Chapter 2: Configuring a Network Operating System

ITP172 – Networking Fundamentals & Project

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Chapter 2 - Objectives

Upon completion of this chapter you will be able to:

- Explain the purpose of the Cisco IOS.
- Explain how to access and navigate Cisco IOS to configure network devices.
- Explain how devices communicate across network media.
- Configure a host device with an IP address.
- Verify connectivity between two end devices.

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2.1 Cisco IOS

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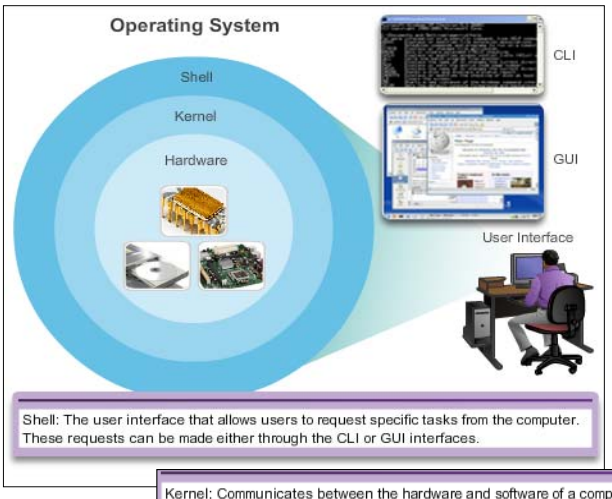
Operating Systems



Shell: The user interface that allows users to request specific tasks from the computer. These requests can be made either through the CLI or GUI interfaces.

Kernel: Communicates between the hardware and software of a computer and manages how hardware resources are used to meet software requirements.

Hardware: The physical part of a computer including underlying electronics.

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Purpose of OS

- PC operating systems (Windows 8 and OS X) perform technical functions that enable:
  - Use of a mouse
  - View output
  - Enter text
- Smart phones also needs OS (e.g. iOS & Andriod, etc).
- Switch or router IOS provides options to:
  - Configure interfaces
  - Enable routing and switching functions
- All networking devices come with a default IOS.
- The operating system on home routers is usually called firmware.
- Possible to upgrade the IOS version or feature set.

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Location of the Cisco IOS

Cisco IOS stored in **Flash**

- Non-volatile storage, not lost when power is lost.
- Can be changed or overwritten as needed.
- Can be used to store multiple versions of IOS.
- IOS copied from flash to volatile RAM.
- Quantity of flash and RAM memory determines IOS that can be used.

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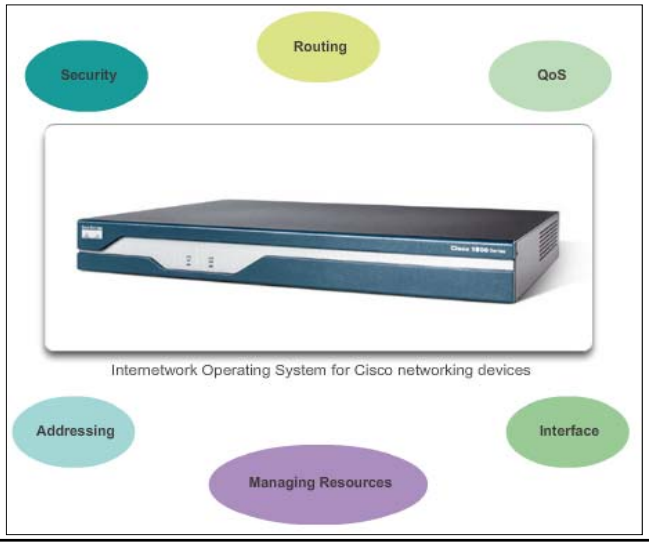
IOS Functions

These are the major functions performed or enabled by Cisco routers and switches.



Console Access Method

Most common methods to access the CLI:

- Console
- Telnet or SSH
- AUX port

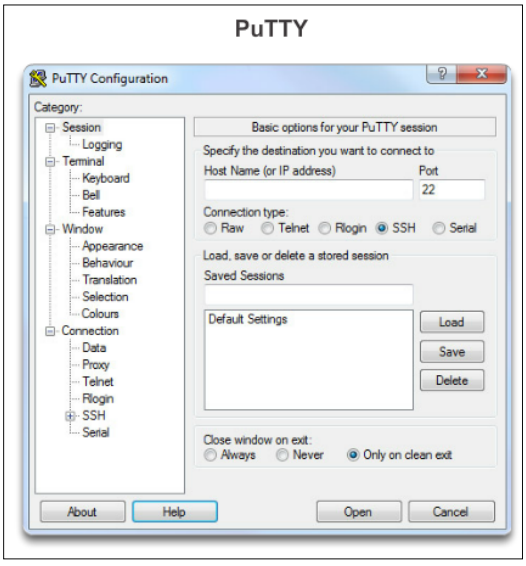
Console Access Method

Console Port

- Device is accessible even if no networking services have been configured (out-of-band).
- Need a special console cable → connects to a PC or Laptop.
- Should be configured with passwords to prevent unauthorized access.
- Device should be located in a secure room so console port cannot be easily accessed.

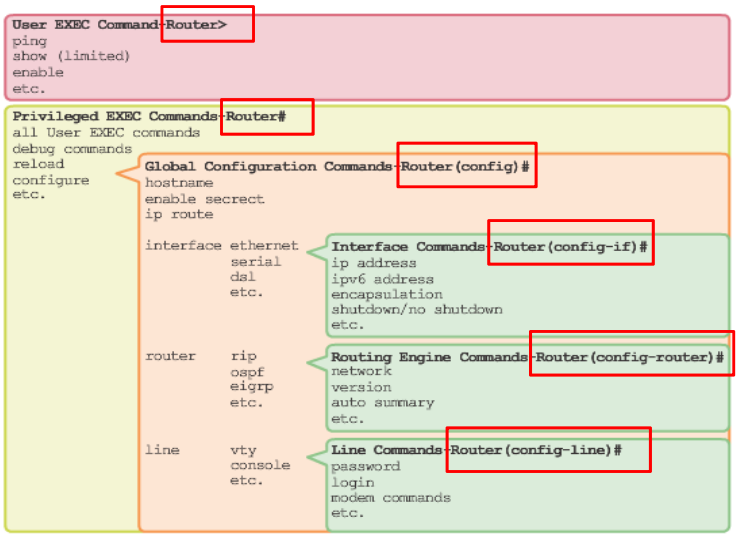
Terminal Emulation Programs

- PC or Laptop needs a software to connect and access a Router or Switch.
- Software available for connecting to a networking device:
  - PuTTY
  - Tera Term
  - SecureCRT
  - HyperTerminal
  - OS X Terminal



Cisco IOS Modes of Operation

IOS Mode Hierarchical Structure



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Primary Modes

User EXEC Mode

Limited examination of router.
Remote access.

```
Switch>
Router>
```

The **User EXEC** mode allows only a limited number of basic monitoring commands and is often referred to as view-only mode.

Router> enable

Privileged EXEC Mode

Detailed examination of router. Debugging and testing. File manipulation. Remote access.

```
Switch#
Router#
```

The **Privileged EXEC** mode, by default, allows all monitoring commands, as well as execution of configuration and management commands.

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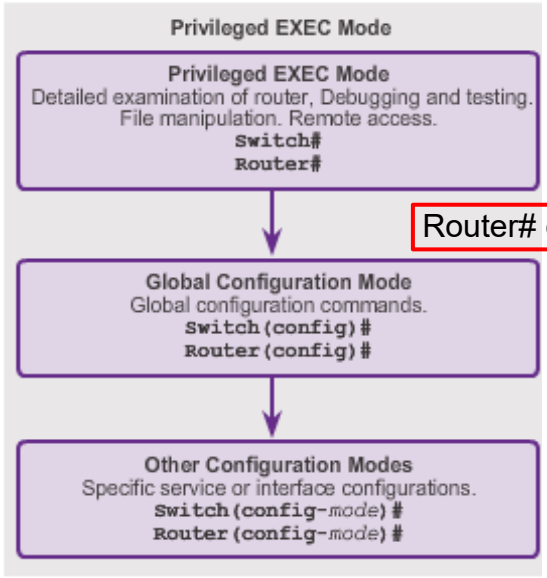
Global Configuration Mode



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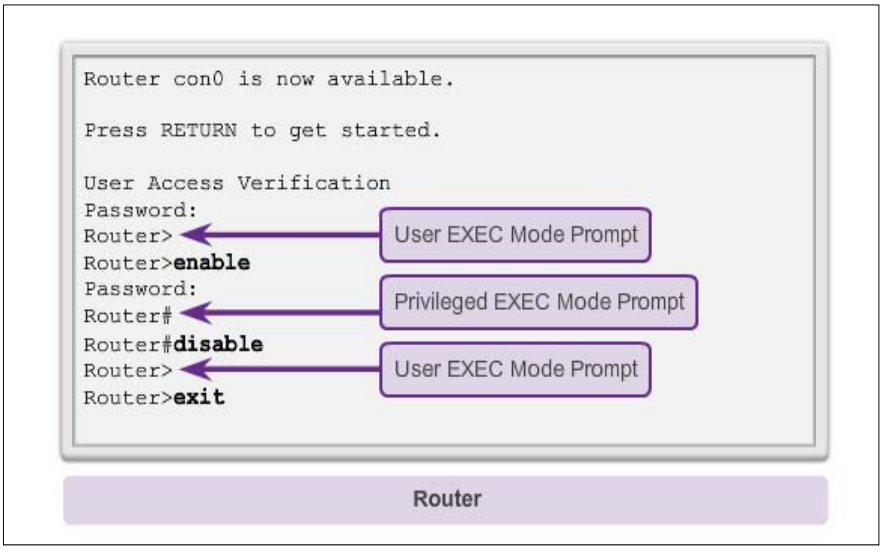
Navigating Between IOS Modes



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Navigating Between IOS Modes (cont.)

```
Switch> enable
Switch# configure terminal
Enter configuration commands, one per line.
End with CNTL/Z.
Switch(config)# interface vlan 1
Switch(config-if)# exit
Switch(config)# exit
Switch#
```

```
Switch# configure terminal
Enter configuration commands, one per line.
End with CNTL/Z.
Switch(config)# line vty 0 4
Switch(config-line)# interface fastethernet 0/1
Switch(config-if)# end
Switch#
```

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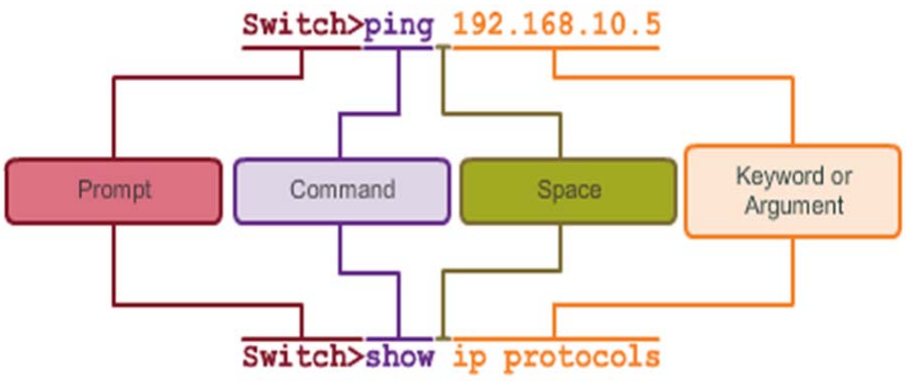
IOS Command Structure



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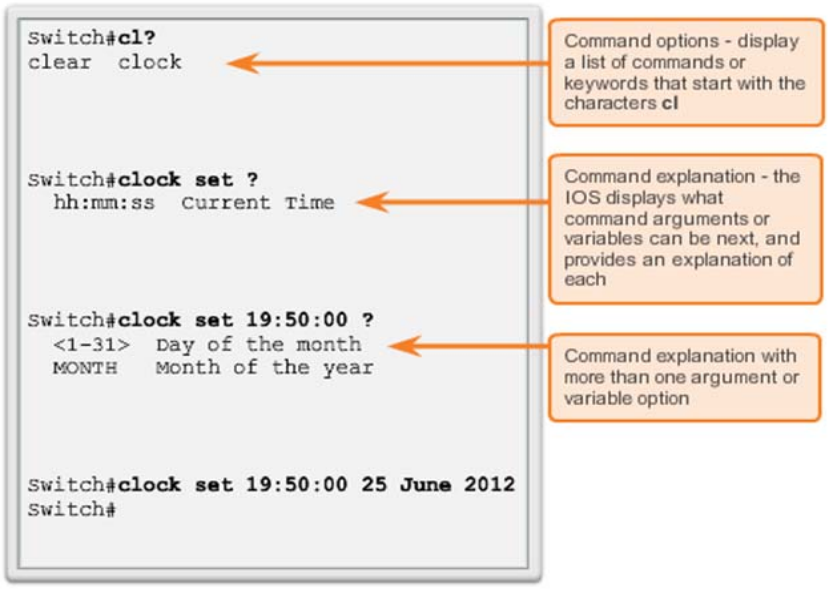
Context-Sensitive Help



Hot Keys and Shortcuts

- **Tab –** Completes the remainder of a partially typed command or keyword.
- **Ctrl-R –** Redisplays a line.
- **Ctrl-A –** Moves to the beginning of the line.
- **Ctrl-Z –** Exits the configuration mode and returns to user EXEC.
- **Down Arrow –** Allows the user to scroll forward through former commands.
- **Up Arrow –** Allows the user to scroll backward through former commands.
- **Ctrl-shift-6 –** Allows the user to interrupt an IOS process such as **ping** or **traceroute**.
- **Ctrl-C –** Exits the current configuration or aborts the current command.

2.2 Getting Basic

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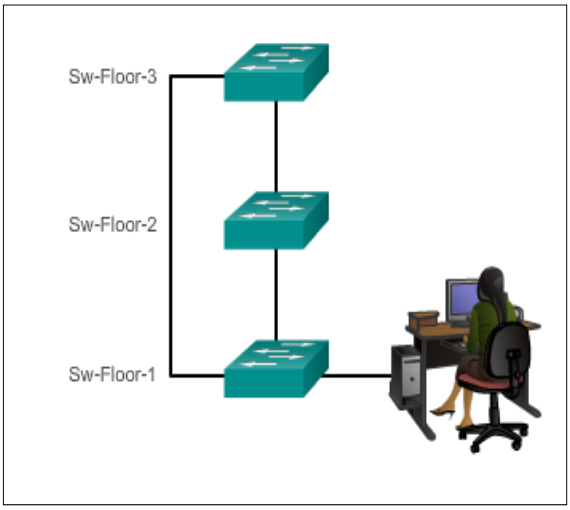
Configuring Device Names

Hostnames allow devices to be identified by network administrators over a network or the Internet.

Without names, network devices are difficult to identify for configuration purposes.



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Configuring Hostnames

Configure a Hostname

Configure the switch hostname to be 'Sw-Floor-1'.

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname Sw-Floor-1
Sw-Floor-1(config)#
```

You successfully configured the switch hostname.

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Securing Device Access

These are device access passwords:

- **enable password** – Limits access to the privileged EXEC mode.
- **enable secret** – **Encrypted**, limits access to the privileged EXEC mode.
- **console password** – Limits device access using the console connection.
- **VTY password** – Limits device access over Telnet.

Note: In most of the labs in this course, we will be using simple passwords such as **cisco** or **class**.

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Securing User EXEC Access

```
Sw-Floor-1(config)#line console 0
Sw-Floor-1(config-line)#password cisco
Sw-Floor-1(config-line)#login
Sw-Floor-1(config-line)#exit
Sw-Floor-1(config)#
Sw-Floor-1(config)#line vty 0 15
Sw-Floor-1(config-line)#password cisco
Sw-Floor-1(config-line)#login
Sw-Floor-1(config-line)#
```

- Console port must be secured.
- It reduces the chance of unauthorized personnel physically plugging a cable into the device and gaining device access.
- VTY lines allow access to a Cisco device via Telnet.
- The number of VTY lines supported varies with the type of device and the IOS version.

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2.3 Addressing Schemes

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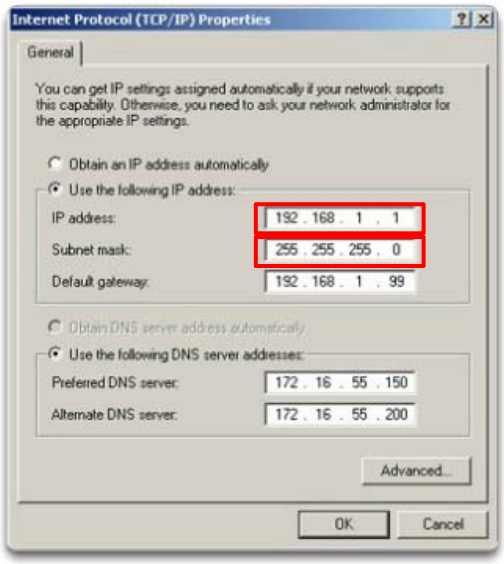
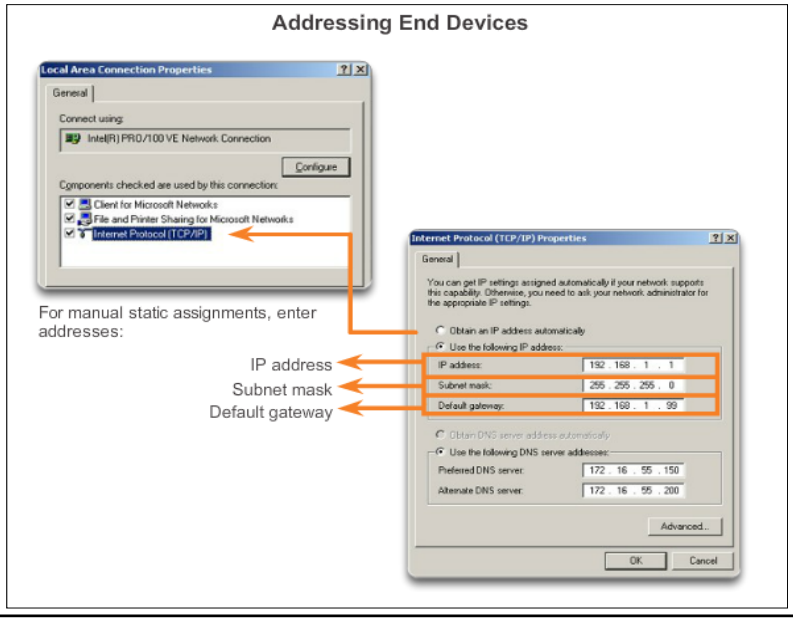
IP Addressing of Devices

- Each end device on a network must be configured with an IP address.
- IP address displayed in dotted decimal notation, with four decimal numbers between 0 and 255.
- With the IP address, a subnet mask is also necessary.
- IP addresses can be assigned to both physical ports and virtual interfaces.



Manual IP Address Configuration for End Devices

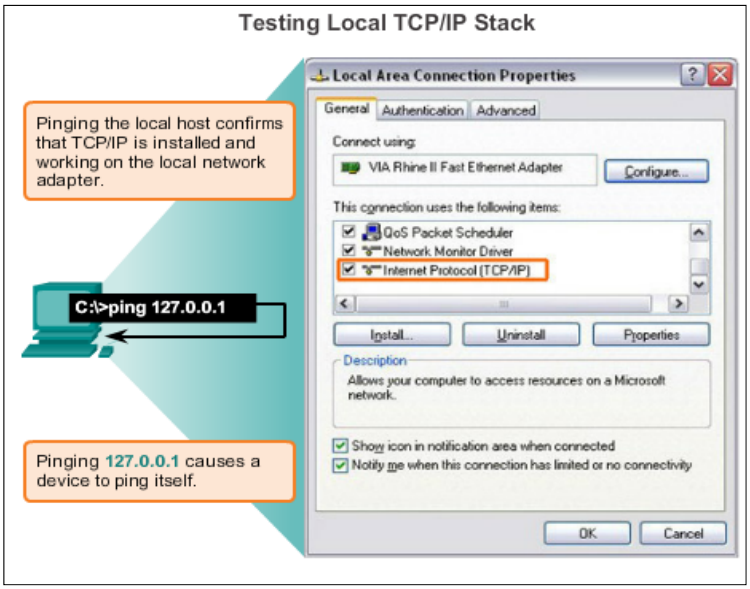


Automatic IP Address Configuration

Assigning Dynamic Addresses

Test the Loopback Address on an End Device

Testing Local TCP/IP Stack



Testing the Interface Assignment

Verifying the VLAN Interface Assignment

Enter the command to verify the interface configuration on S1.

```
S1# show ip interface brief
Interface              IP-Address      OK? Method  Status      Protocol
FastEthernet0/1        unassigned      YES manual  up          up
FastEthernet0/2        unassigned      YES manual  up          up
<output omitted>
Vlan1                  192.168.10.2    YES manual  up          up
```

You are now on S2. Enter the command to verify the interface configuration on S2.

```
S2# show ip interface brief
Interface              IP-Address      OK? Method  Status      Protocol
FastEthernet0/1        unassigned      YES manual  up          up
FastEthernet0/2        unassigned      YES manual  up          up
<output omitted>
Vlan1                  192.168.10.3    YES manual  up          up
```

You successfully verified the interface assignment on S1 and S2.

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Testing End-to-End Connectivity

Enter the command to verify connectivity to PC2 at '192.168.10.11'.

```
C:\> ping 192.168.10.11

Pinging 192.168.10.11 with 32 bytes of data:
Reply from 192.168.10.11: bytes=32 time=838ms TTL=35
Reply from 192.168.10.11: bytes=32 time=820ms TTL=35
Reply from 192.168.10.11: bytes=32 time=883ms TTL=36
Reply from 192.168.10.11: bytes=32 time=828ms TTL=36

Ping statistics for 192.168.10.11:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 820ms, Maximum = 883ms, Average = 842ms

C:\>
```

You successfully verified connectivity to S1 and PC2.

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Chapter 2 Summary

- Services are generally accessed using a command-line interface (CLI), which is accessed by either the console port, the AUX port, or through telnet or SSH.
- Once connected to the CLI, configuration changes can be made to the Cisco IOS devices.
- Cisco IOS is designed as a modal operating system, which means a network administrator can navigate through various hierarchical modes of the IOS.
- Cisco IOS routers and switches support a similar modal operating system.
- They support similar command structures and support many of the same commands.
- In addition, both devices have identical initial configuration steps when implementing them in a network.

Chapter 2 Summary (cont.)