

# Post 5

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## ROUTER BASICS

Cisco routers are designed to address the needs of:

<b>Branch</b>	<ul style="list-style-type: none"><li>– Teleworkers/small business/medium-sized branch sites</li><li>– Cisco 800, 1900, 2900, 3900 ISR (Integrated Series Router) G2 (2nd Generation)</li></ul>
<b>WAN</b>	<ul style="list-style-type: none"><li>– Large businesses/organizations/enterprises</li><li>– Cisco Catalyst 6500 Series switches and Cisco Aggregation Service Router 1000 (ASR)</li></ul>
<b>Service Provider</b>	<ul style="list-style-type: none"><li>– Large service providers</li><li>– Cisco ASR 1000, ASR 9000, Cisco XR 12000, Cisco CRS-3 Carrier Routing System and 7600 Series</li></ul>

All routers are essentially computers and require:

OS	CPU	RAM	ROM	NVRAM
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**NVRAM:** Routers also have a special memory that includes flash and nonvolatile random-access memory

**Router Memory:**

**Routers have access to 4 types of memory:** RAM/ROM/NVRAM/Flash

**RAM**

**Used to store various applications/processes including:**

**Cisco IOS:** IOS is copied into RAM during boot up

**Running configuration file:** the configuration file that stores configuration commands that the router IOS is using

**IP routing table:** Stores information about directly connected/remote networks

– Used to determine the best path to use to forward packets

**ARP cache:** Contains the IPv4 address-to-MAC address mappings, similar to ARP cache on a PC

– ARP cache is used on routers that have LAN interfaces such as Ethernet interfaces

**Packet buffer:** Packets are temporarily stored in a buffer when received on an interface or before they exit one

**Cisco routers use DRAM (dynamic):** Stores the instructions/data needed to be executed by the CPU

Unlike ROM, RAM is volatile memory and requires continual power to maintain its information

– It loses all its content when the router is powered down/restarted

**ROM**

**Cisco routers use ROM to store:**

**Boot up instructions**

**Basic diagnostic software:** Performs the POST of all components

**Limited IOS:** A limited backup version of the OS, in case the router can't load the full-featured IOS

ROM is firmware embedded on an integrated circuit inside the router

– It doesn't lose its contents when the router loses power/is restarted

**NVRAM**

Used by Cisco IOS as permanent storage for the startup configuration file

– Like ROM, NVRAM doesn't lose its contents when powered/turned off

**Flash Memory**

– Nonvolatile computer memory used as permanent storage for the IOS/other system-related files

– IOS is copied from flash into RAM during the boot up process

Memory	Volatile/Nonvolatile	Stores
<b>RAM</b>	V	<ul style="list-style-type: none"><li>– Running IOS</li><li>– Running configuration</li><li>– IP routing/ARP tables</li><li>– Packet buffer</li></ul>
<b>ROM</b>	NV	<ul style="list-style-type: none"><li>– Boot up instructions</li><li>– Basic diagnostic software</li><li>– Limited IOS</li></ul>

<b>NVRAM</b>	NV	– Startup configuration file
<b>Flash</b>	NV	– IOS – Other system files

### Internal components of a Cisco 1841 Router



### Internal Router Components

<b>Power supply</b>	Provides various voltages to internal router components
<b>WIC slot</b>	Supports HWICs (high-speed WAN interface cards)
<b>RAM</b>	Holds running configuration/running IOS/routing tables/buffers: AKA SRAM (synchronous)
<b>ROM</b>	Nonvolatile
<b>NVRAM</b>	Startup Configuration file
<b>Flash</b>	Basic diagnostic/IOS file/ROMMON
<b>CPU</b>	Microprocessor supporting router operations
<b>AIC</b>	Advanced Integration Module option that offloads from the CPU processor-intensive functions such as encryption

### Router Backplane:

<b>Console ports</b>	– 2 console ports for the initial configuration and CLI management access – takes a regular RJ-45 port and a new USB Type-B (mini-B USB connector)
<b>AUX port</b>	– An RJ-45 port for remote management access – Similar to the console port
<b>Two LAN interfaces</b>	– 2 Gigabit Ethernet interfaces for LAN access
<b>EHWIC slots</b>	– Enhanced high-speed WAN interface card – 2 slots provide modularity/flexibility by enabling router to support different interface modules: Including: Serial, DSL, switch port, and wireless

### Connecting to a Router:

#### Cisco router connections can be grouped into 2 categories:

- Cisco devices use LED indicators to provide status information

<b>Management ports</b>	<ul style="list-style-type: none"> <li>– The console/auxiliary ports used to configure/manage/troubleshoot the router</li> <li>– Unlike LAN/WAN interfaces, management ports are not used for packet forwarding</li> </ul>
<b>In-band router interfaces</b>	<ul style="list-style-type: none"> <li>– These are the LAN/WAN interfaces configured with IP addressing to carry user traffic</li> <li>– Ethernet interfaces are the most common LAN connections</li> <li>– Common WAN connections include serial/DSL interfaces</li> </ul>

#### LAN/WAN Interfaces:

<b>Console</b>	– Uses low-speed serial/USB connection to provide direct connect out-of-band management access
<b>Telnet/SSH</b>	– 2 methods for remotely accessing a CLI session
<b>AUX port</b>	– Used for more remote management of the router using a dialup telephone line/modem

#### Router interfaces can usually be grouped into 2 broad categories:

<b>Ethernet LAN interfaces</b>	<ul style="list-style-type: none"> <li>– Used for connecting cables that terminate with LAN devices (computers/switches)</li> <li>– Interface can also be used to connect routers to each other</li> <li>– Ethernet/Fast Ethernet/Gigabit Ethernet</li> </ul>
<b>Serial WAN interfaces</b>	<ul style="list-style-type: none"> <li>– Used for connecting routers to external networks, usually over a geographical distance</li> <li>– Similar to LAN interfaces, each serial WAN interface has its own IP address/subnet mask</li> <li>– It identifies it as a specific member of a specific network</li> </ul>

#### Cisco IOS for routers provide the following:

Addressing	Interfaces	Routing	Security	QoS	Resources Management
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#### The IOS file is 7MB's in size and is stored in flash memory

– Flash allows IOS to be upgraded to newer versions/have new features added

#### During Boot up: IOS is copied from flash memory into RAM:

– DRAM is much faster, therefore copying the IOS into RAM increases performance of the device

#### Bootset Files:

#### Routers load the following 2 files into RAM when it's booted:

<b>IOS image file</b>	<ul style="list-style-type: none"> <li>– Cisco IOS facilitates the basic operation of the device's hardware components</li> <li>– The image file is stored in flash memory</li> <li>– This image is loaded into the device's RAM to provide the OS for the router</li> </ul>
<b>Startup configuration file</b>	<ul style="list-style-type: none"> <li>– Contains commands that are used to initially configure a router</li> <li>– Creates the running configuration file stored in RAM</li> <li>– The startup configuration file is stored in NVRAM and is copied to RAM</li> <li>– This provides the "program" to the device that tells it how to operate</li> <li>– All configuration changes are stored in running config files</li> <li>– Implemented by the IOS</li> </ul>

#### Router Bootstrap Process:

1. Perform the POST and load the bootstrap program
2. Locate and load the Cisco IOS software
3. Locate and load the startup configuration file or enter setup mode

#### Show Version Output

**show version:** You can use the command to verify/troubleshoot basic hardware/software components of the router

#### Output from show version command includes:

<b>IOS version</b>	– Version of Cisco IOS software in RAM and that is being used by router Cisco IOS Software, C1900 Software (C1900-UNIVERSALK9-M), Version 15.1(4) M4, RELEASE SOFTWARE (fc2)
<b>ROM bootstrap program</b>	– Displays version of system bootstrap software stored in ROM that was initially used to boot up the router ROM: System Bootstrap, Version 15.1(4)M4, RELEASE SOFTWARE (fc1)
<b>Location of IOS</b>	– Displays where bootstrap is located/loaded in Cisco IOS System image file is "flash0:c1900-universalk9-mz.SPA.151-1.M4.bin"
<b>CPU/Amt of RAM</b>	Cisco C1900 (revision 1.0) with 491529K/32768K bytes of memory
<b>Interfaces</b>	– Displays physical interfaces on the router

	2 Gigabit Ethernet interfaces 4 Low-speed serial (sync/async) network interfaces(s)
<b>NVRAM/FLASH</b>	Self-explanatory
	<ul style="list-style-type: none"> <li>– Displays current configured value of the software configuration register in hex.</li> <li>– If a second value is displayed in parenthesis, it denotes the config register value that is used during the next reload</li> </ul>