



# ICND2

## Lab Guide

**640-816**

Interconnecting Cisco Networking Devices Part 2

Version: Beta

Labs powered by

**NetSim**<sup>®</sup>  
NETWORK SIMULATOR<sup>®</sup>



# *Interconnecting Cisco Networking Devices Part 2*

*640-816 Lab Guide*



25 Century Blvd. Ste. 500  
Nashville, TN 37214  
[www.boson.com](http://www.boson.com)

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## Boson NetSim Overview

The Boson NetSim<sup>®</sup> Network Simulator<sup>®</sup>, which includes the Boson Router Simulator<sup>®</sup>, is unique compared to all others on the market because of the functionality it supports and its features. NetSim utilizes Boson's proprietary Network Simulator, Router Simulator<sup>®</sup>, and EROUTER<sup>®</sup> software technologies, along with the Boson Virtual Packet Technology<sup>®</sup> engine, to create individual packets. These packets are routed and switched through the simulated network, allowing NetSim to build an appropriate virtual routing table and simulate true networking. Other simulation products on the market do not support this level of functionality.

NetSim is a Windows<sup>®</sup>-based product that simulates a wide variety of Cisco<sup>®</sup> routers, including the 2500 series, 2600 series, 2800 series, and 3600 series routers, as well as the Cisco Catalyst 1900 series, 2900 series, and 3500 series switches. NetSim supports multiple routing protocols, including RIP, IGRP, EIGRP, BGP, and OSPF. It supports different LAN/WAN protocols, including PPP/CHAP, ISDN, and Frame Relay. The labs in NetSim require only the devices and functionality included with NetSim—they do not require access to any external router or switch hardware. NetSim supports many, but not all, of the IOS commands available on a physical router or switch. All the commands referenced in the available labs are supported by NetSim. The labs included in this book have been selected as companions to the Boson Curriculum. However, you can perform any labs that are unlocked for additional practice.

Achieving Cisco CCENT<sup>®</sup>, CCNA<sup>®</sup>, or CCNP<sup>®</sup> certification is the goal of many people who use this product. The Boson NetSim covers not only the new SWITCH (642-813), TSHOOT (642-832), and ROUTE (642-902) certifications but also the ICND1 (640-822), ICND2 (640-816), and CCNA (640-802) certifications, among others. The included labs guide you through the configuration of routers, switches, and workstations in a variety of scenarios. Installed labs are made available (unlocked) depending on the activation key used to activate the product. All labs are downloaded and kept up to date after installation regardless of the activation key used.

Activation keys unlock labs and increase the number of available commands. Beginning with the Demo version of NetSim 8, the command set is limited to those necessary to perform the steps in the lab. For example, if you start your studies with a CCENT activation key, you will have the command set and labs available that are necessary to study for that exam. When you are ready to study for either the CCNA or CCNP exam, you will need to purchase a new activation key, deactivate NetSim, and then reactivate with the new CCNA or CCNP activation key; then, more labs and a larger command set become available.

A small lock icon is displayed next to unavailable labs. Higher-level activation keys allow you to work through all labs unlocked by lower-level activation keys. All labs are unlocked when a CCNP-level activation key is used.

After you load and complete an unlocked lab, you can use the grading function in NetSim to grade the lab so that you can determine whether you completed it correctly. As you progress through the labs, you will master the skills needed to pass the simulation questions in the Cisco certification exams. NetSim has the ability to guide and grade, and using it for practice can actually be more helpful than using real routers and switches. NetSim allows you to gain experience without requiring you to purchase expensive equipment.

The Boson NetSim can be used for additional purposes than only working through labs. The included full version of the **NetMap** tool allows you to practice designing and planning a network. This tool's functionality goes beyond that of most tools because you can actually create the router configurations that are going to be used, save those configurations, and practice using them on simulated devices.

Routing protocol implementation is one of the more challenging tasks you may encounter. Troubleshooting a production network can be a frustrating experience. Fortunately, you can **create a virtual copy of your network topology** by using the Boson NetMap and troubleshoot the problems without interfering with your production network. Although you can use NetSim as an aid in troubleshooting, you should not rely only on NetSim to make decisions about a production network, because NetSim is not designed to test real networks. Instead, it is a tool that you can use to study for Cisco certification.

In summary, Boson NetSim is a flexible and powerful product that can help you become certified and, in some cases, can be used to create a simulation of the topology of your corporate network and help you practice troubleshooting without using devices on the production network.

### Using NetSim to Prepare for Your Certification

By incorporating NetSim as part of your process of achieving a Cisco certification, you can learn and master the skills necessary to help you successfully complete your certification track. The purpose of NetSim is to help you with the practical, hands-on portion of your education and to ensure that you not only understand the concepts of routing but can actually configure and implement routing on Cisco devices.

Mastering Cisco networking involves two fundamental tasks:

1. Learn the theory of routers and switches.
2. Gain the hands-on experience of implementing that theory by configuring the devices in a network and testing them in a lab.

Self-studying for a Cisco certification can be a daunting task. The amount of information a CCNA candidate is required to know and the skills that candidate is required to possess are quite extensive. To begin learning the theory of configuring a network, you can find a good reference book or listen to an instructor. But a reference book might not be enough. The book will not give you the practical, hands-on experience of routing and switching that you can learn from NetSim—experience that will help you build on the theoretical knowledge you learned from the reference book.

Real equipment gives you the ability to practice on actual routers and switches, but it also is a very costly way to practice and leaves a lot of room for error. The Boson NetSim, on the other hand, is an excellent tool to help you prepare for the CCNA ([www.boson.com/certification/CCNA](http://www.boson.com/certification/CCNA)) and CCNP ([www.boson.com/certification/CCNP](http://www.boson.com/certification/CCNP)) exams. NetSim simulates the behavior of a network and does not just return preprogrammed responses to expected command inputs. It allows you to create virtual packets and virtual frames that will be routed and switched through the simulated network. Aside from physically plugging in the cables and listening to the fan noise, your experience with the simulated network will be much the same as your experience with a fully functional lab rack without the expense of the hardware. NetSim will enable you to practice various configurations and master helpful skills.

Once you feel you have mastered the theory and the practical labs, you can test your knowledge by using the Boson ExSim-Max practice exam products available at the ExSim-Max home page ([www.boson.com/exsim-max-practice-exams](http://www.boson.com/exsim-max-practice-exams)). Boson ExSim-Max practice exam products can include complex multiple-choice questions, drag-and-drop questions, Boson NetSimX simulation questions, and trouble tickets which simulate the questions you will see on the live exam.



The Boson NetSim Network Simulator is the most comprehensive product on the market for learning how to configure a Cisco router. The Boson NetSim will not only help you become certified, it will actually help you learn and understand how to configure routers, switches, and networks.

For more information on how to use NetSim 8, please read the NetSim 8 User Manual by clicking **Help > User Manual** from within NetSim 8 or by downloading the User Manual from the following link:

<http://www.boson.com/Files/Support/NetSim-8-User-Manual.pdf>

## Accessing NetSim 8 in the Classroom – Boson LS Client

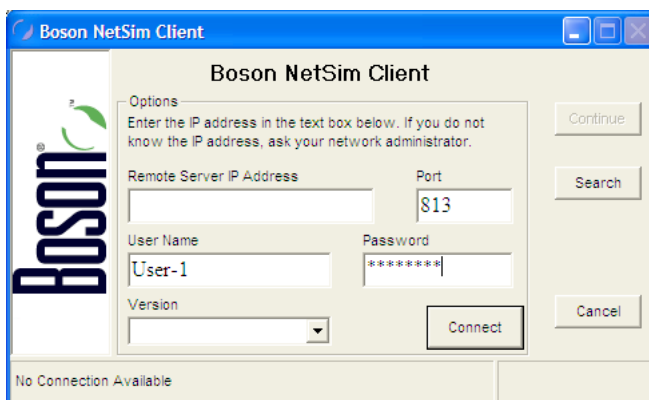
If you are using NetSim 8 in the classroom, it should already be installed on your classroom workstation. You should perform the following steps to configure NetSim 8 to access the NetSim License Server.

As a student using NetSim 8 at a learning institution, you should launch NetSim 8 from the Start menu by clicking **Boson Software > Boson NetSim 8.0 > Boson NetSim LS Client**. This will enable you to configure NetSim 8 to authenticate with the Boson NetSim License Server.

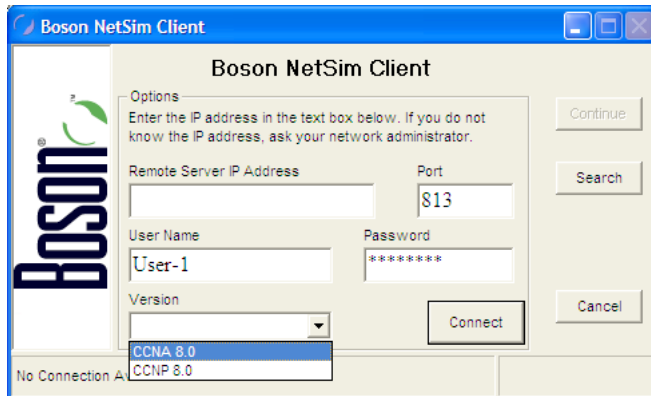
### Configuring NetSim 8 to Authenticate with the Boson NetSim License Server

**Note:** Prior to using the Boson NetSim Client, you may need to associate your Boson.com account information with Boson NetSim. If you receive an activation key from your learning institution, activate Boson NetSim on your personal computer after creating a Boson.com account. Your network administrator/instructor can then add you as an authorized user to the license server application. You may need to provide your learning institution with the e-mail address associated with your Boson.com account. You should not give your Boson.com account password to your instructor or learning institution. Your instructor will assign you a password that he or she has configured on the License Server, which you will need for step 3 below.

1. Run the Boson NetSim LS Client by clicking **Start > All Programs > Boson Software > Boson NetSim 8 > Boson NetSim LS Client**.
2. In the **Boson NetSim - License Agreement** dialog box, select **Yes** to agree to the **Authorized User Agreement**. If you do not agree to the Authorized User Agreement, you will not be able to use the Boson NetSim 8 client.
3. Your instructor will provide you with the settings you need to enter in the **Boson NetSim Client** dialog box. Enter the IP address (or computer name if the client computer and the license server are on a Windows-based network) and the port number of the computer running the NetSim License Server software. Enter the user name/password combination for authentication to the server. The user name will be the login information you used to establish an account with Boson.com, or the user name provided by your instructor. Enter the password assigned to you by your network administrator/instructor.



4. Select either **CCNA 8.0** or **CCNP 8.0** from the **Version** drop-down list; the version you select must match the version that is the current license type configured on the NetSim License Server.



5. Click **Connect**.
6. If a license is available on the license server, the **Continue** button will be enabled. Click the **Continue** button to start using the Boson NetSim.

For additional information on using Boson NetSim 8, please consult the Boson NetSim 8 User Manual on Boson.com or click **Help > User Manual**.

### Loading a Lab

1. You can begin a preloaded Boson NetSim lab by performing one of the following tasks:
  - Expand the **Labs** panel; then, on the **Standard Lab Packs** tab of the **Labs** panel, double-click the lab you want to open.
  - Click to highlight a lab, then click **Lab > Load**.
  - Select a lab from the list of **Recent Labs** on the **Home** tab, and click **Yes** to open the lab.
2. After you have loaded a lab, click the **Lab Instructions** tab on the **Home** panel and read through the lab instructions.
3. From the **Devices** drop-down menu on the **Consoles** panel, select the device(s) that you need to configure in order to complete the lab and follow the steps in the lab. You can also select the device you want to configure by clicking the **NetMap** tab, right-clicking the device, and selecting **Configure in Simulator**.
4. When you have completed the lab, click **Lab > Grade Lab** to ensure that you have completed it successfully.
5. You can choose to save your single device configuration or multiple device configurations by selecting the appropriate option in the **Console** menu.

You might also be instructed to open labs from a custom lab pack. If any custom labs are available, they will be on the **Custom Lab Packs** tab of the **Labs** panel. To open a custom lab, double-click the lab you want to load.

## Using NetSim 8 at Home – Single User

The following steps are for installation and activation for a single user license and should not be performed on a classroom workstation.

### Downloading and Installing NetSim 8

You can download NetSim 8 from the Boson.com downloads page (account required):

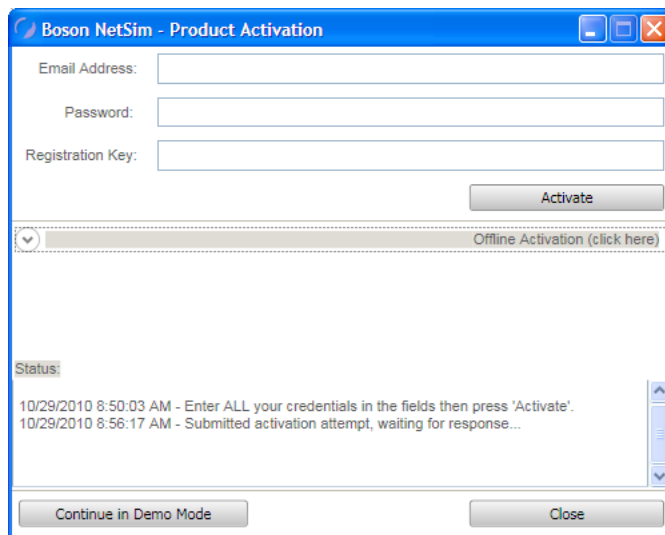
<http://www.boson.com/download>

You must have a Boson account to download the NetSim Demo. To create a free account, visit the Boson Online Account page (<https://www.boson.com/acocunt/default.aspx>) and enter a valid e-mail address to begin creating an account.

You should download the NetSim 8 installer to your computer before beginning the installation. It is recommended that you disable antivirus and firewall software while installing and activating NetSim 8 and then reactivate when the installation is complete. Double-click the downloaded installation file to begin the installation, and perform the steps described in the prompts during installation.

### Activating NetSim 8 – Single User

When you first open NetSim, you will be presented with a **Product Activation** dialog box. Enter your e-mail address, password, and registration key; this information should be in the purchase receipt you received via e-mail, or you can find the receipt online on your Boson Online Account page (<https://www.boson.com/Account/Default.aspx>). If you are a student, you might receive this information from your learning institution or your instructor. You must have an active Internet connection in order to activate the full version of NetSim.



After a successful activation, the lab packs will be updated and NetSim will be ready for you to use. Installed labs are made available (unlocked) depending on the activation key used to activate the product. A small lock icon is displayed next to unavailable labs. To make additional labs available, you will need to purchase a new activation key, deactivate NetSim, and then reactivate with the new activation key; then, more labs and a larger command set become available. Please review the steps to deactivate NetSim 8 in the NetSim 8 User Manual.

If you have not purchased an activation key for NetSim or received an activation key from your learning institution, you will not be able to activate the full version of NetSim on your personal computer. However, you can choose to continue in Demo mode. When you are running the Demo mode, only the demo lab and a limited set of commands are functional. To purchase the full version of NetSim, visit the About NetSim page ([www.boson.com/support/netsim-support-topics](http://www.boson.com/support/netsim-support-topics)) of our Web site.

## Loading a Lab

You can open NetSim from the shortcut installed during the download or from the Start menu by clicking **Boson Software > Boson NetSim 8.0 > Boson NetSim**. If you are a student using NetSim 8 at a learning institution, you should launch NetSim 8 from the Start menu by clicking **Boson Software > Boson NetSim 8.0 > Boson NetSim LS Client**. This will enable you to configure NetSim 8 to authenticate with the Boson NetSim License Server.

1. You can begin a preloaded Boson NetSim lab by performing one of the following tasks:
  - Expand the **Labs** panel; then, on the **Standard Lab Packs** tab of the **Labs** panel, double-click the lab you want to open.
  - Click to highlight a lab, then click **Lab > Load**.
  - Select a lab from the list of **Recent Labs** on the **Home** tab, and click **Yes** to open the lab.
2. After you have loaded a lab, click the **Lab Instructions** tab on the **Home** panel and read through the lab instructions.
3. From the **Devices** drop-down menu on the **Consoles** panel, select the device(s) that you need to configure in order to complete the lab and follow the steps in the lab. You can also select the device you want to configure by clicking the **NetMap** tab, right-clicking the device, and selecting **Configure in Simulator**.
4. When you have completed the lab, click **Lab > Grade Lab** to ensure that you have completed it successfully.
5. You can choose to save your single device configuration or multiple device configurations by selecting the appropriate option in the **Console** menu.

You might also be instructed to open labs from a custom lab pack. If any custom labs are available, they will be on the **Custom Lab Packs** tab of the **Labs** panel. To open a custom lab, double-click the lab you want to load.



# Module 1

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**Stand-Alone Lab:** Configuring Router Interfaces  
**Stand-Alone Lab:** Testing Connectivity with Traceroute

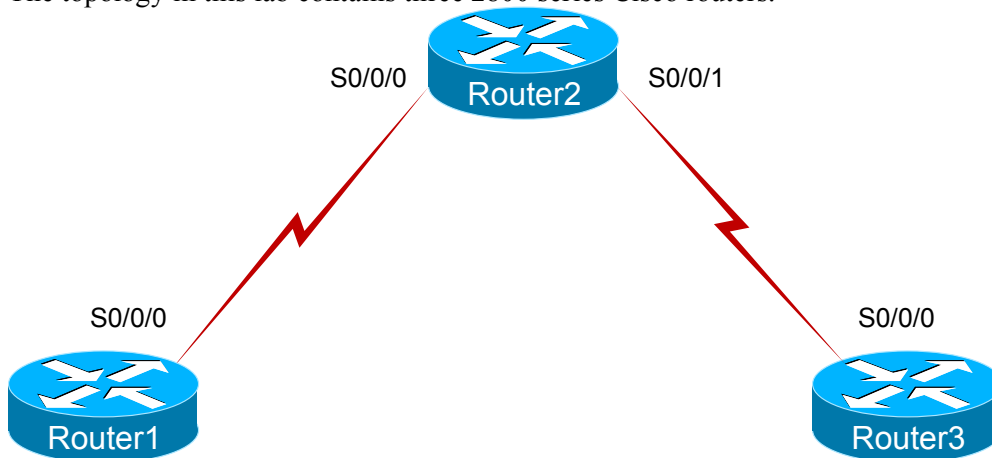
# Stand-Alone Lab: Configuring Router Interfaces

## Objective

Configure the interfaces on a router, and learn what is required for the interface to be up. Configure all three routers with the appropriate settings.

## Lab Topology

The topology in this lab contains three 2800 series Cisco routers.



## Command Summary

Command	Description
<b>clock rate</b> <i>clock-rate</i>	sets the clock rate for a Data Communications Equipment (DCE) interface
<b>configure terminal</b>	enters global configuration mode from privileged EXEC mode
<b>description</b> <i>description-text</i>	assigns a description to an interface, a class map, or a policy map
<b>enable</b>	enters privileged EXEC mode
<b>end</b>	ends and exits configuration mode
<b>exit</b>	exits one level in the menu structure
<b>hostname</b> <i>host-name</i>	sets the device name
<b>interface</b> <i>type number</i>	changes from global configuration mode to interface configuration mode
<b>ip address</b> <i>ip-address subnet-mask</i>	assigns an IP address to an interface
<b>ip host</b> <i>host-name ip-address</i>	configures a static host name-to-address mapping in the host cache of a device
<b>no shutdown</b>	enables an interface
<b>ping</b> <i>ip-address</i>	sends an Internet Control Message Protocol (ICMP) echo request to the specified address
<b>show cdp neighbors</b>	displays information about directly connected Cisco devices



Command	Description
<b>show interfaces</b> [ <i>type number</i> ]	displays statistics for all interfaces configured on the router
<b>show ip interface</b>	displays IP information for an interface
<b>show ip interface brief</b>	displays a brief summary of interface status and configuration
<b>show running-config</b>	displays the active configuration file

The IP addresses and subnet masks used in this lab are shown in the table below:

## IP Addresses

Device	Interface	IP Address	Subnet Mask
Router1	Serial 0/0/0	10.1.1.1	255.255.255.0
Router2	Serial 0/0/0	10.1.1.2	255.255.255.0
	Serial 0/0/1	172.16.10.2	255.255.255.0
Router3	Serial 0/0/0	172.16.10.1	255.255.255.0

## Lab Tasks

### Task 1: Load the Initial Network Configuration

Make sure that the correct topology and configuration files for this lab are loaded. This will occur automatically when you load this lab by using the Lab Navigator.

### Task 2: Enable Router Interfaces

1. On Router1, issue the commands necessary to enter global configuration mode and configure a host name of **Router1**.

```
Router>enable
Router#configure terminal
Router(config)#hostname Router1
```

2. Enter interface configuration mode for the Serial 0/0/0 interface.

```
Router1(config)#interface serial 0/0/0
```

3. Display all the commands available in interface configuration mode by typing ?.

```
Router1(config-if)#?
auto          Configure Automation
backup        Modify backup parameters
bandwidth     Set bandwidth informational parameter
cdp           CDP interface subcommands
clock         Configure serial interface clock
compress      Set serial interface for compression
crypto        Encryption/Decryption commands
custom-queue-list Assign a custom queue list to an interface
description   Interface specific description
encapsulation Set encapsulation type for an interface
end           Exit Configuration Mode
exit          Exit from interface configuration mode
fair-queue    Enable Fair Queuing on an Interface
frame-relay   Set frame relay parameters
interface     Select an interface to configure
ip            Interface Internet Protocol config commands
ipv6          IPv6 interface subcommands
ipx           Novell/IPX interface subcommands
isis          IS-IS commands
keepalive     Enable keepalive
mpls          Configure MPLS interface parameters
ppp           Point-to-Point Protocol
service-policy Configure QoS Service Policy
--MORE--
<output omitted>
```

4. Issue the **no shutdown** command on Router1's Serial 0/0/0 interface to enable the interface. The **shutdown** command shuts down the selected interface. You can often achieve the opposite of a command by typing **no** in front of it. Why does the state of the interface change to up and then down after you issue the **no shutdown** command? \_\_\_\_\_

```
Router1(config-if)#no shutdown
```

5. Add a description for this interface.

```
Router1(config-if)#description Serial 0/0/0 interface on Router1
```

6. To view the interface description, return to privileged EXEC mode and issue the **show interfaces serial 0/0/0** command. You should see the description under Serial 0/0/0.

```
Router1(config-if)#end
Router1#show interfaces serial 0/0/0
Serial0/0/0 is down, line protocol is down
  Hardware is HD64570
  Description: Serial 0/0/0 interface on Router1
  MTU 1500 bytes, BW 1544 Kbit, DLY 2000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input 00:00:00, output 00:00:00, output hang never
  Last clearing of show interface counters never
  Queuing strategy: weighted-fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
    Conversations 7/35/128 (active/max active/max total)
    Reserved Conversations 0/0 (allocated/max allocated)
    Available Bandwidth 1158 kilobits/sec
  5 minute input rate 1000 bits/sec, 2 packets/sec
  5 minute output rate 1000 bits/sec, 2 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
    packets output, 0 bytes, 0 underruns
    0 output errors, 0 collisions, 0 interface resets
    0 babbles, 0 late collision, 0 deferred
    0 lost carrier, 0 no carrier
    0 output buffer failures, 0 output buffers swapped out
```

7. Connect to Router2, and assign it a host name of **Router2**.

```
Router>enable
Router#configure terminal
Router(config)#hostname Router2
```

8. On Router2, access the Serial 0/0/0 and the Serial 0/0/1 interfaces, enable the interfaces, and add a description. Why does Serial 0/0/0 interface's state change to up and then down, even though the interface on Router1 is enabled? \_\_\_\_\_

```
Router2(config)#interface serial 0/0/0
Router2(config-if)#no shutdown
Router2(config-if)#description Serial 0/0/0 interface on Router2
Router2(config-if)#interface serial 0/0/1
Router2(config-if)#no shutdown
Router2(config-if)#description Serial 0/0/1 interface on Router2
```

- Configure a clock rate of 1000 Kbps on both the Serial 0/0/0 and the Serial 0/0/1 interfaces of Router2. A clock rate must be configured on Router2 because it is the DCE end of the links to both Router1 and Router3.

```
Router2(config-if)#interface serial 0/0/0
Router2(config-if)#clock rate 1000000
Router2(config-if)#interface serial 0/0/1
Router2(config-if)#clock rate 1000000
Router2(config-if)#end
```

- Connect to Router3, and assign it a host name of **Router3**.

```
Router>enable
Router#configure terminal
Router(config)#hostname Router3
```

- On Router3, access the Serial 0/0/0 interface, enable the interface, and add a description.

```
Router3(config)#interface serial 0/0/0
Router3(config-if)#no shutdown
Router3(config-if)#description Serial 0/0/0 interface on Router3
Router3(config-if)#exit
```

- Now that the interfaces on both sides of the serial interfaces of Router2 are enabled, Router2 should be able to see Router1 and Router3 through CDP. Issue the **show cdp neighbors** command on Router2 to view all directly connected Cisco routers.

```
Router2#show cdp neighbors
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
S -Switch, H - Host, i - IGMP, r - Repeater
Device ID    Local Intrfce    Holdtme    Capability    Platform    Port ID
Router1      Ser0/0/0         174        R             2811        Ser 0/0/0
Router3      Ser0/0/1         174        R             2811        Ser 0/0/0
```

### Task 3: Configure IP Addresses

Configure the routers with IP addresses, and ping between them to test connectivity.

- On Router1, enter global configuration mode.

```
Router1#configure terminal
```

- On Router1, enter interface configuration mode for the Serial 0/0/0 interface.

```
Router1(config)#interface serial 0/0/0
```

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### **Contact Information**

E-Mail: support@boson.com  
Phone: 877-333-EXAM (3926)  
615-889-0121  
Fax: 615-889-0122  
Address: 25 Century Blvd. Ste. 500  
Nashville, TN 37214





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