#name Faculties
Switch(config-vlan)#int range fa0/1-2
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 1
Switch(config-if-range)#no shutdown
Switch(config-if-range)#int fa0/3
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 20
Switch(config-if)#
Switch(config-if)#
Switch(config-if)#
Switch(config-if)#
Switch(config-if)#int fa0/5
Switch(config-if)#switchport mode trunk
Switch(config-if)#switchport trunk allowed vlan 10-97
Switch(config-if)#
```

Switch 1

```
Switch>en
Switch#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 20
Switch(config-vlan)#name Faculties
Switch(config-vlan)#int fa0/4
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 1
Switch(config-if)#int fa0/3
Switch(config-if)#int range fa0/2-3
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 20
Switch(config-if-range)#wxit
                            ^
% Invalid input detected at '^' marker.

Switch(config-if-range)#exit
Switch(config)#int fa0/5
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state to up

Switch(config-if)#exit
Switch(config)#
```

Switch 2

```
Switch>en
Switch#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 20
Switch(config-vlan)#name Faculties
Switch(config-vlan)#exit
Switch(config)#vlan 97
Switch(config-vlan)#name Management
Switch(config-vlan)#exit
Switch(config)#int fa0/3
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 1
Switch(config-if)#exit
Switch(config)#int fa0/2
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 20
Switch(config-if)#exit
Switch(config)#int fa0/4
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 97
Switch(config-if)#exit
Switch(config)#int fa0/1
Switch(config-if)#switchport mode trunk
Switch(config-if)#switchport trunk allowed vlan 1-97
Switch(config-if)#exit
Switch(config)#
```

Router:

```
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int fa0/0.1
Router(config-subif)#encapsulation dotlq 10
Router(config-subif)#ip address 10.0.0.1 255.255.255.0
Router(config-subif)#int fa0/0.2
Router(config-subif)#
LINK-5-CHANGED: Interface FastEthernet0/0.2, changed state to up

LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.2, changed state to up

Router(config-subif)#encapsulation dotlq 20
Router(config-subif)#ip address 20.0.0.1 255.255.255.0
Router(config-subif)#exit
Router(config)#int fa0/0.3
Router(config-subif)#
LINK-5-CHANGED: Interface FastEthernet0/0.3, changed state to up

LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.3, changed state to up

Router(config-subif)#encapsulation dotlq 97
Router(config-subif)#ip address 97.0.0.1 255.255.255.0
Router(config-subif)#exit
```

Commands for configuring DHCP:

```
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#ip dhcp ?
  excluded-address  Prevent DHCP from assigning certain addresses
  pool              Configure DHCP address pools
  relay             DHCP relay agent parameters
Router(config)#ip dhcp pool
% Incomplete command.
Router(config)#ip dhcp pool?
pool
Router(config)#ip dhcp pool ?
  WORD  Pool name
Router(config)#ip dhcp pool poolv10
Router(dhcp-config)#ip dhcp exclude 10.0.0.1 10.0.0.1
Router(config)#ip dhcp pool poolv10
Router(dhcp-config)#network 10.0.0.0 255.255.255.0
Router(dhcp-config)#de
Router(dhcp-config)#default-router 10.0.0.1
Router(dhcp-config)#dns 0.0.0.0
Router(dhcp-config)#exit
Router(config)#ip dhcp exclude 20.0.0.1 20.0.0.1
Router(config)#ip dhcp pool poolv20
Router(dhcp-config)#network 20.0.0
                         ^
% Invalid input detected at '^' marker.

Router(dhcp-config)#network 20.0.0.0 255.255.255.0
Router(dhcp-config)#de
Router(dhcp-config)#default-router 20.0.0.1
Router(dhcp-config)#dns 0.0.0.0
Router(dhcp-config)#exit
Router(config)#ip dhcp pool exclude 97.0.0.1 97.0.0.1
                               ^
% Invalid input detected at '^' marker.

Router(config)#ip dhcp exclude 97.0.0.1 97.0.0.1
Router(config)#ip dhcp pool poolv97
Router(dhcp-config)#network 97.0.0.0 255.255.255.0
Router(dhcp-config)#de
Router(dhcp-config)#default-router 97.0.0.1
Router(dhcp-config)#dns 0.0.0.0
Router(dhcp-config)#exit
```

```
Router(config)#ip dhcp pool poolv10
Router(dhcp-config)#de
Router(dhcp-config)#network 10.0.0.0 255.255.255.0
Router(dhcp-config)#de
Router(dhcp-config)#default-router 10.0.0.1
Router(dhcp-config)#ip dhcp excluded address 10.0.0.102 10.0.0.255
                          ^
% Invalid input detected at '^' marker.

Router(dhcp-config)#ip dhcp excluded-address 10.0.0.102 10.0.0.255
Router(config)#ip dhcp pool poolv20
Router(dhcp-config)#ip excluded-address 20.0.0.22 20.0.0.255
                       ^
% Invalid input detected at '^' marker.

Router(dhcp-config)#ip dhcp excluded-address 10.0.0.102 10.0.0.255
Router(config)#ip dhcp pool poolv97
Router(dhcp-config)#ip dhcp pool poolv20
Router(dhcp-config)#ip dhcp excluded-address 20.0.0.22 20.0.0.255
Router(config)#ip dhcp pool poolv97
Router(dhcp-config)#ip dhcp excluded-address 97.0.0.12 97.0.0.255
```

Observation:

The screenshots of *show vlan* command in two switches are shown below:
Switch 0

```
VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/2, Fa0/4, Fa0/6
                                                Fa0/7, Fa0/8, Fa0/9, Fa0/10
                                                Fa0/11, Fa0/12, Fa0/13, Fa0/14
                                                Fa0/15, Fa0/16, Fa0/17, Fa0/18
                                                Fa0/19, Fa0/20, Fa0/21, Fa0/22
                                                Fa0/23, Fa0/24, Gig0/1, Gig0/2
20   Faculties                        active    Fa0/3
```

Switch 1

```
VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/4, Fa0/6, Fa0/7
                                                Fa0/8, Fa0/9, Fa0/10, Fa0/11
                                                Fa0/12, Fa0/13, Fa0/14, Fa0/15
                                                Fa0/16, Fa0/17, Fa0/18, Fa0/19
                                                Fa0/20, Fa0/21, Fa0/22, Fa0/23
                                                Fa0/24, Gig0/1, Gig0/2
20   Faculties                        active    Fa0/2, Fa0/3
```

Switch 2

```
VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/3, Fa0/5, Fa0/6, Fa0/7
                                                Fa0/8, Fa0/9, Fa0/10, Fa0/11
                                                Fa0/12, Fa0/13, Fa0/14, Fa0/15
                                                Fa0/16, Fa0/17, Fa0/18, Fa0/19
                                                Fa0/20, Fa0/21, Fa0/22, Fa0/23
                                                Fa0/24, Gig0/1, Gig0/2
20   Faculties                        active    Fa0/2
97   Management                       active    Fa0/4
```

Challenges:

We need to keep in mind that whenever we try to configure interface of router, we need to make sure that it is encapsulated first. Otherwise it shows an error message.