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## L3 switches

### Lab setup

*For this lab boot into windows XP. Choose other option in grub and then choose earlier version of Windows.*

The lab will be demoed in class using ‘Cisco Packet Tracer’ and same can be used by students in lab / hostels for practice. But it is necessary for all students to practice same setup usually physical switches in lab, so that all students are comfortable with actual switches along with simulator.

For physical lab work network connections as shown in figure 1 would be required. For simulator purposes ignore lab network cable, unmanageable switch and main experiment PC with hyperterminal. These items are required for physical lab setup only.

A DHCP server should be added in simulator as it is not available by default in simulator, as in case of actual lab.

### Lab4 objectives

The planned lab4 objectives are:

1. Configuring VLANs in L3 switches
2. Adding static routes to L3 switches
3. ACL configuration (omitted due to time limit)
4. Port mirroring (omitted due to time limit)
5. About ip helper address and centralized DHCP (omitted due to time limit)
6. Looking at VLAN statistics / information (covered briefly)

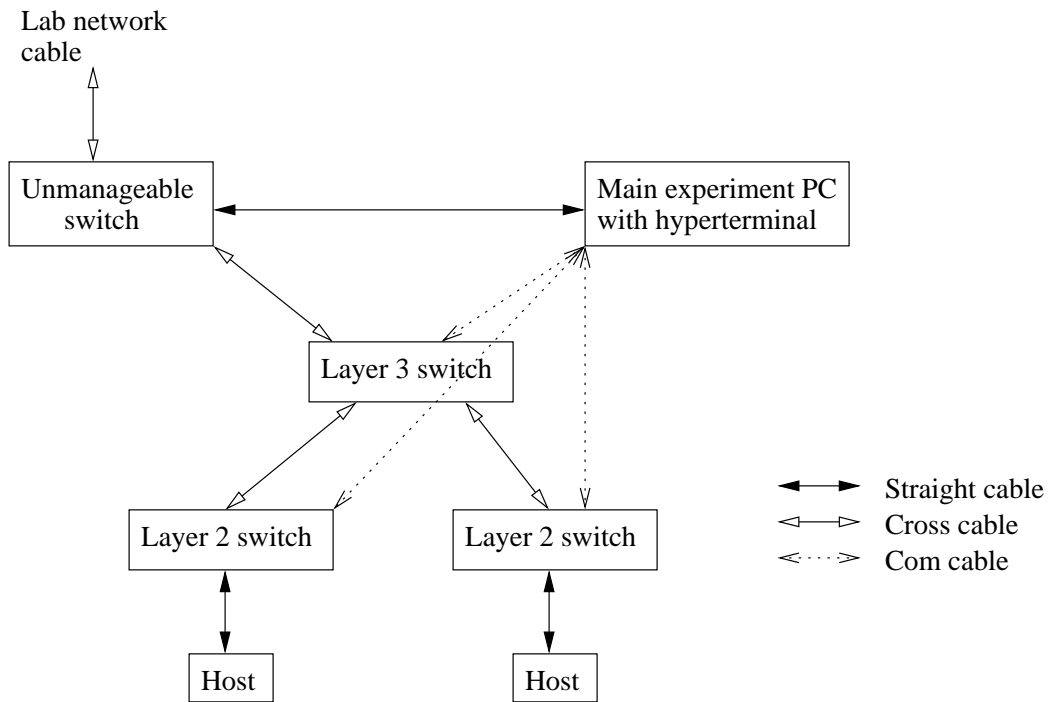


Figure 1: Lab4 setup required to practice L3 switch and VLAN configuration

Due to limited time for labs and availability of only one physical L3 switch for practice the contents have been reduced. Based on personal interests students can pursue omitted lab topics and can approach lab instructor for suggestions or information related to omitted topics. But it is expected that all students do the lab both on physical switches and Packet Tracer so that they are comfortable with real as well as virtual switches.

**Important Note:**

1. Students are supposed to understand in which mode among enable mode, global configuration mode, interface configuration mode / etc. the command needs to be typed. That information is not provided in this lab handout and should be inferred based on whether command applies to whole switch or to a particular interface etc.
2. **Please set all switch passwords for physical switches to ‘iiit123’ only**

**Demo**

1. Erase L3 switch configuration

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```
write erase
reload
```

2. Configure Switch to take IP address from DHCP on VLAN 1

```
ip address dhcp
```

Note that switch will take gateway, search domain and DNS server information also from DHCP server.

3. Normally switch will broadcast on console which IP address it has received through DHCP. To see the IP assigned using command use:

```
show ip aliases (only in physical switch)
show ip interface brief
```

4. Disable bugging by console messages on console line by using

```
logging synchronous
```

5. To see existing VLANs use:

```
show vlan brief
```

6. To remove vlan that already exists use:

```
no vlan <vlan_id>
no interface vlan <vlan_id>
```

7. To create a VLAN we can use:

```
vlan <vlan_id>
```

8. To give above created VLAN some name we can use command

```
name <VLAN_NAME>
```

in VLAN configuration mode that is started after creating vlan.

9. We can assign IP addresses to VLANs in L3 switch. For example to assign IP address 10.10.10.1/24 to vlan 10 we can use:

```
interface vlan 10
ip address 10.10.10.1 255.255.255.0
```

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10. To assign VLAN 10 to fastethernet 0/1 where first L2 switch is connected.

```
switchport mode access
switchport access vlan 10
```

11. Configure VLAN 1 IP in L2 switch connected to fastethernet 0/1 in same subnet as VLAN 10. Then try to ping from VLAN 1 (management IP) of L2 switch to VLAN 10 IP of L3 switch and vice-versa.
12. Try to telnet from VLAN 1 of L2 switch to VLAN 10 of L3 switch. Notice the error message displayed if vty password is not set. Set vty password and telnet from L3 switch to L2 switch and vice-versa.  
  
Also note that if enable password is not set then after connecting to switch over telnet the switch will not accept 'enable' command. To be able to use 'privileged exec mode' through telnet it is necessary that we configure enable password on switch.
13. Create VLAN 20. Assign it IP address 10.10.20.1/24. Configure fa 0/2 in access vlan 20. Configure VLAN 1 IP of second L2 switch in 10.10.20.0/24 subnet. Ping from second L2 switch to VLAN 20 IP of L3 switch and vice-versa.

Configure enable and vty password on this switch so that one can telnet from L3 switch to both L2 switches and we do not have to change console cable frequently.

14. Try to ping from one L2 switch to second L2 switch. The ping should not work as we have not set default gateway which should be used to contact machines which are not in our subnet.

Configure default gateway as 10.10.10.1 (VLAN 10 IP of L3 switch) on switch 1 and 10.10.20.1 (VLAN 20 IP of L3 switch) on switch 2. Also on L3 switch enable inter-VLAN routing using

```
ip routing
```

command. Now ping and telnet from switch 1 to switch 2 (or vice-versa) should work.

15. Use 'show ip route' command on L3 switch and understand significance of all the routes shown.
16. Use 'show vlan brief' command to see list of VLANs that are created.

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17. Use 'show vtp status' to see VTP mode, VTP domain, how many VLANs are supported, VTP version, pruning is enabled or not, etc.
  18. Use 'show interfaces' command on L3 switch and note that VLAN 1, 10, 20 etc. are also treated as interfaces and their statistics are also shown along with statistics of other VLANs.
  19. Change fastethernet 0/1 configuration to:

```
switchport trunk encapsulation dot1q
```

```
switchport mode trunk
```

```
switchport trunk allowed vlan 1,10
```

20. Now ping to 10.10.10.2 will stop working as VLAN 1 of L3 switch will talk to vlan 1 of first L2 switch and VLAN 1 of L3 switch is in 10.3.3.0/24 subnet.

To resolve this log in to first switch and give it IP in 10.3.3.0 series. Note that only 2950+ switches support taking of IP using DHCP. If you are using 2924 etc. switch for lab then you have to manually assign IP in 10.3.3.0/24 range to interface VLAN 1. Ping to 10.3.3.X IP and ensure X is unused before assigning it to switch to prevent IP conflict.

Here lot of things must be right so that setup works:

- (a) Both switches must be in vtp mode server or client.
- (b) Configuration revision number of L3 switch must be greater than configuration revision number of L2 switch, else all VLANs will be lost even if L2 switch is in client mode.
- (c) VTP domain must match on both switches
- (d) We must configure same encapsulation, ie dot1q, on trunk ports

You can use 'show vtp status' to check various values and 'vlan database' vlan / vtp configuration mode to change vtp domain, mode, etc.

21. When ping from switch which is now in 10.3.3.0/24 series to other switch 10.10.20.0/24 is working then configure second port of first switch in access VLAN 10. Connect machine with IP in range 10.10.10.0/24 to second port of first switch. This machine should be able to access all three switches without any problem. The gateway for this machine should be 10.10.10.1 which is L3 switch IP address in VLAN 10.

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22. Use 'show ip arp' to see MAC addresses cached in ARP cache.
  23. Use 'show mac address-table' command to see which MAC address are present on which ports. Notice that L3 switches do switching based on MAC addresses. Login in 30.1 and show mac address table especially for OBH and Library switch ports for which static routing is configured.
  24. Sample static routing command is

```
ip route 10.100.10.0 255.255.255.0 10.10.10.3
```

Explain static routing used in campus by logging into various switches and showing their static routing configuration.

## Lab task

1. Erase configuration and reload one L3 switch and two L2 switches.
2. Configure proper hostnames on all three switches.
3. Configure enable password and telnet passwords on all three switches.
4. Check vtp domain of all switch and set it to 'test123' if not already so.
5. Remove all VLANs from L3 switch.
6. Create VLANs 100, 200 with some IP address range of your choice.
7. Trunk vlans 1, 100 to first switch. Hence give proper IP to first switch so that it can be accessed from other switches.
8. Connect second switch in access vlan 200. Configure proper IP in second switch so that it can be accessed from other switches.
9. Telnet from one switch to another. Ensure that communication between all pairs of two switches is working.
10. Connect one host to second L2 switch in vlan 200 and another host to first L2 switch in VLAN 100. Make sure communication between these two hosts is working.
11. Create aliased IPs in both hosts in some random subnet. Make ping from one host to aliased IP of other host work without changing any route settings in hosts.

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Each group should perform these lab tasks and submit one report per group which includes following information collected after all lab steps have been completed:

- Running configuration of all three switches
- 'ifconfig' output on all hosts
- 'ip route show' output on all hosts
- 'show vtp status' on all three switches
- 'show vlan brief' on L3 switch
- 'show ip interface brief' on L3 switch

You have to submit the solutions on courses website in tar or zip format by dead-line communicated by lab instructor via email / courses portal.