Configuration with IOS

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Sisco's IOS

- Internetwork Operating System (IOS).

- The IOS runs in Cisco routers and also some Cisco switches, which allows you to configure the devices

IOS software is used on Cisco hardware for

- Carry network protocols and functions

- Connect high-speed traffic between devices

- Add security to control access and stop unauthorized network use

IOS software is used on Cisco hardware for..

- Provide scalability for ease of network growth and redundancy

- Supply network reliability for connecting to network resources

- You can access the Cisco IOS through the console port of a router, from a modem, or even through Telnet.

- The console port is usually a RJ-45 connection on the back of the router.

- This is used to connect to and configure the router.

Bringing Up a Router

- When you first bring up a Cisco router, it will run a power-on self test (POST), and if that passes, it will look for and load the Cisco IOS from Flash memory if a file is present.

Bringing Up a Router..

- The IOS will load and then look for a valid configuration called startup-config that is stored by default in non volatile RAM

Bringing Up a Router..

- If there is no configuration in NVRAM, then the router will bring up what is called setup mode.

- This is a step-by-step process to help you configure a router.

- You can also enter setup mode at any time from the command line by typing the command setup from global configuration mode

Setup Mode

- You actually have two options when using setup mode:

    - Basic Management

    - Extended Setup.

- Basic Management only gives you enough configurations to allow connectivity to the router, whereas Extended Setup allows you to configure some global parameters as well as interface configuration parameters.

Sample setup..

--- System Configuration Dialog ---

Would you like to enter the initial configuration dialog?

[yes/no]: y

At any point you may enter a question mark '?' for help.

Use ctrl-c to abort configuration dialog at any prompt.

Default settings are in square brackets '[]'.

Basic Management Setup configures only enough connectivity for man-

agement of the system; Extended Setup will ask you to configure each inter-

face on the system.

Would you like to enter basic management setup?

[yes/no]: n

First, would you like to see the current interface summary?

[yes]:return

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Setting the router by CLI

- Command-Line Interface (CLI) is really the best way to configure a router because it gives you the most flexibility.

- To use the CLI, just say no to entering the Initial Configuration Dialog.

- After you say no, the router will come back with messages stating the status of all the router interfaces

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Would you like to enter the initial configuration dialog?

[yes]: n

Would you like to terminate autoinstall? [yes]:return

Press RETURN to get started!

00:00:42: %LINK-3-UPDOWN: Interface Ethernet0, changed state to up

00:00:42: %LINK-3-UPDOWN: Interface Serial0, changed state to down.......

Logging into the Router

- After the interface status messages appear and you press Return, the **_Router>_** prompt will appear.

- This is called **user mode** and is mostly used to view statistics

Different Modes

- User Mode

- Privilege Mode

- Global Configuration Mode

Privilege Mode

- You can view and change the configuration of a Cisco router, only in **privileged mode**

- To go to privileged mode enter the command *enable.*

Privilege Modes

- **Router>**
- **Router>enable**
- **Router#**

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- You can go back from privileged mode to user mode by using the ***disable*** command

  - **Router#disable**
  - **Router>**

- At this point you can type ***logout*** to exit the console.

  - **Router>logout**

- ***Logout*** or ***exit*** at privileged mode also does same.

Router Modes

- To configure from a CLI, you can make global changes to the router by typing *config terminal* (*config t* for short)

- This puts you in global configuration mode and changes the **running-config**.

- You can type *config* from the privileged mode prompt

Router#config

Configuring from terminal, memory, or network

[terminal]?return

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

Router(config)#

- At this point you make changes that affect the router as a whole, hence the term global configuration mode.

CLI Prompts

- To make changes to an interface, you use the interface command from global configuration mode

Router(config)#interface ?

Async: Async interface

BVI: Bridge-Group Virtual Interface

Dialer: Dialer interface

FastEthernet: FastEthernet IEEE 802.3

Group-Async: Async Group interface

Router(config)#interface fastethernet 0/0

Router(config-if)#

- Notice the prompt changed to

Router(config-if)# and tells you that you are in interface configuration.

Subinterfaces

- Subinterfaces allow you to create virtual interfaces within the router.

- The prompt then changes to

Router(config-subif)#.

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Router(config)#int f0/0.?

<0-4294967295> FastEthernet interface number

Router(config)#int f0/0.1

Router(config-subif)#

Line Command

- To configure user mode passwords, use the line command.

- The prompt then becomes

  Router (config-line)#.

Router#config t

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

Router(config)#line ?

<0-70> First Line number

Aux   Auxiliary line

console   Primary terminal line

Tty   Terminal controller

Vty   Virtual terminal

Router(config)#line console 0

Router(config-line)#

- The line console 0 command is known as a major, or global, command

Routing Protocol Configurations

- To configure routing protocols like RIP and IGRP, use the prompt **(config-router)#.**

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Router#config t

Enter configuration commands, one per line.

End with CNTL/Z.

Router(config)#router rip

Router(config-router)#

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Help Features

- By using a question mark (?) at any prompt, you can see the list of commands available from that prompt

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Router#?

Exec commands:

access-enable

Create a temporary Access-List entry

access-profile

Apply user-profile to interface

access-template Create a temporary Access-List entry

bfe

For manual emergency modes setting

clear

Reset functions

clock

Manage the system clock

- To find commands that start with a certain letter, use the letter and the question mark (?)

  - **Router#c?**
  - clear clock configure connect copy

- To find the next command in a string, type the first command and then a question mark.

Router#clock ?

Set Set the time and date

Router#clock set ?

hh:mm:ss Current Time

Router#clock set 10:30:10 ?

<1-31>   Day of the month

MONTH Month of the year

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Router#clock set 10:30:10 28 ?

MONTH   Month of the year

Router#clock set 10:30:10 28 may ?

<1993-2035> Year

Router#clock set 10:30:10 28 may 2000 ?

<cr>

Router#

Gathering Basic Routing Information

- The command ***show version*** will provide basic configuration for the system hardware as well as the software version, the names and sources of configuration files, and the boot images

Router#sh version

Cisco Internetwork Operating System Software

IOS (tm) 2500 Software (C2500-JS-L), Version 12.0(8),

RELEASE SOFTWARE (fc1)

Copyright (c) 1986-1999 by cisco Systems, Inc.

Compiled Mon 29-Nov-99 14:52 by kpma

Image text-base: 0x03051C3C, data-base: 0x00001000

Setting the Passwords

- There are five passwords used to secure Cisco routers.

- The first two passwords are used to set your enable password, which is used to secure privileged mode.

- This will prompt a user for a password when the command **enable** is used.

- The other three are used to configure a password when user mode is accessed either through the console port, the auxiliary port, or Telnet.

Enable Passwords

- You set the enable passwords from global configuration mode.

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Router(config)#enable ?

Last-resort - Define enable action if no TACACS servers respond

Password - Assign the privileged level password

Secret - Assign the privileged level secret

Use-tacacs - Use TACACS to check enable passwords

- **Password** is used to set the enable password on older, pre-10.3 systems.

- **Secret** is used in new devices and stores password in encrypted mode

- Secret Is the newer, encrypted password.

- Overrides the enable password if set.

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usage

- ***Router(config)#enable password bhat1***

- ***Router(config)#enable secret bhat2***

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- User-mode passwords are assigned by using the *line* command

Router(config)#line ?

<0-4> First Line number

Aux   Auxiliary line

Console Primary terminal line

Vty Virtual terminal

- Aux Is used to set the user-mode password for the auxiliary port

- Console Is used to set a console user-mode password.

- Vty Is used to set a Telnet password on the router.

configure the auxiliary password

Router(config)#line aux ?

<0-0> First Line number

Router(config)#line aux 0

Router(config-line)#login

Router(config-line)#password bhat1

configure the console password

Router(config)#line console ?

<0-0> First Line number

Router(config)#line console 0

Router(config-line)#login

Router(config-line)#password bhat2

Telnet Password

Router(config-line)#line vty 0 ?

<1-197>Last Line Number

Router(config-line)#line vty 0 197

Router(config-line)#login

Router(config-line)#password bhat3

- You can tell the router to allow Telnet connections without a password by using the *no login* command

- *Router(config-line)#line vty 0 197*
- *Router(config-line)#no login*

Encrypting Your Passwords

- Only the enable **secret** encrypts the password by default.

- You need to manually configure the user-mode enable passwords

- Notice that you can see all the passwords except the enable secret when performing a ***show running-config*** or **sh run** on a router.

Router#sh run

[output cut]

!

enable secret 5 1rFbM$8.aXocHg6yHrM/zzeNkAT.

enable password bhat1

!

[output cut]

line con 0

password bhat2

- To manually encrypt your passwords, use the *service password-encryption* command

example

Router#config t

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

Router(config)#**service password-encryption**

Router(config)#**enable password bhat1**

Router(config)#**line vty 0 197**

Router(config-line)#**login**

Router(config-line)#**password bhat2**

Router(config-line)#**line con 0**

Router(config-line)#**login**

Router(config-line)#**password bhat3**

Router(config-line)#**line aux 0**

Router(config-line)#**login**

Router(config-line)#**password bhat4**

Router(config-line)#**exit**

Router(config)#**no service password-encryption**

Router(config)#**^Z**

Check encryption

Router#sh run

Building configuration...

[output cut]

!

enable secret 5 1rFbM$8.aXocHg6yHrM/zzeNkAT.

enable password 7 0835434A0D

!

[output cut]

!

line con 0

password 7 111D160113

The **exec-timeout** command sets the timeout for the console session

Router(config)#line con 0

Router(config-line)#exec-timeout 5 0

Router(config)#line con 0

Router(config-line)#exec-timeout ?

<0-35791> Timeout in minutes

Router(config-line)#exec-timeout 0 ?

<0-2147483> Timeout in seconds

<cr>

Router(config-line)#exec-timeout 0 0

Banners

- You can set a banner on a Cisco router so that when a user logs into the router or an administrator telnets into the router, a banner will give them the information

Banners..

- Another reason for having a banner is to add a security notice to users dialing into your internetwork.

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- There are four different banners available
  - Message of the Day
  - Exec banner
  - Incoming banner
  - Login banner

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Router(config)#banner ?

LINE --   c banner-text c, where 'c' is a delimiting character

Exec --   Set EXEC process creation banner

Incoming --   Set incoming terminal line banner

Login -- Set login banner

Motd -- Set Message of the Day banner

motd

- The Message of the Day is the most used and gives a message to every person dialing in or connecting to the router via Telnet, auxiliary port, or console port

motd

Router(config)#**banner motd** #

Enter TEXT message. End with the character '#'.

If you are not authorized, then you must
   disconnect immediately.

#

Router(config)#**^Z**

Login banner

- You can configure a login banner to be displayed on all connected terminals.

- This banner is displayed after the MOTD banner but before the login prompts

Router Interfaces

- Interface configuration is one of the most important configurations of the router.

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- Some of the configurations used to configure an interface are Network layer addresses, media type, bandwidth, and other administrator commands

- following command shows a 2522 router with 10 serial interfaces, which are labeled 0 through 9

Router(config)#int serial ?

<0-9> Serial interface number

- At this point you must choose the interface you want to configure.

- Once you do that, you will be in interface configuration for that interface.

Router(config)#**int serial ?**

<0-9> Serial interface number

Router(config)#**int serial 5**

Router(config)-if)#

Router(config)#**int ethernet ?**

<0-0> Ethernet interface number

Router(config)#**int ethernet 0**

Router(config-if)#

- To configure an interface, you always use the interface type number sequence.

- However, the 2600, 3600, 4000, and 7000 series routers use a physical slot in the router and a port number on the module plugged into that slot.

- For example, on a 2600 router, the configuration would be interface type slot/port:

on a 2600 router

Router(config)#**int fastethernet?**

<0-1> FastEthernet interface number

Router(config)#**int fastethernet 0**

% Incomplete command.

on a 2600 router..

Router(config)#**int fastethernet 0?**

/

Router(config)#**int fastethernet 0/?**

<0-1> FastEthernet interface

- Notice that you cannot type

  int fastethernet 0.

- You must type the full command,

  int fastethernet 0/0.

- You can type

  int fa 0/0

- To set the type of connector used, use the command **media-type**

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Router(config)#**int fa 0/0**

Router(config-if)#**media-type ?**

100BaseX   Use RJ45 for -TX; SC FO for -FX

MII   Use MII connector

- However, this is typically auto-detected

Bringing Up an Interface

- You can turn off an interface with interface command **shutdown**

- Turn it on with the **no shutdown** command.

- If an interface is shut down, it will display administratively down when using the ***show interface*** command

- The ***show running-config*** command will show the interface as shut down.

- All interfaces are shut down by default.

Router#sh int e0

Ethernet0 is administratively down, line protocol is down

[output cut]

Router(config)#**int e0**

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

Router(config-if)#**^Z**

00:57:08: %LINK-3-UPDOWN: Interface Ethernet0, changed state to up

00:57:09: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0, changed state to up

Router#**sh int e0**

Ethernet0 is up, line protocol is up

Configuring an IP Address on an Interface

- To configure IP addresses on an interface, use the **_ip address_** command

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Router(config)#**int e0**

Router(config-if)#**ip address 172.16.10.2 255.255.255.0**

Router(config-if)#**no shut**

- To add a secondary IP address, use the **secondary** command

Router(config-if)#**ip address 172.16.20.2 255.255.255.0 secondary**

Router(config-if)#**^Z**

- You can verify both addresses are configured on the interface with the ***show running-config*** command(***sh run***)

Router#**sh run**

Building configuration...

Current configuration:

[output cut]

!

interface Ethernet0

ip address 172.16.20.2 255.255.255.0 secondary

ip address 172.16.10.2 255.255.255.0

VIP Cards

- If you have a 7000 or 7500 series router with VIP (Versatile Interface Processor) cards, you define an interface by using

 interface type slot/port adapter/port number

Ex. 7000(config)#interface ethernet 2/0/0

Serial Interface Commands

- Cisco routers, by default, are all DTE devices.

- To act as a DCE device, we need to set clock rate and bandwidth using **clock rate command** & **bandwidth command.**

Router(config)#**int s0**

Router(config-if)#**clock rate ?**

Speed (bits per second)

1200

2400

4800

9600

19200

38400

56000

64000

Router(config-if)#**clock rate 64000**

%Error: This command applies only to DCE
  interfaces

Router(config-if)#**int s1**

Router(config-if)#**clock rate 64000**

- Every Cisco router ships with a default serial link bandwidth of a T1, or 1.544Mbps.

- The bandwidth of a serial link is used by routing protocols such as IGRP, EIGRP, and OSPF

Router(config-if)#**bandwidth ?**

<1-10000000> Bandwidth in kilobits

Router(config-if)#**bandwidth 64**

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- Notice that the clock rate command is in bits per second and bandwidth command is configured in kilobits..

Hostnames

- You can set the hostname of the router with the *hostname* command

Router(config)#hostname bhat

bhat(config)#

bhat(config)#hostname srinivas

srinivas(config)#

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Descriptions

- Setting descriptions on an interface is helpful to the administrator because it can be used to keep track of circuit numbers

Atlanta(config)#**int e0**

Atlanta(config-if)#**description Sales Lan**

Atlanta(config-if)#**int s0**

Atlanta(config-if)#**desc Wan to Miami circuit:6fdda4321**

- You can view the description of an interface either with the **show running-config** command or **show interface** command

Atlanta#**sh run**

[cut]

interface Ethernet0

description Sales Lan

ip address 172.16.10.30 255.255.255.0

interface Serial0

description Wan to Miami circuit:6fdda4321

no ip address

Atlanta#**sh int e0**

Ethernet0 is up, line protocol is up

Hardware is Lance, address is 0010.7be8.25db (bia

0010.7be8.25db)

Description: Sales Lan

[cut]

Atlanta#**sh int s0**

Serial0 is up, line protocol is up

Hardware is HD64570

Description: Wan to Miami circuit:6fdda4321

[cut]

Viewing and Saving Configurations

- If you run through setup mode,then it will copy the configuration running in DRAM, known as **running-config**, to NVRAM and name the file **startup-config**.

- You can manually save the file from DRAM to NVRAM by using the command

copy running-config startup-config

OR

copy run start

Router#copy run start

Destination filename [startup-config]?**return**

Warning: Attempting to overwrite an NVRAM configuration

previously written by a different version of the system

image.

Overwrite the previous NVRAM configuration?
  [confirm]**return**

Building configuration...

- You can view the files by typing the command **show running-config** or **show startup-config** from privileged mode.

Router#**sh run**

Building configuration...

Current configuration:

version 12.0

service timestamps debug uptime

service timestamps log uptime

no service password-encryption

hostname Router

ip subnet-zero

frame-relay switching

[cut]

The **sh start** command, which is the shortcut for **show startup-config** command, shows us the configuration that will be used the next time the router is reloaded

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Router#**sh start**

Using 4850 out of 32762 bytes

version 12.0

service timestamps debug uptime

service timestamps log uptime

no service password-encryption

hostname Router

ip subnet-zero

frame-relay switching

- You can delete the startup-config file by using the command **erase startup-config.**

Router#**erase startup-config**

Erasing the nvram filesystem will remove all files!

Continue? [confirm]

[OK]

Erase of nvram: complete

- Another way to verify your configuration is by typing **show interface** commands.

- The first command is **show interface ?**, which shows us all the available interfaces to configure.

Router#**sh int ?**

Ethernet IEEE 802.3

Null Null interface

Serial Serial

Accounting Show interface accounting

Crb Show interface routing/bridging info

Irb   Show interface routing/bridging info

- The next command is show interface ethernet 0 and shows us the hardware address, logical address, and encapsulation method, as well as statistics on collisions

Router#**sh int e0**

Ethernet0 is up, line protocol is up

Hardware is Lance, address is 0010.7b7f.c26c (bia 0010.7b7f.c26c)

Internet address is 172.16.10.1/24

MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec, reliability 255/255, txload 1/255, rxload 1/255

Encapsulation ARPA, loopback not set, keepalive set

- If Ethernet 0 is up, line protocol is up, and the line is up and running.

RouterA#**sh int e0**

Ethernet0 is up, line protocol is up

- The first parameter refers to the Physical layer and is up when it receives carrier detect.

- The second parameter refers to the Data Link layer and looks for keepalives from the connecting end

- If you see the line is up, but the protocol is down, you are having a clocking (keepalive) or framing issue.

RouterA#**sh int s0**

Serial0 is up, line protocol is down

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- Check the keepalives on both ends to make sure they match; the clock rate is set, if needed; and the encapsulation type is the same on both ends.

RouterA#**sh int s0**

Serial0 is down, line protocol is down

- If you see the line interface and protocol down, it is a cable or interface problem.

- Also, if one end is administratively shut down, then the remote end would show down.

- To turn on the interface, type the command **no shutdown** in interface configuration.

RouterB#**sh int s0**

Serial0 is administratively down, line protocol is
  down

Router#**sh int s0**

Serial0 is up, line protocol is up

Hardware is HD64570

MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,

reliability 255/255, txload 1/255, rxload 1/255

Encapsulation HDLC, loopback not set, keepalive
set (10sec)

- default bandwidth (BW) on all Cisco serial links is 1.544Kbs.

- This is used to determine the bandwidth of the line for routing protocols such as IGRP, EIGRP, and OSPF

- Another important configuration to notice is the keepalive, which is 10 seconds by default.

- Each router sends a keepalive message to its neighbor every 10 seconds.

- If both routers are not configured for the same keepalive time, it will not work.

- You can clear the counters on the interface by typing the command **clear counters**.

Router#**clear counters ?**

Ethernet   IEEE 802.3

Null   Null interface

Serial Serial

Router#**clear counters s0**

Clear "show interface" counters on this interface

[confirm]**return**

Router#

00:17:35: %CLEAR-5-COUNTERS: Clear counter on interface Serial0 by console

Using the Show Controllers Command

- The show controllers command displays information about the physical interface itself.

- It will also give you the type of serial cable plugged into a serial port.

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Router#**sh controllers s 0**

HD unit 0, idb = 0x1229E4, driver structure at 0x127E70

buffer size 1524 HD unit 0, V.35 DTE cable

cpb = 0xE2, eda = 0x4140, cda = 0x4000

Router#**sh controllers s 1**

HD unit 1, idb = 0x12C174, driver structure at 0x131600

buffer size 1524 HD unit 1, V.35 DCE cable

cpb = 0xE3, eda = 0x2940, cda = 0x2800

- Notice that serial 0 has a DTE cable, whereas the serial 1 connection has a DCE cable.

- Serial 1 would have to provide clocking with the **clock rate** command.

- Also, understand that this is the only command that needs to have a space after the command serial

Router#**sh controllers s1**
                                        ^

% Invalid input detected at '^' marker.

Assignments

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