

## 3: Cisco Command Line Interface

## Objectives

- Upon completion of this chapter, you should be able to:
  - Explain the Cisco command modes
  - Use Command Line Interface (CLI) help and editing
  - Enter and use Cisco configuration mode
  - Know and use basic interface commands
  - Know and use basic line commands
  - Perform basic operations with configurations

## Motivation

- We'll later go over configuration options supporting HP Openview and CiscoWorks network management tools
- It can be very helpful in the field to be able to use Cisco router CLI commands to troubleshoot problems
- This chapter covers how to work with the Cisco CLI, help, configuration mode, other modes of operation

## Topics

- Cisco Command Modes
- Command Line Interface (CLI) Help and Editing
- Configuration Mode
- Interface Commands
- Line Commands
- Working with Configurations

## CISCO COMMAND MODES

- EXEC mode is for “do it now” commands, such as
  - Configure (I’m going to configure you now)
  - Reload
  - PING
- You wouldn’t want these to be permanent things the router does when it boots up
- Contrast CONFIGURATION mode, which is for telling the router or switch “this is how I want you to do things”
  - We generally save our configurations (make them permanent until changed)

## CISCO COMMAND MODES

- Two levels of EXEC mode access:
  - User
  - Enabled
- Login to gain user EXEC mode access
  - Limited command access
  - Exit logs you out
- Type enable and the enable password to gain enabled access
  - Full control over router
  - Disable returns you to user mode

**Router>**

**Router>enable**

**password:**

**Router#**

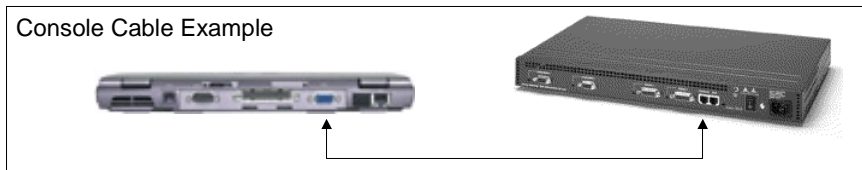
## Topics

- Cisco Command Modes
- Command Line Interface (CLI) Help and Editing
- Configuration Mode
- Interface Commands
- Line Commands
- Working with Configurations

## CLI HELP AND EDITING

- If you're connected via console cable or telnet, you can enter commands by:
  - Typing
  - Cutting and pasting
  - "Send file as ASCII" in your terminal software
- When you press ENTER, the router or switch parses the command
  - If the syntax is OK, the router does what you told it
- This works reasonably well over noisy low speed links
- There is also a web interface

Console Cable Example



## CLI HELP AND EDITING

- The Cisco IOS CLI has built-in help
- View commands available in any context by pressing “?” or typing “help”

router1#?

Exec commands:

<1-99>	Session number to resume
access-enable	Create a temporary Access-List entry
access-profile	Apply user-profile to interface
access-template	Create a temporary Access-List entry
archive	manage archive files
bfe	For manual emergency modes setting
cd	Change current directory

--More--



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## CLI HELP AND EDITING

- When you see “--More--”, the router is paginating multiple screens of output
  - Press Space for another screenful
  - Press Enter for another line of output at a time
  - Press any other key to terminate the output

--More--

- *Optional activity: use global help and experiment with the various options at the “--More--” prompt*



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## CLI HELP AND EDITING

- View the rest of a command keyword (possible command completions) by typing the first part of the command, followed immediately by ?
  - Example: r? shows all commands starting with the letters “r”
- If there’s only one possible completion, press TAB to fill in the rest of the letters
  - Not necessary, commands can be abbreviated as long as there’s no ambiguity

```
Router#r?
```

```
*r=resume reload rlogin rsh
```

```
Router#r
```



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## CLI HELP AND EDITING

- If you’re not sure what comes next in a command, press SPACE and “?”
  - Cisco IOS will show choices for next keyword or entry
  - Cisco IOS will repeat what you typed before the “?”

```
Router#configure ?
```

```
memory
```

```
Configure from NV memory
```

```
network
```

```
Configure from a TFTP network host
```

```
overwrite-network
```

```
Overwrite NV memory from TFTP network host
```

```
terminal
```

```
Configure from the terminal
```

```
<cr>
```

```
Router#configure
```



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## CLI HELP AND EDITING

- Unrecognized command: first word not recognized
- Incomplete command: add more to the end
- Invalid input: the “^” points to the first character that doesn’t match any known commands

```
Router#clok ?  
% Unrecognized command  
Router#clock set  
% Incomplete command.  
Router# clok set  
      ^  
% Invalid input detected at '^' marker.
```

## CLI HELP AND EDITING

- The Cisco IOS retains commands you’ve typed in a history buffer

```
Router#show history  
show ip interface brief  
show ip route  
show users  
clear line 1  
show running-config  
show startup-config  
show configuration  
show ip interface serial 1  
show ip interface ethernet 0  
show history  
Router#
```

## CLI HELP AND EDITING

- Use up/down arrows keys to move between commands (or Ctrl+P, Ctrl+N)

```
Router#show history  
show ip interface brief  
show ip route  
Router#
```

Press Ctrl+P or Up Arrow

```
Router#show ip route
```

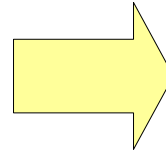
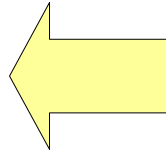
Press Ctrl+P or Up Arrow

```
Router# show ip interface brief
```



## CLI HELP AND EDITING

- Backspace deletes the character before the cursor
- Ctrl+D deletes the character after the cursor
- Left/right arrow to move left/right (also Ctrl+B, Ctrl+F)
- Arrow key functions require ANSI or VT100 terminal emulation



Moving  
around:

**Left arrow**  
**Ctrl + B**

**Right arrow**  
**Ctrl + F**

Deleting:

**Backspace**

**Ctrl + D**

## CLI HELP AND EDITING

Command Line Editing Key	Description
<b>Ctrl+A</b>	Move to beginning of command line
<b>Ctrl+E</b>	Move to end of command line
<b>Ctrl+B</b>	Move back one character
<b>Ctrl+F</b>	Move forward one character
<b>Esc B</b>	Move back (left) one word
<b>Esc F</b>	Move forwards (right) one word
<b>Ctrl+D</b>	Delete character to right of the cursor
<b>Backspace</b>	Delete character to left of cursor
<b>Tab</b>	Complete command (if unique)

## CLI HELP AND EDITING

Command Line Editing Key	Description
<b>Ctrl+R</b>	Redisplay line
<b>Ctrl+K</b>	Cut to end of line
<b>Ctrl+Y</b>	Paste what was last cut at current cursor position
<b>Ctrl+U</b>	Cut to beginning of line
<b>Ctrl+T</b>	Transpose 2 characters
<b>Ctrl+W</b>	Delete previous word
<b>Esc L</b>	Change next word to lowercase
<b>Esc C</b>	Capitalize next word
<b>Esc U</b>	Change next word to uppercase

- These are keystrokes from the UNIX/Linux EMACS editor

## Topics

- Cisco Command Modes
- Command Line Interface (CLI) Help and Editing
- Configuration Mode
- Interface Commands
- Line Commands
- Working with Configurations

## CONFIGURATION MODE

- The router or switch configuration contains permanent instructions on how the router or switch is to operate
- To enter configuration mode, type “Conf t”

```
Router#configure terminal
```

```
Enter configuration commands, one per line. End with CNTL/Z
```

```
Router(config)#
```

- Note the config mode prompt!

## CONFIGURATION MODE

- To exit configuration mode, type one of:
  - End: leave config mode completely
  - Ctrl+Z: leave config mode completely
  - Exit: back out of config mode one level
    - We'll see there are sub-configuration modes
- To get configuration help, use “?”
  - The help for configuration and sub-configuration modes is mode-sensitive
  - When in a sub-mode, help and command completion will only show sub-mode commands
  - But you can still enter global configuration commands
- *Optional: look at the config mode help: the beginning keywords for various Cisco commands*



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## CONFIGURATION MODE

- When you enter configuration mode, you're in GLOBAL config mode
  - For commands that apply to the entire router
- Examples follow:
  - Hostname
  - Banner message
  - Enable password
  - Local host table
  - Config register



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## CONFIGURATION MODE

- Command to specify the name of the router:

```
hostname routename
```

- Also used as the router prompt unless you over-ride with a “**prompt**” command
- Note that as soon as you press ENTER, the prompt changes
- Almost all configuration commands take effect immediately when you press ENTER

```
Router#config t  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#hostname GeneralDynamics001  
GeneralDynamics001(config)#exit  
GeneralDynamics001#
```



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## CONFIGURATION MODE

- Command for setting the banner message of the day (motd)

```
banner motd # message #
```

- Message must be surrounded by a delimiter character (any character of your choice that is not in your message)
  - Message can be multi-line
- Message is seen when someone logs into the router

```
Router(config)#banner motd %  
ATTENTION!  
THIS IS A DOD COMPUTER SYSTEM. BEFORE PROCESSING  
CLASSIFIED INFORMATION, CHECK THE SECURITY  
ACCREDITATION LEVEL OF THIS SYSTEM. DO NOT PROCESS,  
STORE OR TRANSMIT INFORMATION CLASSIFIED ABOVE  
ACCREDITATON LEVEL OF THIS SYSTEM. THIS COMPUTER  
SYSTEM, INCLUDING ALL RELATED EQUIPMENT, NETWORKS AND  
NETWORK DEVICES (INCLUDES INTERNET ACCESS) ARE  
PROVIDED ONLY FOR AUTHORIZED U.S. GOVERNMENT USE.  
%
```



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## CONFIGURATION MODE

- Command to specify the enable password, used to get into enabled EXEC mode

```
enable password password
```

- Can add service password-encryption for weak encryption
- Use enable secret for stronger MD5 hashing, still crackable

```
enable secret password
```

```
Router(config)#enable password secret  
Router(config)#service password-encryption  
Router(config)#enable secret san-fran  
Router(config)#
```

## CONFIGURATION MODE

- Command to allow the router to locally map a name to one or more addresses and vice versa

```
ip host name [port] address1 address2 ... address8
```

- Typing “*name*” or “telnet *name*” causes the router to
  - telnet to the first listed address
  - if that fails, telnet to the next, etc.
- ping and trace *name* will only use the first local host address
- A local host table helps if DNS server is down or can't be reached because the network is down. You can use names instead of addresses when troubleshooting the problem.

```
Router(config)#ip host nc3 148.33.1.29 148.33.8.129  
Router(config)# ip host sen31 148.33.1.33 148.33.9.65  
Router(config)# ip host sen32 148.33.1.37 148.33.10.65
```

## CONFIGURATION MODE

- Command to tell the router to not use DNS lookup

```
no ip domain-lookup
```

- This is useful since the router by default uses 255.255.255.255 to attempt to contact a DNS server. This can take a while to time out.
- Suppose you mis-type something like “clok” in a router without the “no ip domain-lookup” command configured. The router will try to resolve clok to a hostname and the terminal will not respond until DNS times out.

```
Router#clok  
Translating “clok”...domain server (255.255.255.255)
```



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## CONFIGURATION MODE

- After DNS timeout:

```
Router#clok  
Translating “clok”...domain server (255.255.255.255)  
% Unknown command or computer name, or unable to find computer  
address  
Router#
```

- Add the “no ip domain-lookup” command and here’s what happens immediately:

```
Router#clok  
Translating “clok”  
% Unknown command or computer name, or unable to find computer  
address  
Router#
```



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## CONFIGURATION MODE

- DNS Lookup
  - If you have a DNS server that you wish the router to use for its name to address mapping, tell the router the address of the DNS server

```
ip domain-lookup address1 address2 ... address6
```

- For example, tell the router to use server 148.33.1.10 for DNS lookups, configure:

```
Router(config)#ip domain-lookup 148.33.1.10
```

## CONFIGURATION MODE

- Config register sets software “jumpers” for permanent router or switch behavior
  - Despite being a configuration command, this does not have to be saved (see later)
  - Does not take effect until next reboot
- Routers are generally set to 0x2102, which is 0010 0001 0000 0010 in binary

Bit	Meaning
0-3	Which image in flash to boot from
6	Ignore NVRAM if 1
8	Break disabled
11-12	Console baud rate
13	Boot from ROM if all else fails

## CONFIGURATION MODE

- To set the configuration register, use the following command:

```
config-register hex-value
```

- For example, to reset the config register to its usual router setting:

```
Router(config)#config-register 0x2102
```

## Undoing Commands

- To remove or undo a command, precede it with “**no**”
- Note that typing more commands or pasting text from a file **appends** to what’s already configured
  - Does not replace or overwrite it!
- If you edit in Notepad then paste in, in some cases you’ll need the “**no**” version of commands to remove previous configuration

## CONFIGURATION MODE

- Configuration mode has a number of sub-modes as well:
  - Interface
  - Router
  - Line
  - Others
- We'll see that when we're in a configuration sub-mode, the prompt changes

## Topics

- Cisco Command Modes
- Command Line Interface (CLI) Help and Editing
- Configuration Mode
- Interface Commands
- Line Commands
- Working with Configurations

## Interface Commands

- The configuration sub-modes save us typing
- They set a context
  - “Let’s talk about what you’re doing on interface serial 0 for a while...”
- This is better than having to type something like (imaginary interface configuration)

**Interface serial 0 do this**  
**Interface serial 0 do that**  
**Interface serial 0 do something else**

- To get into interface configuration mode, put in “**interface *name-of-interface***”
- Prompt will change
- Examples coming up shortly!

## Interface Commands

- *Optional activity: enter configuration mode and put yourself into interface configuration sub-mode*
- *Use “?” to examine what command beginnings are available*

## INTERFACE COMMANDS

- Address and Description
  - Each interface needs an IP address and subnet mask or IP is ignored on that interface
  - Optionally add a description line, documents the network and assists in troubleshooting

```
Router(config)#int s0  
Router(config-if)#ip address 10.10.10.10 255.0.0.0  
Router(config-if)#description Connection to 1234 Sig BN
```

## INTERFACE COMMANDS

- The interface serial 0 portion of a running configuration follows
- Note that this configuration is fairly readable: all the subsequent commands refer to the serial 0 interface!

```
interface Serial0  
ip address 10.10.10.10 255.0.0.0  
description Connection to 1234 Sig BN  
bandwidth 250  
no ip directed-broadcast
```

## INTERFACE COMMANDS

- Bandwidth Command
  - The bandwidth command is used on serial interfaces to tell the router the actual bandwidth on the link
  - Defaults to T1 or E1 speed

```
Router(config)#int s0  
Router(config-if)#bandwidth ?  
<1-1000000> bandwidth in kilobits  
Router(config-if)#bandwidth 1544
```

## INTERFACE COMMANDS

- The bandwidth command is used for
  - Routing metrics
  - SNMP ifSpeed variable, used to calculate interface utilization levels
  - Load numbers you see in show interface output
- Does NOT set clock speed
- Should NOT be used to implement a routing policy. If you try to implement routing policy this way, someone may 'fix' your bandwidth statement to reflect actual bandwidth, thus breaking your scheme.

## INTERFACE COMMANDS

- Shutdown Command
  - Shutdown marks the interface as administratively down
  - Good practice if interface is taken out of service
    - Router stops resetting the interface (over and over)
    - Router stops sending SNMP traps and syslog messages about the interface being down
    - HPOV will stop pinging the interface and reporting it as down
- Shutdown examples follow...

## INTERFACE COMMANDS

- Interface Shutdown Example:
  - Serial 0 and Serial 3 are down and will be down for an extended period
  - It would be better to shut them down for now

```
Router#show ip int brief
Interface      IP-Address    OK?  Method  Status  Protocol
Ethernet0     148.33.8.129  YES  NVRAM   up      up
Loopback0     148.33.1.29   YES  NVRAM   up      up
Serial0       148.33.0.18   YES  NVRAM   down    down
Serial1       148.33.0.29   YES  NVRAM   up      up
Serial2       148.33.0.33   YES  NVRAM   up      up
Serial3       148.33.0.42   YES  NVRAM   down    down
Router#
```

## INTERFACE COMMANDS

- Example showing configuring the interface to be shut down

```
Router(config)#int serial 0
Router(config-if)#shutdown

*Mar 1 07:40:44 UTC: %LINK-5-CHANGED: Interface
Serial0, changed state to administratively down

Router(config-if)#end
Router#
*Mar 1 07:40:53 UTC: %SYS-5-CONFIG_I: Configured from
console by console

Router#
```

## INTERFACE COMMANDS

- Interface Shutdown Example:
  - Serial 0 and 3 are now administratively down

```
Router#show ip int brief
Interface  IP-Address  OK?  Method  Status  Protocol
Ethernet0  148.33.8.129  YES  NVRAM   up      up
Loopback0  148.33.1.29  YES  NVRAM   up      up
Serial0    148.33.0.18  YES  NVRAM   administratively down  down
Serial1    148.33.0.29  YES  NVRAM   up      up
Serial2    148.33.0.33  YES  NVRAM   up      up
Serial3    148.33.0.42  YES  NVRAM   up      up
Router#
```

## INTERFACE COMMANDS

- Shutdown Command (Continued)
  - No shutdown brings the interface back to being administratively up

```
NC3(config)#int s 1
NC3(config-if)#no shutdown
NC3(config-if)#
.Aug 8 21:19:46 UTC: %LINK-3-UPDOWN: Interface Serial1, changed
state to up
NC3(config-if)#
.Aug 8 21:19:47 UTC: %LINEPROTO-5-UPDOWN: Line protocol on
Interface Serial1, changed state to up
```

## INTERFACE COMMANDS

- Clockrate Command
  - In commercial WAN, carrier provides clocking on synchronous serial links: synch of sending bits
  - In labs, routers are often connected back to back
    - Routers normally use DTE cable
    - One needs a DCE cable in the lab (or special combination DTE-DCE cable)
    - The router with the DCE cable needs a clock rate command telling it to supply clocking

```
NC3(config-if)#clock rate ?
Speed (bits per second)
 1200      2400      4800      9600
 19200     38400     56000     64000
 72000     125000    148000    250000
500000     800000    1000000   1300000
2000000    4000000
```

## INTERFACE COMMANDS

- Clock rate command: after the clock rate is selected, it can be checked with “show controllers” or “show run”

```
Router#show controller serial 1
HD unit 1, idb = 0x1009FC, driver structure at 0x105E88
buffer size 1524 HD unit 1, V.35 DCE cable, clockrate 125000
....

Router#Show running-config
....
interface Serial1
description Distant End: SEN31
bandwidth 125
ip address 148.33.0.29 255.255.255.252
no ip directed-broadcast
ip ospf interface-retry 0
clockrate 125000
```



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## INTERFACE COMMANDS

- On many of the different kinds of interface, we also have to tell the router which encapsulation to use
- This is done with the “encapsulation *protocol*” interface mode configuration command

```
NC3(config)#int s 0
NC3(config-if)#encapsulation ?
atm-dxi      ATM-DXI encapsulation
bstun        Block Serial tunneling (BSTUN)
frame-relay  Frame Relay networks
hdlc         Serial HDLC synchronous
lapb         LAPB (X.25 Level 2)
ppp          Point-to-Point protocol
sdlc         SDLC
...
smds         Switched Megabit Data Service (SMDS)
stun         Serial tunneling (STUN)
x25          X.25
```



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## Interface Commands

- *Optional activity: enter configuration mode*
- *Use help to find out what types of encapsulation are available for an Ethernet interface*

## Topics

- Cisco Command Modes
- Command Line Interface (CLI) Help and Editing
- Configuration Mode
- Interface Commands
- Line Commands
- Working with Configurations

## LINE COMMANDS

- Settings for console, aux, or vty (telnet) terminal lines
  - “login” causes the router to ask for a password
  - “password *word*” tells it what password to accept
- Same commands can be entered for the physical ports “line con 0”, “line aux 0” or the telnet ports “line vty 0 4”

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

## LINE COMMANDS

- Specify the terminal idle interval with the line command

```
exec-timeout minutes seconds
```

- If terminal is idle that amount of time, the user is logged off
- Please don't use times like “0 2” because the resulting idle time is 2 seconds!

```
Router(config)#line vty 0 4  
Router(config-line)#login  
Router(config-line)#password cisco  
Router(config-line)#exec-timeout 10 0
```

## Line Commands

- *Optional activity: enter configuration mode and put yourself into line configuration sub-mode*
- *Use “?” to examine what command beginnings are available*
- *We’ll later cover routing. For now, exit line config mode and use the command “**router rip**” to put yourself into router config sub-mode.*
- *Use “?” to examine what command beginnings are available*

## Topics

- Cisco Command Modes
- Command Line Interface (CLI) Help and Editing
- Configuration Mode
- Interface Commands
- Line Commands
- Working with Configurations

## WORKING WITH CONFIGURATIONS

- There are two configurations in Cisco routers (and many of the switches)
  - Running: **current** set of config commands
  - Startup: **last saved** set of config commands
- To look at the configuration commands

```
show run  
show startup
```

- What does “show config” do?
  - Causes confusion: shows last SAVED config, not the running one
  - Be careful with this! Best: don't use it

## WORKING WITH CONFIGURATIONS

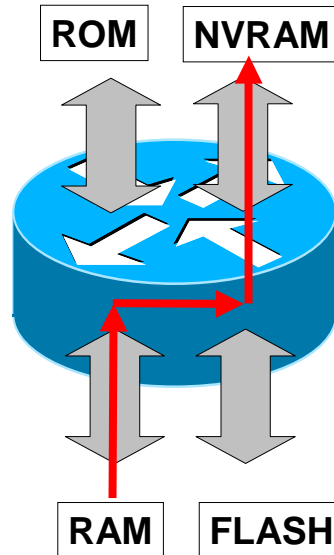
- “show run” shows the current running configuration

```
Router#show run  
Building configuration...  
  
Current configuration : 2237 bytes  
!  
version 12.1  
no service single-slot-reload-enable  
service timestamps debug uptime  
service timestamps log uptime  
no service password-encryption  
!  
hostname top  
!  
logging rate-limit console 10 except errors  
enable password san-fran  
(etc.)
```

## WORKING WITH CONFIGURATIONS

- Copy the current running configuration to NVRAM (“startup-configuration”):

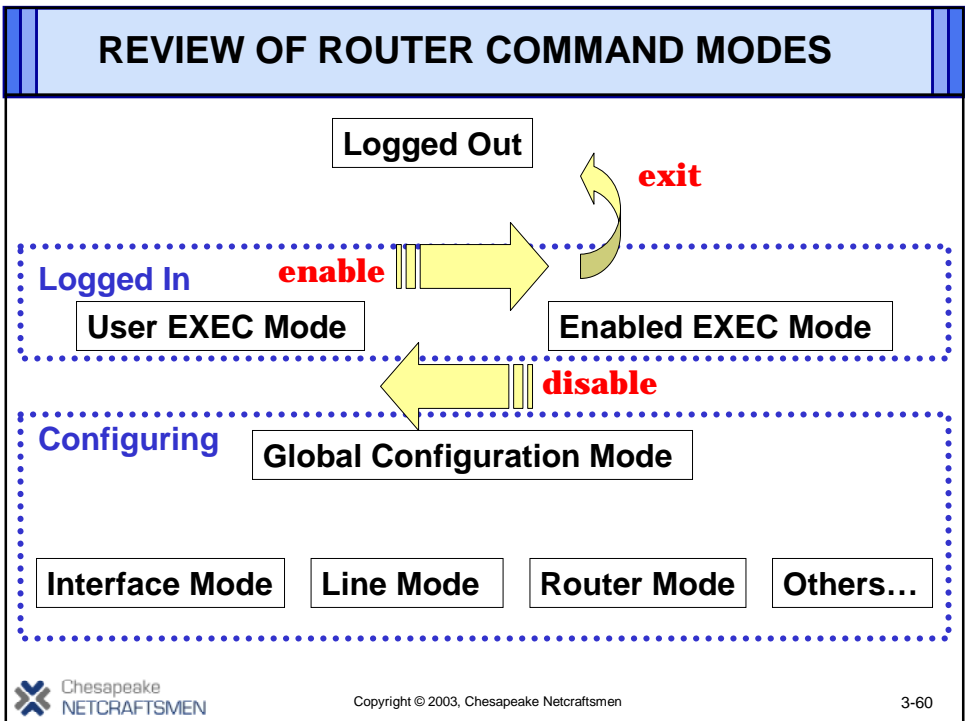
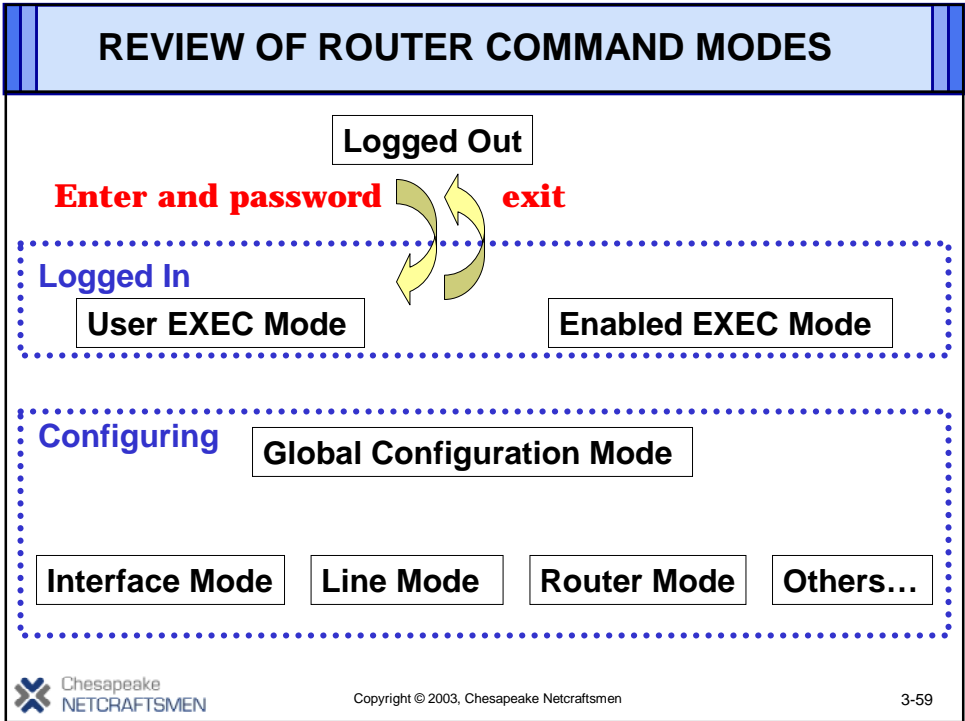
```
Router#copy running-config startup-config
```

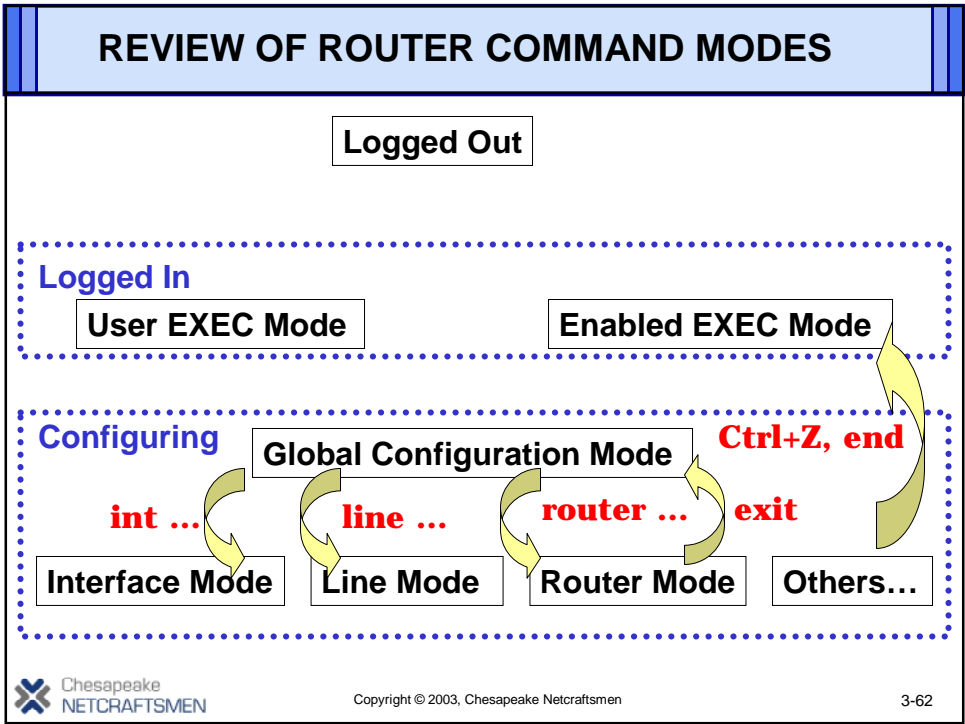
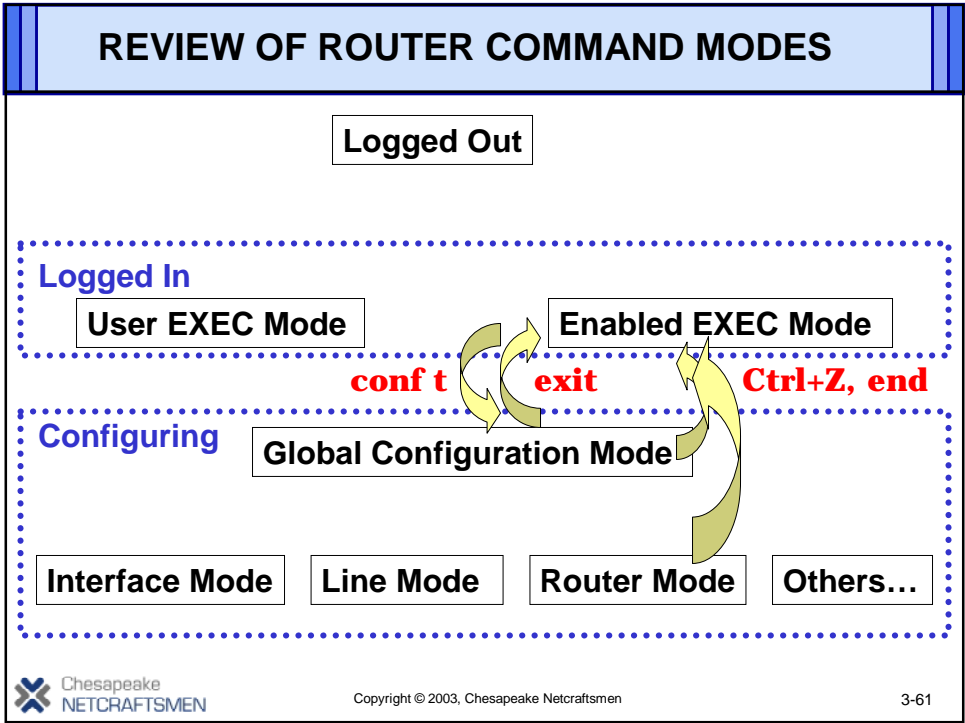


## WORKING WITH CONFIGURATIONS

There are other possible sources for a configuration:

- SETUP dialog on startup if router boots with no saved configuration
  - This is easy but time-consuming
  - Experienced professionals prefer to edit an existing (captured) router configuration
- Web (HTTP)
  - Needs to be enabled on the router CLI
- TFTP
  - Use “copy tftp run” or “copy tftp start” to load a text file from a TFTP server
- Autoinstall
  - Uses TFTP to load a prepared configuration to a new router





## Review Questions

- What is the purpose of router configuration modes?
  - Saves specifying information over & over
  - Simplifies help: only commands appropriate for the context shown
- Name three different ways to use “?” to get help
  - Beginning of blank line: command beginnings
  - After a character: command completions
  - After some keywords and a space: next keyword in command
- What is the usual config register setting?
  - 0x2102
- If an interface is shutdown, how do you re-activate it?
  - Type “**no shutdown**”, in interface configuration mode

## Review Questions – 2

- Name and describe some interface commands
- Name and describe some router commands
- Name and describe some line commands
- Name and describe some global configuration commands
- Name and describe some EXEC mode commands
- It is a good idea to administratively disable unused interfaces. What command does this?
- (Discussion) What do you think happens when a router is configured with a console password but no “**login**” statement on the console line?

## Summary

- Having completed this chapter, you should be able to:
  - Explain the Cisco command modes
  - Use Command Line Interface (CLI) help and editing
  - Enter and use Cisco configuration mode
  - Know and use basic interface commands
  - Know and use basic line commands
  - Perform basic operations with configurations

## References

- *Cisco CCNA Study Guide.*
  - Wendell Odom, Cisco Press, ISBN 0-7357-0971-8