ENCS4130 Computer Networks Laboratory

# EXP#2 Router Configuration and Static Routing

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# Objectives

- Learn how to configure a Cisco IOS router using the IOS command line interface (CLI).
- Learn how to use router simulator.





# Introduction

- Connecting Multiple Networks:
  - A router connects different networks (subnets) and directs data to the correct destination.
- Layer-3 Device:
  - Uses IP addresses (Layer-3) to route packets to their destination.
- Why Subnets?
  - To control traffic, dividing the network into segments.
- Routing Types:
  - Static Routing: Manually updated by the network admin.
  - Dynamic Routing: Automatically updates routing information.



# **Cisco Routers**





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# The Cisco Router User Interface

- Cisco Internetwork Operating System (IOS):
  - The core software (kernel) for Cisco routers and some switches.
  - Manages hardware, security, and resources.
- Key Responsibilities of Cisco IOS:
  - Handles network protocols and functions.
  - Connects high-speed traffic between devices.
  - Adds security to control access.
  - Supports scalability for network growth.
  - Ensures reliability for accessing network resources.
- Accessing an Interface:

- Use the command: interface <TYPE> <SLOT>/<PORT> STUDENTS-HUB.com





# Connecting to a Cisco Router

#### • Console Port:

- RJ-45 connection at the back of the router.
- No password set by default.
- Auxiliary Port:
  - Similar to the console port.
  - Can be used with a modem for remote access (out-of-band configuration).
  - Physical connection; you directly connect a modem or serial device to the router.
- Telnet:
  - In-band connection through any active interface.
  - Uses terminal emulation for remote access.

- Network-based connection; you connect remotely over the network using Telnet protocol. STUDENTS-HUB.com Uploaded By: anonyr

# Routing







# What is Routing?

- Routing:
  - Sending a packet from one device to another on a different network.
- Routers' Role:
  - Focus on networks, not individual hosts.
  - Use the host's MAC address (hardware address) only after the packet has reached the correct network.
- Key Things a Router Needs to Know:
  - Destination address.
  - Neighbouring routers.
  - Routes to remote networks.
  - Best route to each network.
- How to maintain routing information. STUDENTS-HUB.com





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# **Routing Table**



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# **Static Routing**

- What is Static Routing?
  - Manually adding routes to each router's routing table.
- Benefits:
  - No CPU overhead on the router (cheaper routers can be used).
  - No bandwidth usage between routers (saves money on WAN links).
  - Adds security by controlling which networks can be routed.
- Disadvantages:
  - Requires a deep understanding of the network for correct configuration.
  - Manually updating routes when changes occur.
  - Not suitable for large networks due to maintenance difficulty.

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# **Dynamic Routing**

- What is Dynamic Routing?
  - Routers automatically communicate and update routing tables using protocols.

#### • Advantages:

- Automatically adjusts to network changes.
- Reduces the need for manual updates.
- Disadvantages:
  - Uses more CPU and bandwidth than static routing.
  - Can be more complex to configure.



# **Procedure**



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# **IP** Address

The IP address as follows: 192.X.10.0 → where X is : for example, student ID is 1224530, X = 30, and so the network will be 192.30.10.0/S.M





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# Topology

• The topology contains:

Name	Quantity	Symbol
Router-PT	2	Router-PT
Switch-PT	2	Switch-PT
PC-PT	2	PC-PT

Use Automatically use connection type:









#### IP Address Distribution Network 0 Network 0 192.X.0.0/24 **Device/Interface IP** address Subnet mask Network PC0 192.X.0.2/24 255.255.255.0 Network 0 192.X.0.0/24 Router0 Fa0/0 192.X.0.1/24 255.255.255.0 Fa0





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# **IP Address Distribution Network 1**

Network	Device/Interface	IP address	Subnet mask
Network 1	PC1	192.X.1.2/24	255.255.255.0
192.X.1.0/24	Router1 Fa0/0	192.X.1.1/24	255.255.255.0





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# **IP Address Distribution Network 2**



Network	Device/Interface	IP address	Subnet mask
Network 2	Router0 Se2/0	192.X.2.1/24	255.255.255.0
192.X.2.0/24	Router1 Se2/0	192.X.2.2/24	255.255.255.0

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# **IP Address Distribution Networks**

Network	Device/Interface	IP address	Subnet mask	
Network 0	PC0	192.X.0.2/24	255.255.255.0	
192.X.0.0/24	Router0 Fa0/0	192.X.0.1/24	255.255.255.0	
Network 1	PC1	192.X.1.2/24	255.255.255.0	
192.X.1.0/24	Router1 Fa0/0	192.X.1.1/24	255.255.255.0	
Network 2	Router0 Se2/0	192.X.2.1/24	255.255.255.0	
192.X.2.0/24	Router1 Se2/0	192.X.2.2/24	255.255.255.0	



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# Gateway IP

- Definition:
  - A Gateway IP is the IP address of a network device (like a router) that connects your local network to external networks, including the internet.
- Purpose:
  - It acts as an exit point for data leaving your local network and directs traffic to the correct destination.
- Example:
  - If your device is trying to access a website, the Gateway IP helps route the request from your home network to the internet.
- **Common Gateway IP:** Usually the first available IP address in the network.
- Note: It's not the same as the Network IP.

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# Gateway IP (Cont.)





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# Show the port labels







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# Configuring IPs for the PCs

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Physical Config	Desktop	tom Interface			
106			run	http:	^
IP Configuration	Dial-up	Terminal	Command Prompt	Web Browser	
(('0')) Å		<b>F</b>	MIB		
PC Wireless	VPN	Traffic Generator	MIB Browser	Cisco IP Communicato	or
	mm		IPv4	IPv6	
Email	PPPoE Dialer	Text Editor	Firewall	IPv6 Firewall	
					×

Physical Config Desktop	Programming Attributes
IP Configuration	X
Interface FastEthernet	0 ~
IP Configuration	
⊖ DHCP	<ul> <li>Static</li> </ul>
IPv4 Address	192.30.0.2
Subnet Mask	255.255.255.0
Default Gateway	192.30.0.1
DNS Server	0.0.0.0
IPv6 Configuration	
O Automatic	<ul> <li>Static</li> </ul>
IPv6 Address	
Link Local Address	FE80::2D0:58FF:FE54:B816
Default Gateway	
DNS Server	

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# Configuring IPs for the Routers







# **Router Modes**

- User Mode: This is the most basic mode, where you have limited access to view basic information.
  - Router>
- **Privileged Mode:** Provides access to more detailed information and some configuration capabilities.
  - Router#
- Global Configuration Mode: This is where you make global changes to the router's configuration.
  - Router(config)#
- **Global Configuration Mode On Interface:** A sub-mode of Global Configuration Mode used to configure specific interfaces like Ethernet, Serial, etc.
  - Router(config-if)#

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# Router Modes (Cont.)





# Configuring IPs for the Routers





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# Configuring IPs for the Routers (Cont.)

	TOS Command Line Interface			
Software c	lause at DFARS sec. 252.227-7013.			1
	cisco Systems, Inc.			
	170 West Tasman Drive			
	San Jose, California 95134-1706			
Cisco Inte	rnetwork Operating System Software			
IOS (tm) P	T1000 Software (PT1000-I-M), Version 12.2(28), RELE	EASE SOFTWARE	(fc5)	
Technical	Support: http://www.cisco.com/techsupport			
Copyright	(a) 1985-2005 by alson Systems The			
	(c) 1900-2003 by cisco Systems, inc.			
Compiled W	ed 27-Apr-04 19:01 by miwang			
Compiled W	ed 27-Apr-04 19:01 by miwang FSC2005) processor (revision 0x200) with 60416K/512	20K bytes of m	emory	
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Compiled W PT 1001 (P Processor 1 PT2005 pro	ed 27-Apr-04 19:01 by miwang ISC2005) processor (revision 0x200) with 60416K/512 board ID PT0123 (0123) cessor: part number 0, mask 01	20K bytes of m	emory	
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Compiled W PT 1001 (P Processor ) PT2005 pro Bridging s X.25 softw 4 FastEthe 2 Low-spee 20 hourse	<pre>d 27-Apr-04 19:01 by miwang ISC2005) processor (revision 0x200) with 60416K/512 board ID PT0123 (0123) cessor: part number 0, mask 01 oftware. are, Version 3.0.0. rnet/IEEE 802.3 interface(s) d serial(sync/async) network interface(s) of processor.</pre>	20K bytes of m	emory	
Compiled W PT 1001 (P Processor 1 PT2005 pro Bridging s X.25 softw 4 FastEthe 2 Low-spee 32K bytes 63488K byte	<pre>d 27-Apr-04 19:01 by miwang TSC2005) processor (revision 0x200) with 60416K/512 board ID PT0123 (0123) cessor: part number 0, mask 01 oftware. are, Version 3.0.0. rnet/IEEE 802.3 interface(s) d serial(sync/async) network interface(s) of non-volatile configuration memory. as of ATA CompactFlash (Read/Write)</pre>	20K bytes of m	emory	
Compiled W PT 1001 (P Processor 1 PT2005 pro Bridging s X.25 softw 4 FastEthe 2 Low-spee 32K bytes 63408K byte	<pre>d 27-Apr-04 19:01 by miwang TSC2005) processor (revision 0x200) with 60416K/51; board ID PT0123 (0123) cessor: part number 0, mask 01 oftware. are, Version 3.0.0. rnet/IEEE 802.3 interface(s) d serial(sync/async) network interface(s) of non-volatile configuration memory. es of ATA CompactFlash (Read/Write)</pre>	20K bytes of m	emory	
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**1- Enter User Mode** 

	System Configuration Dialog			]
	Would you like to enter the initial configuration dialog? [yes/no]: % Please answer 'yes' or 'no'. Would you like to enter the initial configuration dialog? [yes/no]: no		- 1	
	Press RETURN to get started!			
	Router>			
		Сору	Paste	
	) Тор			□ <b>α</b> ,
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# Configuring IPs for the Routers (Cont.)

### **2- Go to Privileged Mode**

	Would you like to enter the initial configuration dialog? [yes/no]: % Please answer 'yes' or 'no'.		
	Would you like to enter the initial configuration dialog? [yes/no]: no		
	Press RETURN to get started!		
ſ	Routerbenable		
	Router#		
	Router# Router#		
	Router#		
	Router# Router#	-	٩
Ľ		Copy Paste	
N٦	TS-HUB.com	Uploaded By	: anonymous
		-	



### **3-** Go to Global Configuration Mode

Router#	
Router#config t	
Enter configuration commands, one per line. End with CNTL/Z.	
Router(config)#	
	Copy Paste

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### **4-** Go to Global Configuration Mode On Interface





### **5- Bringing Up an Interface**

Router(config-if)#no shutdown		
Router(config-if)# %LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up		I
<pre>%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed</pre>	state to up	
Router(config-if)# Router(config-if)#		
	Сору	Paste

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# Configuring IPs for the Routers (Cont.)

### **6-** Configuring the first IP Address on an interface

	Router(config-if)# Router(config if)#ip add Router(config-if)#ip address 192.99.0.1 255.255.255.0 Router(config-if)#		
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C	] Тор		

# 7- Assign the rest of the IP addresses to the rest of the interfaces.



# **Configuring Static Routing**





# Configuring Static Routing (Cont.)





# **Other Important Configurations**

- 1. Showing all router configuration
  - Router# show running-config
- 2. Showing the routing table
  - Router# show ip route
- 3. Editing and Help Features
  - Router# c?
- 4. Set the hostnames
  - Router(config)# hostname RouterA
  - RouterA(config)#

- 5. Set the time and date
  - Router# clock set 10:30:10 28 January 2020
- 6. Set the clock rate
  - Router(config-if)# clock rate 64000
- 7. Set the bandwidth
  - Router(config-if)# bandwidth 64





# Passwords

- 1. Console
  - Router(config)# line con 0
  - Router(config-line)# password 111
  - Router(config-line)# login
- 2. Privileged
  - Router(config)# enable password 222
    - or
  - Router(config)# enable secret 222
- 3. Telnet
  - Router(config)# line vty 0 4
  - Router(config-line)# password 333
  - Router(config-line)# login





# Viewing and Saving Configurations

• Don't forget to save the configurations on your router.

→ Router# write
→ Router# copy run start





# Video explaining the experiment

https://www.youtube.com/watch?v=A8hdPdOdUtM&ab\_channel=TariqOdeh





## References

- Manual for ENCS4130 Computer Networks Laboratory.
- Slides from Dr. Amr Slimi.

