

# Switch Emulator

## Introduction

This document is a tutorial related to the Switch Emulator which is available at:

[http://www.dcs.napier.ac.uk/~bill/cnds\\_switch.htm](http://www.dcs.napier.ac.uk/~bill/cnds_switch.htm)  
or [http://buchananweb.co.uk/cnds\\_switch.htm](http://buchananweb.co.uk/cnds_switch.htm)

A demo can be run using the **demo** command.

The requirements for it are:

- Macromedia Flash 6.

The following sections relate to the programming a Cisco switch. For this purpose a special emulator has been developed. This is shown in Figure 1.

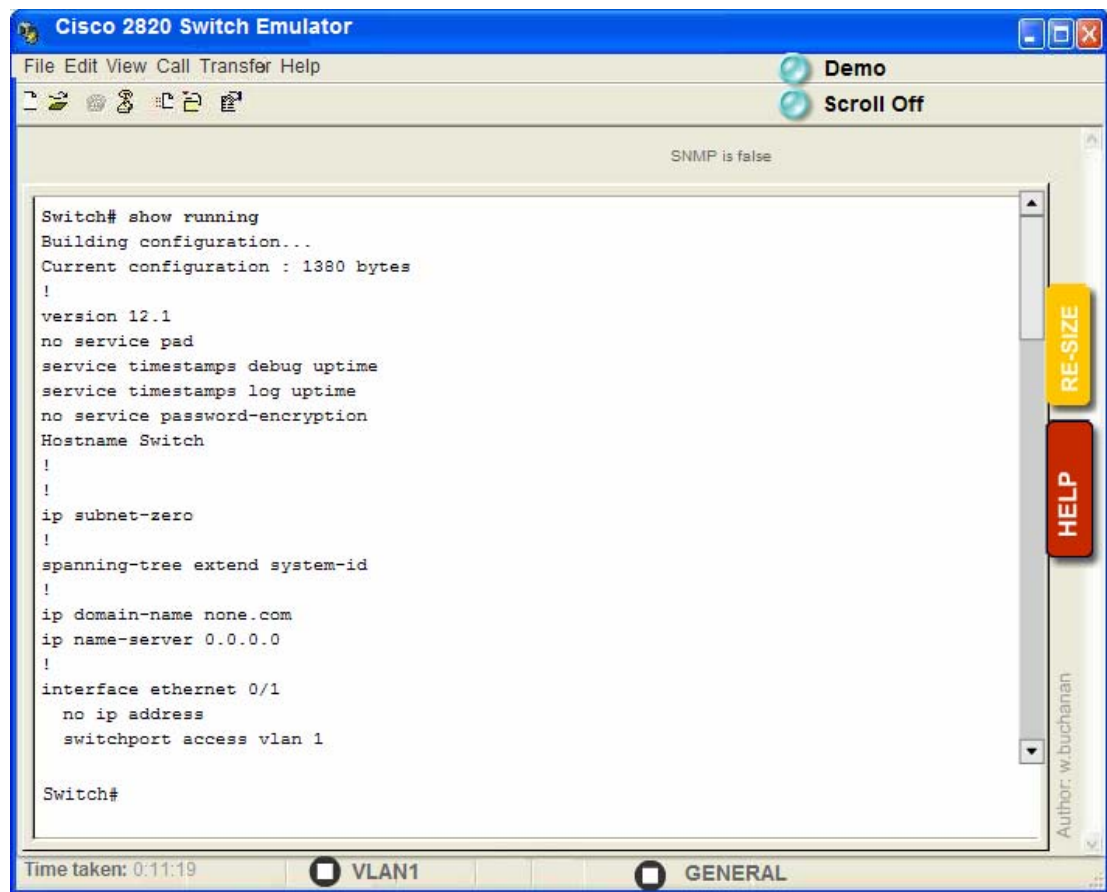


Figure 1: Cisco 1900/2800 switch emulator

## Showing version of switch

Initially you will be in the user executive (Exec) mode, and the functions that you can perform are limited.

- 1 Use the `?` command to view the commands in this mode.
  - What commands are available in Exec mode?
- 2 Use the `show version` command to show the current operating system details.
  - How many Ethernet ports does the switch have?
  - What is the MAC address of the switch?

## Setting host and IP information

Next go into the privileged executive mode:

- 1 Go into the privileged mode by typing `enable`.
  - How does the prompt change?
- 2 Use the `?` command to view the commands in this mode.
  - What commands are available in Privileged Exec mode?
- 3 Configure the device using by typing `config t`.
  - How does the prompt change?
- 4 Set the hostname by typing `hostname myhost`.
- 5 Go back to the user executive mode with the command `exit`.
- 6 Show the IP parameters of the switch with the command `show ip interface`.
  - What are the parameters displayed?
- 7 Go back to configuration mode with `config t`.
- 8 Configure the VLAN with the `interface vlan 1` command.
- 9 Set the IP address and subnet mask with the command `ip address 192.168.0.1 255.255.255.0`.
- 10 Go back to privileged mode with `exit`.
- 11 Show the IP parameters again with `show ip interface`.
  - What are the parameters displayed?
- 12 From the config mode, set the gateway address to 192.168.0.2, the domain-name is mycomp.com, the name-server to 192.168.0.10, using:

```
(config)# ip default-gateway 192.168.0.2
(config)# ip domain-name mycomp.com
(config)# ip name-server 192.168.0.10
```

- 14 Show the main system configuration with `show running-config`.
  - What are the parameters displayed?

## Setting telnet interface

It is possible to remotely log into the switch over the network using TELNET. To do this the following is achieved:

- 1 Go to the Executive Privileged mode (that is, with the `#` prompt).
- 2 Go to the configuration mode (that is, with the `(config) #` prompt).
- 3 Use the `line vty 0 15` to create up to 16 possible TELNET sessions.
- 4 Use the `password fred` to define the password as fred
- 5 Exit from the config mode with `end`.

- 6 Show the current running configuration with `show running-config`.
  - Has the configuration been updated?

## Saving the configuration

The changes that are made are made only to the running configuration (running-configuration). Once the user has verified that the new changes are okay, they should copy the running configuration into the startup configuration (startup-configuration). Once this is done, the switch will startup with the updated changes. To do this the copy running-config startup-config command is used.

- 1 Go to the configuration model (that is, with the (config) # prompt).
- 2 Use the `copy running-config startup-config` command.

Other methods include:

`copy running-config tftp` which copies the running config to the TFTP server.  
`copy tftp running-config` which copies from the TFTP server to the current running config.

## Showing the commands

The switch stores all the previous commands, which can be recalled with the show history command.

- 1 Use the `show history` to display the previous commands.

## Scrolling through commands

The UP and DOWN arrow keys can be used to scroll through the previous command, of which the user can select any of them, as required.

- 1 Use the UP and DOWN arrows to scroll through the command.

## Setting up a VLAN

One of the great advantages of switches is that it is possible to create a VLAN, which allows the actual topology of the network to be defined by software rather than actual physical connections. In the following the VLAN is given a name, and then ports are assigned to it.

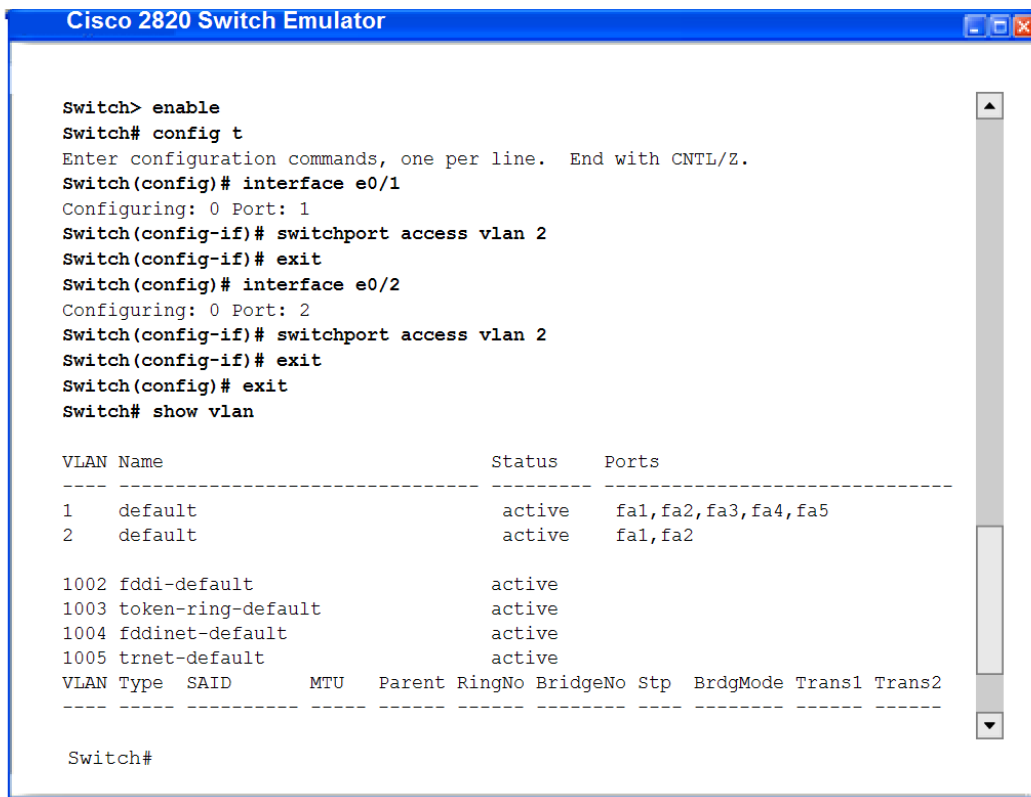
- 1 Go to the privileged executive mode (that is, with the # prompt).
- 2 Use the `show vlan` command to view the currently assigned VLANs.
  - What are the names of the currently assigned VLANs?
- 3 Use the `vlan database` command to go into the vlan configuration mode.
  - How does the prompt change?
- 4 Use the ? command to view the commands in this mode.
- 5 Use the `show` command to view the currently assigned VLANs.
  - What VLANs are currently present?
- 6 Use the `vlan 2 name fred` to change the name of VLAN number 2 to fred.
  - What message is displayed?
- 7 Use the show command to view the currently assigned VLANs.
  - Has the VLAN been added?

- 8 Exit from vlan and configuration modes, and run `show vlan` again.
  - How have the names of the VLANs changed?

## Programming interfaces and assigning to VLANs

- 1 Configure the interface by typing interface.
  - How does the prompt change?
- 2 Determine the commands that can be used in the interface menu with ?. List a few of these command.
  - What commands are available in Interface Configuration mode?
- 3 Program the first Ethernet port on the switch (which is 0/1, where the first digit identifies the Ethernet port and the second digit identifies the port number). Do this by entering the `Ethernet 0/1` command.
- 4 Define the this port is assigned to VLAN 2 with the `switchport access vlan 2` command.
- 5 Program the second Ethernet port on the switch (which is 0/2). Do this by entering the `Ethernet 0/2` command.
- 6 Define the this port is assigned to VLAN 2 with the `switchport access vlan 2` command.
- 7 Go back to the Privileged Exec mode, and use the `show vlan` command to show the assigned VLANs against ports.

This is shown next:



```

Cisco 2820 Switch Emulator

Switch> enable
Switch# config t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# interface e0/1
Configuring: 0 Port: 1
Switch(config-if)# switchport access vlan 2
Switch(config-if)# exit
Switch(config)# interface e0/2
Configuring: 0 Port: 2
Switch(config-if)# switchport access vlan 2
Switch(config-if)# exit
Switch(config)# exit
Switch# show vlan

VLAN Name                Status    Ports
-----
1    default                 active    fa1, fa2, fa3, fa4, fa5
2    default                 active    fa1, fa2

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
-----
Switch#
  
```

Time taken: 0:3:40      Privileged EXEC mode

## Resetting the switch

The two commands to reset the switch are `delete nvram` and `delete vtp`, which can be entered from the config mode.

- 1 Go to the user exec mode (that is, with the # prompt).
- 2 Use the `erase nvram` command.
- 2 Use the `erase vtp` command.

## Reducing commands

Many commands can be truncated to a shorter form, such as: sh (show), conf (configuration), e (ethernet), fa (fastethernet), and so on.

## Setting other parameters on the port

Apart from defining shutdown, no shutdown and description on the ports, it is possible to set the speed with the speed command (10 - 10 Mbps, 100 - 100 Mbps or auto - autospeed), and with duplex whether the port supports full-duplex (full), half-duplex (half) or auto.

- 1 Go to the privileged interface mode (that is, with the (config) # prompt). Next configure the third Ethernet port with the command `int e0/1` (which is the short form of interface ethernet 0/1)
- 2 Use the `speed 10` command to set the speed to 10Mbps.
- 3 Use the `duplex half` command for half-duplex.
- 4 Go back to the Privileged mode (#) and run `show running-config`, and check that the parameters have been set.

## Enabling spanning-tree

Spanning-tree is used to allow the switch to discover the layout of interconnected networks.

- 1 Go to the privileged interface mode (that is, with the (config) # prompt).
- 2 Use the `spanning-tree vlan 1` command to enable it.
- 3 Use the `show spanning` to show the spanning-tree topology.

## Setting line-console password

The console password is set by using the line con 0 command from the Privileged Exec mode, and then using the password command.

- 1 Go to the privileged interface mode (that is, with the (config) # prompt). Next configure the third Ethernet port with the `line con 0` (which is the short form of line console 0)
- 2 Use the `password fred` command to set the password to fred.
- 3 Go back to the Privileged mode (#) and run `show running-config`, and check that the parameters have been set.

## Restarting the switch

Often the administrator must restart the switch (possibly to be able to reapply settings). To do this the reload command is used:

- 1 Go to Privileged Exec mode.
- 2 Use the `reload` command to reboot the switch.
  - What are the messages shown?

## Enabling SNMP

SNMP is an excellent protocol which allows remote devices to interrogate network parameters on the local device. As SNMP could cause a security breach if it is not setup correctly, it is off by default. To turn it on:

- 1 Go to Config mode.
- 2 Use the `snmp enable traps` command to initialise snmp.
- 3 Use the `show running-config` to view the snmp setup.
- 4 Use the `show snmp` to view the results from the SNMP agent.

## Showing help

Many commands contain a help version. For this type in the command and a '?'. For example:

- 1 `show ?`
- 2 `show ip ?`

## Showing contents of Flash memory

The Flash memory contains the OS, HTML pages, and so on. It can be viewed using the following command:

- 1 `show flash`
  - ✦ What files and directories are shown?

## Changing and listing directories

The file structure can be listed using the `DIR` command and the directory can be changed with `CD` (as with DOS).

- 1 Go into the `html` folder using the `cd html` command, and then uses the `dir` command to list its contents.
  - ✦ What files are shown?
- 2 Go back to the top level folder using the `cd ..` command, and then uses the `dir` command to list its contents.

Other commands:

<code>show interface e0/1</code>	Show the interface parameters for port 1.
<code>show users</code>	Show connected users.
<code>show snmp</code>	Show SNMP statistics.
<code>show hosts</code>	Show host parameters (domain name, name server, etc).
<code>show alias</code>	Show host parameters (domain name, name server, etc).
<code>show boot</code>	Show boot parameters.
<code>show post</code>	Show the results of the post test.
<code>show dot1x</code>	Show details of IEEE 802.1x.

## Showing details

Initially you will be in the user executive (Exec) mode, and the functions that you can perform are limited.

- 1 From Exec prompt (>):
- 2 Use show ? to show the show commands
- 3 Use show env ? to show the show env commands
- 4 Use show env all to show the show all env details
- 5 Use show errdisable ? command to view the commands.
- 6 Use show etherchannel ? command to view the commands in this mode.
- 7 Use show exception command to view exceptions.
- 8 Use show mac-address-table command to view the mac-address table.
- 9 Use show mls ? command to view the commands in this mode.
- 10 Use show monitor command to view the monitor.
- 11 Use show pagp command to view the pagp.
- 12 Use show pm command to view the pm.
- 13 Use show queue ? command to view the queue.
- 14 Use show queueing command to view the commands in this mode.
- 15 Use show rmon ? command to view the commands in this mode.
- 16 Use show rtr ? command to view the commands in this mode.
- 17 Use show storm-control command to view the storm-control.
- 18 Use show template command to view the template.
- 19 Use show uddl command to view uddl.
- 20 Use show version command to view the version.

## SHOWING DETAILS in EXEC mode

Go into Priv. Exec mode.

- 1 From Priv. Exec prompt (#):
- 2 Use show access-lists
- 3 Use show accounting
- 4 Use show aliases t
- 5 Use show arp
- 6 Use show boot
- 7 Use show buffers
- 8 Use show clock
- 9 Use show clusters
- 10 Use show cns ?
- 11 Use show configuration
- 12 Use show controllers
- 13 Use show debugging
- 14 Use show dhcp ?
- 15 Use show dhcp server
- 16 Use show dot1x
- 17 Use show dtp
- 18 Use show errdisable ?
- 19 Use show file ?
- 20 Use show file description
- 21 Use show file information ?
- 22 Use show file systems .
- 23 Use show interfaces ?

- 24 Use show interfaces counters
- 25 Use show interfaces status
- 26 Use show interfaces switchport
- 27 Use show interfaces etherchannel
- 28 Use show interfaces irb
- 29 Use show ip sockets
- 30 Use show ip traffic
- 31 Use show ip aliases
- 32 Use show ip igmp snooping
- 33 Use show ip redirects
- 34 Use show ip arp
- 35 Use show ip accounting
- 36 Use show ip access-lists
- 37 Use show line
- 38 Use show line console 0
- 39 Use show line vty 1
- 40 Use show line summary
- 41 Use show logging
- 42 Use show memory
- 43 Use show process ?
- 44 Use show process
- 45 Use show process cpu
- 46 Use show process memory
- 47 Use show privilege
- 48 Use show snmp ?
- 49 Use show subsystem
- 50 Use show port-security
- 51 Use show system ?
- 52 Use show system mtu

## Outline of commands using in this tutorial

The outline of the commands is:

```
Switch> show version
Switch> enable
Switch# config t
myhost(config)# hostname myhost
myhost(config)# exit
myhost# show ip interface
myhost# config t
myhost(config)# interface vlan 1
myhost(config-if)# ip address 192.168.0.1 255.255.255.0
myhost(config-if)# no shutdown
myhost(config-if)# exit
myhost(config)# exit
myhost# show ip interface
myhost# config t
myhost(config)# ip default-gateway 192.168.0.2
myhost(config)# ip domain-name mycomp.com
myhost(config)# ip name-server 192.168.0.10
myhost(config)# exit
myhost# show running-conf
myhost# config t
myhost(config)# line con 0
myhost(config-line)# password fred
myhost(config-line)# exit
```

```
myhost(config)# line vty 0 15
myhost(config-line)# password fred
myhost(config-line)# exit
myhost(config)# exit
myhost# copy running-config startup-conf
myhost# show history
myhost# show vlan
myhost# vlan database
myhost(vlan)# vlan 2 name fred
myhost(vlan)# exit
myhost# show vlan
myhost# config t
myhost(config)# interface e0/1
myhost(config-if)# switchport access vlan 2
myhost(config-if)# exit
myhost(config)# interface e0/2
myhost(config-if)# switchport access vlan 2
myhost(config-if)# exit
myhost(config)# exit
myhost# show vlan
myhost# delete nvram
myhost# delete vtp
myhost# config t
myhost(config)# interface e0/1
myhost(config-if)# speed 10
myhost(config-if)# duplex half
myhost(config-if)# exit
myhost(config)# exit
myhost# show running-config
myhost# show snmp
myhost# show flash
myhost# cd html
myhost# dir
myhost# cd ..
myhost# dir
myhost# config t
myhost(config)# interface e0/1
myhost(config-if)# no cdp enable
myhost(config-if)# exit
myhost(config)# exit
myhost# show cdp
myhost# show cdp traffic
myhost# show cdp neighbors
myhost# config t
myhost(config)# cdp holdtime 20
myhost(config)# cdp timer 30
myhost(config)# exit
myhost# show running
myhost# config t
myhost(config)# ip http server
myhost(config)# exit
myhost# show running
```

## CCNP labs

*The following labs are based on the material taken from the CNAP CCNP 3 Multilayered Switching v 3.0 Lab Manual.*

**Title:** Lab 1.6.1 Catalyst 2950T and 3550 Series Basic Setup

**Aim:** Configure switch name, privileged password, console password and virtual terminal password.

**Ref:** CCNP 3: Multilayered Switching V 3.0 - Lab 1.6.1

- 1 First setup the switch name, privileged password, console password and virtual terminal password:

```
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname Switch1
Switch1(config)#enable password cisco
Switch1(config)#enable secret class
Switch1(config)#line con 0
Switch1(config-line)#password cisco
Switch1(config-line)#login
Switch1(config-line)#line vty 0 15
Switch1(config-line)#password cisco
Switch1(config-line)#login
Switch1(config-line)#exit
Switch1(config)#exit
Switch1#
```

- 2 Issue show running-config and check that the details have been entered correctly.
- 3 Next configure VLAN 1, of which every port on the switch belongs to, and a default gateway:

```
Switch1#configure terminal
Switch1(config)#interface vlan 1
Switch1(config-if)#ip address 10.1.1.251 255.255.255.0
Switch1(config-if)#no shutdown
Switch1(config-if)#exit
Switch1(config)#ip default-gateway 10.1.1.1
Switch1(config)#exit
```

- 4 To setup the WWW server on the switch:

```
Switch1#configure terminal
Switch1(config)#ip http server
```

**Title:** Lab 1.6.2 Catalyst 2950T and 3550 Configuration and IOS Files

**Aim:** Upload/download configurations rules and an outline of IOS files

**Ref:** CCNP 3: Multilayered Switching V 3.0 - Lab 1.6.2

1 First use the show file systems to view the filters that are available on the switch:

```
Switch#show file systems
```

2 Next a copy of the startup-config can be copied to a remote location:

```
Switch#copy ?
bs:          Copy from bs: file system
flash:      Copy from flash: file system
ftp:        Copy from ftp: file system
null:       Copy from null: file system
nvram:      Copy from nvram: file system
rcp:        Copy from rcp: file system
running-config Copy from current system configuration
startup-config Copy from startup configuration
system:     Copy from system: file system
tftp:       Copy from tftp: file system
vb:         Copy from vb: file system
xmodem:     Copy from xmodem: file system
ymodem:     Copy from ymodem: file system
zflash:     Copy from zflash: file system
Switch#copy startup-config ?
```

3 To copy from the startup-config onto the TFTP server:

```
Switch#copy startup-config tftp
```

4 To view the version and filename of the IOS:

```
Switch#view version
Cisco Internetwork Operating System Software
IOS (tm) C2950 Software (C2950-I6Q4L2-M), Version 12.1(9)EA1, RELEASE
SOFTWARE (fc1)
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Wed 24-Apr-02 06:57 by antonino
Image text-base: 0x80010000, data-base: 0x804E8000

ROM: Bootstrap program is CALHOUN boot loader

Switch uptime is 2 hours, 0 minutes
System returned to ROM by power-on
System image file is flash:c2950-i6q4l2-mz.121-9.EA1.bin

cisco WS-C2950-24 (RC32300) processor (revision E0) with 20815K bytes of
memory.
Processor board ID FOC0625W26W
Last reset from system-reset
Running Standard Image
24 FastEthernet/IEEE 802.3 interface(s)

32K bytes of flash-simulated non-volatile configuration memory.
Base ethernet MAC Address: 00:0A:41:10:FA:80
Motherboard assembly number: 73-5781-10
```

5 To list a directory:

```
Switch#dir
Directory of flash:/

   2  -rwx      2490607   Mar 01 1993 00:03:57  c2950-i6q412-mz.121-9.EA1.bin
   3  -rwx         269   Jan 01 1970 00:01:18  env_vars
   4  -rwx         108   Mar 01 1993 00:02:37  info
   7  drwx         640   Mar 01 1993 00:04:46  html
  18  -rwx         108   Mar 01 1993 00:04:46  info.ver
7741440 bytes total (3578368 bytes free)
```

6 To view the files that can be copied from the root directory:

```
Switch#copy flash:?
flash:c2950-i6q412-mz.121-9.EA1.bin  flash:env_vars
flash:info                          flash:html
flash:info.ver
```

7 Then to copy the IOS image to the TFTP server:

```
Switch#copy flash:c2950-i6q412-mz.121-9.EA1.bin tftp
Address or name of remote host []?W.X.Y.Z
Destination filename [c2950-i6q412-mz.121-6.EA2c.bin]?
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
2253443 bytes copied in 25.616 secs (90137 bytes/sec)
```

8 Then to copy the IOS image from the TFTP server:

```
Switch#copy tftp flash:c2950-i6q412-mz.121-9.EA1.bin
Address or name of remote host []? W.X.Y.Z
Source filename []? c2950-i6q412-mz.121-11.EA1.bin
Destination filename [c2950-i6q412-mz.121-11.EA1.bin]?
%Warning:There is a file already existing with this name
Do you want to over write? [confirm]
Accessing tftp://10.1.1.10/ c2950-i6q412-mz.121-11.EA1.bin...
Loading c2950-i6q412-mz.121-11.EA1.bin from 10.1.1.10 (via Vlan1):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 2253443/4506624 bytes]
2253443 bytes copied in 61.504 secs (36941 bytes/sec)
```

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