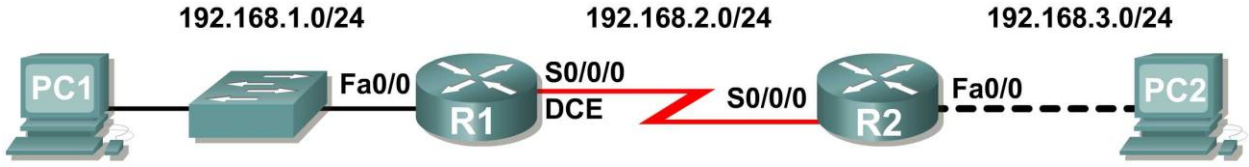
Lab 1.5.1: Cabling a Network and Basic Router Configuration (Instructor Version)

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	**Fa0/0**	192.168.1.1	255.255.255.0	N/A
	S0/0/0	192.168.2.1	255.255.255.0	N/A
R2	**Fa0/0**	192.168.3.1	255.255.255.0	N/A
	S0/0/0	192.168.2.2	255.255.255.0	N/A
PC1	**N/A**	192.168.1.10	255.255.255.0	192.168.1.1
PC2	**N/A**	192.168.3.10	255.255.255.0	192.168.3.1

Learning Objectives

Upon completion of this lab, you will be able to:

- Cable devices and establish console connections.
- Erase and reload the routers.
- Perform basic IOS command line interface operations.
- Perform basic router configuration.
- Verify and test configurations using show commands, ping and traceroute.
- Create a startup configuration file.
- Reload a startup configuration file.
- Install a terminal emulation program.

Scenario

(Instructor Note: This lab replaces **Lab 1.5.2: Basic Router Configuration** and should be used if the student needs extensive review of prior skills.)In this lab activity, you will review previously learned skills including cabling devices, establishing a console connection, and basic IOS command line interface operation and configuration commands. You will also learn to save configuration files and capture your configurations to a text file. The skills presented in this lab are essential to completing the rest of the labs in this course. However, you may substitute the shorter version, **Lab 1.5.2: Basic Router Configuration**, if your instructor determines that you are proficient in the essential skills reviewed in this lab.

Task 1: Cable the Ethernet Links of the Network.

Cable the Ethernet links for a network that is similar to the one in the Topology Diagram. The output used in this lab is from Cisco 1841 routers. But you can use any current router in your lab as long as it has the required interfaces as shown in the topology. A simple way to identify the available interfaces on a router is by entering the **`show ip interface brief`** command.

Which of the devices in the Topology Diagram require an Ethernet cable between them?

_____ PC1 to S1, S1 to R1, and R2 to PC2_____

Step 1: Connect the R1 Router to the S1 Switch.

Use a straight-through Ethernet cable to connect the FastEthernet 0/0 interface of the R1 router to the FastEthernet 0/1 interface on the S1 switch.

What color is the link status light next to the FastEthernet 0/0 interface on R1? _____green_____

What color is the link status light next to the FastEthernet 0/1 interface on S1? _____green_____

Step 2: Connect PC1 to the S1 Switch.

Use a straight-through Ethernet cable to connect the network interface card (NIC) of PC1 to the FastEthernet 0/2 Interface of the S1 switch.

What color is the link status light next to the NIC interface on PC1? _____green_____

What color is the link status light next to the FastEthernet 0/2 interface on S1? _____green_____

If the link status lights are not green, wait a few moments for the link between the two devices to become established. If the lights do not turn green after a few moments, check that you are using a straight-through Ethernet cable and that the power is on for the S1 switch and PC1.

Step 3: Connect PC2 to the R2 Router.

Use a crossover Ethernet cable to connect the FastEthernet 0/0 interface of the R2 router to the NIC of PC2. Because there is no switch between PC2 and the R2 router, a crossover cable is required for a direct link between the PC and the router.

What color is the link status light next to the NIC interface on PC2? _____green_____

What color is the link status light next to the FastEthernet 0/0 interface on R2? _____green_____

Task 2: Cable the Serial Link between the R1 and R2 Routers.

In a real-world WAN connection, the customer premises equipment (CPE), which is often a router, is the data terminal equipment (DTE). This equipment is connected to the service provider through a data circuit-terminating equipment (DCE) device, which is commonly a modem or channel service unit (CSU)/ data service unit (DSU). This device is used to convert the data from the DTE into a form acceptable to the WAN service provider.

Unlike the cables in the academy lab setup, the serial cables in the real world are not connected back to back. In a real-world situation, one router might be in New York, while another router might be in Sydney, Australia. An administrator located in Sydney would have to connect to the router in New York through the WAN cloud in order to troubleshoot the New York router.

In the academy labs, devices that make up the WAN cloud are simulated by the connection between the back-to-back DTE-DCE cables. The connection from one router serial interface to another router serial interface simulates the whole circuit cloud.

Step 1: Create a null serial cable to connect the R1 router to the R2 router.

In the academy labs, the WAN connection between routers uses one DCE cable and one DTE cable. The DCE-DTE connection between routers is referred to as a null serial cable. The labs will use one V.35 DCE cable and one V.35 DTE cable to simulate the WAN connection. The V.35 DCE connector is usually a female V.35 (34-pin) connector. The DTE cable has a male V.35 connector. The cables are also labeled as DCE or DTE on the router end of the cable.

The DTE and DCE V.35 cables must be joined together. Holding one of the V.35 ends in each hand, examine the pins and sockets as well as the threaded connectors. Note that there is only one proper way for the cables to fit together. Align the pins on the male cable with the sockets on the female cable and gently couple them. Very little effort should be required to accomplish this. When they are joined, turn the thumbscrews clockwise and secure the connectors.

Step 2: Connect the DCE end of the null serial cable to the Serial 0/0/0 interface of the R1 router, and the DTE end of the null serial cable to the Serial 0/0/0 interface of the R2 router.

Review the information provided below before making these connections.

Before making the connection to one of the routers, examine the connector on the router and the cable. Note that the connectors are tapered to help prevent improper connection. Holding the connector in one hand, orient the cable and router connecters so that the tapers match. Now push the cable connector partially into the router connector. It probably will not go in all the way because the threaded connectors need to be tightened in order for the cable to be inserted completely. While holding the cable in one hand and gently pushing the cable toward the router, turn one of the thumb screws clockwise, 3 or 4 rounds, to start the screws. Now turn the other thumbscrew clockwise, 3 or 4 rounds, to get it started. At this point the cable should be attached sufficiently to free both hands to advance each thumbscrew at the same rate until the cable is fully inserted. Do not over-tighten these connectors.

Task 3: Establish a Console connection to the R1 Router.

The console port is a management port used to provide out-of-band access to a router. It is used to set up the initial configuration of a router and to monitor it.

A rollover cable and an RJ-45 to DB-9 adapter are used to connect a PC to the console port. As you know from your previous studies, terminal emulation software is used to configure the router over the console connection. The Cisco Networking Academy Program recommends using Tera Term. However, you can also use HyperTerminal, which is part of the Windows operating system.

At the end of this lab, the following three appendices are available for your reference concerning these two terminal emulation programs:

- Appendix 1: Installing and Configuring Tera Term for use on Windows XP
- Appendix 2: Configuring Tera Term as the Default Telnet Client in Windows XP
- Appendix 3: Accessing and Configuring HyperTerminal

Step 1: Examine the router and locate the RJ-45 connector labeled Console.

Step 2: Examine PC1 and locate a 9-pin male connector serial port.

It may—or may not—be labeled as COM1 or COM2.

Step 3: Locate the console cable.

Some console cables have an RJ-45 to DB-9 adapter built into one end. Others do not. Locate either a console cable with a built-in adapter or a console cable with a separate RJ-45 to DB-9 adapter attached to one end.

Step 4: Connect the console cable to the router and PC.

First, connect the console cable to the router console port, an RJ-45 connector. Next, connect the DB-9 end of the console cable to the serial port of PC1.

Step 5: Test router connection.

1. Open your terminal emulation software (HyperTerminal, Tera Term, or other software specified by your instructor).
2. Configure the software parameters specific to your applications (see appendices for help).
3. Once the terminal window is open, press the **Enter** key. There should be a response from the router. If there is, then the connection has been successfully completed. If there is no connection, troubleshoot as necessary. For example, verify that the router has power. Check the connection to the serial port on the PC and the console port on the router.

Task 4: Erase and Reload the Routers.

Step 1: Using the HyperTerminal session established in Task 3, enter privileged EXEC mode on R1.

```
Router>enable
Router#
```

Step 2: Erase the configuration.

To clear the configuration, issue the **erase startup-config** command. Confirm the objective when prompted, and answer **no** if asked to save changes. The result should look something like this:

```
Router#erase startup-config
Erasing the nvram filesystem will remove all files! Continue? [confirm]
[OK]
Erase of nvram: complete
Router#
```

Step 3: Reload the configuration.

When the prompt returns, issue the **reload** command. Confirm the objective when prompted. After the router finishes the boot process, choose not to use the AutoInstall facility, as shown:

```
Would you like to enter the initial configuration dialog? [yes/no]: no
Would you like to terminate autoinstall? [yes]:
Press Enter to accept default.
Press RETURN to get started!
```

Step 4: Establish a HyperTerminal Session to R2.

Repeat Steps 1 through 3 to remove any startup configuration file that may be present.

Task 5: Understand Command Line Basics.

Step 1: Establish a HyperTerminal session to router R1.

Step 2: Enter privileged EXEC mode.

```
Router>enable
Router#
```


Step 3: Enter an incorrect command and observe the router response.

```
Router#comfigure terminal
                ^
% Invalid input detected at '^' marker.

Router#
```

Command line errors occur primarily from typing mistakes. If a command keyword is incorrectly typed, the user interface uses the caret symbol (^) to identify and isolate the error. The ^ appears at or near the point in the command string where an incorrect command, keyword, or argument was entered.

Step 4: Correct the previous command.

If a command is entered incorrectly, and the **Enter** key is pressed, the **Up Arrow** key on the keyboard can be pressed to repeat the last command. Use the **Right Arrow** and **Left Arrow** keys to move the cursor to the location where the mistake was made. Then make the correction. If something needs to be deleted, use the **Backspace** key. Use the directional keys and the **Backspace** key to correct the command to **`configure terminal`**, and then press **Enter**.

```
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
```

Step 5: Return to privileged EXEC mode with the `exit` command.

```
Router(config)#exit
%SYS-5-CONFIG_I: Configured from console by console
Router#
```

Step 6: Examine the commands that are available for privileged EXEC mode.

A question mark, **?**, can be entered at the prompt to display a list of available commands.

```
Router#?
Exec commands:
  <1-99>      Session number to resume
  clear       Reset functions
  clock       Manage the system clock
  configure   Enter configuration mode
  connect     Open a terminal connection
  copy        Copy from one file to another
  debug       Debugging functions (see also 'undebug')
  delete      Delete a file
  dir         List files on a filesystem
  disable     Turn off privileged commands
  disconnect  Disconnect an existing network connection
  enable      Turn on privileged commands
  erase       Erase a filesystem
  exit        Exit from the EXEC
  logout      Exit from the EXEC
  no          Disable debugging informations
  ping        Send echo messages
  reload      Halt and perform a cold restart
  resume      Resume an active network connection
  setup       Run the SETUP command facility
  show        Show running system information
 --More--
```


Notice the `--More--` at the bottom of the command output. The `--More--` prompt indicates that there are multiple screens of output. When a `--More--` prompt appears, press the **Spacebar** to view the next available screen. To display only the next line, press the **Enter** key. Press any other key to return to the prompt.

Step 7: View output.

View the rest of the command output by pressing the **Spacebar**. The remainder of the output will appear where the `--More--` prompt appeared previously.

```
telnet      Open a telnet connection
traceroute  Trace route to destination
undebug     Disable debugging functions (see also 'debug')
vlan        Configure VLAN parameters
write       Write running configuration to memory, network, or terminal
```

Step 8: Exit privileged EXEC mode with the `exit` command.

```
Router#exit
```

The following output should be displayed:

```
Router con0 is now available


Press RETURN to get started.
```

Step 9: Press the Enter key to enter user EXEC mode.

The `Router>` prompt should be visible.

Step 10: Type an abbreviated IOS command.

IOS commands can be abbreviated, as long as enough characters are typed for the IOS to recognize the unique command.

Enter only the character **`e`** at the command prompt and observe the results.

```
Router>e
% Ambiguous command: "e"
Router>
```

Enter **`en`** at the command prompt and observe the results.

```
Router>en
Router#
```

The abbreviated command **`en`** contains enough characters for the IOS to distinguish the **`enable`** command from the **`exit`** command.

Step 11: Press the Tab key after an abbreviated command to use auto-complete.

Typing an abbreviated command, such as **`conf`**, followed by the **Tab** key completes a partial command name. This functionality of the IOS is called auto-complete. Type the abbreviated command **conf**, press the **Tab** key, and observe the results.

```
Router#conf
Router#configure
```


This auto-complete feature can be used as long as enough characters are typed for the IOS to recognize the unique command.

Step 12: Enter IOS commands in the correct mode.

IOS commands must be entered in the correct mode. For example, configuration changes cannot be made while in privileged EXEC mode. Attempt to enter the command hostname **R1** at the privileged EXEC prompt and observe the results.

```
Router#hostname R1
                ^
% Invalid input detected at '^' marker.

Router#
```

Task 6: Perform Basic Configuration of Router R1.

Step 1: Establish a HyperTerminal session to router R1.

Step 2: Enter privileged EXEC mode.

```
Router>enable
Router#
```

Step 3: Enter global configuration mode.

```
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
```

Step 4: Configure the router name as R1.

Enter the command **hostname R1** at the prompt.

```
Router(config)#hostname R1
R1(config)#
```

Step 5: Disable DNS lookup with the `no ip domain-lookup` command.

```
R1(config)#no ip domain-lookup
R1(config)#
```

Why would you want to disable DNS lookup in a lab environment?

_____

_____

So that the router does not attempt to look up a DNS entry for a name that is really only a typing error.

What would happen if you disabled DNS lookup in a production environment?

_____

_____

A router would not be able to resolve names, causing potential problems when the router needs an IP address to address a packet.

Step 6: Configure an EXEC mode password.

Configure an EXEC mode password using the **enable secret** *password* command. Use **class** for the *password*.

```
R1(config)#enable secret class
R1(config)#
```

The **enable secret** command is used to provide an additional layer of security over the **enable password** command. The **enable secret** command provides better security by storing the **enable secret** password using a non-reversible cryptographic function. The added layer of security encryption provides is useful in environments where the password crosses the network or is stored on a TFTP server. When both the **enable password** and **enable secret** passwords are configured, the router expects the password as defined in the **enable secret** command. In this case, the router ignores the password defined in the **enable password** command.

Step 7: Remove the enable password.

Because the **enable secret** is configured, the **enable password** is no longer necessary. IOS commands can be removed from the configuration using the **no** form of the command.

```
R1(config)#no enable password
R1(config)#
```

Step 8: Configure a message-of-the-day banner using the banner motd command.

```
R1(config)#banner motd &
Enter TEXT message.  End with the character '&'.
********************************
  !!!AUTHORIZED ACCESS ONLY!!!
********************************
&
R1(config)#
```

When does this banner display?

_____

_____

When a user logs in to the router either through Telnet or the console connection.

Why should every router have a message-of-the-day banner?

_____

_____

To provide a warning to intentional or unintentional unauthorized access.

Step 9: Configure the console password on the router.

Use **cisco** as the password. When you are finished, exit from line configuration mode.

```
R1(config)#line console 0
R1(config-line)#password cisco
R1(config-line)#login
R1(config-line)#exit
R1(config)#
```


Step 10: Configure the password for the virtual terminal lines.

Use **cisco** as the password. When you are finished, exit from line configuration mode.

```
R1(config)#line vty 0 4
R1(config-line)#password cisco
R1(config-line)#login
R1(config-line)#exit
R1(config)#
```

Step 11: Configure the FastEthernet 0/0 interface with the IP address 192.168.1.1/24.

```
R1(config)#interface fastethernet 0/0
R1(config-if)#ip address 192.168.1.1 255.255.255.0
R1(config-if)#no shutdown

%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed
state to up
R1(config-if)#
```

Step 12: Use the description command to provide a description for this interface.

```
R1(config-if)#description R1 LAN
R1(config-if)#
```

Step 13: Configure the Serial0/0/0 interface with the IP address 192.168.2.1/24.

Set the clock rate to 64000.

Note: Because the routers in the labs will not be connected to a live leased line, one of the routers will need to provide the clocking for the circuit. This is normally provided to each of the routers by the service provider. To provide this clocking signal in the lab, one of the routers will need to act as the DCE on the connection. This function is achieved by applying the **clock rate 64000** command on the serial 0/0/0 interface, where the DCE end of the null modem cable has been connected. The purpose of the **clock rate** command is discussed further in Chapter 2, "Static Routes."

```
R1(config-if)#interface serial 0/0/0
R1(config-if)#ip address 192.168.2.1 255.255.255.0
R1(config-if)#clock rate 64000
R1(config-if)#no shutdown
R1(config-if)#
```

Note: The interface will not be activated until the serial interface on R2 is configured and activated.

Step 14: Use the description command to provide a description for this interface.

```
R1(config-if)#description Link to R2
R1(config-if)#
```

Step 15: Use the end command to return to privileged EXEC mode.

```
R1(config-if)#end
R1#
```

Step 16: Save the R1 configuration.

Save the R1 configuration using the **copy running-config startup-config** command.

```
R1#copy running-config startup-config
Building configuration...
```



```
[OK]
R1#
```

Task 7: Perform Basic Configuration of Router R2.

Step 1: For R2, repeat Steps 1 through 10 from Task 6.

Step 2: Configure the Serial 0/0/0 interface with the IP address 192.168.2.2/24.

```
R2(config)#interface serial 0/0/0
R2(config-if)#ip address 192.168.2.2 255.255.255.0
R2(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state
to up
R2(config-if)#
```

Step 3: Use the `description` command to provide a description for this interface.

```
R1(config-if)#description Link to R1
R1(config-if)#
```

Step 4: Configure the FastEthernet 0/0 interface with the IP address 192.168.3.1/24.

```
R2(config-if)#interface fastethernet 0/0
R2(config-if)#ip address 192.168.3.1 255.255.255.0
R2(config-if)#no shutdown

%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed
state to up
R2(config-if)#
```

Step 5: Use the `description` command to provide a description for this interface.

```
R1(config-if)#description R2 LAN
R1(config-if)#
```

Step 6: Use the `end` command to return to privileged EXEC mode.

```
R2(config-if)#end
R2#
```

Step 7: Save the R2 configuration.

Save the R2 configuration using the **`copy running-config startup-config`** command,

```
R2#copy running-config startup-config
Building configuration...
[OK]
R2#
```


Task 8: Configure IP Addressing on the Host PCs.

Step 1: Configure the host PC1.

Configure the host PC1 that is attached to R1 with an IP address of 192.168.1.10/24 and a default gateway of 192.168.1.1.

Step 2: Configure the host PC2.

Configure the host PC2 that is attached to R2 with an IP address of 192.168.3.10/24 and a default gateway of 192.168.3.1.

Task 9: Examine Router `show` Commands.

There are many **`show`** commands that can be used to examine the operation of the router. In both privileged EXEC and user EXEC modes, the command **`show ?`** provides a list of available **`show`** commands. The list is considerably longer in privileged EXEC mode than it is in user EXEC mode.

Step 1: Examine the `show running-config` command.

The **`show running-config`** command is used to display the contents of the currently running configuration file. From privileged EXEC mode on the R1 router, examine the output of the **`show running-config`** command. If the `--More--` prompt appears, press the **Spacebar** to view the remainder of the command output.

```
R1#show running-config
!
version 12.3
!
hostname R1
!
!
enable secret 5 $1$AFDd$0HCi0iYHkEWR4cegQdTQu/
!
no ip domain-lookup
!
interface FastEthernet0/0
 description R1 LAN
 mac-address 0007.eca7.1511
 ip address 192.168.1.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet0/1
 mac-address 0001.42dd.a220
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface Serial0/0/0
 description Link to R2
 ip address 192.168.2.1 255.255.255.0
 clock rate 64000
!
interface Serial0/0/1
 no ip address
```



```
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
ip classless
!
!
!
!
line con 0
 password cisco
line vty 0 4
 password cisco
 login
!
end
```

Step 2: Examine The `show startup-config` command.

The **`show startup-config`** command displays the startup configuration file contained in NVRAM. From privileged EXEC mode on the R1 router, examine the output of the **`show startup-config`** command. If the `--More--` prompt appears, press the **Spacebar** to view the remainder of the command output.

```
R1#show startup-config
Using 583 bytes
!
version 12.3
!
hostname R1
!
!
no ip domain-lookup
!
interface FastEthernet0/0
 description R1 LAN
 mac-address 0007.eca7.1511
 ip address 192.168.1.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet0/1
 mac-address 0001.42dd.a220
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface Serial0/0/0
 description Link to R2
 ip address 192.168.2.1 255.255.255.0
 clock rate 64000
!
interface Serial0/0/1
 no ip address
```



```
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
ip classless
!
!
!
!
line con 0
 password cisco
line vty 0 4
 password cisco
 login
!
end
```

Step 3: Examine the `show interfaces` command.

The **`show interfaces`** command displays statistics for all interfaces configured on the router. A specific interface can be added to the end of this command to display the statistics for only that interface. From privileged EXEC mode on the R1 router, examine the output of the **`show interfaces fastEthernet0/0`** command. If the `--More--` prompt appears, press the **Spacebar** to view the remainder of the command output.

```
R1# show interfaces fastEthernet 0/0
FastEthernet0/0 is up, line protocol is up (connected)
  Hardware is Lance, address is 0007.eca7.1511 (bia 0002.1625.1bea)
  Description: R1 LAN
  Internet address is 192.168.1.1/24
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set
  ARP type: ARPA, ARP Timeout 04:00:00,
  Last input 00:00:08, output 00:00:05, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue :0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 input packets with dribble condition detected
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
R1#
```

Step 4: Examine the `show version` command.

The **`show version`** command displays information about the currently loaded software version along with hardware and device information. From privileged EXEC mode on the R1 router, examine the output

of the **show version** command. If the --More-- prompt appears, press the **Spacebar** to view the remainder of the command output.

```
R1#show version
Cisco IOS Software, 1841 Software (C1841-IPBASE-M), Version 12.3(14)T7,
RELEASE SOFTWARE (fc2)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2006 by Cisco Systems, Inc.
Compiled Mon 15-May-06 14:54 by pt_team

ROM: System Bootstrap, Version 12.3(8r)T8, RELEASE SOFTWARE (fc1)

System returned to ROM by power-on
System image file is "flash:c1841-ipbase-mz.123-14.T7.bin"


This product contains cryptographic features and is subject to United
States and local country laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply
third-party authority to import, export, distribute or use encryption.
Importers, exporters, distributors and users are responsible for
compliance with U.S. and local country laws. By using this product you
agree to comply with applicable laws and regulations. If you are unable
to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found
at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html

If you require further assistance please contact us by sending email to
export@cisco.com.

Cisco 1841 (revision 5.0) with 114688K/16384K bytes of memory.
Processor board ID FTX0947Z18E
M860 processor: part number 0, mask 49
2 FastEthernet/IEEE 802.3 interface(s)
2 Low-speed serial(sync/async) network interface(s)
191K bytes of NVRAM.
31360K bytes of ATA CompactFlash (Read/Write)

Configuration register is 0x2102

R1#
```

Step 5: Examine the show ip interface brief command.

The **show ip interface brief** command displays a summary of the usability status information for each interface. From privileged EXEC mode on the R1 router, examine the output of the **show ip interface brief** command. If the --More-- prompt appears, press the **Spacebar** to view the remainder of the command output.

```
R1#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol

FastEthernet0/0        192.168.1.1     YES manual up                    up

FastEthernet0/1        unassigned      YES manual administratively down down
```



```
Serial0/0/0            192.168.2.1   YES manual up                    up

Serial0/0/1            unassigned    YES manual administratively down down

Vlan1                unassigned    YES manual administratively down down
R1#
```

Task 10: Using `ping`.

The **`ping`** command is a useful tool for troubleshooting Layers 1 though 3 of the OSI model and diagnosing basic network connectivity. This operation can be performed at either the user or privileged EXEC modes. Using **`ping`** sends an Internet Control Message Protocol (ICMP) packet to the specified device and then waits for a reply. Pings can be sent from a router or a host PC.

Step 1: Use the `ping` command to test connectivity between the R1 router and PC1.

```
R1#ping 192.168.1.10

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.10, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 72/79/91 ms
```

Each exclamation point (!) indicates a successful echo. Each period (.) on the display indicates that the application on the router timed out while it waited for a packet echo from a target. The first ping packet failed because the router did not have an ARP table entry for the destination address of the IP packet. Because there is no ARP table entry, the packet is dropped. The router then sends an ARP request, receives a response, and adds the MAC address to the ARP table. When the next ping packet arrives, it will be forwarded and be successful.

Step 2: Repeat the ping from R1 to PC1.

```
R1#ping 192.168.1.10

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 72/83/93 ms

R1#
```

All of the pings are successful this time because the router has an entry for the destination IP address in the ARP table.

Step 3: Send an extended ping from R1 to PC1.

To accomplish this, type **`ping`** at the privileged EXEC prompt and press **Enter**. Fill out the rest of the prompts as shown:

```
R1#ping
Protocol [ip]:
Target IP address: 192.168.1.10
Repeat count [5]: 10
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]:
```



```
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 10, 100-byte ICMP Echos to 192.168.1.10, timeout is 2 seconds:
!!!!!!!!!!
Success rate is 100 percent (10/10), round-trip min/avg/max = 53/77/94 ms

R1#
```

Step 4: Send a ping from PC1 to R1.

From Windows go to **Start > Programs > Accessories > Command Prompt**. In the Command Prompt window that opens, ping R1 by issuing the following command:

```
C:\> ping 192.168.1.1
```

The ping should respond with successful results.

Step 5: Send an extended ping from PC1 to R1.

To accomplish this, enter the following command at the Windows command prompt:

```
C:\>ping 192.168.1.1 –n 10
```

There should be 10 successful responses from the command.

Task 11: Using `traceroute`.

The **`traceroute`** command is an excellent utility for troubleshooting the path that a packet takes through an internetwork of routers. It can help to isolate problem links and routers along the way. The **`traceroute`** command uses ICMP packets and the error message generated by routers when the packet exceeds its Time-To-Live (TTL). This operation can be performed at either the user or privileged EXEC modes. The Windows version of this command is **tracert**.

Step 1: Use the `traceroute` command at the R1 privileged EXEC prompt to discover the path that a packet will take from the R1 router to PC1.

```
R1#traceroute 192.168.1.10
Type escape sequence to abort.
Tracing the route to 192.168.1.10

     1   192.168.1.10    103 msec  81 msec   70 msec
   R1#
```

Step 2: Use the `tracert` command at the Windows command prompt to discover the path that a packet will take from the R1 router to PC1.

```
C:\>tracert 192.168.1.1

Tracing route to 192.168.1.1 over a maximum of 30 hops:

  1   71 ms 70 ms 73 ms 192.168.1.1

Trace complete.

C:\>
```


Task 12: Create a start.txt File.

Router configurations can be captured to a text (.txt) file and saved for later use. The configuration can be copied back to the router so that the commands do not have to be entered one at a time.

Step 1: View the running configuration of the router using the `show running-config` command.

```
R1#show running-config
!
version 12.3
!
hostname R1
!
!
enable secret 5 $1$J.hq$Ds72Qz86tvpcuW2X3FqBS.
!
no ip domain-lookup
!
interface FastEthernet0/0
 description R1 LAN
 mac-address 0007.eca7.1511
 ip address 192.168.1.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet0/1
 mac-address 0001.42dd.a220
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface Serial0/0/0
 description Link to R2
 ip address 192.168.2.1 255.255.255.0
 clock rate 64000
!
interface Serial0/0/1
 no ip address
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
ip classless
!
!
!
!
line con 0
 password cisco
line vty 0 4
 password cisco
 login
```



```
!
end

R1#
```

Step 2: Copy the command output.

Select the command output. From the HyperTerminal Edit menu, choose the copy command.

Step 3: Paste output in Notepad.

Open Notepad. Notepad is typically found on the **Start** menu under **Programs > Accessories**. From the Notepad Edit menu, click **Paste**.

Step 4: Edit commands.

Some commands will have to be edited or added before the startup script can be applied to a router. Some of these changes are:

- Adding a **`no shutdown`** command to FastEthernet and serial interfaces that are being used.
- Replacing the encrypted text in the **`enable secret`** command with the appropriate password.
- Removing the **`mac-address`** command from the interfaces.
- Removing the **`ip classless`** command.
- Removing unused interfaces.

Edit the text in the Notepad file as shown below:

```
hostname R1
!
!
enable secret class
!
no ip domain-lookup
!
interface FastEthernet0/0
 description R1 LAN
  ip address 192.168.1.1 255.255.255.0
 no shutdown
 duplex auto
 speed auto
!
interface Serial0/0/0
 description Link to R2
 ip address 192.168.2.1 255.255.255.0
 clock rate 64000
 no shutdown
!
!
!
!
line con 0
 password cisco
line vty 0 4
 password cisco
```



```
 login
!
end
```

Step 5: Save the open file in Notepad to start.txt.

Task 13: Load the start.txt File onto the R1 Router.

Step 1: Erase the current startup configuration of R1.

Confirm the objective when prompted, and answer **no** if asked to save changes. The result should look something like this:

```
R1#erase startup-config
Erasing the nvram filesystem will remove all files! Continue? [confirm]
[OK]
Erase of nvram: complete
Router#
```

Step 2: When the prompt returns, issue the `reload` command.

Confirm the objective when prompted. After the router finishes the boot process, choose not to use the AutoInstall facility, as shown:

```
Would you like to enter the initial configuration dialog? [yes/no]: no
Would you like to terminate autoinstall? [yes]:
Press Enter to accept default.
Press RETURN to get started!
```

Step 3: Enter global configuration mode.

```
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
```

Step 4: Copy the commands.

In the start.txt file that was created in Notepad, select all the lines, and then choose **Edit > Copy**.

Step 5: From the HyperTerminal Edit menu, choose Paste to Host.

Step 6: Verify the running configuration.

After all of the pasted commands have been applied, use the **show running-config** command to verify that the running configuration appears as expected.

Step 7: Save the running configuration,

Save the running configuration to NVRAM using the **copy running-config startup-config** command.

```
R1#copy running-config startup-config
Building configuration...
[OK]
R1#
```


Appendix 1: Installing and Configuring Tera Term for use on Windows XP

Tera Term is a free terminal emulation program for Windows. It can be used in the lab environment in place of Windows HyperTerminal. Tera Term can be obtained at the following URL:

http://hp.vector.co.jp/authors/VA002416/teraterm.html

Download the “ttermp23.zip”, unzip it, and install Tera Term.

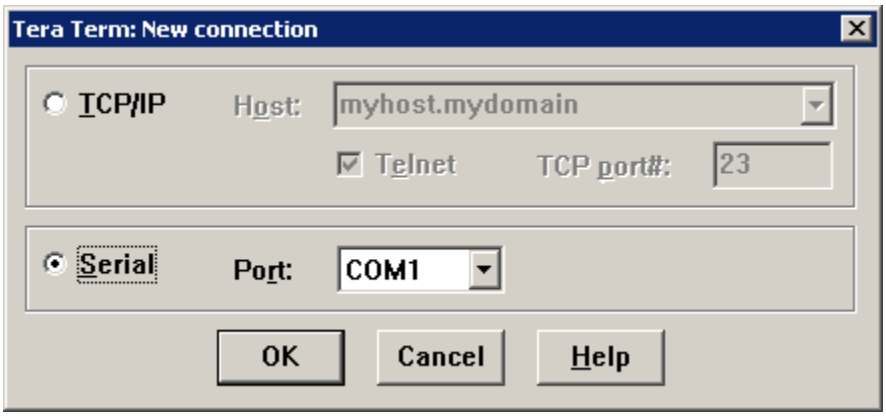
Step 1: Open the Tera Terminal program.

Step 2: Assign Serial port.

To use Terra Term to connect to the router console, open the **New connection** dialog box and select the **Serial** port.

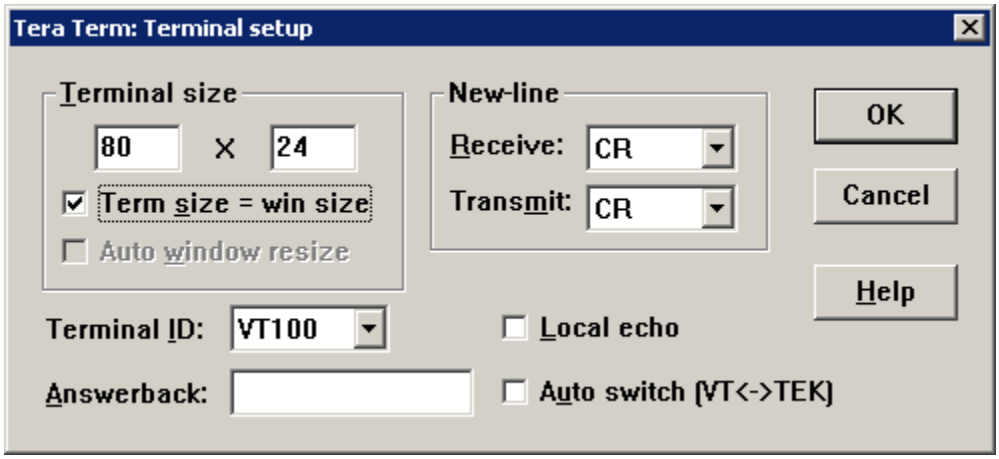
Step 3: Set Serial port parameters.

Set appropriate parameters for Port in the Serial section of the **Tera Term:New Connection** dialog box. Normally, your connection is through COM1. If you are unsure what port to use, ask your instructor for assistance.



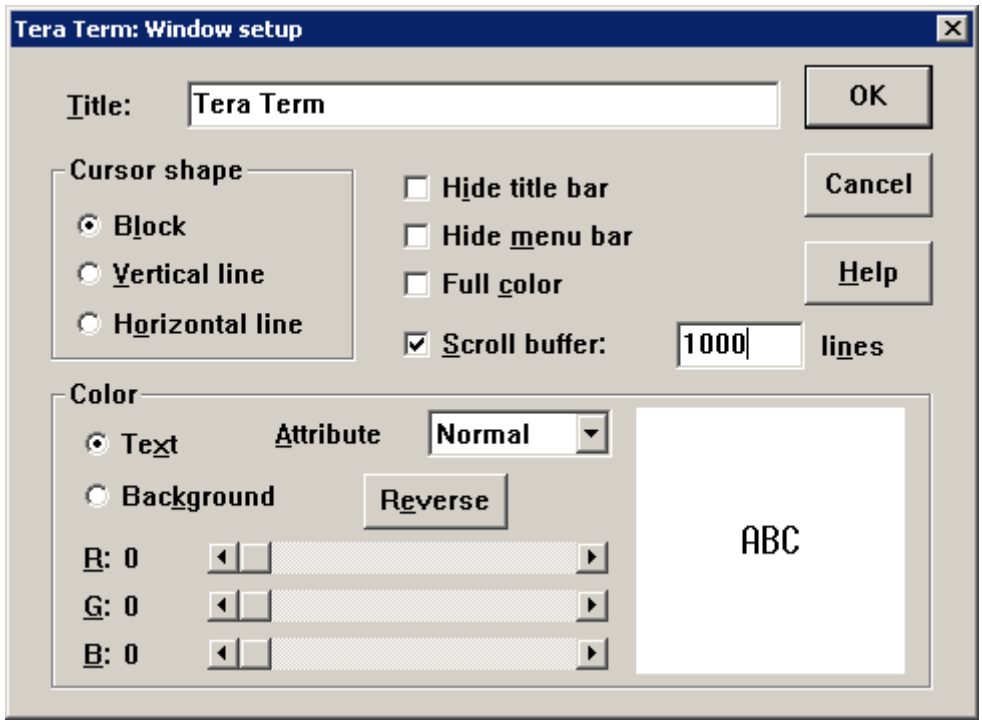
Step 4: Configure settings.

Terra Term has some settings that can be changed to make it more convenient to use. From the **Setup > Terminal** menu, check the **Term size = win size** checkbox. This setting allows command output to remain visible when the Terra Term window is resized.



Step 5: Change scroll buffer number.

From the **Setup > Window** menu, change the scroll buffer number to a number higher than 100. This setting allows you to scroll up and view previous commands and outputs. If there are only 100 lines available in the buffer, only the last 100 lines of output are visible. In the example below, the scroll buffer has been changed to 1000 lines.



Appendix 2: Configuring Tera Term as the Default Telnet Client in Windows XP

Be default, Windows may be set to use HyperTerminal as the Telnet client. Windows may also be set to use the DOS version of Telnet. In the NetLab environment, you can change the Telnet client to **Local Telnet Client**, which means that NetLab will open the current Windows default Telnet client. This may be set to HyperTerminal or to the DOS-like version of Telnet embedded in the Windows operating system.

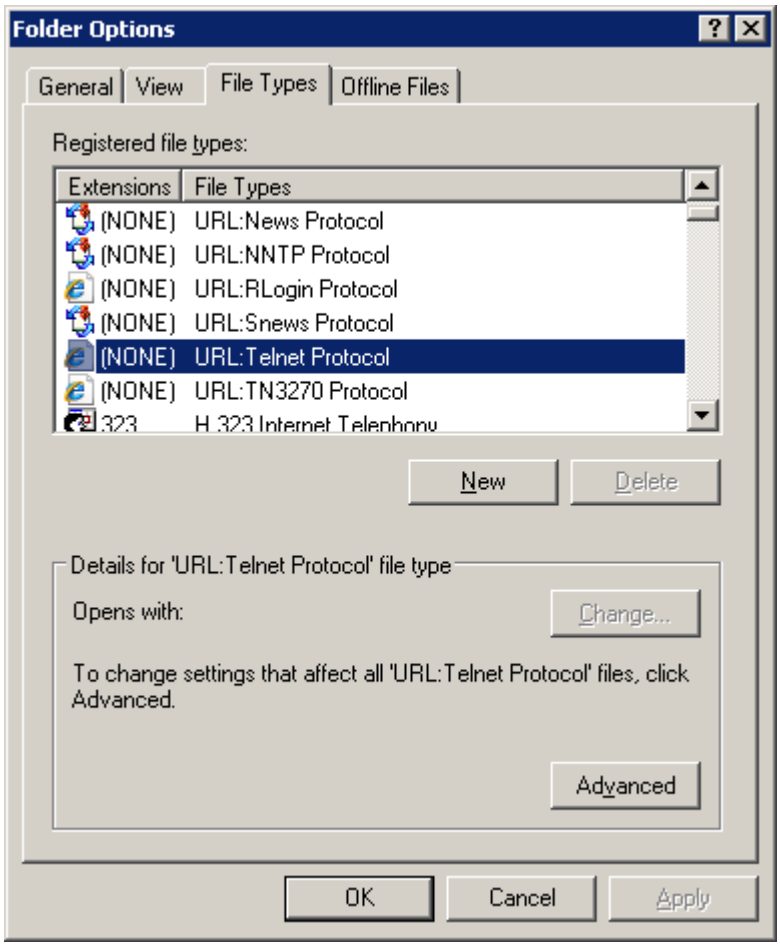
Complete the following steps to change your default Telnet client to Tera Term (or any other Telnet client):

Step 1: Go to Folder Options.

Double-click **My Computer**, and then choose **Tools > Folder Options**.

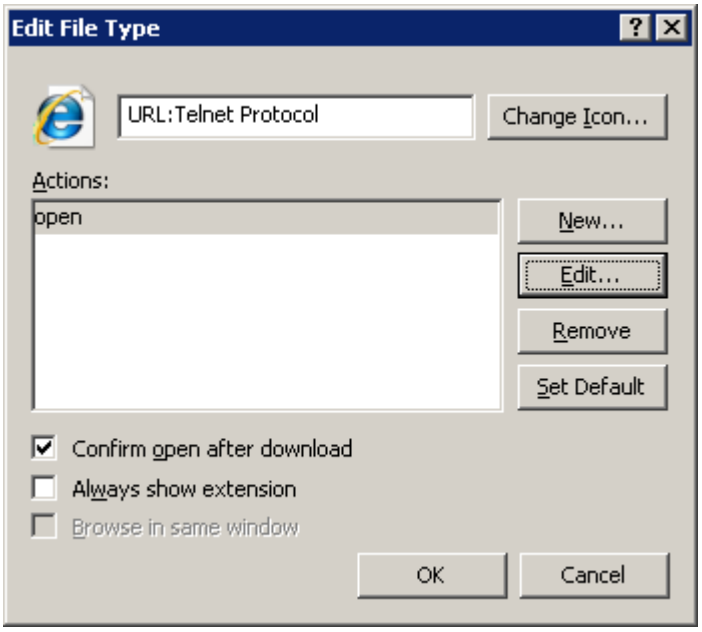
Step 2: Go to (NONE) URL:Telnet Protocol.

Click the **File Types** tab and scroll down in the list of **Registered file types:** until you find the **(NONE) URL:Telnet Protocol** entry. Select it and then click the **Advanced** button.



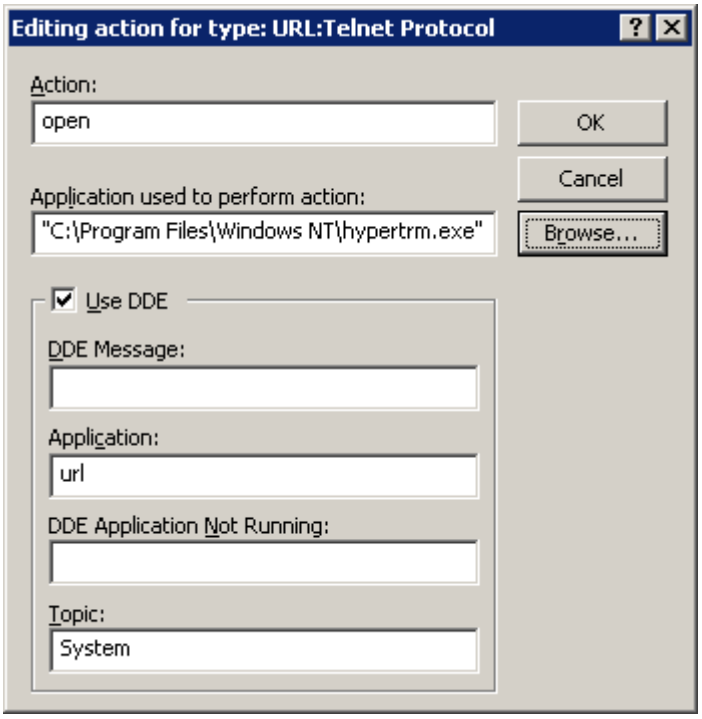
Step 3: Edit the open action.

In the **Edit File Type** dialog box, click **Edit** to edit the **open** action.



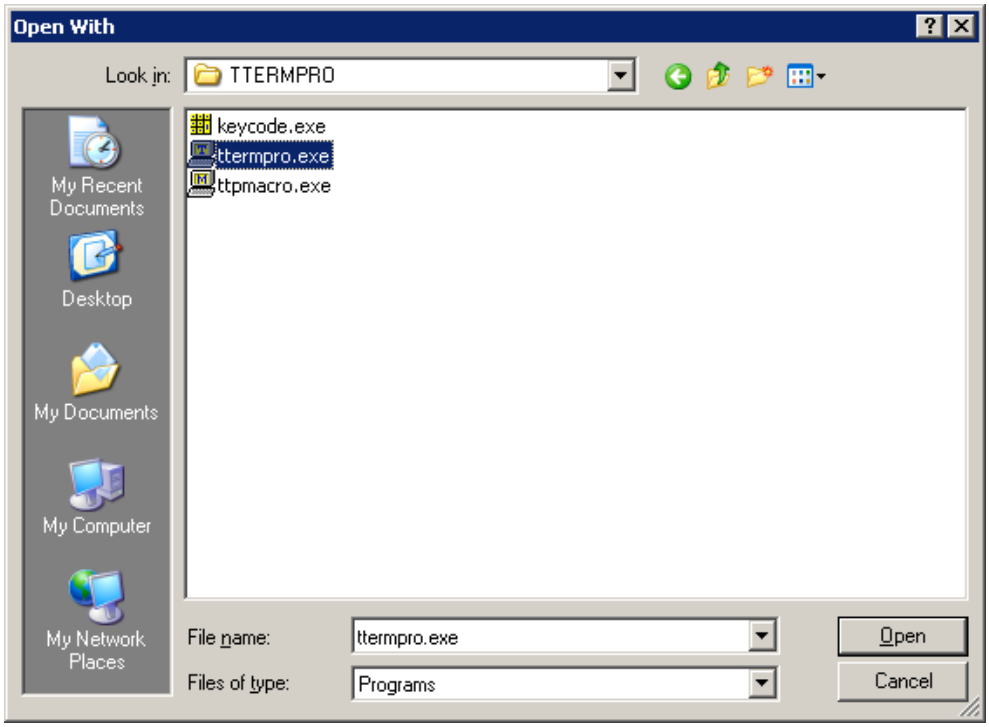
Step 4: Change the application.

In the **Editing action for type: URL: Telnet Protocol** dialog box, the **Application used to perform action** is currently set to HyperTerminal. Click **Browse** to change the application.



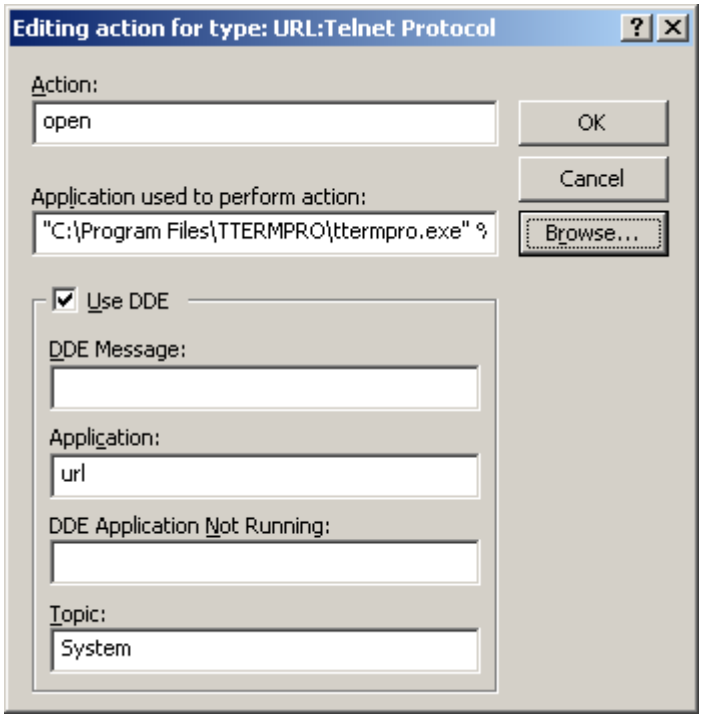
Step 5: Open ttermpro.exe.

Browse to the Tera Term installation folder. Click the ttermpro.exe file to specify this program for the **open** action, and then click **Open**.



Step 6: Confirm ttermpro.exe and close.

Click **OK** twice and then **Close** to close the **Folder Options** dialog box. The Windows default Telnet client is now set to Tera Term.

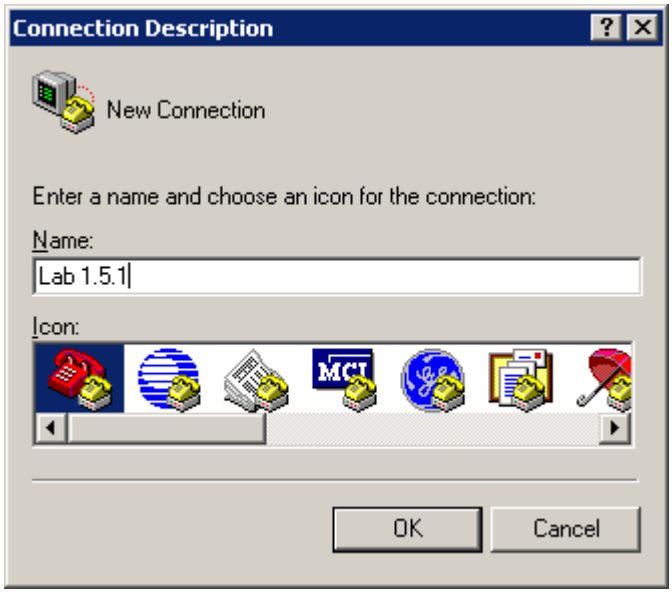


Appendix 3: Accessing and Configuring HyperTerminal

In most versions of Windows, HyperTerminal can be found by navigating to **Start > Programs > Accessories > Communications > HyperTerminal**.

Step 1: Create a new connection.

Open HyperTerminal to create a new connection to the router. Enter an appropriate description in the **Connection Description** dialog box and then click **OK**.

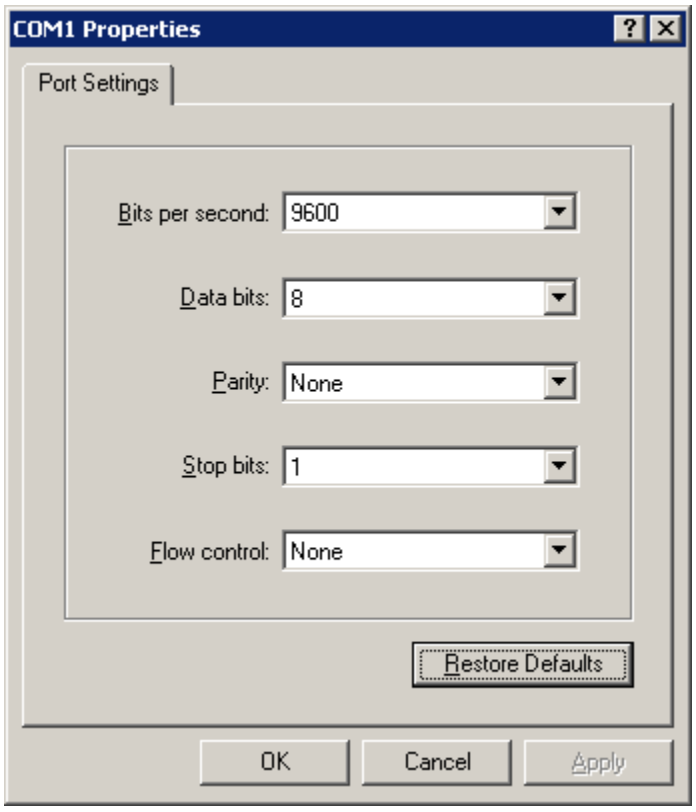


Step 2: Assign COM1 port.

On the **Connect To** dialog box, make sure the correct serial port is selected in the **Connect using** field. Some PCs have more than one COM port. Click **OK**.

Step 3: Set COM1 properties.

In the **COM1 Properties** dialog box under Port Setting, clicking **Restore Defaults** normally sets the correct properties. If not, set the properties to the values show in the following graphic, and then click OK.

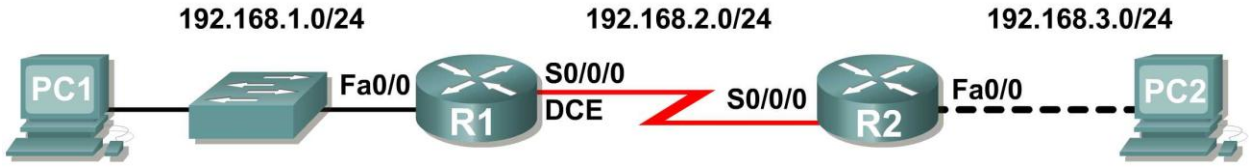


Step 4: Verify connection.

You should now have a console connection to the router. Press **Enter** to get a router prompt.

Lab 1.5.2: Basic Router Configuration (Instructor Version)

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Def. Gateway
R1	**Fa0/0**	192.168.1.1	255.255.255.0	N/A
	S0/0/0	192.168.2.1	255.255.255.0	N/A
R2	**Fa0/0**	192.168.3.1	255.255.255.0	N/A
	S0/0/0	192.168.2.2	255.255.255.0	N/A
PC1	**N/A**	192.168.1.10	255.255.255.0	192.168.1.1
PC2	**N/A**	192.168.3.10	255.255.255.0	192.168.3.1

Learning Objectives

Upon completion of this lab, you will be able to:

- Cable a network according to the Topology Diagram.
- Erase the startup configuration and reload a router to the default state.
- Perform basic configuration tasks on a router.
- Configure and activate Ethernet interfaces.
- Test and verify configurations.
- Reflect upon and document the network implementation.

Scenario

(Instructor Note: Skip this lab if the student is required to complete **Lab 1.5.1: Cabling a Network and Basic Router Configuration.**) In this lab activity, you will create a network that is similar to the one shown in the Topology Diagram. Begin by cabling the network as shown in the Topology Diagram. You will then perform the initial router configurations required for connectivity. Use the IP addresses that are provided in the Topology Diagram to apply an addressing scheme to the network devices. When the network configuration is complete, examine the routing tables to verify that the network is operating properly. This lab is a shorter version of **Lab 1.5.1: Cabling a Network and Basic Router Configuration** and assumes you are proficient in basic cabling and configuration file management.

Task 1: Cable the Network.

Cable a network that is similar to the one in the Topology Diagram. The output used in this lab is from 1841 routers. You can use any current router in your lab as long as it has the required interfaces as shown in the topology. Be sure to use the appropriate type of Ethernet cable to connect from host to switch, switch to router, and host to router. Refer to **Lab 1.5.1: Cabling a Network and Basic Router Configuration** if you have any trouble connecting the devices. Be sure to connect the serial DCE cable to router R1 and the serial DTE cable to router R2.

Answer the following questions:

What type of cable is used to connect the Ethernet interface on a host PC to the Ethernet interface on a switch? _____ Straight-through (Patch) cable_____

What type of cable is used to connect the Ethernet interface on a switch to the Ethernet interface on a router? _____ Straight-through (Patch) cable_____

What type of cable is used to connect the Ethernet interface on a router to the Ethernet interface on a host PC? _____Crossover cable_____

Task 2: Erase and Reload the Routers.

Step 1: Establish a terminal session to router R1.

Refer to Lab 1.5.1, "Cabling a Network and Basic Router Configuration," for review of terminal emulation and connecting to a router.

Step 2: Enter privileged EXEC mode.

```
Router>enable
Router#
```

Step 3: Clear the configuration.

To clear the configuration, issue the **`erase startup-config`** command. Press **Enter** when prompted to **`[confirm]`** that you really do want to erase the configuration currently stored in NVRAM.

```
Router#erase startup-config
Erasing the nvram filesystem will remove all files! Continue? [confirm]
[OK]
Erase of nvram: complete
Router#
```

Step 4: Reload configuration.

When the prompt returns, issue the **`reload`** command. Answer **no** if asked to save changes.

What would happen if you answered **yes** to the question, "`System configuration has been modified. Save?`"

_____

_____

The current running configuration would be saved to NVRAM negating the whole purpose of erasing the startup configuration. The router would bootup with a configuration.

The result should look something like this:

```
Router#reload
```



```
System configuration has been modified. Save? [yes/no]: no
Proceed with reload? [confirm]
```

Press **Enter** when prompted to **[confirm]** that you really do want to reload the router. After the router finishes the boot process, choose not to use the AutoInstall facility, as shown:

```
Would you like to enter the initial configuration dialog? [yes/no]: no
Would you like to terminate autoinstall? [yes]: [Press Return]
Press Enter to accept default.
Press RETURN to get started!
```

Step 5: Repeat Steps 1 through 4 on router R2 to remove any startup configuration file that may be present.

Task 3: Perform Basic Configuration of Router R1.

Step 1: Establish a HyperTerminal session to router R1.

Step 2: Enter privileged EXEC mode.

```
Router>enable
Router#
```

Step 3: Enter global configuration mode.

```
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
```

Step 4: Configure the router name as R1.

Enter the command **hostname R1** at the prompt.

```
Router(config)#hostname R1
R1(config)#
```

Step 5: Disable DNS lookup.

Disable DNS lookup with the **no ip domain-lookup** command.

```
R1(config)#no ip domain-lookup
R1(config)#
```

Why would you want to disable DNS lookup in a lab environment?

_____

_____

So that the router does not attempt to lookup up a DNS entry for a name that is really only a typing error.

What would happen if you disabled DNS lookup in a production environment?

_____

_____

A router would not be able to resolve names causing potential problems when the router needs an IP address for to address a packet.

Step 6: Configure the EXEC mode password.

Configure the EXEC mode password using the **enable secret** *password* command. Use **class** for the *password*.

```
R1(config)#enable secret class
R1(config)#
```

Why is it not necessary to use the **enable password** *password* command?

_____

_____

Although both passwords are listed in the configuration, the **enable secret** command overrides the **enable password** command.

Step 7: Configure a message-of-the-day banner.

Configure a message-of-the-day banner using the **banner motd** command.

```
R1(config)#banner motd &
Enter TEXT message.  End with the character '&'.
********************************
  !!!AUTHORIZED ACCESS ONLY!!!
********************************
&
R1(config)#
```

When does this banner display?

_____

When a user logins into the router either through telnet or the console connection.

Why should every router have a message-of-the-day banner?

_____

To provide a warning to intentional or unintentional unauthorized access.

Step 8: Configure the console password on the router.

Use **cisco** as the password. When you are finished, exit from line configuration mode.

```
R1(config)#line console 0
R1(config-line)#password cisco
R1(config-line)#login
R1(config-line)#exit
R1(config)#
```

Step 9: Configure the password for the virtual terminal lines.

Use **cisco** as the password. When you are finished, exit from line configuration mode.

```
R1(config)#line vty 0 4
R1(config-line)#password cisco
```



```
R1(config-line)#login
R1(config-line)#exit
R1(config)#
```

Step 10: Configure the FastEthernet0/0 interface.

Configure the FastEthernet0/0 interface with the IP address 192.168.1.1/24.

```
R1(config)#interface fastethernet 0/0
R1(config-if)#ip address 192.168.1.1 255.255.255.0
R1(config-if)#no shutdown

%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed
state to up
R1(config-if)#
```

Step 11: Configure the Serial0/0/0 interface.

Configure the Serial0/0/0 interface with the IP address 192.168.2.1/24. Set the clock rate to 64000.

Note: The purpose of the **clock rate** command is explained in Chapter 2: Static Routes.

```
R1(config-if)#interface serial 0/0/0
R1(config-if)#ip address 192.168.2.1 255.255.255.0
R1(config-if)#clock rate 64000
R1(config-if)#no shutdown
R1(config-if)#
```

Note: The interface will not be activated until the serial interface on R2 is configured and activated

Step 12: Return to privileged EXEC mode.

Use the **end** command to return to privileged EXEC mode.

```
R1(config-if)#end
R1#
```

Step 13: Save the R1 configuration.

Save the R1 configuration using the **copy running-config startup-config** command.

```
R1#copy running-config startup-config
Building configuration...
[OK]
R1#
```

What is a shorter version of this command? _____**copy run start**_____

Task 4: Perform Basic Configuration of Router R2.

Step 1: For R2, repeat Steps 1 through 9 from Task 3.

Step 2: Configure the Serial 0/0/0 interface.

Configure the Serial 0/0/0 interface with the IP address 192.168.2.2/24.

```
R2(config)#interface serial 0/0/0
```



```
R2(config-if)#ip address 192.168.2.2 255.255.255.0
R2(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state
to up
R2(config-if)#
```

Step 3: Configure the FastEthernet0/0 interface.

Configure the FastEthernet0/0 interface with the IP address 192.168.3.1/24.

```
R2(config-if)#interface fastethernet 0/0
R2(config-if)#ip address 192.168.3.1 255.255.255.0
R2(config-if)#no shutdown

%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed
state to up
R2(config-if)#
```

Step 4: Return to privileged EXEC mode.

Use the **end** command to return to privileged EXEC mode.

```
R2(config-if)#end
R2#
```

Step 5: Save the R2 configuration.

Save the R2 configuration using the **copy running-config startup-config** command.

```
R2#copy running-config startup-config
Building configuration...
[OK]
R2#
```

Task 5: Configure IP Addressing on the Host PCs.

Step 1: Configure the host PC1.

Configure the host PC1 that is attached to R1 with an IP address of 192.168.1.10/24 and a default gateway of 192.168.1.1.

Step 2: Configure the host PC2.

Configure the host PC2 that is attached to R2 with an IP address of 192.168.3.10/24 and a default gateway of 192.168.3.1.

Task 6: Verify and Test the Configurations.

Step 1: Verify that routing tables have the following routes using the `show ip route` command.

The **show ip route** command and output will be thoroughly explored in upcoming chapters. For now, you are interested in seeing that both R1 and R2 have two routes. Both routes are designated with a **C**. These are the directly connected networks that were activated when you configured the interfaces on each router. If you do not see two routes for each router as shown in the following output, proceed to Step 2.


```
R1#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

C    192.168.1.0/24 is directly connected, FastEthernet0/0
C    192.168.2.0/24 is directly connected, Serial0/0/0
R1#

R2#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

C    192.168.2.0/24 is directly connected, Serial0/0/0
C    192.168.3.0/24 is directly connected, FastEthernet0/0
R2#
```

Step 2: Verify interface configurations.

Another common problem is router interfaces that are not configured correctly or not activated. Use the **show ip interface brief** command to quickly verify the configuration of each router's interfaces. Your output should look similar to the following:

```
R1#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        192.168.1.1     YES manual up                    up
FastEthernet0/1        unassigned      YES unset  administratively down down
Serial0/0/0              192.168.2.1     YES manual up                    up
Serial0/0/1              unassigned      YES unset  administratively down down
Vlan1                    unassigned      YES manual administratively down down

R2#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        192.168.3.1     YES manual up                    up
FastEthernet0/1        unassigned      YES unset  administratively down down
Serial0/0/0              192.168.2.2     YES manual up                    up
Serial0/0/1              unassigned      YES unset  down                  down
Vlan1                    unassigned      YES manual administratively down down
```

If both interfaces are **up** and **up**, then both routes will be in the routing table. Verify this again by using the **show ip route** command.

Step 3: Test connectivity.

Test connectivity by pinging from each host to the default gateway that has been configured for that host.

From the host attached to R1, is it possible to ping the default gateway? _____Yes_____

From the host attached to R2, is it possible to ping the default gateway? _____Yes_____

If the answer is **no** for any of the above questions, troubleshoot the configurations to find the error using the following systematic process:

1. Check the PCs.

   Are they physically connected to the correct router? (Connection could be through a switch or directly.) _____ Yes _____

   Are link lights blinking on all relevant ports? _____ Yes _____

2. Check the PC configurations.

   Do they match the Topology Diagram? _____ Yes _____

3. Check the router interfaces using the **`show ip interface brief`** command.

   Are the interfaces **up** and **up**? _____ Yes _____

If your answer to all three steps is **yes**, then you should be able to successfully ping the default gateway.

Step 4: Test connectivity between router R1 and R2.

From the router R1, is it possible to ping R2 using the command **`ping 192.168.2.2`**? ____ Yes ____

From the router R2, is it possible to ping R1 using the command **`ping 192.168.2.1`**? ____ Yes ____

If the answer is **no** for the questions above, troubleshoot the configurations to find the error using the following systematic process:

1. Check the cabling.

   Are the routers physically connected? ____ Yes ____

   Are link lights blinking on all relevant ports? ____ Yes ____

2. Check the router configurations.

   Do they match the Topology Diagram? ____ Yes ____

   Did you configure the **`clock rate`** command on the DCE side of the link? ____ Yes ____

3. Check the router interfaces using the **`show ip interface brief`** command.

   Are the interfaces “up” and “up”? ____ Yes ____

If your answer to all three steps is **yes**, then you should be able to successfully ping from R2 to R1 and from R2 to R3.

Task 7: Reflection

Step 1: Attempt to ping from the host connected to R1 to the host connected to R2.

This ping should be unsuccessful.

Step 2: Attempt to ping from the host connected to R1 to router R2.

This ping should be unsuccessful.

Step 3: Attempt to ping from the host connected to R2 to router R1.

This ping should be unsuccessful.

What is missing from the network that is preventing communication between these devices?

_____

_____

After reading the chapter text, the student should be able to state that this network is missing either static or dynamic routing (or both!).

Task 8: Documentation

On each router, capture the following command output to a text (.txt) file and save for future reference.

- **`show running-config`**
- **`show ip route`**
- **`show ip interface brief`**

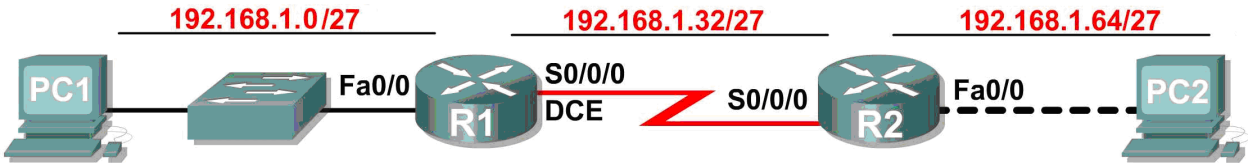
If you need to review the procedures for capturing command output, refer to Lab 1.5.1, “Cabling a Network and Basic Router Configuration.”

Task 9: Clean Up

Erase the configurations and reload the routers. Disconnect and store the cabling. For PC hosts that are normally connected to other networks (such as the school LAN or to the Internet), reconnect the appropriate cabling and restore the TCP/IP settings.

Lab 1.5.3: Challenge Router Configuration (Instructor Version)

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	Fa0/0	192.168.1.1	255.255.255.224	N/A
	S0/0/0	192.168.1.33	255.255.255.224	N/A
R2	Fa0/0	192.168.1.65	255.255.255.224	N/A
	S0/0/0	192.168.1.62	255.255.255.224	N/A
PC1	NIC	192.168.1.30	255.255.255.224	192.168.1.1
PC2	NIC	192.168.1.94	255.255.255.224	192.168.1.65

Learning Objectives

Upon completion of this lab, you will be able to:

- Subnet an address space given requirements.
- Assign appropriate addresses to interfaces and document.
- Cable a network according to the Topology Diagram.
- Erase the startup configuration and reload a router to the default state.
- Perform basic configuration tasks on a router.
- Configure and activate Serial and Ethernet interfaces.
- Test and verify configurations.
- Reflect upon and document the network implementation.

Scenario

In this lab activity, you will design and apply an IP addressing scheme for the topology shown in the Topology Diagram. You will be given one class C address that you must subnet to provide a logical addressing scheme for the network. You must first cable the network as shown before the configuration can begin. Once the network is cabled, configure each device with the appropriate basic configuration commands. The routers will then be ready for interface address configuration according to your IP addressing scheme. When the configuration is complete, use the appropriate IOS commands to verify that the network is working properly.

Note: Use classful subnetting for this lab.

Task 1: Subnet the Address Space.

Step 1: Examine the network requirements.

You have been given the 192.168.1.0/24 address space to use in your network design. The network consists of the following segments:

- The network connected to router R1 will require enough IP addresses to support 20 hosts.
- The network connected to router R2 will require enough IP addresses to support 20 hosts.
- The link between router R1 and router R2 will require IP addresses at each end of the link.

(**Note:** Remember that the interfaces of network devices are also host IP addresses and are included in the above addressing scheme.)

Step 2: Consider the following questions when creating your network design.

How many subnets are needed for this network? _____

3

What is the subnet mask for this network in dotted decimal format? _____

255.255.255.224

What is the subnet mask for the network in slash format? _____

/27

How many usable hosts are there per subnet? _____

30

Step 3: Assign subnetwork addresses to the Topology Diagram.

1. Assign the first subnet (lowest subnet) to the network attached to R1.
2. Assign the second subnet to the link between R1 and R2.
3. Assign the third subnet to the network attached to R2.

Task 2: Determine Interface Addresses.

Step 1: Assign appropriate addresses to the device interfaces.

1. Assign the first valid host address in first subnet to the LAN interface on R1.
2. Assign the last valid host address in first subnet to PC1.
3. Assign the first valid host address in second subnet to the WAN interface on R1.
4. Assign the last valid host address in second subnet to the WAN interface on R2.
5. Assign the first valid host address in third subnet to the LAN interface of R2.
6. Assign the last valid host address in third subnet to PC2.

Note: The fourth (highest) subnet is not required in this lab.

Step 2: Document the addresses to be used in the table provided under the Topology Diagram.

Task 3: Prepare the Network

Step 1: Cable a network that is similar to the one in the Topology Diagram.

You can use any current router in your lab as long as it has the required interfaces as shown in the topology.

Step 2: Clear any existing configurations on the routers.

Task 4: Perform Basic Router Configurations.

Perform basic configuration of the R1 and R2 routers according to the following guidelines:

1. Configure the router hostname.
2. Disable DNS lookup.
3. Configure an EXEC mode password.
4. Configure a message-of-the-day banner.
5. Configure a password for console connections.
6. Configure a password for VTY connections.

Task 5: Configure and Activate Serial and Ethernet Addresses.

Step 1: Configure the router interfaces.

Configure the interfaces on the R1 and R2 routers with the IP addresses from your network design. When you have finished, be sure to save the running configuration to the NVRAM of the router.

Step 2: Configure the PC interfaces.

Configure the Ethernet interfaces of PC1 and PC2 with the IP addresses and default gateways from your network design.

Task 6: Verify the Configurations.

Answer the following questions to verify that the network is operating as expected.

From the host attached to R1, is it possible to ping the default gateway? _____

From the host attached to R2, is it possible to ping the default gateway? _____

From the router R1, is it possible to ping the Serial 0/0/0 interface of R2? _____

From the router R2, is it possible to ping the Serial 0/0/0 interface of R1? _____

Answers: All answers should be **yes**.

The answer to the above questions should be **yes**. If any of the above pings failed, check your physical connections and configurations. If necessary, refer to Lab 1.5.2, “Basic Router Configuration.”

What is the status of the FastEthernet 0/0 interface of R1? _____

What is the status of the Serial 0/0/0 interface of R1? _____

What is the status of the FastEthernet 0/0 interface of R2? _____

What is the status of the Serial 0/0/0 interface of R2? _____

All interfaces should be **up** and **up**.

What routes are present in the routing table of R1?

_____

_____

C 192.168.1.32 is directly connected, Serial0/0/0

C 192.168.1.0 is directly connected, FastEthernet0/0

What routes are present in the routing table of R2?

_____

_____

C 192.168.1.64 is directly connected, FastEthernet0/0

C 192.168.1.32 is directly connected, Serial0/0/0

Task 7: Reflection

Are there any devices on the network that cannot ping each other?

_____

_____

R1 cannot ping the FastEthernet interface on R2.

What is missing from the network that is preventing communication between these devices?

_____

_____

After reading the chapter text, the student should be able to state that this network is missing either static or dynamic routing (or both!).

Task 8: Document the Router Configurations.

On each router, capture the following command output to a text (.txt) file and save for future reference.

- Running configuration
- Routing table
- Summary of status information for each interface

