

Lab - VLANs

Topology Overview

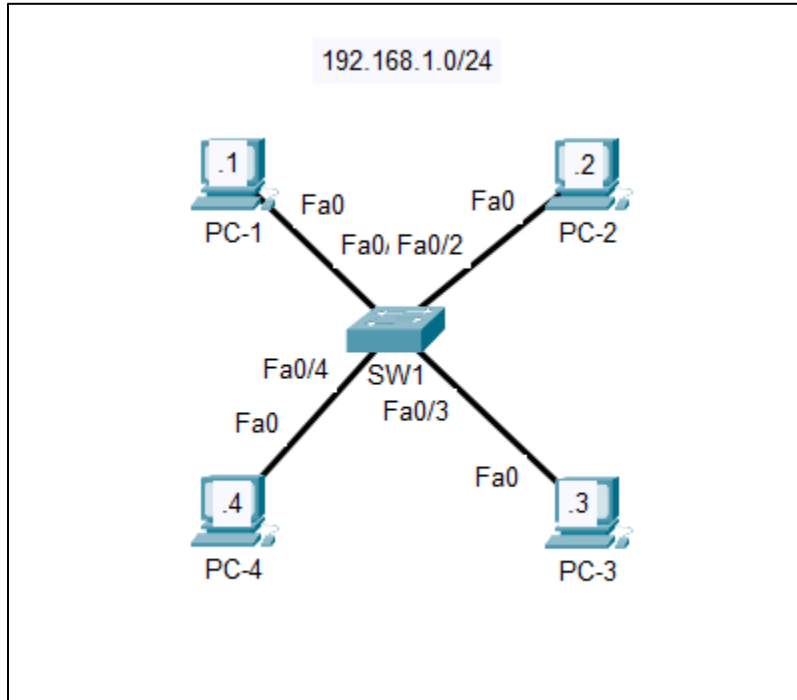


Figure 1 – Lab Topology

Requirement

Traffic from an odd-numbered PC must not be able to reach an even-numbered PC.

- From PC-1, ping the broadcast IP of 192.168.1.255 to validate reachability to all devices. All PCs should respond.
- Change PC-4's IP to 172.16.1.4 and PC-2's IP to 172.16.1.2. Both should have a mask of 255.255.255.0. Turn on Simulation Mode. From PC-1, ping PC-4 then press play.

Observe

A red X appears on the frame and it is not transmitted onto the wire.

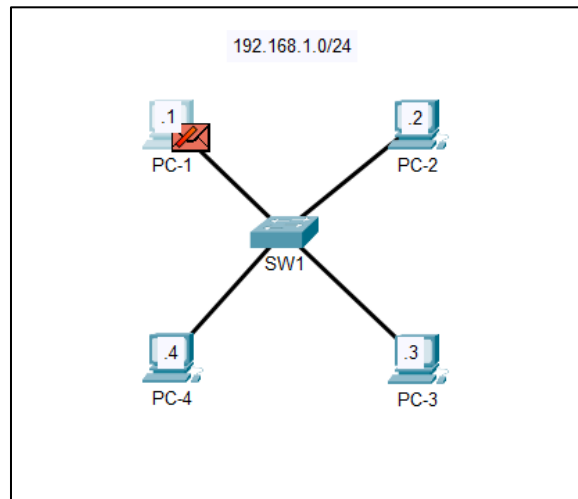


Figure 2 – Ping from PC-1 to PC-4

Engineer Insight

Changing the IP addresses of the even-numbered PCs resulted in the even and odd PCs losing IP reachability. This is expected because the odd and even PCs are now on different IP networks. Devices on different IP networks cannot communicate directly with each other, by default. Do not concern yourself with the specifics of why just yet.

Question

- Devices in different IP networks are unable to send traffic directly to each other. Has the requirement been met?

- c. Reset Simulation Mode and repeat step a. If the ping from PC-1 is still going, enter ctrl+c.

Observe

The broadcast is received by **all devices, both odd and even**. The requirement has not been met.

The Problem

All ports on a switch, by default, are members of the same **broadcast domain**. A broadcast domain is the set of ports that will receive the same broadcast messages and can be thought of as a boundary. A broadcast is used to address all devices connected to the LAN segments that are part of that broadcast domain. When a switch receives a broadcast, it is flooded out all ports except the one it was received on.

To prevent **any traffic** from an odd-numbered PC from being received by an even-numbered PC, they must reside in different broadcast domains. If a device can "see" another device's broadcasts, both devices are within the same broadcast domain, creating the possibility for traffic to reach devices that should be isolated from one another.

The Solution

Purchasing an additional physical switch and placing the odd and even PCs on separate, **unconnected switches** would meet the requirement. The two physically separated switches would represent two separate **broadcast domains**. This **physical segmentation** would work; however, it would not scale well and would be a waste of resources.

A better solution is to use **Virtual Local Area Networks (VLANs)**. VLANs allow a single physical switch to be **logically separated into multiple broadcast domains**, resulting in a similar effect to using two separate physical switches.

- d. On SW1, view the status of the interfaces.

Observe

The value in the Vlan column is 1 because all switchports are **assigned to VLAN 1 by default**.

SW1#show interface status						
Port	Name	Status	Vlan	Duplex	Speed	Type
Fa0/1	PC-1	connected	1	a-full	a-100	10/100BaseTX
Fa0/2	PC-2	connected	1	a-full	a-100	10/100BaseTX
Fa0/3	PC-3	connected	1	a-full	a-100	10/100BaseTX
Fa0/4	PC-4	connected	1	a-full	a-100	10/100BaseTX

Figure 3 – SW1 show interface status output

- e. On SW1, view the current VLANs. Create **VLAN 2** and assign the ports connected to the even-numbered PCs to VLAN 2. Then, view the updated list of VLANs and the interface statuses.

```
SW1# show vlan
SW1# configure terminal
SW1(config)# vlan 2
SW1(config-vlan)# interface range fa0/2, fa0/4
SW1(config-if)# switchport access vlan 2
```

Observe

The VLANs initially present are **1 and 1002–1005**.

```
SW1#show vlan
```

VLAN Name	Status	Ports
1 default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 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
1002 fddi-default	active	
1003 token-ring-default	active	
1004 fddinet-default	active	
1005 trnet-default	active	

VLAN Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	0	0
1004	fdnet	101004	1500	-	-	ieee	-	0	0
1005	trnet	101005	1500	-	-	ibm	-	0	0

VLAN Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2

Remote SPAN VLANs

Primary	Secondary	Type	Ports

```
SW1#
```

Figure 4 – SW1 show vlan output (Before)

After the changes, the updated VLAN list includes **VLAN 2**.

```
SW1#show vlan
```

VLAN Name	Status	Ports
1 default	active	Fa0/1, 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
2 VLAN0002	active	Fa0/2, Fa0/4

Figure 5 – SW1 show vlan output (After)

The ports connected to the even-numbered PCs are shown as assigned to VLAN 2 in the output of the show interface status command.

```
SW1#show interfaces status
```

Port	Name	Status	Vlan	Duplex	Speed	Type
Fa0/1	PC-1	connected	1	a-full	a-100	10/100BaseTX
Fa0/2	PC-2	connected	2	a-full	a-100	10/100BaseTX
Fa0/3	PC-3	connected	1	a-full	a-100	10/100BaseTX
Fa0/4	PC-4	connected	2	a-full	a-100	10/100BaseTX
Fa0/5		notconnect	1	auto	auto	10/100BaseTX

Figure 6 – SW1 show interfaces status output

Engineer Insight

The output of the show vlan command displays the VLANs currently configured on the switch. **VLAN 1** is the default VLAN, while VLANs **1002–1005** are reserved for legacy technologies. VLAN IDs range from **0–4095**, although some values are reserved and cannot be used as normal VLANs.

VLAN ID(s)	Type / Status	Use
0	Reserved	Cannot be used as a normal VLAN
1	Default VLAN	Usable, but cannot be deleted
2–1001	Normal range	Available for normal VLAN use
1002–1005	Reserved	Reserved for legacy technologies
1006–4094	Extended range	Available for normal VLAN use
4095	Reserved	Cannot be used as a normal VLAN

Table 1 – VLAN ranges

- f. Turn on Simulation Mode. From PC-1, ping the broadcast IP of 192.168.1.255 and press play.

Observe

The broadcast from PC-1 was not forwarded to the ports connected to the even-numbered PCs.

Engineer Insight

The odd-numbered PCs remain in the default VLAN, while the even-numbered PCs are members of VLAN 2. The two groups now exist in different **broadcast domains** and have neither direct IP reachability nor the ability to receive each other's broadcasts. It is essential that you understand

and can distinguish between these two layers of reachability. The distinction will become clearer as you progress through the CCNA training labs.

Type of Reachability	What the Learner Observed
IP Reachability	Lost when the PCs were placed in different IP networks.
Layer 2 Reachability	Lost when the PCs were placed in different VLANs (broadcast domains).

- g. On SW1, assign the ports connected to the odd-numbered PCs to **VLAN 3**. Do not use the vlan command to create VLAN 3. View the updated VLAN list and interface statuses.

Observe

Assigning the ports to VLAN 3 with the command switchport access vlan 3 resulted in VLAN 3 being created. **The VLAN must exist to be used.**

```
SW1(config-if-range)#switchport access vlan 3
% Access VLAN does not exist. Creating vlan 3
SW1(config-if-range)#
```

Figure 7 – SW1 Port Assigned to VLAN 3

VLAN 3 is displayed in the VLAN list.

```
SW1#show vlan

VLAN Name                Status    Ports
-----
1    default                active    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
2    VLAN0002               active    Fa0/2, Fa0/4
3    VLAN0003               active    Fa0/1, Fa0/3
1002 fddi-default         active
```

Figure 8 – SW1 show vlan output (After)

Engineer Insight

A VLAN can be explicitly created using the vlan command, as with VLAN 2, or it can be created automatically when a port is assigned to a VLAN that does not already exist, as you just observed with VLAN 3.

The original network consisted of one **broadcast domain**, giving all PCs **broadcast, or Layer 2, reachability** to one another. VLANs allow a switch to be logically divided into separate broadcast domains without the need for additional physical switches.