Department of Computer Science and Engineering
Islamic University of Technology (IUT)
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Laboratory Report

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. Cisco Packet Tracer

Theory:

Inter VLAN Routing:

Inter-VLAN routing refers to the movement of packets across the network between end devices that are in different network segments (VLANs). We know that VLAN allow multiple networks to exist on the same physical infrastructure. To move packets from one VLAN to another and enable communications among hosts, we have to configure the VLAN network. Which will result to **inter-VLAN** routing.
Let's say there are 3 different groups of users in an office: Sales department, Finance department and IT department.
If a sales representative needs to access a file stored on a server that is located on another floor and used by the finance team, the inter-VLAN routing mechanism will route the traffic **between the VLANs** to allow the user to access the required resource.
Without inter-VLAN routing, devices in the sales VLAN would not be able to communicate with devices in the finance VLAN, even though they are physically located in the same building. Inter-VLAN routing allows devices in different **VLANs to communicate with each other** while maintaining the isolation of their broadcast domains.

DHCP Service:
DHCP (Dynamic Host Configuration Protocol) is a network management protocol that helps us to dynamically assign an IP address to any devices.

This process is automated and is centrally managed. So, it simplifies network administration because network configuration is not done manually rather it's done automatically.

Pros	Cons
- Automatic assignment of IP addresses - Manual configuration time is saved - Simplifies administration of the network - Centrally Managed - No chance of having duplicate IP - No chance of IP conflicts (If configured properly)	- If a DHCP server is unavailable then devices won't be able to connect to network - IP conflicts may arise if there's more than one DHCP servers on the same network - It can become a Single Point of Failure - It can be used to carry out man-in-the-middle, IP spoofing attacks - Misconfigured DHCP lead to connectivity issues

Exclusion of Addresses in DHCP Services:

"Exclusion of addresses" is a process of **reserving a range** of IP addresses within the available IP address range of a DHCP server. **Ensuring** that these addresses are **not assigned** to any device on the network by the DHCP server.
By excluding IP addresses from DHCP service, it can be made sure that certain devices or network services always have the same IP address, making them easier to locate and manage. It also helps to prevent conflicts when multiple devices attempt to use the same IP address. To accommodate only the first 100 IP for a VLAN (Max 100):

Router(config)# ip dhcp excluded-address 10.0.10.101 10.0.10.254

Diagram of the experiment:
The route: PC → Switch → Router → Switch → PC

Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	PC0	ICMP
	0.001	PC0	Switch0	ICMP
	0.002	Switch0	Router	ICMP
	0.003	Router	Switch0	ICMP
	0.004	Switch0	Switch1	ICMP
	0.005	Switch1	PC5	ICMP
	0.006	PC5	Switch1	ICMP
	0.007	Switch1	Switch0	ICMP
	0.008	Switch0	Router	ICMP
	0.009	Router	Switch0	ICMP
	0.010	Switch0	PC0	ICMP

VLAN 10 Student (Max 100)

VLAN 97 Management (Max 20)

VLAN 20 Faculty (Max 20)

DHCP Services, Inter VLAN routing
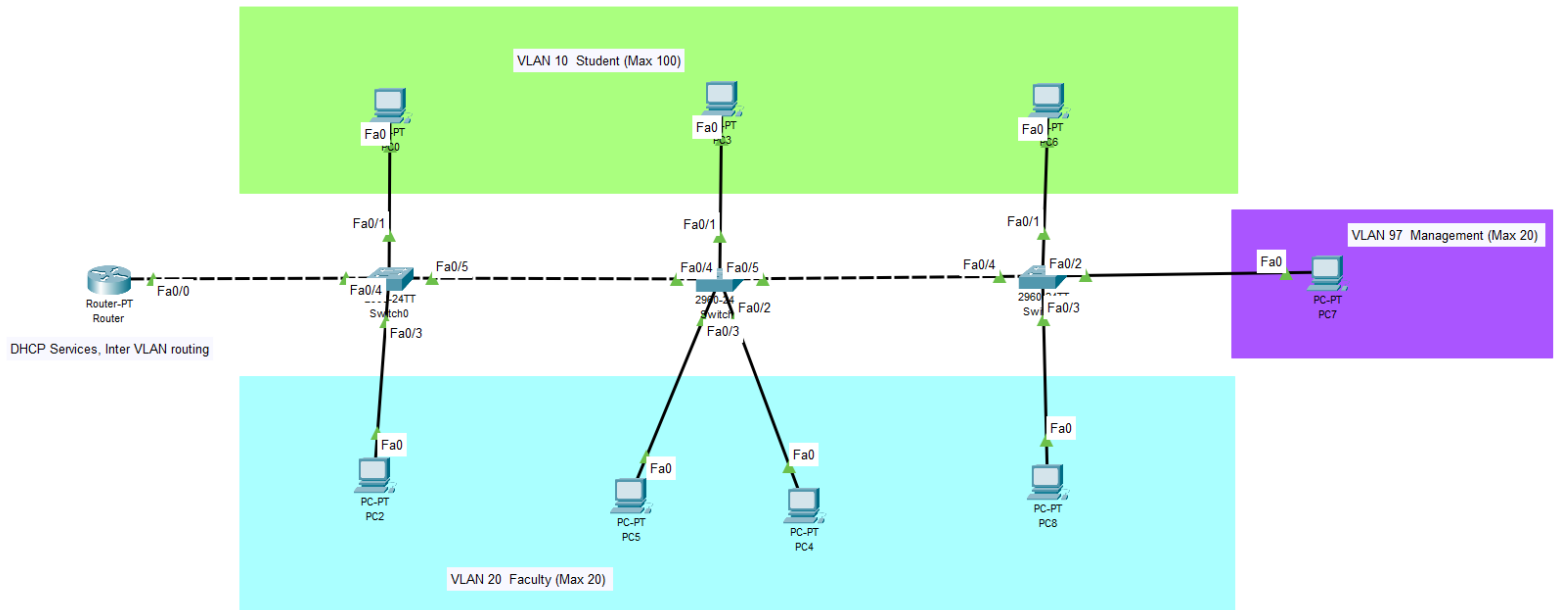
Configuration of Routers:

Commands for configuring VLAN:

(Mainly for switch2)

Switch(config)# vlan 10
Switch(config-vlan) # name student
Switch(config)# vlan 20
Switch(config-vlan) # name faculty
Switch(config)# vlan 97
Switch(config-vlan) # name management

All the other switches will have the same configurations

Switch(config) # interface fastEthernet 0/1
Switch(config-if) # switchport mode access
Switch(config-if) # switchport access vlan 10

Switch(config) # interface fastEthernet 0/2
Switch(config-if) # switchport mode access
Switch(config-if) # switchport access vlan 20

Switch(config) # interface fastEthernet 0/3
Switch(config-if) # switchport mode access
Switch(config-if) # switchport access vlan 97

Switch(config)# interface fastEthernet 0/4
Switch(config-if) # switchport mode trunk

Commands for configuring DHCP:

Router(config)# interface fastEthernet 0/0
Router(config-if) # ip address 200.100.1.1 255.255.255.0
Router(config-if) # no shutdown

Router(config)# interface fastEthernet 0/0.10
Router(config-subif) # encapsulation dot1q 10
Router(config-subif) # ip address 10.0.10.1 255.255.255.0
Router(config-subif) # ip helper-address 200.100.1.1 255.255.255.0
Router(config)# ip dhcp pool student
Router(config)# network 10.0.10.0 255.255.255.0
Router(config)# default-router 10.0.10.1
Router(config)# dns-server 8.8.8.8
Router(config)# ip dhcp excluded-address 10.0.10.101 10.0.10.254

To make a default gateway (for all switches):

Switch(config)# ip default-gateway 200.100.1.1

Router(config)# interface fastEthernet 0/0.20
Router(config-subif) # encapsulation dot1q 20
Router(config-subif) # ip address 10.0.20.1 255.255.255.0
Router(config-subif) # ip helper-address 200.100.1.1 255.255.255.0
Router(config)# ip dhcp pool faculty
Router(config)# network 10.0.20.0 255.255.255.0
Router(config)# default-router 10.0.20.1
Router(config)# dns-server 8.8.8.8
Router(config)# ip dhcp excluded-address 10.10.20.21 10.10.20.254

Router(config)# interface fastEthernet 0/0.97
Router(config-subif) # encapsulation dot1q 97
Router(config-subif) # ip address 10.0.97.1 255.255.255.0
Router(config-subif) # ip helper-address 200.100.1.1 255.255.255.0
Router(config)# ip dhcp pool management
Router(config)# network 10.0.97.0 255.255.255.0
Router(config)# default-router 10.0.97.1
Router(config)# dns-server 8.8.8.8
Router(config)# ip dhcp excluded-address 10.10.97.21 10.10.97.254

Observation:

The **show vlan** and **show running-config** command for "Switch0" is shown below:

```
interface FastEthernet0/1        Switch#show vlan
 switchport access vlan 10
!                                VLAN Name                          Status    Ports
interface FastEthernet0/2        ---- ------------------------------ --------- -------------------------------
 switchport access vlan 20       1    default                       active    Fa0/6, Fa0/7, Fa0/8, Fa0/9
!                                                                              Fa0/10, Fa0/11, Fa0/12, Fa0/13
interface FastEthernet0/3                                                      Fa0/14, Fa0/15, Fa0/16, Fa0/17
 switchport access vlan 20                                                     Fa0/18, Fa0/19, Fa0/20, Fa0/21
!                                                                              Fa0/22, Fa0/23, Fa0/24, Gig0/1
interface FastEthernet0/4        10   Student                       active    Gig0/2
 switchport mode trunk           20   Faculties                     active    Fa0/1
!                                97   Management                     active    Fa0/2, Fa0/3
interface FastEthernet0/5
 switchport mode trunk
!
```

The "show vlan" command for other routers will be similar.

Running-config of "Router0":

```
ip dhcp pool student             interface FastEthernet0/0
 network 10.0.10.0 255.255.255.0  ip address 200.100.1.1 255.255.255.0
 default-router 10.0.10.1         duplex auto
 dns-server 8.8.8.8               speed auto
ip dhcp pool faculty             !
 network 10.0.20.0 255.255.255.0 interface FastEthernet0/0.10
 default-router 10.0.20.1         encapsulation dot1Q 10
 dns-server 8.8.8.8               ip address 10.0.10.1 255.255.255.0
ip dhcp pool management           ip helper-address 200.100.1.1
 network 10.0.97.0 255.255.255.0 !
 default-router 10.0.97.1        interface FastEthernet0/0.20
 dns-server 8.8.8.8               encapsulation dot1Q 20
                                  ip address 10.0.20.1 255.255.255.0
                                  ip helper-address 200.100.1.1
                                 !
                                 interface FastEthernet0/0.97
                                  encapsulation dot1Q 97
                                  ip address 10.0.97.1 255.255.255.0
                                  ip helper-address 200.100.1.1
                                 !
```

Other important commands:

Router# show ip dhcp pool student/faculty/management

Switch(config-if) # switchport trunk allowed vlan all

Challenges:

- It took a lot of time to gather all the necessary information and compile it into a comprehensive report.
- Familiarity issues.