

# **NET 363**

# **Introduction to LANs**

## **Cisco IOS**

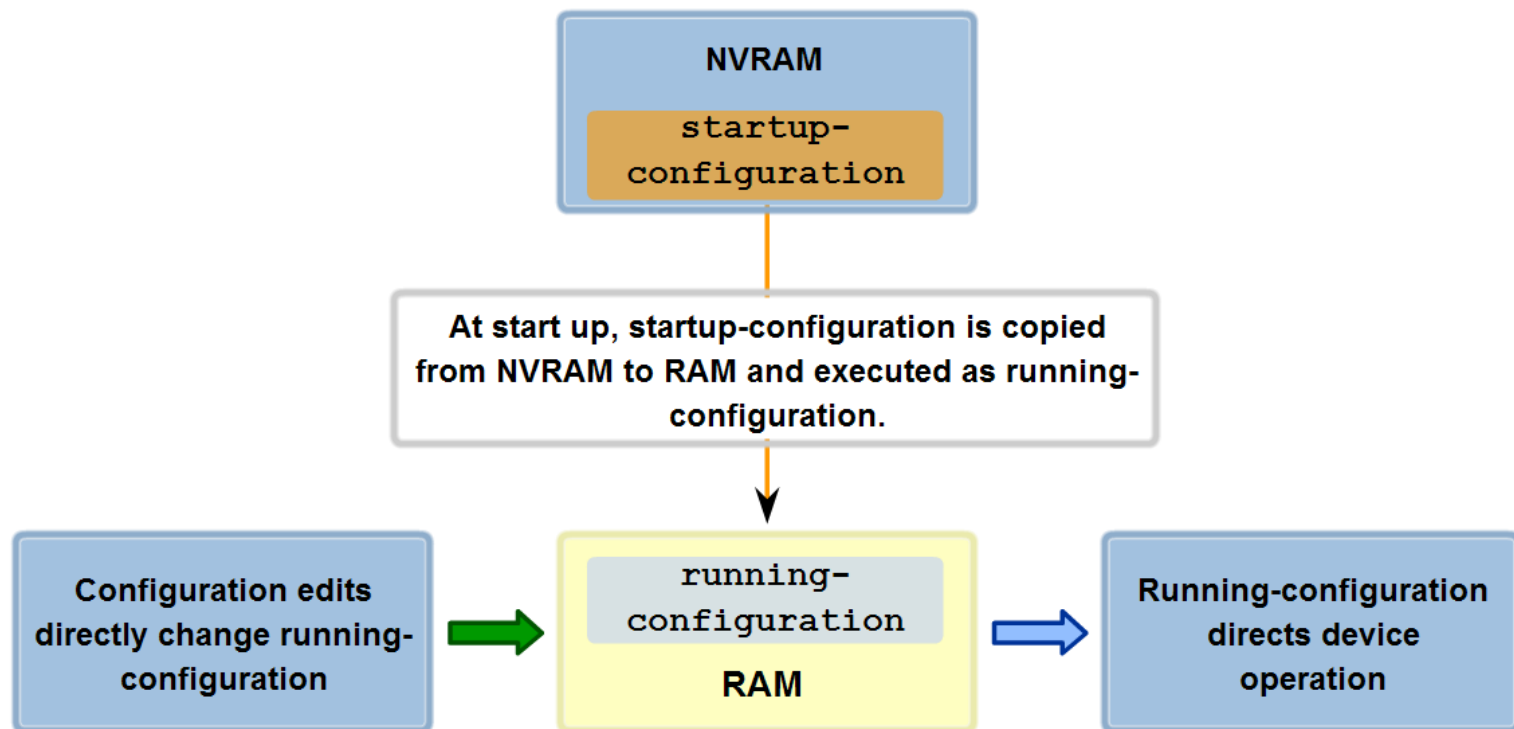
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# A Router/Switch is a Computer

- Router components and their functions”
  - **CPU** - Executes operating system instructions
  - **Random access memory (RAM)** - Contains the running copy of configuration file. Stores routing table. RAM contents lost when power is off
  - **Read-only memory (ROM)** - Holds diagnostic software used when router is powered up. Stores the router’s bootstrap program.
  - **Non-volatile RAM (NVRAM)** - Stores startup configuration. This may include IP addresses (Routing protocol, Hostname of router)
  - **Flash memory** - Contains the operating system (Cisco IOS)
  - **Interfaces** - There exist multiple physical interfaces that are used to connect network. Examples of interface types and names:
    - Ethernet (example names: Eth0/0, Eth1/1)
    - Fast Ethernet (example names: Fa0/0, Fa1/1)
    - Gigabit Ethernet (example names: Gi0/0, Gi1/1)
    - Serial interface (example names: Se0/0, Se1/1)

# startup-config vs. running-config

## Configuration Files



To save current configuration: **copy running-config startup-config**  
(not needed on Packet Tracer)

# Cisco CLI

- We will configure devices using text-based Command Line Interface (CLI) management, as opposed to web-based management.
- If you have not used CLI before – see *Network Academy* and <http://www.cisco.com/en/US/docs/ios/preface/usingios.html>

# Command Line Modes

- User EXEC Mode (Level 1)
  - *Hostname>*
- Privileged EXEC Mode (Level 15)
  - From User Mode, enter enable
  - *Hostname#*
- Global Configuration Mode
  - From Privileged Mode, enter configure terminal
  - *Hostname(config)#*
- Interface Configuration Mode
  - From Global Config Mode, enter interface command
  - *Hostname(config-if)#*
- To exit up one mode, type exit
- To exit all Config, type CTL-Z

# Command Types

- **Show** commands
  - Display current configuration and statistics
- **Configuration** Commands
  - Set internetworking parameters to specify how the device will forward packets
- Debug commands
  - Monitors events and prints status messages

# Keystroke Shortcuts

- Shortened Commands
  - Commands require only enough characters to be unique (i.e. “configure terminal” can be “conf t”)
- To interrupt current command and go back to command prompt, type Ctrl-Alt-6
- AutoComplete a Command
  - Tab Key
- Jump
  - Ctrl-A (beginning of line)
  - Ctrl-E (end of line)
- Command History
  - CTL-N or <Down-arrow>



# Help Function

- The Question Mark
  - Type “?” anywhere in CLI command to see all choices for the next word / command.
  - Example: ?
    - Displays all commands
  - Example: show ?
    - Displays all show commands
  - The best way to learn how to navigate the Cisco IOS!!

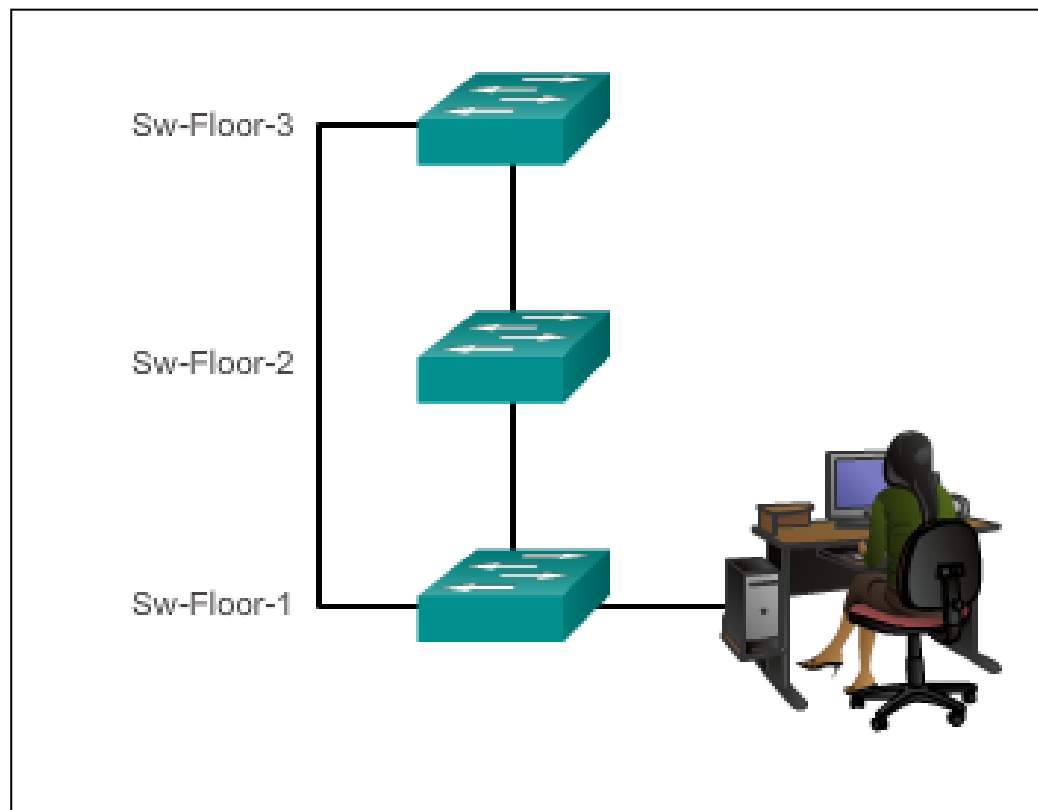




## Hostnames

# Configuring Device Names

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





## Hostnames

# 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)#
```

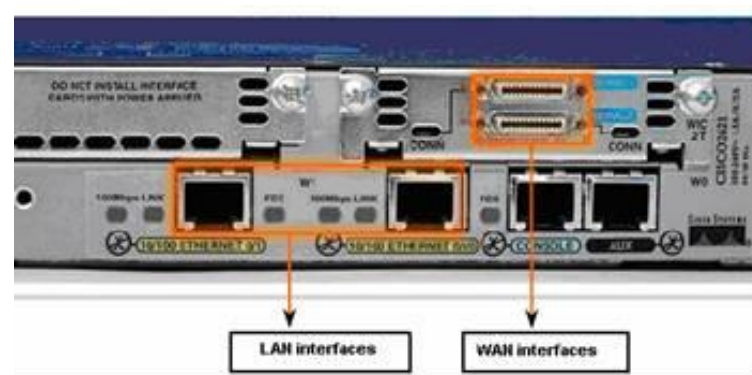
**You successfully configured the switch hostname.**

# Router Interfaces

- Two major groups of Router Interfaces

## LAN Interfaces:

- Are used to connect router to LAN network
- Has a layer 2 MAC address
- Has a Layer 3 IP address
- Usually an RJ-45 jack



- WAN Interfaces

- Are used to connect routers to external networks that interconnect LANs.
- Depending on the WAN technology, a layer 2 address may or may not be used.
- Has a layer 3 IP address
- Usually a Serial cable interface

# Interface Configuration

## Setting the IP address

- **interface <name>** to enter interface mode.
- **ip address <address> <subnet-mask>**
  - Sets interface address to <ip-address>
  - (Not on Pkt Tracer) Adds a /32 host address entry into routing table (code **L** = “local”)
  - Adds a /n subnet entry into routing table (code **C** = “connected”)
- **no shutdown**
  - Interface will not be active until you execute this (for security)

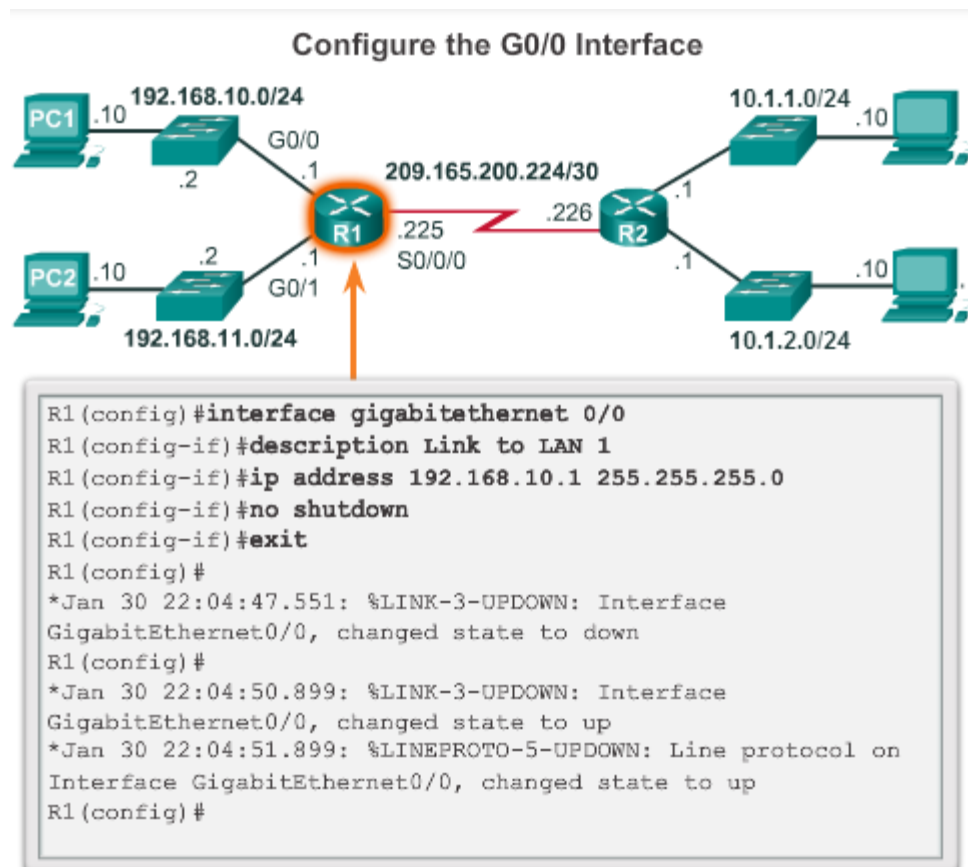


## Basic Settings on a Router

# Configure an IPv4 Router Interface

To be available, a router interface must be:

- Configured with an address and subnet mask .
- Must be activated using no shutdown command. By default LAN and WAN interfaces are not activated.
- Serial cable end labeled DCE must be configured with the clock rate command.
- Optional description can be included.



# Serial Interfaces

- Serial interfaces use special Cisco serial cables.
  - One cable end is DTE
  - One cable end is DCE
    - Router at the DCE end must set link speed using **clock rate** command
  - Also, may define encapsulation (layer 2 protocol) to be used. If not, then default is Cisco HDLC protocol

Example:  
1 Mbps PPP  
serial link

```
interface serial0/1
encapsulation ppp
clock rate 1000000
ip address 192.168.5.1 255.255.255.0
no shutdown
```

# Ex: Set 2 Interface IPs

Short forms

Rtr> **enable**

Rtr# **configure terminal**

Rtr (config)# **interface fa0/0**

Rtr (config-if)# **ip address 130.88.55.1 255.255.255.0**

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

Rtr (config-if)# **exit**

Rtr (config)# **interface se0/0**

Rtr (config-if)# **ip address 130.88.56.1 255.255.255.0**

Rtr (config-if)# **clock rate 2000000 ! Needed at DCE end**

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

Rtr (config-if)# **exit**

Rtr (config)#

[en]  
[conf t]  
[int fa0/0]



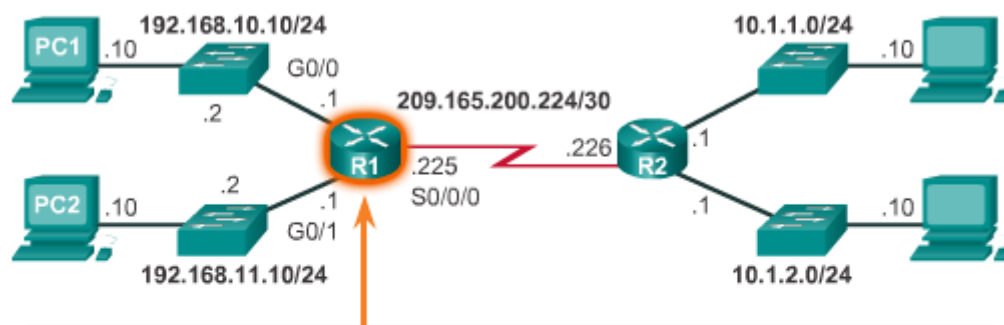
## Basic Settings on a Router

# Configure a Loopback Interface

**A loopback interface is a logical interface that is internal to the router:**

- It is not assigned to a physical port, it is considered a software interface that is always in an UP state.
- Other devices can ping to this address.
- A loopback interface is useful for testing.
- It is important in the OSPF routing process.

Configure the Loopback0 Interface



```

R2(config)#interface loopback 0
R2(config-if)#ip address 10.0.0.1 255.255.255.0
R2(config-if)#exit
R1(config)#
*Jan 30 22:04:50.899: %LINK-3-UPDOWN: Interface loopback0,
changed state to up
*Jan 30 22:04:51.899: %LINEPROTO-5-UPDOWN: Line protocol on
Interface loopback0, changed state to up
    
```



# Router CLI – Status Commands

- Show run
- Show interface
- Show ip interface brief
- Show ip route
- Show arp
- Show ip protocols
- Ping [extended]
- Traceroute

# Show ip interface brief

```
golem# sh ip int brief
```

Interface	IP-Address	OK?	Method	Status	Protocol
ATM0/0	unassigned	YES	NVRAM	up	up
ATM0/0.1	unassigned	YES	unset	up	up
FastEthernet0/0	192.168.254.1	YES	NVRAM	up	up
FastEthernet0/1	192.168.253.1	YES	NVRAM	up	up
Virtual-Access1	unassigned	YES	unset	up	up
Dialer1	67.37.249.78	YES	IPCP	up	up
Loopback0	10.255.255.255	YES	NVRAM	up	up

# Show arp

```
golem#show arp
```

Protocol	Address	Age (min)	Hardware Addr	Type	Interface
Internet	192.168.254.25	41	0008.a3db.8760	ARPA	FastEthernet0/0
Internet	192.168.253.1	-	00d0.bae8.00a1	ARPA	FastEthernet0/1
Internet	192.168.254.1	-	00d0.bae8.00a0	ARPA	FastEthernet0/0
Internet	192.168.254.76	41	0008.a3db.8760	ARPA	FastEthernet0/0
Internet	192.168.254.77	0	Incomplete	ARPA	
Internet	192.168.254.74	39	0008.a3db.8760	ARPA	FastEthernet0/0
Internet	192.168.254.75	41	0008.a3db.8760	ARPA	FastEthernet0/0
Internet	192.168.254.73	41	0008.a3db.8760	ARPA	FastEthernet0/0
Internet	192.168.253.101	10	0004.5a0d.29f8	ARPA	FastEthernet0/1
Internet	192.168.253.103	0	0030.1bab.43df	ARPA	FastEthernet0/1
Internet	192.168.253.110	46	0004.5a0d.29f8	ARPA	FastEthernet0/1
Internet	192.168.253.105	7	0003.6b40.869d	ARPA	FastEthernet0/1
Internet	192.168.253.104	13	0004.5a0d.3255	ARPA	FastEthernet0/1
Internet	192.168.253.106	3	0800.4643.1aed	ARPA	FastEthernet0/1

# Show ip protocols

## (shows routing protocol information)

```
golem#show ip protocols
```

Routing Protocol is "eigrp 77"

Outgoing update filter list for all interfaces is not set

Incoming update filter list for all interfaces is not set

Redistributing: eigrp 77

Automatic network summarization is in effect

Routing for Networks:

192.168.0.0

Routing Information Sources:

Gateway	Distance	Last Update
192.168.81.28	90	0:02:36
192.168.80.28	90	0:03:04
192.168.80.31	90	0:03:04

Distance: internal 90 external 170

# Show ip route

**golem#show ip route**

**Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP  
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area  
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2  
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP  
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area  
\* - candidate default, U - per-user static route, o - ODR  
P - periodic downloaded static route**

**Gateway of last resort is 0.0.0.0 to network 0.0.0.0**

**67.0.0.0/32 is subnetted, 2 subnets**

**C 67.37.248.1 is directly connected, Dialer1**

**C 67.37.249.78 is directly connected, Dialer1**

**10.0.0.0/32 is subnetted, 1 subnets**

**C 10.255.255.255 is directly connected, Loopback0**

**C 192.168.254.0/24 is directly connected, FastEthernet0/0**

**C 192.168.253.0/24 is directly connected, FastEthernet0/1**

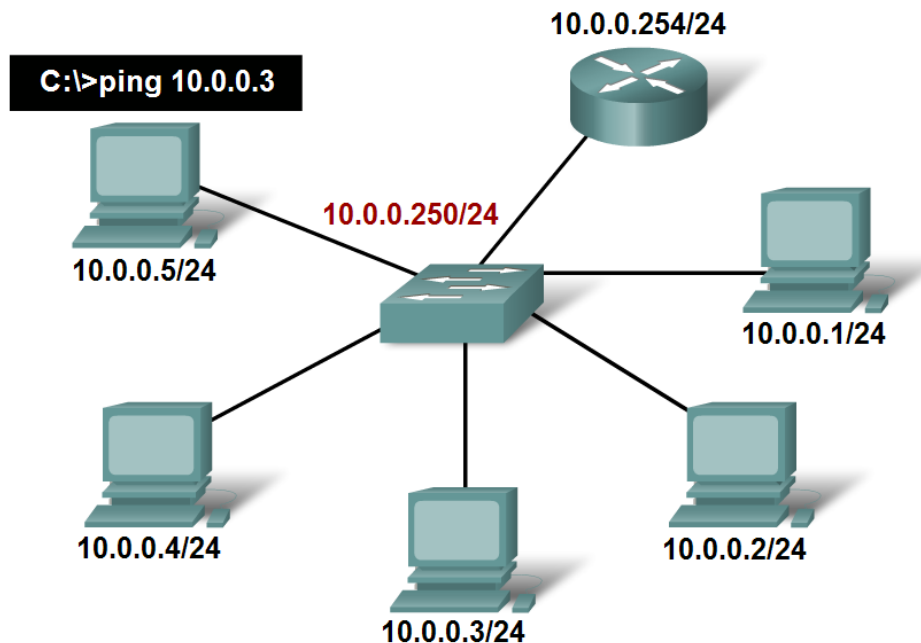
**S\* 0.0.0.0/0 is directly connected, Dialer1**

# PING

- Use the **ping** command to determine if a host can actively communicate across the local network

## Testing Local Network

Successfully pinging the other host's IPv4 addresses will verify that not only the local host is configured properly but the other hosts are configured correctly as well.



# Router Ping [extended]

```
golem#ping
Protocol [ip]:
Target IP address: 192.168.1.1
Repeat count [5]:
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]: y
Source address or interface: loopback0
Type of service [0]:
Set DF bit in IP header? [no]:
Validate reply data? [no]:
Data pattern [0xABCD]:
Loose, Strict, Record, Timestamp, Verbose[none]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
```

# Ping Fails?

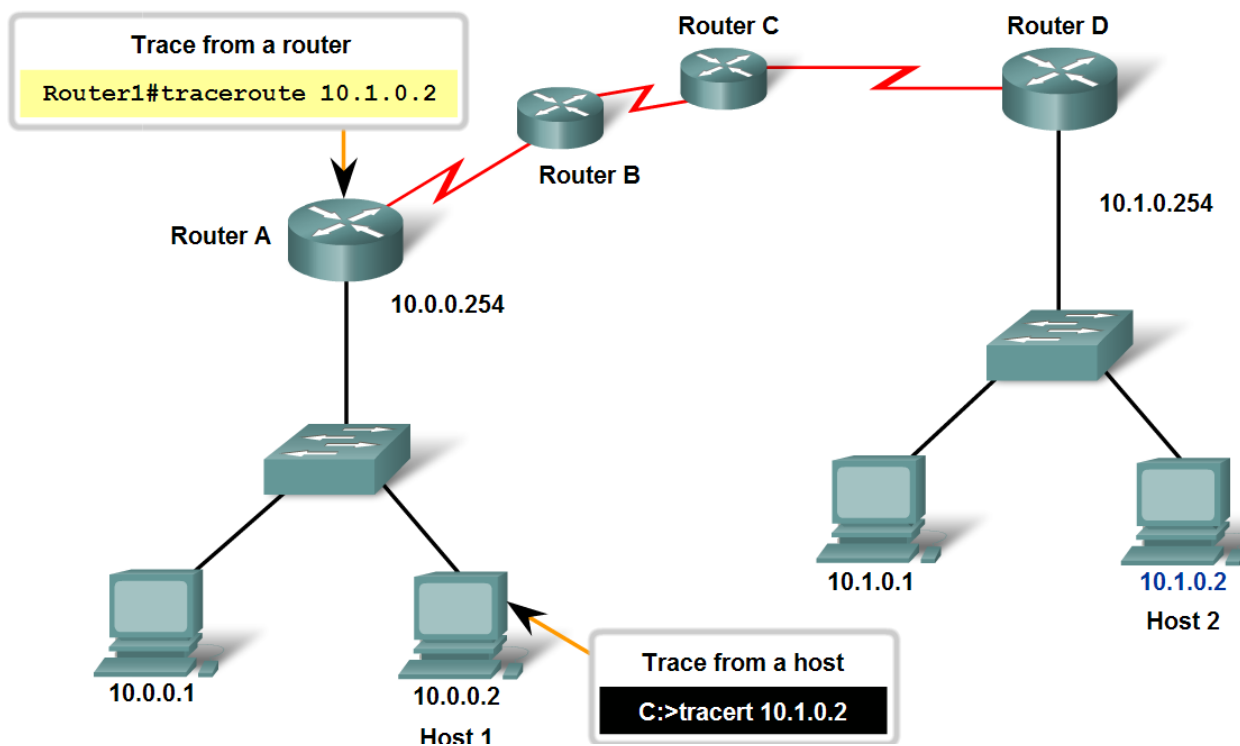
- Router/Switch ping results show:
  - “!” if ping successful
  - “.” if ping fails
- If ping fails, then you should check each routing table in both directions:
  - From Source to Destination
  - From Destination to Source
- When Router CLI command sends a ping, the source address in ping packet is the IP address of the interface it sends the ping packet out.
- When Switch creates a ping, the source address in ping packet is the SVI IP address.



# TRACEROUTE

- Use the **traceroute** command (tracert on Windows clients) to verify each router on a path across the intern

Testing the Path to a Remote Host





## Connect Devices

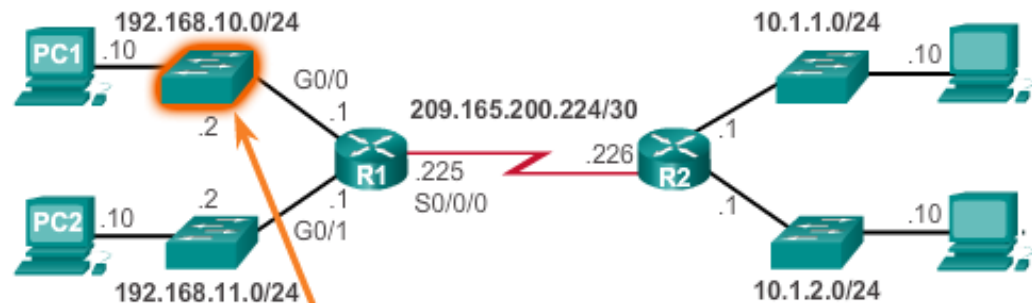
# Enable IP on a Switch

- Switches do not require IP addresses to forward packets.
- However, switches DO require IP addresses to enable remote management or ping/traceroute.

- The switch management IP address is assigned on a **switch virtual interface** (SVI) named VLAN1.

- The SVI IP is accessible through any switch interface.

Configure the Switch Management Interface



```
S1(config)#interface vlan 1
S1(config-if)#ip address 192.168.10.2 255.255.255.0
S1(config-if)#no shutdown
%LINK-5-CHANGED: Interface Vlan1, changed state to up
S1(config-if)#exit
S1(config)#
S1(config)#ip default-gateway 192.168.10.1
S1(config)#
```

# Switch CLI – Status Commands

- Show run
- Show interface
- Show mac-address-table
- Show vlan brief
- Show spanning-tree
- If an SVI IP address is enabled then:
  - Ping
  - Traceroute

# Show mac-address-table

Switch>**show mac-address-table**

Mac Address Table

-----

Vlan	Mac Address	Type	Ports
----	-----	-----	-----
1	0001.433b.7596	DYNAMIC	Fa0/2
1	000d.bd3c.9e01	DYNAMIC	Fa0/3
1	0060.2fa7.a482	DYNAMIC	Fa0/1

Switch>

# Show vlan brief

Switch>**show vlan brief**

VLAN	Name	Status	Ports
1	default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 Fa0/5, Fa0/6, Fa0/7, Fa0/8 Fa0/9, Fa0/10, Fa0/11, Fa0/12 Fa0/13, Fa0/14, Fa0/15, Fa0/16 Fa0/17, Fa0/18, Fa0/19, Fa0/20 Fa0/21, Fa0/22, Fa0/23, Fa0/24 Gig0/1, Gig0/2

Switch>