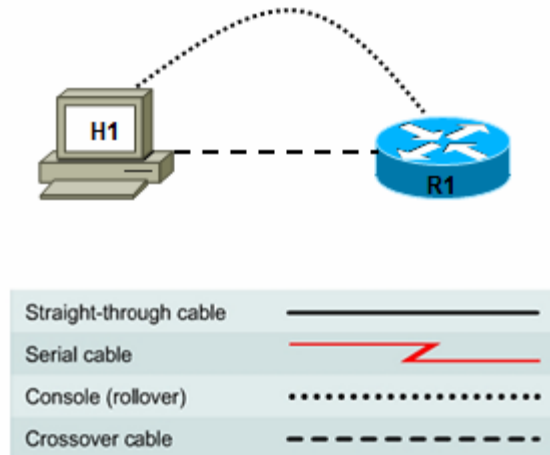


Lab 8.4.3b Managing Cisco IOS images with ROMMON and TFTP



Device	Host Name	Interface	IP Address	Subnet Mask
R1	R1	Fast Ethernet 0/0	172.17.0.1	255.255.0.0

Objectives

- Analyze the Cisco IOS image and router flash memory.
- Back up a Cisco IOS software image to a TFTP server.
- Use ROM monitor (ROMmon) and the **tftpdnld** command to restore an image from a TFTP server.

Background / Preparation

In this lab, you use the **show flash** command to view the Cisco IOS image in the router flash memory. You use TFTP server software to back up the image to the TFTP server. You then simulate the loss of the image and use the ROMmon **tftpdnld** command to copy the image from the TFTP server back to the router.

Important: Check with the instructor before performing Task 6 in this lab. The **tftpdnld** command erases all existing files in flash memory before downloading a new software image to the router. If there are files in the router flash memory that you do not want to lose, they must be backed up to the TFTP server and then copied back to flash memory after the Cisco IOS image has been restored. The process for copying files to and from a TFTP server is described in Lab 8.4.3a, “Managing Cisco IOS Images with TFTP.”

Set up a network similar to the one in the topology diagram. Any router that meets the interface requirements displayed in that diagram—such as 800, 1600, 1700, 1800, 2500, or 2600 routers, or a combination of these—can be used. See the Router Interface Summary table at the end of the lab to determine which interface identifiers to use based on the equipment in the lab. This lab uses a Cisco 1841 router with Cisco IOS software release 12.4. Depending on the model of the router, output may vary from what is shown in this lab.

Required Resources

The following resources are required:

- One router with an Ethernet interface
- One Windows XP computer (or Discovery Server)
- Crossover Category 5 Ethernet cable (H1 to router R1)
- Console cable (from H1 to R1)
- Access to the computer host command prompt
- Access to the computer host network TCP/IP configuration

Note: Instead of using a PC and installing TFTP server software, you may use the Discovery Server, which has Linux-based TFTP server software pre-installed. Check with the instructor on the availability of a Discovery Server CD. The Discovery Server can take the place of host H1 in the topology diagram. The IP addresses used to configure host H1 and R1 in this lab are compatible with the Discovery Server.

From host H1, start a HyperTerminal session to the attached router.

Note: Make sure that the router has been erased and has no startup configurations. Instructions for erasing are provided in the Lab Manual, located on Academy Connection in the Tools section. Check with the instructor if you are unsure of how to do this.

Task 1: Build the Network and Verify Connectivity

Step 1: Configure the TFTP server host.

Connect the router and host H1 according to the topology diagram. Configure host H1 IP address with the following settings.

IP address: 172.17.0.2
Subnet mask: 255.255.0.0
Default gateway: 172.17.0.1

Step 2: Log in to router R1 and configure the basic settings.

- a. Configure the host name for R1.

```
Router>enable
Router#configure terminal
Router(config)#hostname R1
```

- b. Configure a console, vty, and enable secret passwords. Configure synchronous logging for the console line.

```
R1(config)#line console 0
R1(config-line)#password cisco
R1(config-line)#login
R1(config-line)#logging synchronous
R1(config-line)#line vty 0 4
R1(config-line)#password cisco
R1(config-line)#login
R1(config-line)#exit
R1(config)#enable secret class
R1(config)#exit
```

- c. Configure a message-of-the-day (MOTD) banner using and no ip domain lookup.

```
R1(config)#banner motd #Unauthorized Use Prohibited#
R1(config)#no ip domain lookup
```

- d. Configure the R1 Fast Ethernet interface.

```
R1(config)#interface FastEthernet 0/0
R1(config-if)#description R1 LAN Default Gateway
R1(config-if)#ip address 172.17.0.1 255.255.0.0
R1(config-if)#no shutdown
R1(config-if)#end
```

Step 3: Display the R1 router configuration.

Issue the **show running-config** command in privileged EXEC mode, and verify all the configuration commands that you have entered so far. Note that this command can be abbreviated as **sh run**.

```
R1#show running-config
```

Step 4: Verify basic connectivity.

Host H1 will be the TFTP server, and router R1 will be the TFTP client. To copy files to and from a TFTP server, you must have IP connectivity between the server and the client.

From host H1, ping the router Fast Ethernet interface at IP address 172.17.0.1. Are the pings successful?

If the pings are not successful, troubleshoot the host and router configs until they are.

Step 5: Save the configuration on R1.

Save the running configuration to the startup configuration from the privileged EXEC prompt.

```
R1#copy running-config startup-config
```

Task 2: Collect Router Memory and Image Information

Step 1: Collect information to document the router.

- a. From the router HyperTerminal session, issue the **show version** command.

```
Router>show version
```

- b. What is the value of the config-register? _____
- c. How much flash memory does this router have? _____
- d. What is the version number of the boot ROM? _____

Step 2: Collect information about flash memory.

- a. Issue the **show flash** command.

```
Router>show flash
```

- b. Is the Cisco IOS image already stored in flash? _____
- c. If yes, what is the exact name of that file? _____
- d. What is the size of the image in flash memory? _____
- e. How much flash is available or unused? _____
- f. To what value is the configuration register set? _____

Note: There must be enough flash memory to hold the new Cisco IOS image.

- g. How many files are in Flash memory? _____

```
R1>show flash
-#- --length-- -----date/time----- path
1      22063220 Mar 15 2007 07:03:50 c1841-advipservicesk9-mz.124-10b.bin
2          1038 May 18 2007 14:25:40 home.shtml
3          1821 May 18 2007 14:25:40 sdmconfig-18xx.cfg
4          113152 May 18 2007 14:25:42 home.tar
5          1164288 May 18 2007 14:25:44 common.tar
6          6036480 May 18 2007 14:25:54 sdm.tar
7           861696 May 18 2007 14:26:04 es.tar
8           527849 May 18 2007 14:25:42 128MB.sdf
9          1684577 Mar 15 2007 07:23:20 securedesktop-ios-3.1.1.27-k9.pkg
10         398305 Mar 15 2007 07:23:54 sslclient-win-1.1.0.154.pkg

31121408 bytes available (32874496 bytes used)
```

Task 3: Use TFTP to Save the Cisco IOS Image

Step 1: Obtain and install the TFTP server application.

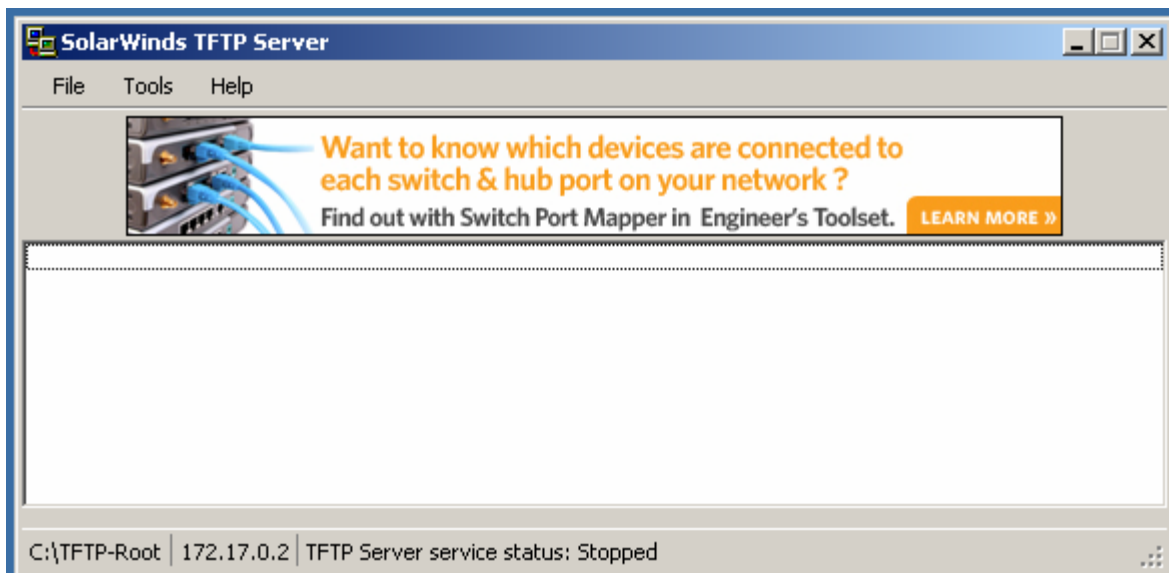
There are many free TFTP servers available. A search for “free TFTP server” identifies several you can choose from to download. This lab uses the free SolarWinds TFTP Server application. SolarWinds is a multithreaded TFTP server commonly used to upload and download executable images and configurations to routers and switches. It runs on most Microsoft® operating systems, including Windows® XP, Vista, 2000, and 2003. The SolarWinds software requires the Microsoft .NET 2.0 framework to install.

Note: Check with the instructor for a copy of SolarWinds or another TFTP server that you can install.

- Go to the SolarWinds website and download the free TFTP server software and save it to your desktop.
<http://www.solarwinds.com/downloads/>
- Double-click on the SolarWinds TFTP application to begin installation. Select **Next**. Agree to the license agreement, and accept default settings. After the installation has finished, click **Finish**.

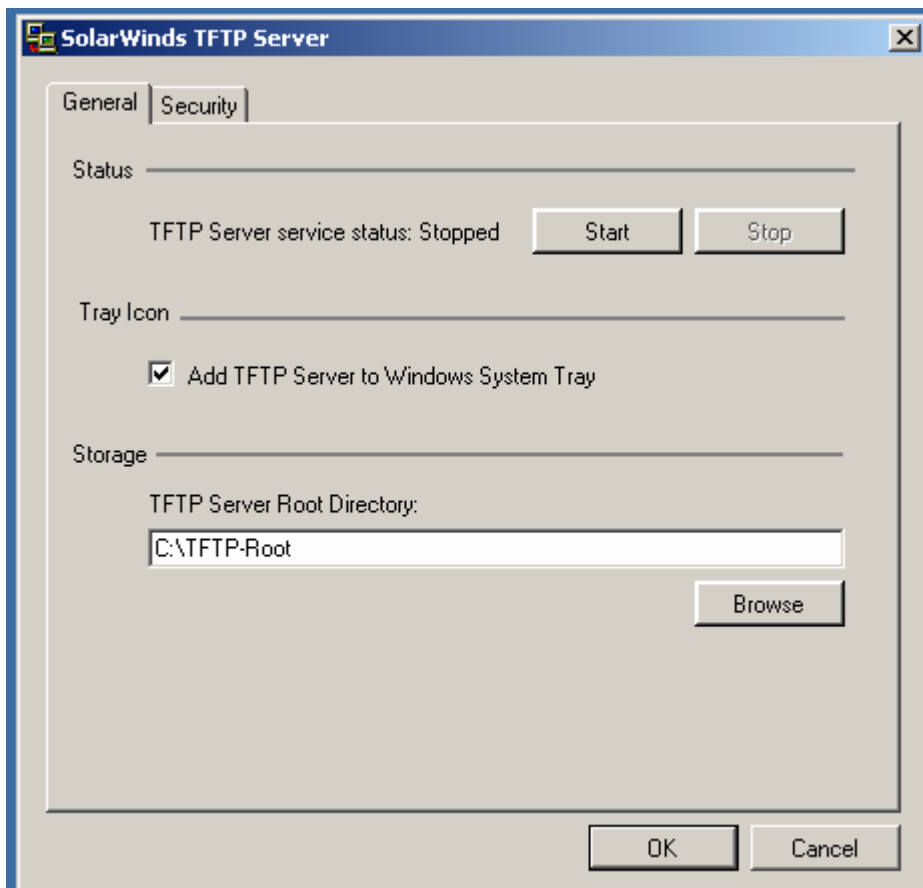
Step 2: Start the TFTP application.

Start the TFTP server by choosing **Start > Programs > SolarWinds TFTP Server > TFTP Server**.

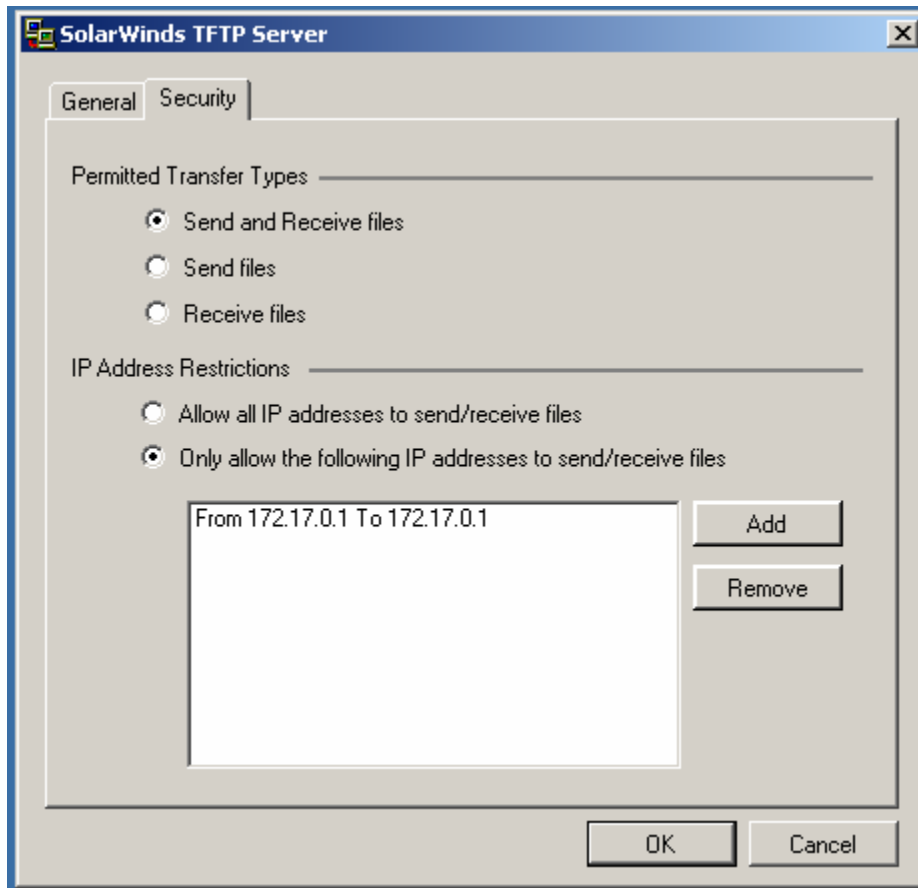


Step 3: Configure the TFTP server.

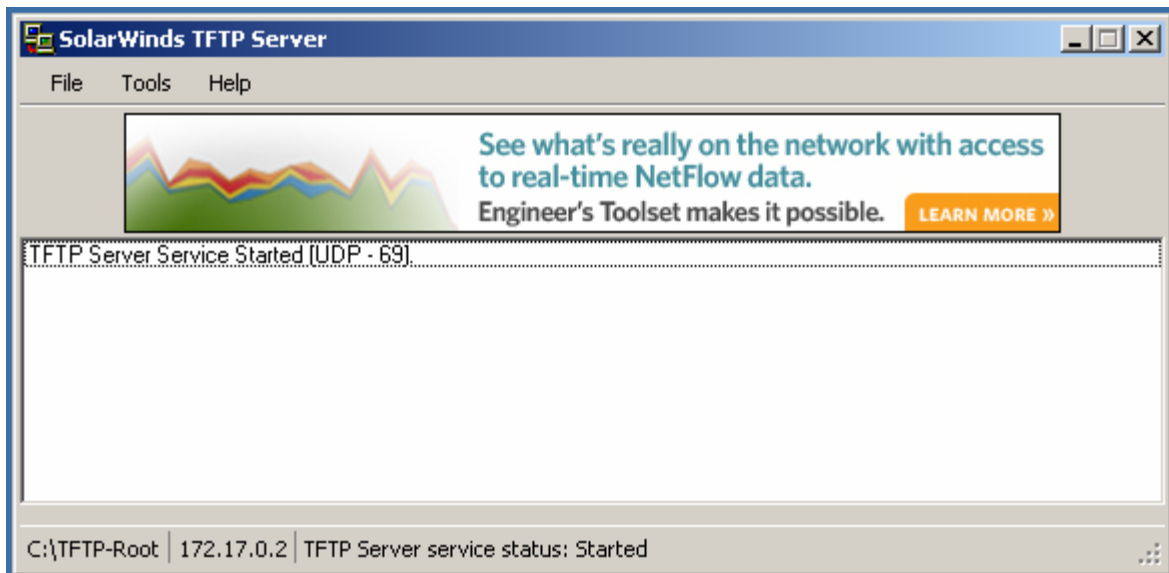
- a. To configure the TFTP server, choose **File > Configure**. The screen displayed should be similar to the following. On the **General** tab, check that the default TFTP Server Root Directory is set to C:\TFTP-Root.



- b. Click on the **Security** tab. Check that **Permitted Transfer Types** is set to **Send and Receive files**, and set **IP Address Restrictions** to allow transfers from only the router R1 Fast Ethernet 0/0 IP address (172.17.0.1 To 172.17.0.1).



- c. In the **General** tab, click the **Start** button to activate the TFTP Server.
d. When finished, click **OK**. The screen should look similar to the following.



- e. On which well-known UDP port number is the TFTP server operating? _____
- f. Leave the TFTP Server window open so that you can view the activity as the file is copied.

Step 4: Save the R1 Cisco IOS image file to TFTP server.

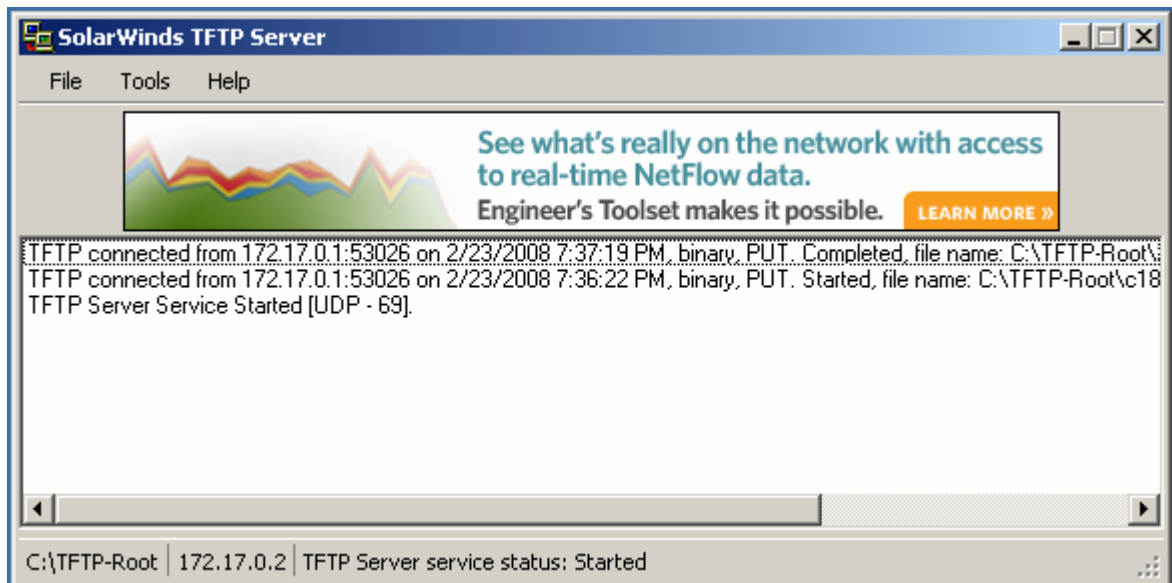
- a. Write down the Cisco IOS image filename that you will be copying.

- b. From the HyperTerminal session on router R1, begin uploading the Cisco IOS image to the TFTP server using the **copy flash tftp** command. Respond to the prompts as shown below, but replace the image filename shown with the one on your router.

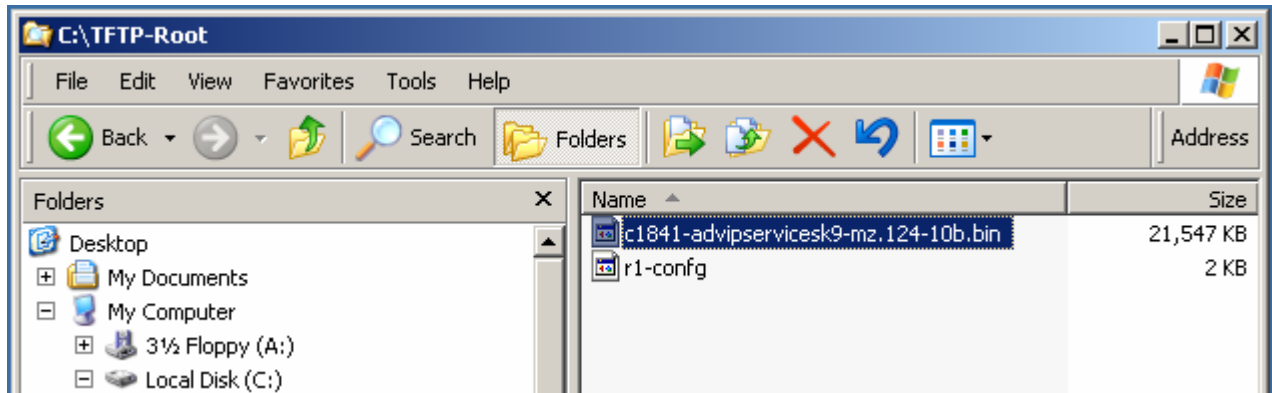
```
R1#copy flash tftp
Source filename []? c1841-advipservicesk9-mz.124-10b.bin
Address or name of remote host []? 172.17.0.2
Destination filename [c1841-advipservicesk9-mz.124-10b.bin]?
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!
22063220 bytes copied in 58.264 secs (378677 bytes/sec)
```

Step 5: Verify the TFTP server activity.

- a. Observe the TFTP Server window, which shows the connection entries for the transfer of the running-config file to the server. The output should look similar to the following.



- b. Use Windows Explorer to examine the contents of folder C:\TFTP-Root\ on the host H1 TFTP server. Verify the flash image size in the TFTP server directory. The file size in the **show flash** command should be the same size as the file stored on the TFTP server. If the file sizes are not identical, check with the instructor. The IOS image file should be listed similar to the one shown in the screen below.



Task 4: Consider IOS Restoration Options

There are several options for restoring a corrupted or missing Cisco IOS image.

Option 1. Using ROMmon and tftpdnld (part of this lab) – This option can be used if the image is missing or corrupt. The router boots up in ROMmon mode if this is the case. Ethernet and IP connectivity must be available to access the TFTP server.

Option 2. Using ROMmon and xmodem (not part of this lab) – This option is used as an emergency when the Cisco IOS image is missing or corrupt and there is no possibility of downloading a new version from a TFTP server. The **xmodem** command is used at the console to download Cisco IOS software using ROMmon and HyperTerminal. This procedure can also be used if there are no TFTP servers or network connections, and a direct PC connection through the console (or through a modem connection) is the only viable option. Because this procedure relies on the console speed of the router and the serial port of the PC, it can take a long time to download an image. Depending on the image size and the console baud rate, the download can take several hours.

Option 3. Replacing the flash card (not part of this lab) – If the router only boots up in ROMmon mode, you may be able to recover the image if you have a similar router with a compatible flash card. You can download the correct Cisco IOS image on that router, and then move the flash card to the router that has a problem.

Task 5: Working in ROMmon Mode

Step 1: Configure the boot register to enter ROMmon mode.

Typically, if the Cisco IOS software image is corrupt, the router only boots up in ROMmon mode.

You will simulate the loss of the Cisco IOS image by changing the router config-register so that it boots up to the **rommon >** prompt. The config register is normally set to 0x2102 to enable the router to boot the Cisco IOS image from flash. See the **show version** command output in Task 2, Step 1 to see the config-register setting.

- a. Change the configuration register to 0x2100 to cause the router to start up in ROMmon mode.

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#config-register 0x2100
Router(config)#exit
Router#
```


- b. Issue the **show version** command to verify that the new config register setting will take effect at the next reload. What is the last line of the **show version** output?

- c. Issue the **reload** command to restart the router.

```
Router#reload
System Bootstrap, Version 12.4(13r)T, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 2006 by Cisco Systems, Inc.
PLD version 0x10
GIO ASIC version 0x127
c1841 platform with 196608 Kbytes of main memory
Main memory is configured to 64 bit mode with parity disabled

Upgrade ROMMON initialized
rommon 1 >
```

Step 2: View available commands from the ROMmon prompt.

Enter a question mark (?) at the ROMmon prompt.

```
rommon 2 >?
alias                set and display aliases command
boot                 boot up an external process
break                set/show/clear the breakpoint
confreg              configuration register utility
cont                 continue executing a downloaded image
context              display the context of a loaded image
cookie               display contents of motherboard cookie PROM in hex
dev                  list the device table
dir                  list files in file system
dis                  disassemble instruction stream
dnld                 serial download a program module
frame                print out a selected stack frame
gioshow              show the gio version
help                 monitor builtin command help
history              monitor command history
iomemset             set IO memory percent
meminfo              main memory information
repeat               repeat a monitor command
reset                system reset
rommon-pref          Select ROMMON
set                  display the monitor variables
showmon              display currently selected ROM monitor
stack                produce a stack trace
sync                 write monitor environment to NVRAM
sysret               print out info from last system return
tftpdnld             tftp image download
unalias              unset an alias
unset                unset a monitor variable
xmodem               x/ymodem image download
```

Step 3: Find a valid image in flash.

In some cases, a Cisco IOS image fails to load properly, and the router boots to the ROMmon prompt, but the image may still be valid. There may also be more than one image in flash memory. You can use the **boot** command at the ROMmon prompt to attempt to load a single image, or you can select from multiple images in flash if they exist.

- a. From the ROMmon prompt, issue the **dir flash:** command. Look for a valid Cisco IOS software image.

```
rommon 3 > dir flash:
program load complete, entry point: 0x8000f000, size: 0xcb80
Directory of flash:

 2          22063220  -rw-      c1841-advipservicesk9-mz.124-10b.bin
5389        491213   -rw-      128MB.sdf
5509        1052160  -rw-      common.tar
5766        833024   -rw-      es.tar
5970        1038     -rw-      home.shtml
5971        4734464   -rw-      sdm.tar
7127        1821     -rw-      sdmconfig-18xx.cfg
7128        1684577   -rw-      securedesktop-ios-3.1.1.27-k9.pkg
7540        398305   -rw-      sslclient-win-1.1.0.154.pkg
rommon 4 >
```

- b. Boot from any image that is listed in the previous step (typically files with a .bin extension). If the image is valid, it brings back normal operation.

```
rommon 4 > boot flash:c1841-advipservicesk9-mz.124-10b.bin
program load complete, entry point: 0x8000f000, size: 0x150a6d4
Self decompressing the image :
#####
##### ...
```

- c. Restart the router using the **reload** command. It comes up in ROMmon mode again, because the config register is still set to 0x2100.

Step 4: Reset the config register so that the router boots from flash on the next reload.

From the ROMmon prompt, set the boot register back to 0x2102, before the Cisco IOS image transfer, using the **confreg** command. Depending on the router model and ROMmon prompt, you may need to use the **o/r** command.

Note: The number at the ROMmon prompt increments with each command issued.

```
rommon 5 > confreg 0x2102
or
> o/r 0x2102
```

The router responds with:

```
You must reset or power cycle for new config to take effect
rommon 6 >
```

Note: Do not reset the router at this time.

Task 6: Use ROMmon and tftpdnld to Restore a Cisco IOS Image (Optional)

Important: Check with the instructor before performing Task 6 in this lab. The **tftpdnld** command erases all existing files in flash memory before downloading a new software image to the router. If there are files in the router flash memory that you do not want to lose, they must be backed up to the TFTP server and then copied back to flash memory after the Cisco IOS image has been restored. The process for copying files to and from a TFTP server is described in Lab 8.4.3a, "Managing Cisco IOS Images with TFTP."

Note: If performing this task presents a problem to the lab environment, just read through the steps to become familiar with the procedure.

Step 1: Use the tftpdnld command to transfer the image.

- a. Record the name of the Cisco IOS image displayed in the **show flash** output in Task 2, Step 2. This file was saved to the TFTP server.
- b. The ROMmon TFTP transfer works only on the first LAN port. To use TFTP in ROMmon mode, you must first set a few environmental variables, including the IP address of the LAN interface, and then use the **tftpdnld** command to restore the image. To set a ROMmon environment variable, type the variable name, an equal sign (=), and the value for the variable. For example, to set the IP address to 172.17.0.1, type IP_ADDRESS=172.17.0.1.

Commonly required environment variables are:

IP_ADDRESS – IP address on the LAN interface

IP_SUBNET_MASK – Subnet mask for the LAN interface

DEFAULT_GATEWAY – Default gateway for the LAN interface

TFTP_SERVER – IP address of the TFTP server

TFTP_FILE – Cisco IOS filename on the server

Enter the environment variables as follows (be sure to replace the image name with the one for the router that you are using).

```
rommon 7 > IP_ADDRESS=172.17.0.1
rommon 8 > IP_SUBNET_MASK=255.255.0.0
rommon 9 > DEFAULT_GATEWAY=172.17.0.1
rommon 10 > TFTP_SERVER=172.17.0.2
rommon 11 > TFTP_FILE=c1841-advipservicesk9-mz.124-10b.bin
```

- c. Use the **set** command to view and verify the ROMmon environment variables.

```
rommon 12 > set
PS1=rommon ! >
BSI=0
RANDOM_NUM=1770598170
WARM_REBOOT=
RET_2_RTS=18:04:12 UTC Mon Feb 25 2008
RET_2_RCATS=1203962657
?=0
IP_ADDRESS=172.17.0.1
IP_SUBNET_MASK=255.255.0.0
TFTP_SERVER=172.17.0.2
TFTP_FILE=c1841-advipservicesk9-mz.124-10b.bin
```

- d. Use the **tftpdnld** command to start the Cisco IOS image transfer from the TFTP server. As each datagram of the Cisco IOS file is received, an exclamation point (!) is displayed. When the entire Cisco IOS file is copied, the flash is erased and the new image file is written.

```
rommon 13 > tftpdnld

IP_ADDRESS: 172.17.0.1
IP_SUBNET_MASK: 255.255.0.0
DEFAULT_GATEWAY: 172.17.0.1
TFTP_SERVER: 172.17.0.2
TFTP_FILE: c1841-advipservicesk9-mz.124-10b.bin
TFTP_MACADDR: 00:1b:53:25:25:6e
TFTP_VERBOSE: Progress
TFTP_RETRY_COUNT: 18
TFTP_TIMEOUT: 7200
TFTP_CHECKSUM: Yes
```

```
FE_PORT: 0
FE_SPEED_MODE: Auto Detect
```

```
Invoke this command for disaster recovery only.
WARNING: all existing data in all partitions on flash: will be lost!
Do you wish to continue? y/n: [n]: y
```

```
.
Receiving c1841-advipservicesk9-mz.124-10b.bin from 172.17.0.2
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
<output omitted>
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!
File reception completed.
Validating checksum.
Copying file c1841-advipservicesk9-mz.124-10b.bin to flash:.
program load complete, entry point: 0x8000f000, size: 0xcb80

Format: Drive communication & 1st Sector Write OK...
Writing Monlib sectors.
.....
.....
.....
Monlib write complete

Format: All system sectors written. OK...
Format: Operation completed successfully.

Format of flash: complete
program load complete, entry point: 0x8000f000, size: 0xcb80
```

- e. When the ROMmon prompt appears, restart the router using the **reset** command or type the letter **i**. The router should now boot from the new Cisco IOS image in flash.

```
rommon 14 > reset
```

Step 2: Verify that the image file transfer was successful.

- a. Restart the router using the **reload** command and observe the startup process to confirm that there were no flash errors. If there are none, the router Cisco IOS software should have started correctly.
- b. Verify the new image in flash using the **show flash** command.

```
R1#show flash
#- --length-- -----date/time----- path
1      22063220 Feb 23 2008 01:25:20 c1841-advipservicesk9-mz.124-10b.bin

41947136 bytes available (22065152 bytes used)
```

- c. How many files are in flash memory now? _____

Task 7: Reflection

What are some advantages and disadvantages to using ROMmon and **tfcpdnl** to restore a Cisco IOS image?

Router Interface Summary Table

Router Interface Summary				
Router Model	Ethernet Interface #1	Ethernet Interface #2	Serial Interface #1	Serial Interface #2
800 (806)	Ethernet 0 (E0)	Ethernet 1 (E1)		
1600	Ethernet 0 (E0)	Ethernet 1 (E1)	Serial 0 (S0)	Serial 1 (S1)
1700	Fast Ethernet 0 (FA0)	Fast Ethernet 1 (FA1)	Serial 0 (S0)	Serial 1 (S1)
1800	Fast Ethernet 0/0 (FA0/0)	Fast Ethernet 0/1 (FA0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2500	Ethernet 0 (E0)	Ethernet 1 (E1)	Serial 0 (S0)	Serial 1 (S1)
2600	Fast Ethernet 0/0 (FA0/0)	Fast Ethernet 0/1 (FA0/1)	Serial 0/0 (S0/0)	Serial 0/1 (S0/1)
Note: To find out exactly how the router is configured, look at the interfaces. The interface identifies the type of router and how many interfaces the router has. There is no way to effectively list all combinations of configurations for each router class. What is provided are the identifiers for the possible combinations of interfaces in the device. This interface chart does not include any other type of interface, even though a specific router may contain one. An example of this might be an ISDN BRI interface. The information in parenthesis is the legal abbreviation that can be used in Cisco IOS commands to represent the interface.				