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# CCNA Exploration Network Fundamentals

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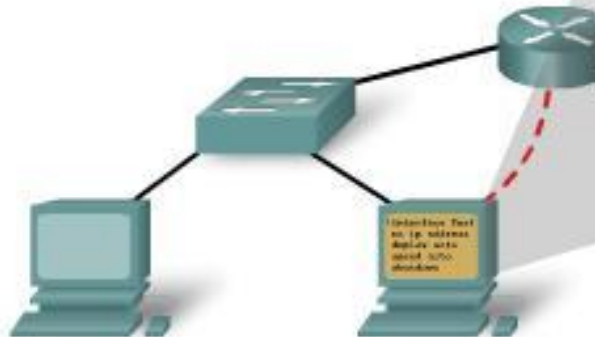
## Chapter 11

### Configuring and Testing Your Network

# 11.0.1 Introduction



```
version 12.2
!  
hostname Router
!  
!interface FastEthernet0/0
no ip address
duplex auto
speed auto
shutdown
!  
interface Serial0/0
no ip address
shutdown
!  
interface Serial0/1
no ip address
shutdown
```



Configuring and Testing the Network

## 11.0.1 Introduction

- In this chapter, the process for connecting and configuring computers, switches, and routers into an Ethernet LAN is examined.
- The basic configuration procedures for Cisco network devices will be introduced. These procedures require the use of the Cisco Internetwork Operating System (IOS) and the related configuration files for intermediary devices.
- An understanding of the configuration process using the IOS is essential for network administrators and network technicians. The labs will familiarize you with common practices used to configure and monitor Cisco devices.

# 11.1 Configuring Cisco Devices – IOS Basics

## 11.1.1 Cisco IOS

Cisco IOS

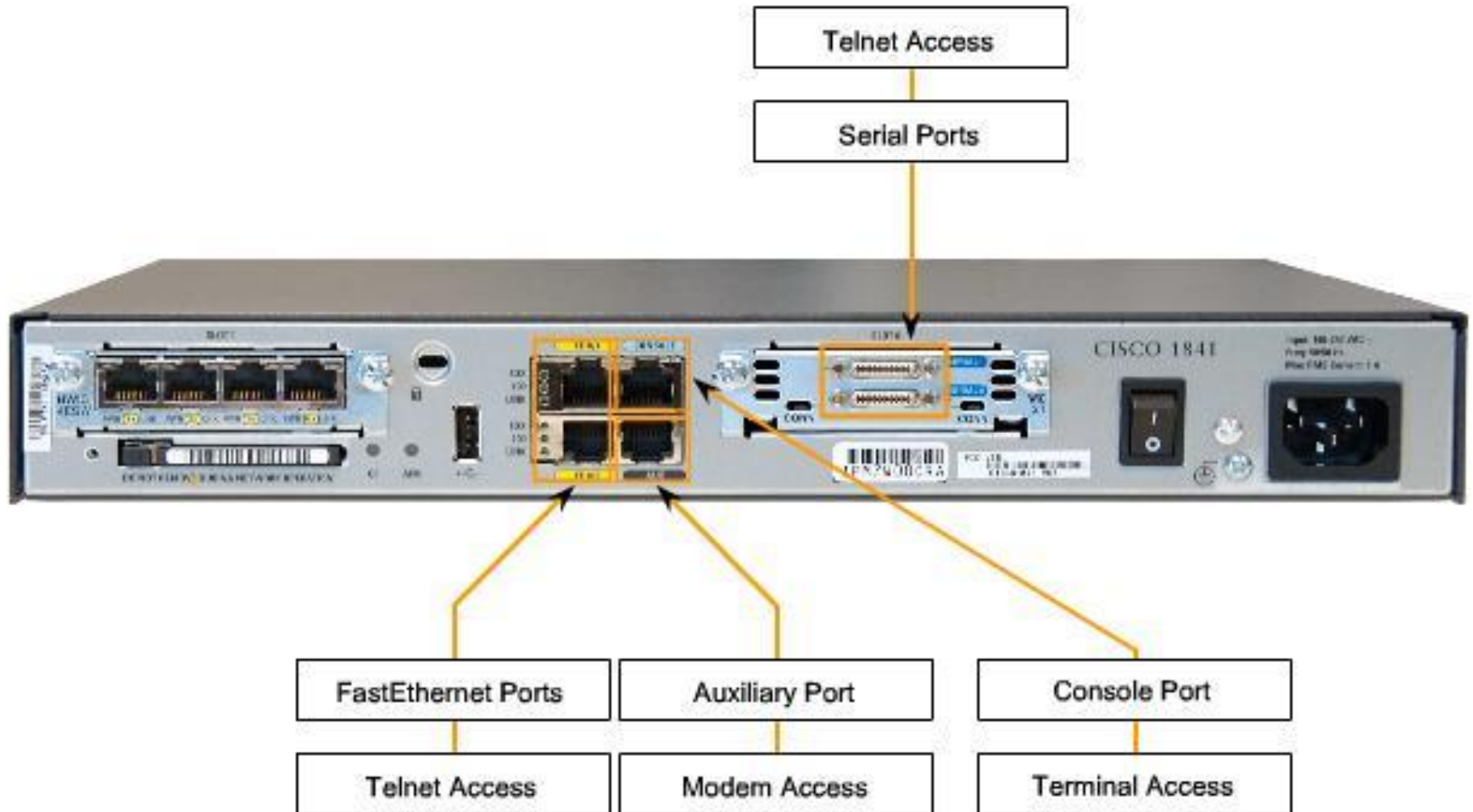


Internetwork Operating System for Cisco networking devices



# 11.1.1 Cisco IOS

Accessing the Cisco IOS on a Device



## 11.1.1 Cisco IOS

- Similar to a personal computer, a router or switch cannot function without an operating system. Without an operating system, the hardware does not have any capabilities. The Cisco Internetwork Operating System (IOS) is the system software in Cisco devices. It is the core technology that extends across most of the Cisco product line. The Cisco IOS is used for most Cisco devices regardless of the size and type of the device. It is used for routers, LAN switches, small Wireless Access Points, large routers with dozens of interfaces, and many other devices.
- The Cisco IOS provides devices with the following network services:
  - Basic routing and switching functions
  - Reliable and secure access to networked resources
  - Network scalability
- The IOS operational details vary on different internetworking devices, depending on the device's purpose and feature set.

## 11.1.1 Cisco IOS

- The services provided by the Cisco IOS are generally accessed using a command line interface (CLI). The features accessible via the CLI vary based on the version of the IOS and the type of device.
- The IOS file itself is several megabytes in size and is stored in a semi-permanent memory area called flash. Flash memory provides non-volatile storage. This means that the contents of the memory are not lost when the device loses power. Even though the contents are not lost they can be changed or overwritten if needed.
- Using flash memory allows the IOS to be upgraded to newer versions or to have new features added. In many router architectures, the IOS is copied into RAM when the device is powered on and the IOS runs from RAM when the device is operating. This function increases the performance of the device.

# 11.1.1 Cisco IOS

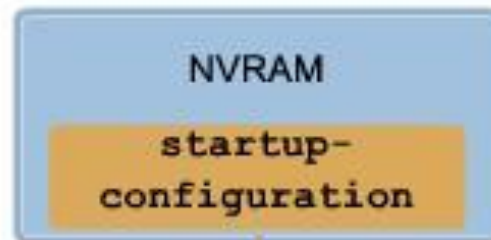
## Access Methods

- There are several ways to access the CLI environment. The most usual methods are:
  - Console
  - Telnet or SSH
  - AUX port
  - Console
- The CLI can be accessed through a console session, also known as the CTY line. A console uses a low speed serial connection to directly connect a computer or terminal to the console port on the router or switch.
- The console port is a management port that provides out-of-band access to a router. The console port is accessible even if no networking services have been configured on the device. The console port is often used to access a device when the networking services have not been started or have failed.



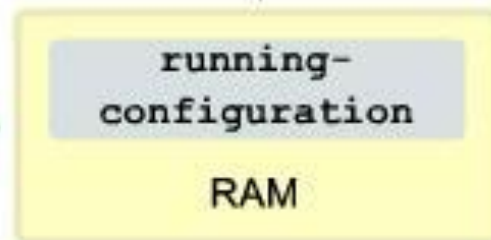
## 11.1.2 Configuring Files

### Configuration Files



At start up, startup-configuration is copied from NVRAM to RAM and executed as running-configuration.

Configuration edits change running-configuration



Running-configuration directs device operation

## 11.1.3 Cisco IOS Modes

### IOS Modes

```
Router con0 is now available.  
Press RETURN to get started.  
  
User Access Verification  
Password:  
Router> ← User-Mode Prompt  
Router>enable  
Password:  
Router# ← Privileged-Mode  
Router#disable  
Router> ← User-Mode Prompt  
Router>exit
```

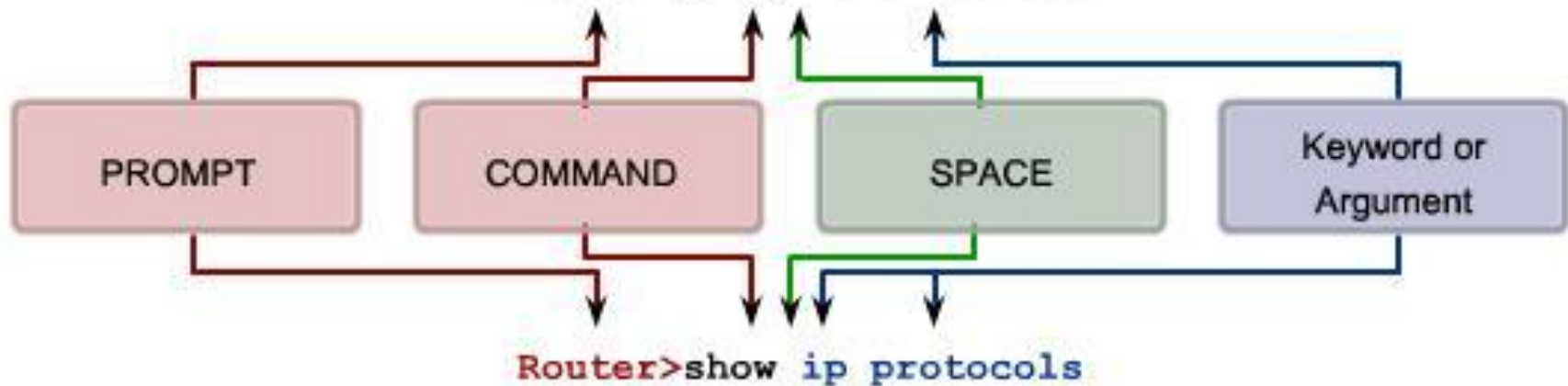
## 11.1.3 Cisco IOS Modes

- The Cisco IOS is designed as a modal operating system. The term modal describes a system where there are different modes of operation, each having its own domain of operation. The CLI uses a hierarchical structure for the modes.
- In order from top to bottom, the major modes are:
  - User executive mode
  - Privileged executive mode
  - Global configuration mode
  - Other specific configuration modes

## 11.1.4 Basic IOS Command Structure

### Basic IOS Command Structure

```
Router>ping 192.168.10.5
```



Prompt commands are followed by a space and then the keyword or arguments.

## 11.1.5 Using CLI Help

- The IOS has several forms of help available:
  - Context-sensitive help
  - Command Syntax Check
  - Hot Keys and Shortcuts

### Context-Sensitive Help

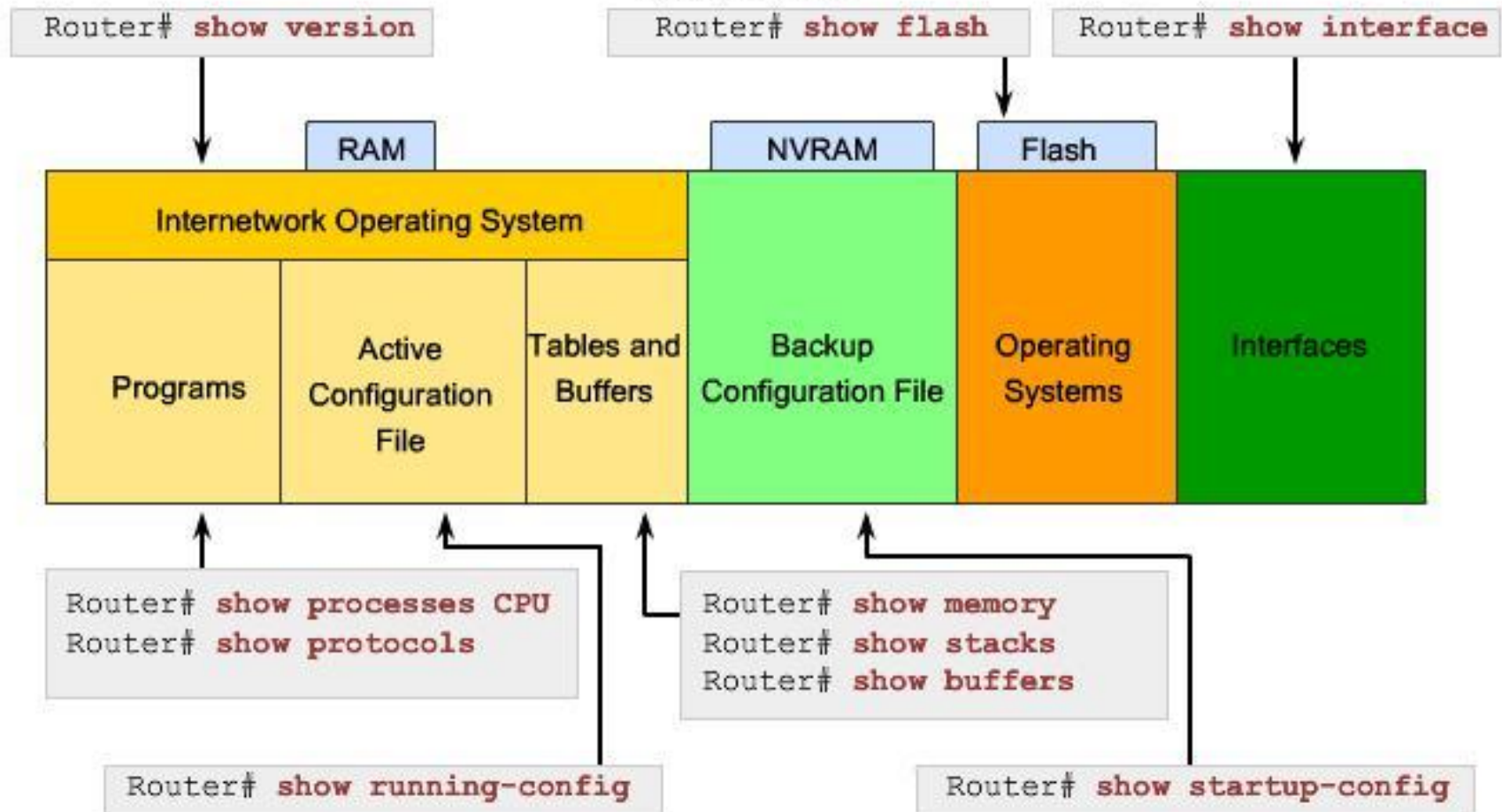
- The context-sensitive help provides a list of commands and the arguments associated with those commands within the context of the current mode. To access context-sensitive help, enter a question mark, ?, at any prompt. There is an immediate response without the need to use the <Enter> key.
- One use of context-sensitive help is to get a list of available commands. This can be used when you are unsure of the name for a command or you want to see if the IOS supports a particular command in a particular mode.
- For example, to list the commands available at the user EXEC level, type a question mark ? at the Router> prompt.

## 11.1.5 Using CLI Help

- Another use of context-sensitive help is to display a list of commands or keywords that start with a specific character or characters. After entering a character sequence, if a question mark is immediately entered-without a space-the IOS will display a list of commands or keywords for this context that start with the characters that were entered.
- For example, enter `sh?` to get a list of commands that begin with the character sequence `sh`.
- A final type of context-sensitive help is used to determine which options, keywords, or arguments are matched with a specific command. When entering a command, enter a space followed by a `?` to determine what can or should be entered next.
- As shown in the figure, after entering the command `clock set 19:50:00`, we can enter the `?` to determine the options or keywords that fit with this command.

# 11.1.6 IOS “Examination” Commands

IOS `show` commands can provide information about the configuration, operation and status of parts of a Cisco router.



# 11.1.7 IOS Configuration Modes

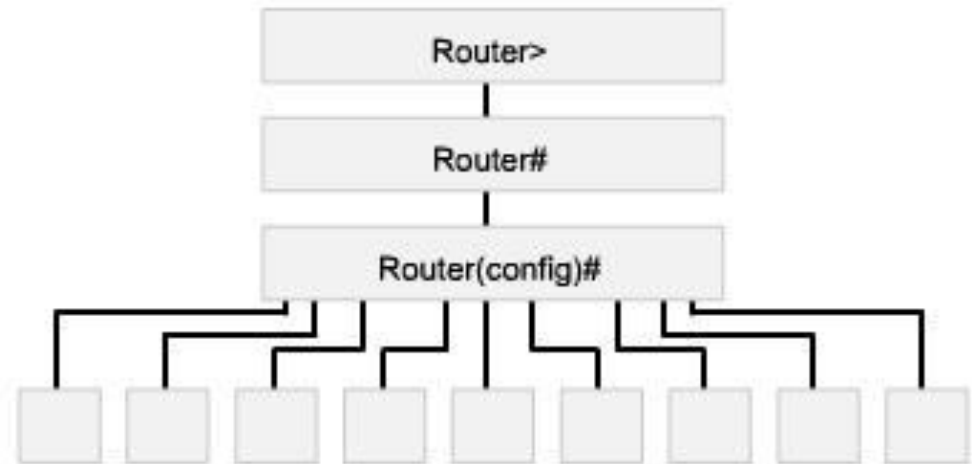
## IOS Configuration Modes

User EXEC mode

Privileged EXEC mode

Global configuration mode

Specific configuration mode

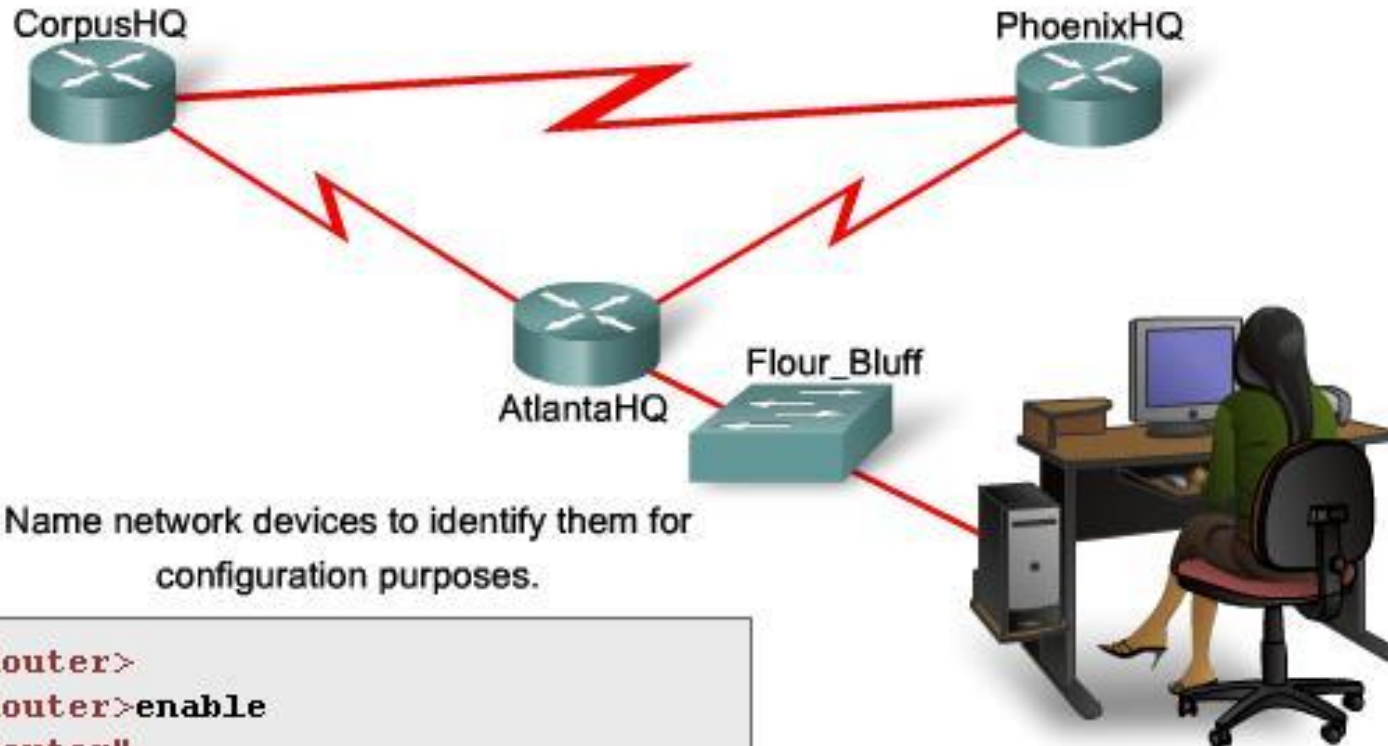


Configuration Mode	Prompt
<b>Interface</b>	<b>Router (config-if)#</b>
<b>Line</b>	<b>Router (config-line)#</b>
<b>Routers</b>	<b>Router (config-router)#</b>



# 11.2.1 Devices Need Names

## Configuring Device Names



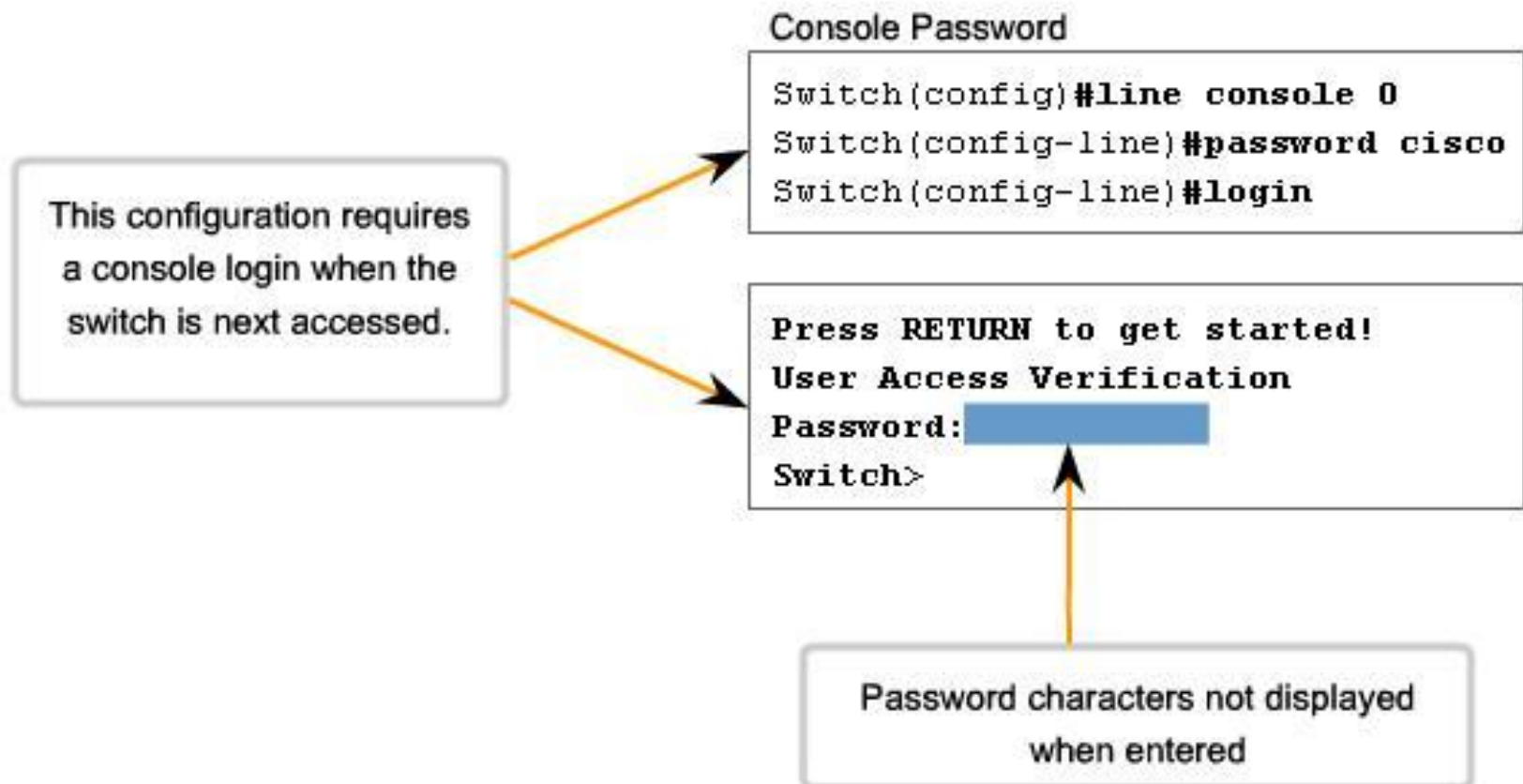
Name network devices to identify them for configuration purposes.

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

A yellow arrow points from the underlined 'AtlantaHQ' in the terminal output back to the 'AtlantaHQ' label in the network diagram.

## 11.2.2 Limiting Access – Configuring Passwords and using Banners

### Limiting Device Access - Configuring Console Passwords



# 11.2.2 Limiting Access – Configuring Passwords and using Banners

## Limiting Device Access Configuring Telnet and Password Encryption

### Virtual Terminal Password

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

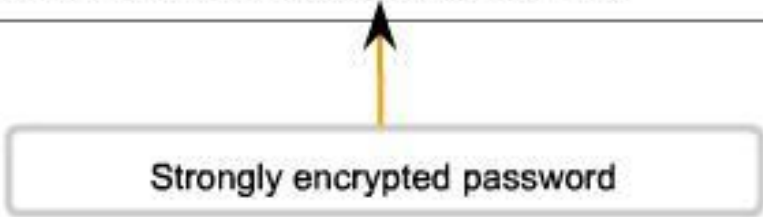
### Enable Password

```
Router (config)#enable password san fran
```

### Enable Secret Password

```
Router (config)#enable secret cisco
```

Strongly encrypted password



## 11.2.2 Limiting Access – Configuring Passwords and using Banners

### Limiting Device Access – Login Banner

```
LAB_A(config)#banner motd # This is a secure system. Authorized Access ONLY!!! #
```

Delimiting characters not included in message

This configuration results in this message of the day banner

```
Router
LAB_A con0 is now available
Press RETURN to get started.
This is a secure system. Authorized Access ONLY!!!
User Access Verification
password:
LAB_A>enable
Password:
LAB_A#
```

## 11.2.3 Managing Configuration Files

### Checking Configuration Files

```
Router# show running-configuration
```

Lists the complete configuration currently active in RAM.

The active configuration can be copied to NVRAM.

```
version 12.2
hostname Router

!interface FastEthernet0/0

no ip address
duplex auto
speed auto
shutdown

interface Serial0/0
no ip address
shutdown
!
interface Serial0/1
no ip address
```

```
Router# copy running-configuration startup-configuration
```

```
Router#copy running-config tftp
Remote host []? 131.108.2.155
Name of configuration file to write[tokyo-config]?tokyo.2
Write file tokyo.2 to 131.108.2.155? [confirm] y
Writing tokyo.2 !!!!! [OK]
```

## 11.2.4 Configuring Interfaces

### Configuring Router Interfaces

All interfaces are accessed by issuing the `interface` command at the global configuration prompt.

In the following commands, the `type` argument includes serial, ethernet, fastethernet, and others:

```
Router(config)#interface type port  
Router(config)#interface type slot/port  
Router(config)#interface type slot/subslot/port
```

The following command is used to administratively turn off the interface:

```
Router(config-if)#shutdown
```

The following command is used to turn on an interface that has been shutdown:

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

The following command is used to quit the current interface configuration mode:

```
Router(config-if)#exit
```

When the configuration is complete, the interface is enabled and interface configuration mode is exited.

## 11.2.4 Configuring Interfaces

### Configuring Router Ethernet Interfaces



```
Router(config)#interface FastEthernet 0/0
Router(config-if)#ip address 192.168.10.1 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#
```

## 11.2.4 Configuring Interfaces

### Configure Router Serial Interfaces



```
Router(config)#interface Serial 0/0/0
Router(config-if)#ip address 192.168.11.1 255.255.255.252
Router(config-if)#clock rate 56000
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#
```



# 11.2.4 Configuring Interfaces

Router Interfaces Descriptions



```
Router(config)#interface FastEthernet 0/0
Router(config-if)#description Building B Sales LAN
Router(config-if)#exit
```

Description is all text after this  
space

Interface description used for internal  
network documentation

```
Router(config)#interface Serial 0/0/0
Router(config-if)#description To Perth CKT-PT27834365-01
Router(config-if)#exit
```

Description is all text after this  
space

## 11.2.4 Configuring Interfaces

- In the lab, if a clock rate needs to be set on an interface identified as DCE, use the 56000 clock rate.
- The commands that are used to set a clock rate and enable a serial interface are:
  - Router(config)#interface Serial 0/0/0
  - Router(config-if)#clock rate 56000
  - Router(config-if)#no shutdown
- Once configuration changes are made to the router, remember to use the show commands to verify the accuracy of the changes, and then save the changed configuration as the startup configuration.

# 11.3 Verifying Connectivity

## 11.3.1 Testing the Stack

### Testing Local TCP/IP Stack

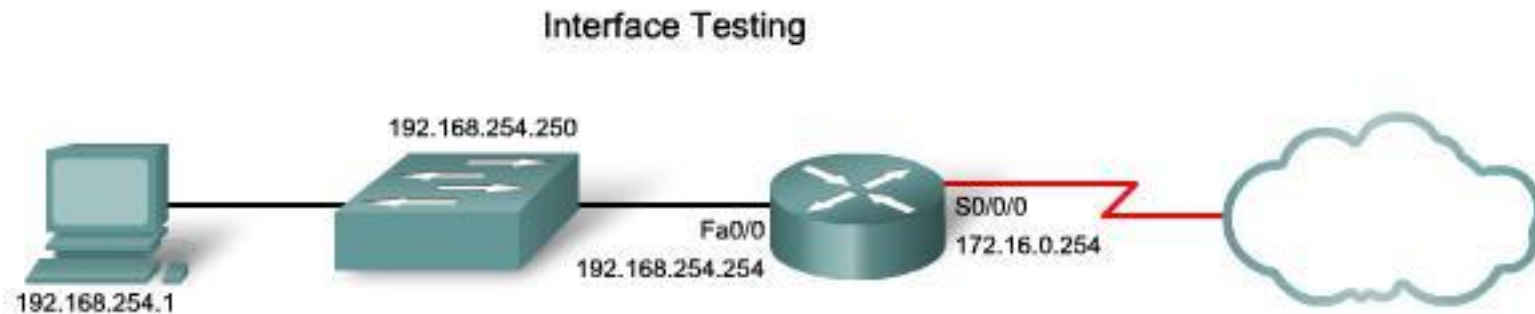
Pinging the local host confirms that TCP/IP is installed and working on the local network adapter.



Pinging 127.0.0.1 causes a device to ping itself.



## 11.3.2 Testing the Interface Assignment



### Interface Testing

```
Router1#show ip interface brief
```

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/0	192.168.254.254	YES	NVRAM	up	up
FastEthernet0/1/0	unassigned	YES	unset	down	down
Serial0/0/0	172.16.0.254	YES	NVRAM	up	up
Serial0/0/1	unassigned	YES	unset	administratively down	down

```
Router1#ping 192.168.254.1
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.254.1, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms

```
Router1#traceroute 192.168.0.1
```

Type escape sequence to abort.

Tracing the route to 192.168.0.1

1 172.16.0.253 8 msec 4 msec 8 msec

2 10.0.0.254 16 msec 16 msec 8 msec

3 192.168.0.1 16 msec \* 20 msec

## 11.3.2 Testing the Interface Assignment

### Testing the Local NIC Assignment

```
IP Address . . . . . : 10.0.0.5  
Subnet Mask . . . . . : 255.255.255.0  
Default Gateway . . . . : 10.0.0.254
```



Verify the host NIC address is bound and ready for transmitting signals across the media by pinging its own IP address.

## 11.4.3 Learning about the Nodes on the Network

- To execute an arp command, at the command prompt of a host, enter:
  - `C:\host1>arp -a`
- As shown in the figure the arp command lists all devices currently in the ARP cache, which includes the IPv4 address, physical address, and the type of addressing (static/dynamic), for each device.
- The router cache can be cleared by using the arp -d command, in the event the network administrator wants to repopulate the cache with updated information.
- Note: The ARP cache is only populated with information from devices that have been recently accessed. To ensure that the ARP cache is populated, ping a device so that it will have an entry in the ARP table.