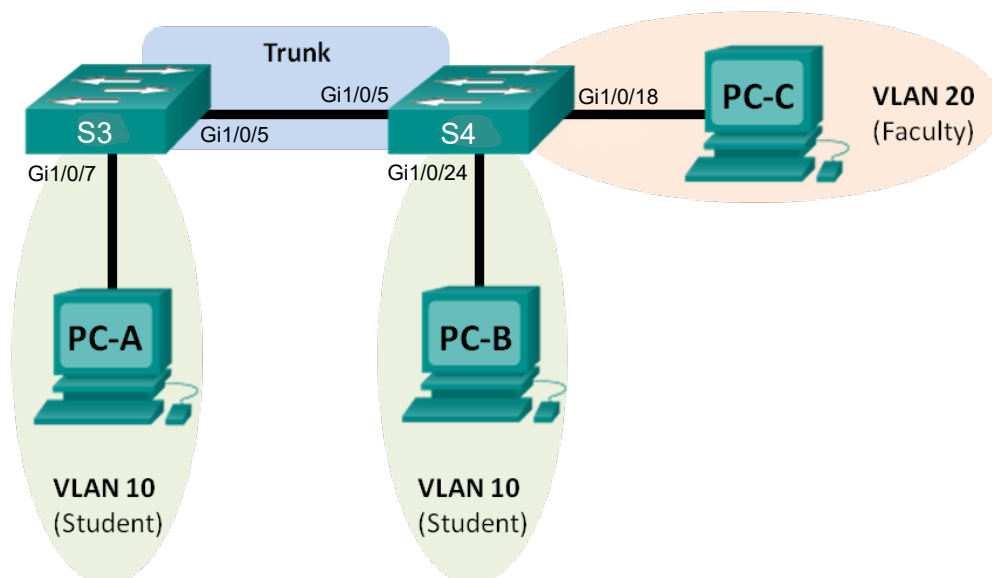


# Lab - Configuring VLANs and Trunking

## Topology Diagram



## Modifications to Network Drawing

If you are working via **remote access**, the PCs in the diagram are just for reference and will not be connected to your lab topology.

If you are working on-campus, you will use test PCs as specified in the **On-campus tests** sections.

## Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
S3	VLAN 99	192.168.1.11	255.255.255.0	N/A
S4	VLAN 99	192.168.1.12	255.255.255.0	N/A
PC-A	NIC	192.168.10.3	255.255.255.0	192.168.10.1
PC-B	NIC	192.168.10.4	255.255.255.0	192.168.10.1
PC-C	NIC	192.168.20.3	255.255.255.0	192.168.20.1

## Objectives

**Part 1: Build the Network and Configure Basic Device Settings**

**Part 2: Create VLANs and Assign Switch Ports**

**Part 3: Maintain VLAN Port Assignments and the VLAN Database**

**Part 4: Configure an 802.1Q Trunk between the Switches**

**Part 5: Delete the VLAN Database**

## Background / Scenario

Modern switches use virtual local-area networks (VLANs) to improve network performance by separating large Layer 2 broadcast domains into smaller ones. VLANs can also be used as a security measure by controlling which hosts can communicate. In general, VLANs make it easier to design a network to support the goals of an organization.

VLAN trunks are used to span VLANs across multiple devices. Trunks allow the traffic from multiple VLANs to travel over a single link, while keeping the VLAN identification and segmentation intact.

In this lab, you will create VLANs on both switches in the topology, assign VLANs to switch access ports, verify that VLANs are working as expected, and then create a VLAN trunk between the two switches to allow hosts in the same VLAN to communicate through the trunk, regardless of which switch the host is actually attached to.

**Note:** The switches used are Cisco Catalyst 3650s with Cisco IOS Release 16.6.2 (universalk9 image). Other switches and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and output produced might vary from what is shown in the labs.

**Note:** Ensure that the switches have been erased and have no startup configurations and default vlan database. If you are unsure contact your instructor.

## Required Resources

- 2 Switches (Cisco 3650 with Cisco IOS Release 16.6.2 universalk9 image or comparable)
- 2 test PCs (when working on-campus)

## Part 1: Build the Network and Configure Basic Device Settings

In Part 1, you will set up the network topology and configure basic settings on the switches.

### Step 1: Interconnect the switches as shown in the topology.

Turn on the switches and verify the switch interconnection shown in the topology diagram (i.e. port Gi1/0/5 on both switches) is active.

Shutdown port Gi1/0/6 on both switches as we will be needing just one switch interconnection for this lab.

### Step 2: Initialize and reload the switches as necessary.

Check that your switches are running with default settings and no existing VLAN configuration. If not, erase the startup-config, delete the vlan.dat and reload your switches.

### Step 3: Configure basic settings for each switch.

- Disable DNS lookup.
- Configure device name as shown in the topology.
- Enable **ssh** login with the username **lab** and the password **ccna** to all 16 vty lines
- Configure **logging synchronous** for the console line.
- Configure a MOTD banner to warn users that unauthorized access is prohibited.
- Administratively deactivate all unused ports on the switch.

#### Step 4: Connectivity scenarios

If you connected PC-A, PC-B and PC-C as show in the Topology Diagram and configured them with the IP settings specified in the Addressing Table.

**Note:** ping between the switches can be tested. For all other questions, use your networking knowledge to provide an answer.

Would PC-A ping PC-B?	<u>Yes</u>
Would PC-A ping PC-C?	<u>No</u>
Would PC-A ping S3?	<u>No</u>
Would PC-B ping PC-C?	<u>No</u>
Would PC-B ping S4?	<u>No</u>
Would PC-C ping S4?	<u>No</u>
Can S3 ping S4?	<u>No</u>

If you answered no to any of the above questions, why would the pings be unsuccessful?

The devices (PC & Switches) are not in the same subnet, hence, they cannot ping one another. As for switches not being able to ping one another, trunking might not have been configured.

#### Step 5: On-campus tests.

- Connect the **VAN PC** to Gi1/0/24 on S4. Configure it with PC-B IP settings as per the Addressing Table.
- Request instructor assistance to connect the **Ethernet PC** to port Gi1/0/7 on S3. Configure it with PC-A IP settings as per the Addressing Table.

Can PC-A ping PCB?	<u>Yes</u>
Can PC-A ping S3?	<u>No</u>
Can PC-B ping S4?	<u>No</u>

Are the results consistent with your answers to the questions in Step 4?

Yes

## Part 2: Create VLANs and Assign Switch Ports

In Part 2, you will create student, faculty, and management VLANs on both switches. You will then assign the VLANs to the appropriate interface. The **show vlan** command is used to verify your configuration settings.

#### Step 1: Create VLANs on the switches.

- Create the VLANs on S3.

```
S3(config)# vlan 10
S3(config-vlan)# name Student
S3(config-vlan)# vlan 20
S3(config-vlan)# name Faculty
S3(config-vlan)# vlan 99
S3(config-vlan)# name Management
S3(config-vlan)# end
```
- Create the same VLANs on S4.

- c. Issue the **show vlan** command to view the list of VLANs on S3.

S3# **show vlan**

VLAN	Name	Status	Ports
1	default	active	Gi1/0/1, Gi1/0/2, Gi1/0/3, Gi1/0/4 Gi1/0/5, Gi1/0/6, Gi1/0/7, Gi1/0/8 Gi1/0/9, Gi1/0/10, Gi1/0/11, Gi1/0/12 Gi1/0/13, Gi1/0/14, Gi1/0/15, Gi1/0/16 Gi1/0/17, Gi1/0/18, Gi1/0/19, Gi1/0/20 Gi1/0/21, Gi1/0/22, Gi1/0/23, Gi1/0/24 Gi1/1/1, Gi1/1/2, Gi1/1/3, Gi1/1/4

10	Student	active
20	Faculty	active
99	Management	active

1002	fddi-default	act/unsup
1003	token-ring-default	act/unsup
1004	fddinet-default	act/unsup
1005	trnet-default	act/unsup

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0
20	enet	100020	1500	-	-	-	-	-	0	0
99	enet	100099	1500	-	-	-	-	-	0	0

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
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

Remote SPAN VLANs

Primary	Secondary	Type	Ports
---------	-----------	------	-------

What is the default VLAN? Default Vlan is 1

What ports are assigned to the default VLAN?

All port

**Step 2: Assign VLANs to the correct switch interfaces.**

- a. Assign VLANs to the interfaces on S3.

- 1) Assign PC-A to the Student VLAN.

```
S3(config)# interface g1/0/7
S3(config-if)# switchport mode access
S3(config-if)# switchport access vlan 10
```

- 2) Enable port security on interface **g1/0/7**

- 3) Configure the management virtual interface

```
S3(config)# interface vlan 99
S3(config-if)# ip address 192.168.1.11 255.255.255.0
S3(config-if)# end
```

- b. Issue the **show vlan brief** command and verify that the VLANs are assigned to the correct interfaces.

```
S3# show vlan brief
```

VLAN	Name	Status	Ports
1	default	active	Gi1/0/1, Gi1/0/2, Gi1/0/3, Gi1/0/4 Gi1/0/5, Gi1/0/6, Gi1/0/8, Gi1/0/9 Gi1/0/10, Gi1/0/11, Gi1/0/12, Gi1/0/13 Gi1/0/14, Gi1/0/15, Gi1/0/16, Gi1/0/17 Gi1/0/18, Gi1/0/19, Gi1/0/20, Gi1/0/21 Gi1/0/22, Gi1/0/23, Gi1/0/24, Gi1/1/1 Gi1/1/2, Gi1/1/3, Gi1/1/4
10	Student	active	Gi1/0/7
20	Faculty	active	
99	Management	active	
1002	fddi-default	act/unsup	
1003	token-ring-default	act/unsup	
1004	fddinet-default	act/unsup	
1005	trnet-default	act/unsup	

- c. Issue the **show ip interface brief** command.

What is the status of VLAN 99? Why?

Status: Up, as we just created it and did not use shutdown command.

- d. Use the Topology to assign VLANs to the appropriate ports on S4.

- e. Use the **show vlan brief** command to verify that the VLANs are assigned to the correct interfaces.

```
S4# show vlan brief
```

VLAN	Name	Status	Ports
1	default	active	Gi1/0/1, Gi1/0/2, Gi1/0/3, Gi1/0/4 Gi1/0/5, Gi1/0/6, Gi1/0/7, Gi1/0/8 Gi1/0/9, Gi1/0/10, Gi1/0/11, Gi1/0/12 Gi1/0/13, Gi1/0/14, Gi1/0/15, Gi1/0/16 Gi1/0/17, Gi1/0/19, Gi1/0/20, Gi1/0/21

Gi1/0/22, Gi1/0/23, Gi1/1/1, Gi1/1/2

Gi1/1/3, Gi1/1/4

10	Student	active	Gi1/0/24
20	Faculty	active	Gi1/0/18
99	Management	active	
1002	fddi-default	act/unsup	
1003	token-ring-default	act/unsup	
1004	fddinet-default	act/unsup	
1005	trnet-default	act/unsup	

Would PC-A be able to ping PC-B? Why?

Yes, they are on the same subnet and are in the same VLAN

Is S3 able to ping S4? Why?

No, as trunking has not been enable.

### Step 3: On-campus tests.

- Can PC-A ping PC-B? Yes
- Can S3 ping S4? No
- Are the ping results consistent with your answers to the questions in Step 2? Yes

## Part 3: Maintain VLAN Port Assignments and the VLAN Database

In Part 3, you will change VLAN assignments to ports and remove VLANs from the VLAN database.

### Step 1: Assign a VLAN to multiple interfaces.

- On S3, assign interfaces Gi1/0/11 – 24 to VLAN 10.  

```
S3(config)# interface range g1/0/11-24
S3(config-if-range)# switchport mode access
S3(config-if-range)# switchport access vlan 10
S3(config-if-range)# end
```
- Enable switch port security on all these interfaces
- Issue the **show vlan brief** command to verify VLAN assignments.
- Reassign Gi1/0/11 and Gi1/0/21 to VLAN 20.
- Verify that VLAN assignments are correct.

### Step 2: Remove a VLAN assignment from an interface.

- Use the **no switchport access vlan** command to remove the VLAN 10 assignment to G1/0/24.  

```
S3(config)# interface g1/0/24
S3(config-if)# no switchport access vlan
S3(config-if)# end
```
- Verify that the VLAN change was made.  

Which VLAN is Gi1/0/24 is now associated with? Vlan 1

**Step 3: Remove a VLAN ID from the VLAN database.**

- a. Add VLAN 30 to interface Gi1/0/24 without issuing the VLAN command.

```
S3(config)# interface g1/0/24
S3(config-if)# switchport access vlan 30
% Access VLAN does not exist. Creating vlan 30
```

**Note:** Current switch technology no longer requires that the **vlan** command be issued to add a VLAN to the database. By assigning an unknown VLAN to a port, the VLAN adds to the VLAN database.

- b. Verify that the new VLAN is displayed in the VLAN table.

```
S3# show vlan brief
```

VLAN	Name	Status	Ports
1	default	active	Gi1/0/1, Gi1/0/2, Gi1/0/3, Gi1/0/4 Gi1/0/5, Gi1/0/6, Gi1/0/8, Gi1/0/9 Gi1/0/10, Gi1/1/1, Gi1/1/2, Gi1/1/3 Gi1/1/4
10	Student	active	Gi1/0/7, Gi1/0/12, Gi1/0/13, Gi1/0/14 Gi1/0/15, Gi1/0/16, Gi1/0/17, Gi1/0/18 Gi1/0/19, Gi1/0/20, Gi1/0/21, Gi1/0/22 Gi1/0/23, Gi1/1/1, Gi1/1/2, Gi1/1/3 Gi1/1/4
20	Faculty	active	Gi1/0/11, Gi1/0/21
30	VLAN0030	active	Gi1/0/24
99	Management	active	
1002	fddi-default	act/unsup	
1003	token-ring-default	act/unsup	
1004	fddinet-default	act/unsup	
1005	trnet-default	act/unsup	

What is the default name of VLAN 30? VLAN0030

- c. Use the **no vlan 30** command to remove VLAN 30 from the VLAN database.

```
S3(config)# no vlan 30
S3(config)# end
```

- d. Issue the **show vlan brief** command. Gi1/0/24 was assigned to VLAN 30.

After deleting VLAN 30, what VLAN is port Gi1/0/24 assigned to? What happens to the traffic destined to the host attached to Gi1/0/24?

The port will revert to the native VLAN. As per the traffic, those came from the same vlan will be forwarded as usual, where as those not in the same vlan, it would depends on the routing configuration.

```
S3# show vlan brief
```

VLAN	Name	Status	Ports
1	default	active	Gi1/0/1, Gi1/0/2, Gi1/0/3, Gi1/0/4 Gi1/0/5, Gi1/0/6, Gi1/0/8, Gi1/0/9 Gi1/0/10, Gi1/1/1, Gi1/1/2, Gi1/1/3 Gi1/1/4
10	Student	active	Gi1/0/7, Gi1/0/12, Gi1/0/13, Gi1/0/14

```

                                Gi1/0/15, Gi1/0/16, Gi1/0/17, Gi1/0/18
                                Gi1/0/19, Gi1/0/20, Gi1/0/21, Gi1/0/22
                                Gi1/0/23, Gi1/1/1, Gi1/1/2, Gi1/1/3
                                Gi1/1/4
20  Faculty                    active  Gi1/0/11, Gi1/0/21
99  Management                 active
1002 fddi-default              act/unsup
1003 token-ring-default        act/unsup
1004 fddinet-default           act/unsup
1005 trnet-default             act/unsup

```

- e. Issue the **no switchport access vlan** command on interface Gi1/0/24.
- f. Issue the **show vlan brief** command to determine the VLAN assignment for Gi1/0/24. To which VLAN is Gi1/0/24 assigned?

Vlan 1

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**Note:** Before removing a VLAN from the database, it is recommended that you reassign all the ports assigned to that VLAN.

Why should you reassign a port to another VLAN before removing the VLAN from the VLAN database?

- Prevents disruption, Avoids broadcast storms, Ensures stability, Prevents errors, Simplifies

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## Part 4: Configure an 802.1Q Trunk Between the Switches

In Part 4, you will configure interface Gi1/0/5 to use the Dynamic Trunking Protocol (DTP) to allow it to negotiate the trunk mode. After this has been accomplished and verified, you will disable DTP on interface Gi1/0/5 and manually configure it as a trunk.

### Step 1: Use DTP to initiate trunking on Gi1/0/5.

The default DTP mode of a 2960 switch port is dynamic auto. This allows the interface to convert the link to a trunk if the neighboring interface is set to trunk or dynamic desirable mode.

- a. Set Gi1/0/5 on S3 to negotiate trunk mode.

```

S3(config)# interface g1/0/5
S3(config-if)# switchport mode dynamic desirable
*Mar  1 05:07:28.746: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed
state to down
*Mar  1 05:07:29.744: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1,
changed state to down
S3(config-if)#
*Mar  1 05:07:32.772: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1,
changed state to up
S3(config-if)#
*Mar  1 05:08:01.789: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan99, changed
state to up
*Mar  1 05:08:01.797: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed
state to up

```



You should also receive link status messages on S4.

S4#

```
*Mar 1 05:07:29.794: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1,
changed state to down
```

S4#

```
*Mar 1 05:07:32.823: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1,
changed state to up
```

S4#

```
*Mar 1 05:08:01.839: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan99, changed
state to up
```

```
*Mar 1 05:08:01.850: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed
state to up
```

- b. Issue the **show vlan brief** command on S3 and S4. Interface Gi1/0/5 is no longer assigned to VLAN 1. Trunked interfaces are not listed in the VLAN table.

S3# **show vlan brief**

VLAN	Name	Status	Ports
1	default	active	Gi1/0/1, Gi1/0/2, Gi1/0/3, Gi1/0/4, Gi1/0/6, Gi1/0/8, Gi1/0/9, Gi1/0/10, Gi1/0/24, Gi0/1, Gi0/2
10	Student	active	Gi1/0/7, Gi1/0/12, Gi1/0/13, Gi1/0/14, Gi1/0/15, Gi1/0/16, Gi1/0/17, Gi1/0/18, Gi1/0/19, Gi1/0/20, Gi1/0/22, Gi1/0/23
20	Faculty	active	Gi1/0/11, Gi1/0/21
99	Management	active	
1002	fddi-default	act/unsup	
1003	token-ring-default	act/unsup	
1004	fddinet-default	act/unsup	
1005	trnet-default	act/unsup	

- c. Issue the **show interfaces trunk** command to view trunked interfaces. Notice that the mode on S3 is set to desirable, and the mode on S4 is set to auto.

S3# **show interfaces trunk**

Port	Mode	Encapsulation	Status	Native vlan
Gi1/0/5	desirable	802.1q	trunking	1

Port	Vlans allowed on trunk
Gi1/0/5	1-4094

Port	Vlans allowed and active in management domain
Gi1/0/5	1,10,20,99

Port	Vlans in spanning tree forwarding state and not pruned
Gi1/0/5	1,10,20,99

S4# **show interfaces trunk**

Port	Mode	Encapsulation	Status	Native vlan
Gi1/0/5	auto	802.1q	trunking	1

Port	Vlans allowed on trunk
Gi1/0/5	1-4094

Port	Vlans allowed and active in management domain
Gi1/0/5	1,10,20,99

Port	Vlans in spanning tree forwarding state and not pruned
Gi1/0/5	1,10,20,99

**Note:** By default, all VLANs are allowed on a trunk. The **switchport trunk** command allows you to control what VLANs have access to the trunk. For this lab, keep the default settings which allows all VLANs to traverse Gi1/0/5.

- d. Verify that VLAN traffic is traveling over trunk interface Gi1/0/5.

Can S3 ping S4? Yes

Would PC-A ping PC-B? No

Would PC-A ping PC-C? No

Would PC-B ping PC-C? No

Would PC-A ping S3? No

Would PC-B ping S4? No

Would PC-C ping S4? No

If you answered no to any of the above questions, explain below.

The devices (PC & Switches) are not in the same subnet, hence, they cannot ping one another. For PC-A and PC-B situation, since the previous part we have removed the VLAN configuration (interface no longer in VLAN 10) for PC-B.

## Step 2: On-campus tests.

Can S3 ping S4? Yes

Can PC-A ping PC-B? Yes

Can PC-A ping S3? No

Can PC-B ping S4? No

(Optional) Move and reconfigure the VAN PC as PC-C. Can PC-C ping any other device? No

Are the results consistent with your answers to the questions in Step 2?

Yes

## Step 3: Manually configure trunk interface Gi1/0/5.

The **switchport mode trunk** command is used to manually configure a port as a trunk. This command should be issued on both ends of the link.

- a. Change the switchport mode on interface Gi1/0/5 to force trunking. Make sure to do this on both switches.

```
S3(config)# interface g1/0/5
S3(config-if)# switchport mode trunk
```

- b. Issue the **show interfaces trunk** command to view the trunk mode. Notice that the mode changed from **desirable** to **on**.

```
S4# show interfaces trunk
```

Port	Mode	Encapsulation	Status	Native vlan
Gi1/0/5	on	802.1q	trunking	1

Port	Vlans allowed on trunk
Gi1/0/5	1-4094

Port	Vlans allowed and active in management domain
Gi1/0/5	1,10,20,99

Port	Vlans in spanning tree forwarding state and not pruned
Gi1/0/5	1,10,20,99

Why might you want to manually configure an interface to trunk mode instead of using DTP?

Increased control and security, ensures full control over trunking behavior, while also avoids unauthorized trunking negotiations. Enhance stability and performance via Improves network stability by avoiding DTP-related issues. Increase predictability and compatibility as it provides consistent trunking behavior for troubleshooting, while also ensuring trunking consistency across devices.

## Part 5: Delete the VLAN Database

In Part 5, you will delete the VLAN Database from the switch. It is necessary to do this when initializing a switch back to its default settings.

### Step 1: Determine if the VLAN database exists.

Issue the **show flash:** command to determine if a **vlan.dat** file exists in flash.

```
S3# show flash:
```

```
Directory of flash:/
```

2	-rwx	1285	Mar 1 1993 00:01:24 +00:00	config.text
3	-rwx	43032	Mar 1 1993 00:01:24 +00:00	multiple-fs
4	-rwx	5	Mar 1 1993 00:01:24 +00:00	private-config.text
5	-rwx	11607161	Mar 1 1993 02:37:06 +00:00	c2960-lanbasek9-mz.150-2.SE.bin
6	-rwx	736	Mar 1 1993 00:19:41 +00:00	vlan.dat

```
32514048 bytes total (20858880 bytes free)
```

**Note:** If there is a **vlan.dat** file located in flash, then the VLAN database does not contain its default settings.

**Note:** the contents of the flash will not be the same as shown in the output, as the output was taken on a different switch.

### Step 2: Delete the VLAN database.

- a. Issue the **delete vlan.dat** command to delete the **vlan.dat** file from flash and reset the VLAN database back to its default settings. You will be prompted twice to confirm that you want to delete the **vlan.dat** file. Press Enter both times.

```
S3# delete vlan.dat
Delete filename [vlan.dat]?
Delete flash:/vlan.dat? [confirm]
S3#
```

- b. Issue the **show flash** command to verify that the vlan.dat file has been deleted.

```
S3# show flash
```

```
Directory of flash:/
```

```
 2  -rwx          1285   Mar 1 1993 00:01:24 +00:00  config.text
 3  -rwx         43032   Mar 1 1993 00:01:24 +00:00  multiple-fs
 4  -rwx           5    Mar 1 1993 00:01:24 +00:00  private-config.text
 5  -rwx       11607161   Mar 1 1993 02:37:06 +00:00  c2960-lanbasek9-mz.150-2.SE.bin
```

```
32514048 bytes total (20859904 bytes free)
```

To initialize a switch back to its default settings, what other commands are needed?

erase startup-config and reload. Or alternatively just reload without saving configuration.

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## Reflection

1. What is needed to allow hosts on VLAN 10 to communicate to hosts on VLAN 20?

We can achieve communication between 2 VLAN by means of: router/layer 3 switches, and routing (inter-vlan routing or routing protocol)

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2. What are some primary benefits that an organization can receive through effective use of VLANs?

VLANs segregate, isolate traffic, limiting access to resources, etc. Therefore it improve security and network performance. Moreover, it can help simplify network management by dividing bigger VLAN into smaller ones. And because it does not require extra physical devices, it can help reduce infrastructure cost, which also enhance scalability.

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