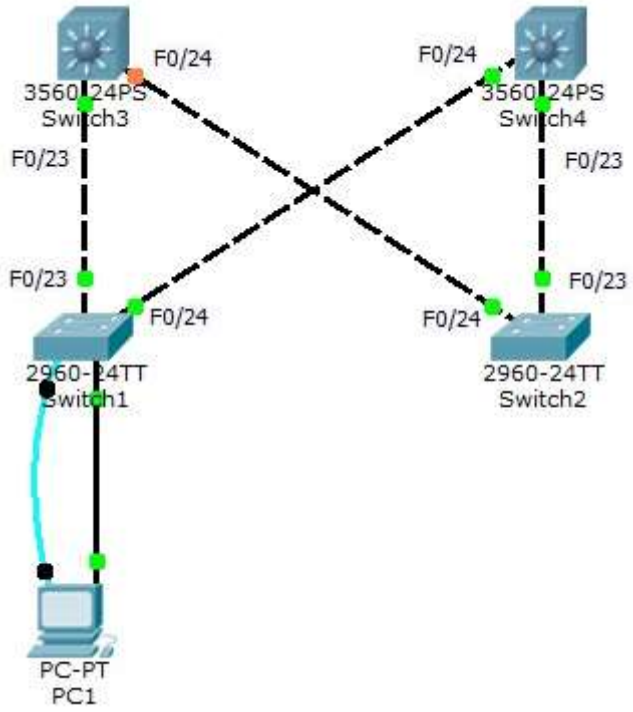
Lab 1.Switched LANs

Objective

- Understand the LAN technologies of switched LANs.

Topology



Host name	Interface	IPv4 address	IPv6 address
Switch1	Vlan 1	192.168.1.101/24	N/A
Switch2	Vlan 1	N/A	N/A
Switch3	Vlan 1	N/A	N/A
Switch4	Vlan 1	N/A	N/A
PC1	FastEthernet 0	192.168.1. 11 /24	N/A

Part 1 - Switched LANs.

Step 1 - Connect to the switch.

1. Connect PC1 to the console of Switch1 using a rollover cable, and login in to Switch1 from PC1 using the application, Terminal.

2. Display the interfaces of Switch1.
   Switch1# ***show ip interface brief***

   Output of Switch1:

```
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/1        unassigned      YES manual up                    up
FastEthernet0/2        unassigned      YES manual down                  down
  <omit some output>
FastEthernet0/23       unassigned      YES manual up                    up
FastEthernet0/24       unassigned      YES manual up                    up
GigabitEthernet1/1     unassigned      YES manual down                  down
GigabitEthernet1/2     unassigned      YES manual down                  down
Vlan1                  unassigned      YES manual administratively down down
```

3. How many Ethernet interfaces are there in Switch1?
   24 FastEthernet interfaces and 2 GigabitEthernet interfaces.

4. What is the interface Vlan1? What is the purpose of this interface?
   This is the switch virtual interface (SVI), and this interface is used for accessing the switch using TCP/IP.

   (Note: Switch1 and Switch2 are layer 2 switches, which support only one SVI. Whereas Switch3 and Switch4 are layer 3 switches, which support multiple SVIs, each in a separate VLAN.)

5. Configure the SVI of Switch1.
   (Note: The hosts that connected to the ports in VLAN 1 have access to the SVI by default.)
   Switch1(config)# ***interface vlan 1***
   Switch1(config-if)# ***ip address*** *192.168.1.101 255.255.255.0*

Switch1(config-if)# ***no shutdown***
(Note: The default gateway is necessary only if the SVI is accessed from the external IP networks, and is configured using the ***ip default-gateway*** global configuration command.)

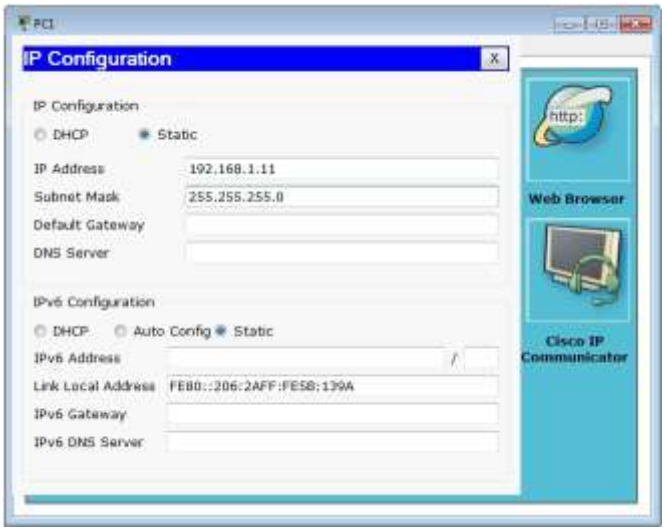
6. Display the status of SVI of Switch1.
   Switch1# ***show interface vlan 1***

   Output of Switch1:

```
Vlan1 is up, line protocol is up
  Hardware is CPU Interface, address is 000a.f382.abd5 (bia 000a.f382.abd5)
  Internet address is 192.168.1.101/24

  <omit output below>
```

7. Configure the telnet lines on Switch1.
   (Note: Telnet is an unsecure protocol using plaintext transmission, whereas secure shell (ssh) is a secure protocol using encrypted transmission.)
   Switch1(config)# ***line vty 0 4***
   Switch1(config-line)# ***transport input telnet***
   Switch1(config-line)# ***password*** cisco
   Switch1(config-line)# ***login***

8. Configure and verify the IPv4 address of PC1, using the applications, IP Configuration and Command Prompt.



   PC:\> ***ipconfig***

   Output of PC1:

```
FastEthernet0 Connection:(default port)
Link-local IPv6 Address.....: FE80::206:2AFF:FE5B:139A
IP Address.....: 192.168.1.11
Subnet Mask.....: 255.255.255.0
Default Gateway.....: 0.0.0.0
```

9. Connect PC1 to Switch1 using telnet.
   PC:\> ***telnet*** *192.168.1.101*

Output of PC1:

```
Trying 192.168.1.101 ...Open


User Access Verification

Password:
Switch1>
```

10. Display the telnet session on Switch1.
    Switch1# ***show users***

    Output of Switch1:

```
    Line       User       Host(s)              Idle       Location
*   0 con 0                idle                 00:00:00
    2 vty 0                idle                 00:00:18 192.168.1.11

  Interface    User               Mode         Idle     Peer Address
```

11. Configure the ssh lines on Switch1.
    (Note: By default, ssh supports both versions 1 and 2. Version 1 has known vulnerabilities, thus it is recommended to enable only version 2.)
    Switch1(config)# ***ip ssh version 2***

```
Please create RSA keys (of at least 768 bits size) to enable SSH v2.
```

    Switch1(config)# ***ip domain-name*** fit.must.edu.mo
    Switch1(config)# ***crypto key generate rsa***

```
The name for the keys will be: Switch1.fit.must.edu.mo
Choose the size of the key modulus in the range of 360 to 2048 for your
  General Purpose Keys. Choosing a key modulus greater than 512 may take
  a few minutes.

How many bits in the modulus [512]: 1024
% Generating 1024 bit RSA keys, keys will be non-exportable...[OK]

%SSH-5-ENABLED: SSH 2 has been enabled
```

    Switch1(config)# ***ip ssh time-out 60***
    Switch1(config)# ***ip ssh authentication-retries 3***

    Switch1(config)# ***username*** student ***privilege 15 password*** student
    (Note: Create a username in local database for authentication.)
    Switch1(config)# ***line vty 0 4***
    Switch1(config-line)# ***transport input ssh***
    Switch1(config-line)# ***no password***
    Switch1(config-line)# ***login local***

12. Connect PC1 to Switch1 using telnet.
    PC:\> ***ssh -l*** student *192.168.1.101*

Output of PC1:

```
Open
Password:

Switch1#
```

13. Display the ssh session on Switch1.

Switch1# ***show users***

Output of Switch1:

```
    Line       User       Host(s)              Idle       Location
*   0 con 0                idle                 00:00:00
    2 vty 0    student    idle                 00:01:28

  Interface    User               Mode         Idle     Peer Address
```

Step 2 - Manage the switch.

14. Display the switching table of Switch1.
(Note: A LAN switch maintains a MAC address table that it uses to determine how to forward traffic through the switch.)
Switch1# ***show mac-address-table***

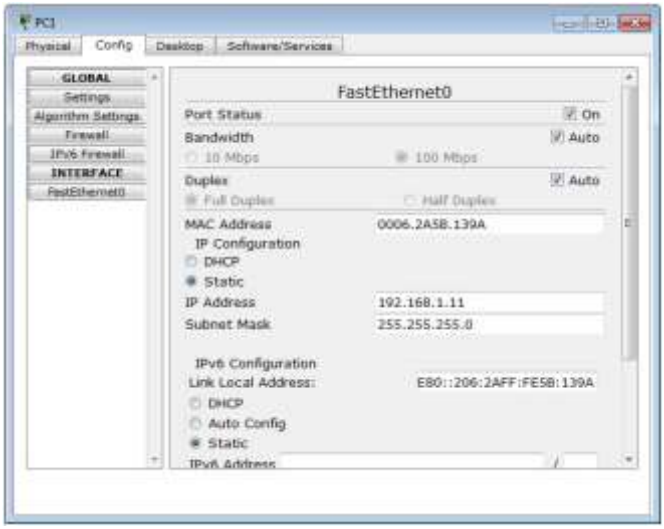
Output of Switch1:

```
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----

   1    0006.2a5b.139a    DYNAMIC     Fa0/1
   1    0030.a398.9517    DYNAMIC     Fa0/23
   1    00e0.8fdd.1718    DYNAMIC     Fa0/24
```

15. What type of these MAC address entries?
Dynamic

(Note: The MAC addresses that dynamically learned by the switch are then aged when they are not in use. The default aging time is 300 seconds. The ***clear mac-address-table*** command can be used to clear the table entries, ensures that invalid MAC addresses are removed immediately.)

16. Display the MAC address of PC1.



17. What is the MAC address of PC1?
    0006.2A5B.139A

18. Which interface of Switch1 does PC1 connect to?
    PC1 are connected to the interface FastEthernet 0/1 of Switch1.

19. Display the status of interface FastEthernet 0/1 of Switch1.
    Switch1# ***show interface fastethernet 0/1***

    Output of Switch1:

```
FastEthernet0/1 is up, line protocol is up (connected)
  Hardware is Lance, address is 00e0.f7b8.5301 (bia 00e0.f7b8.5301)
 BW 100000 Kbit, DLY 1000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s

  <omit output below>
```

20. What are the speed and the duplex mode of the interface FastEthernet 0/1 of Switch1?
    The FasEthernet 0/1 is 100Mbps and full duplex.

    (Note: The Ethernet ports of a switch default to auto-speed and auto-duplex. Auto-negotiation is processed to determine the speed and the duplex mode when a device is connected to the port.)

21. Display the neighboring devices of Switch1.
    Switch1# ***show cdp neighbors***

    Output of Switch1:

```
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone
Device ID     Local Intrfce   Holdtme    Capability   Platform     Port ID
Switch3        Fas 0/23         124                     3560         Fas 0/23
Switch4        Fas 0/24         124                     3560         Fas 0/24
```

22. Which devices are directly connected to Switch1?
    Switch3 and Switch4.

(Note: The Cisco Discovery Protocol (CDP) is a Cisco proprietary protocol that all Cisco devices can discover other Cisco devices that are directly connected. By default, most Cisco routers and switches have CDP-enabled on all ports.)

23. Why Switch2 is not shown in the above output?
    Switch2 is not directly connected to Switch1.

Part 2 - Redundant switched LANs.

Step 1 - Display the default topology of the switched LAN.

24. Display the spanning-tree topology of the switched LAN.
    Switch1~4# ***show spanning-tree vlan 1***
    (Note: the spanning-tree protocol (STP) is used in the redundant switch LANs to create a loop-free topology.)

    Output of Switch1:

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    32769
              Address     0007.EC2C.51EC
              Cost        19
              Port        24(FastEthernet0/24)
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     000A.F382.ABD5
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/1            Desg FWD 19        128.1    P2p
Fa0/23           Desg FWD 19        128.23   P2p
Fa0/24           Root FWD 19        128.24   P2p
```

    Output of Switch2:

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    32769
              Address     0007.EC2C.51EC
              Cost        19
              Port        23(FastEthernet0/23)
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     00E0.F953.04A4
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/23           Root FWD 19        128.23   P2p
Fa0/24           Desg FWD 19        128.24   P2p
```

Output of Switch3:

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    32769
              Address     0007.EC2C.51EC
              Cost        38
              Port        23(FastEthernet0/23)
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     000B.BE7B.8A54
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/23           Root FWD 19        128.23   P2p
Fa0/24           Altn BLK 19        128.24   P2p
```

Output of Switch4:

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    32769
              Address     0007.EC2C.51EC
              This bridge is the root
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     0007.EC2C.51EC
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/23           Desg FWD 19        128.23   P2p
Fa0/24           Desg FWD 19        128.24   P2p
```

25. Fill in the answers in below table?

Switch name	Switch1	Switch2	Switch3	Switch4
Bridge ID (priority, MAC)	32769, 000A.F382.ABD5	32769, 00E0.F953.04A4	32769, 000B.BE7B.8A54	32769, 0007.EC2C.51EC
Root bridge / Non-root bridge	Non-root bridge	Non-root bridge	Non-root bridge	Root bridge
Root port	Fa0/24	Fa0/23	Fa0/23	N/A
Designated ports	Fa0/23	Fa0/24	None	Fa0/23, Fa0/24
Non-designated ports / Alternate Port	None	None	Fa0/24	None

26. Which ports are in the blocking state?
    FastEthernet 0/24 of Switch3.

Step 2 - Force a Non-root switch to be the Root switch.

27. Force the Non-root bridge, Switch1, to be the Root bridge by configuring the lower bridge priority to Switch1.
    Switch1(config)# ***spanning-tree vlan 1 priority*** 4096

28. Display the spanning-tree topology of the switched LAN.
Switch1~4# ***show spanning-tree vlan 1***

Output of Switch1:

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    4097
              Address     000A.F382.ABD5
              This bridge is the root
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    4097  (priority 4096 sys-id-ext 1)
              Address     000A.F382.ABD5
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/1            Desg FWD 19        128.1    P2p
Fa0/23           Desg FWD 19        128.23   P2p
Fa0/24           Desg FWD 19        128.24   P2p
```

Output of Switch2:

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    4097
              Address     000A.F382.ABD5
              Cost        38
              Port        23(FastEthernet0/23)
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     00E0.F953.04A4
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/23           Root FWD 19        128.23   P2p
Fa0/24           Altn BLK 19        128.24   P2p
```

Output of Switch3:

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    4097
              Address     000A.F382.ABD5
              Cost        19
              Port        23(FastEthernet0/23)
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     000B.BE7B.8A54
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/23           Root FWD 19        128.23   P2p
Fa0/24           Desg FWD 19        128.24   P2p
```

Output of Switch4:

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    4097
              Address     000A.F382.ABD5
              Cost        19
              Port        24(FastEthernet0/24)
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     0007.EC2C.51EC
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/23           Desg FWD 19        128.23   P2p
Fa0/24           Root FWD 19        128.24   P2p
```

29. Fill in the answers in below table?

Switch name	Switch1	Switch2	Switch3	Switch4
Bridge ID (priority, MAC)	4097, 000A.F382.ABD5	32769, 00E0.F953.04A4	32769, 000B.BE7B.8A54	32769, 0007.EC2C.51EC
Root bridge / Non-root bridge	Root bridge	Non-root bridge	Non-root bridge	Non-root bridge
Root port	None	Fa0/23	Fa0/23	Fa0/24
Designated ports	Fa0/23, Fa0/24	None	Fa0/24	Fa0/23
Non-designated ports / Alternate Port	None	Fa0/24	None	None

30. Which ports are in the blocking state?

FastEthernet 0/24 of Switch2.