Starting and Configuring the Router

This chapter describes how to start the system and perform a basic configuration for your Cisco 7301 router. The chapter contains the following sections:

This chapter guides you through a basic router configuration, which is sufficient for you to access your network. Complex configuration procedures are beyond the scope of this publication and can be found in the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.

To configure a Cisco 7301 router from a console, you need to connect a terminal to the router console port.

Functional Overview

This section provides a functional overview of the Cisco 7301 router. It describes the numbering and addressing scheme of the port adapter for the router, the environmental monitoring and reporting functions, and online insertion and removal (OIR). These descriptions help you become familiar with the capabilities of the Cisco 7301 router.

Chassis Slot and Logical Interface Numbering

In the Cisco 7301 router, the *port-adapter-slot-number* is the chassis slot in which a port adapter is installed, whereas the *logical-interface-number* is the physical location of the interface port on a port adapter.

The port adapter slot in the Cisco 7301 router is numbered slot 1. Port adapter slot 0 is always reserved for logical ports 10/100/1000.

The Media Access Control (MAC) or hardware address is a standardized data link layer address that is required for certain network interface types. These addresses are not used by other devices in the network; they are specific and unique to each port. The Cisco 7301 router uses a specific method to assign and control the MAC addresses of its port adapters. For a description of the MAC address, see the "MAC Address" section on page 3-3.

You can identify port adapter slots by using software commands. To display information about all port adapter slots, use the **show interfaces** command. To display information about a specific port adapter slot, use the **show interfaces** command with the port adapter type and slot number in the format **show interfaces** *port-adapter-type slot-number/port-number*. If you abbreviate the command (**sh int**) and do not specify port adapter type and slot number (or arguments), the system interprets the command as **show interfaces** and displays the status of all port adapters and ports.

The following example shows how the **show interfaces** command, used without arguments, displays status information (including the physical port adapter number) for the port adapter in a Cisco 7301 router.

In the following example, most of the status information for each interface is omitted.

```
Router# show interfaces
GigabitEthernet0/0 is up, line protocol is up
  Hardware is BCM1250 Internal MAC, address is 0005.dd2c.7c1b (bia 0005.dd2c.7c1b)
  Internet address is 10.1.3.153/16
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Half-duplex, 100Mb/s, media type is RJ45
  output flow-control is off, input flow-control is off
  ARP type:ARPA, ARP Timeout 04:00:00
  Last input 00:00:01, output 00:00:07, output hang never
  Last clearing of "show interface" counters 19:00:50
  Input queue:0/75/63658/0 (size/max/drops/flushes); Total output drops:0

(display text omitted)

GigabitEthernet0/1 is up, line protocol is up
  Hardware is BCM1250 Internal MAC, address is 0005.dd2c.7c1a (bia 0005.dd2c.7c1a)
  Internet address is 192.18.1.1/24
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
     reliability 255/255, txload 5/255, rxload 6/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 1000Mb/s, link type is autonegotiation, media type is SX
  output flow-control is off, input flow-control is off
  ARP type:ARPA, ARP Timeout 04:00:00
  Last input 18:56:46, output 00:00:09, output hang never
  Last clearing of "show interface" counters 19:00:52
  Input queue:0/75/16176489/0 (size/max/drops/flushes); Total output drops:0

(display text omitted)

GigabitEthernet0/2 is up, line protocol is up
```

```
       Hardware is BCM1250 Internal MAC, address is 0005.dd2c.7c19 (bia 0005.dd2c.7c19)
       Internet address is 1.1.1.1/24
       MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
           reliability 255/255, txload 1/255, rxload 5/255
       Encapsulation ARPA, loopback not set
       Keepalive set (10 sec)
       Full-duplex, 1000Mb/s, link type is autonegotiation, media type is SX
       output flow-control is off, input flow-control is off
       ARP type:ARPA, ARP Timeout 04:00:00
       Last input 00:04:42, output 00:00:01, output hang never
       Last clearing of "show interface" counters 19:00:54
       Input queue:0/75/22087/0 (size/max/drops/flushes); Total output drops:0

(display text omitted)
```

You can also use arguments such as the interface type (Ethernet, Token Ring, ATM, and so forth) and the port address (*slot-number/port-number*) to display information about a specific interface only.

The following example shows the display for the first port on the Gigabit Ethernet port:

```
Router# show interfaces g0/0
GigabitEthernet0/0 is up, line protocol is up
  Hardware is BCM1250 Internal MAC, address is 0005.dd2c.7c1b (bia 0005.dd2c.7c1b)
  Internet address is 10.1.3.153/16
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
      reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Half-duplex, 100Mb/s, media type is RJ45
  output flow-control is off, input flow-control is off
  ARP type:ARPA, ARP Timeout 04:00:00
  Last input 00:00:00, output 00:00:01, output hang never
  Last clearing of "show interface" counters 19:04:04
  Input queue:0/75/63658/0 (size/max/drops/flushes); Total output drops:0

(display text omitted)
```

For complete descriptions and instructions of the commands used to configure your Cisco 7301 router, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* publications at the following URL:

http://www.cisco.com/en/US/products/sw/iosswrel/tsd_products_support_category_home.html

MAC Address

All LAN interfaces (ports) require unique MAC addresses, also known as *hardware addresses*. Typically, the MAC address of an interface is stored on a memory component that resides directly on the interface circuitry; however, the OIR feature requires a different method. (For a description of OIR, see the "Online Insertion and Removal" section on page 3-4.)

Using OIR, you can remove a port adapter and replace it with another identically configured one. If the new port adapter matches the port adapter you removed, the system immediately brings it online. In order to enable OIR, an address allocator with unique MAC addresses is stored in an EEPROM on the system board. Each address is reserved for a specific port and slot in the router regardless of whether a port adapter resides in that slot. The MAC address for the port adapter slot in the Cisco 7301 is slot 0. You can remove a port adapter and insert it into another router without causing the MAC addresses to move around the network or be assigned to multiple devices.

Note that if the MAC addresses were stored on each port adapter, OIR would not function because you could never replace one port adapter with an identical one; the MAC addresses would always be different. Also, each time a port adapter was replaced, other devices on the network would have to update their data structures with the new address. If the other devices did not update quickly enough, the same MAC address could appear in more than one device at the same time.

Note   Storing the MAC addresses for every slot in one central location means the addresses stay with the memory device on which they are stored.

Online Insertion and Removal

All port adapters and service adapters in the Cisco 7301 routers support online insertion and removal (OIR). However, it is wise to shut down the interface before removing a port adapter that has active traffic moving through it. Removing a port adapter while traffic is flowing through the ports can cause system disruption. Once the port adapter is inserted, the ports can be brought back up.

Note   As you disengage the port adapter from the router or switch, online insertion and removal (OIR) administratively shuts down all active interfaces in the port adapter.

OIR allows you to install and replace port adapters and service adapters while the router is operating; you do not need to notify the software or shut down the system power, although you should not run traffic through the port adapter you are removing while it is being removed. OIR is a method that is seamless to end users on the network, maintains all routing information, and preserves sessions.

The following is a functional description of OIR for background information only; for specific procedures for installing and replacing a port adapter or service adapter in a Cisco 7301 router, refer to the online configuration note for each port adapter or service adapter.

Each port adapter or service adapter has a bus connector that connects it to the router. The connector has a set of tiered pins in three lengths that send specific signals to the system as they make contact with the port adapter or service adapter. The system assesses the signals it receives and the order in which it receives them to determine if a port adapter or service adapter is being removed or inserted into the system. From these signals, the system determines whether to reinitialize a new interface or shut down a removed interface.

For example, when you insert a port adapter or service adapter, the longest pins make contact with the port adapter or service adapter first, and the shortest pins make contact last. The system recognizes the signals and the sequence in which it receives them.

When you remove or insert a port adapter or service adapter in a Cisco 7301 router, the pins send signals to notify the system, which then performs as follows:

1. Rapidly scans the system for configuration changes.

2. Initializes all newly inserted port adapters or service adapters, noting any removed interfaces and placing them in the administratively shutdown state.

3. Brings all previously configured interfaces on the port adapter back to the state they were in when they were removed. Any newly inserted interface is put in the administratively shutdown state, as if it was present (but not configured) at boot time. If a similar port adapter type is reinserted into a slot, its ports are configured and brought online up to the port count of the original port adapter. (A service adapter has no configurable ports.)

Environmental Monitoring and Reporting Functions

Environmental monitoring and reporting functions allow you to maintain normal system operation by identifying and resolving adverse conditions prior to loss of operation. The environmental monitoring functions constantly monitor the internal chassis air temperature and DC supply voltages and currents. If conditions reach shutdown thresholds, the system shuts down to avoid equipment damage from excessive heat. The reporting functions periodically log the values of measured parameters so that you can retrieve them for analysis later, and the reporting functions display warnings on the console if any of the monitored parameters exceed defined thresholds.

Environmental Monitoring

The environmental monitoring functions use two sensors, Sensor 1 (U62) on the underneath front edge of the system board, and Sensor 2 (U5), near the fans. If the air temperature exceeds a defined threshold, the system controller displays warning messages on the console terminal, and if the temperature exceeds the shutdown threshold, the system controller shuts down the system. The system stores the present parameter measurements for both temperature and DC voltage in NVRAM so you can retrieve them later as a report of the last shutdown parameters.

If an internal power supply temperature or voltage reaches a critical level, the power supply shuts down without any interaction with the system processor.

The environmental monitoring functions use the following levels of status conditions to monitor the system:

- Normal—All monitored parameters are within normal tolerances.
- Warning—The system has exceeded a specified threshold. The system continues to operate, but operator action is recommended to bring the system back to a normal state.
- Critical—An out-of-tolerance temperature or voltage condition exists. The system continues to operate; however, the system is approaching shutdown. Immediate operator action is required.
- Shutdown—The processor has detected a temperature condition that could result in physical damage to system components and has disabled DC power to all internal components. This condition requires immediate operator action. All DC power remains disabled until you toggle the power switch. Before any shutdown, the system logs the status of monitored parameters in NVRAM so you can retrieve it later to help determine the cause of the problem.
- Power supply shutdown—The power supply detected an internal out-of-tolerance overvoltage, overcurrent, or temperature condition and shut itself down. All DC power remains disabled until you toggle the power switch.

Table 3-1 lists the typical temperature thresholds for the Cisco 7301 router, and Table 3-2 lists the DC power thresholds for the normal, warning, and critical (power supply-monitored) levels.

Table 3-1   Typical Processor-Monitored Temperature Thresholds

Parameter	High Warning	High Critical	Shutdown
Sensor 1 (U62, beneath the front edge of the system board under the port adapter slot)	113ºF (45ºC)	122ºF (50ºC)	131ºF (55ºC)
Sensor 2 (U5, near the fans, top of system board)	122ºF (50ºC)	131ºF (55ºC)	140ºF (60ºC)

Note   Table 3-2 shows output from the **show environment table** command.

Table 3-2   ***Typical Power Supply-Monitored DC-Voltage Thresholds***

Parameter	Low Critical	Low Warning	High Warning	High Critical
+3.30V	+2.96	+3.12	+3.46	+3.62
+2.50V	+2.24	+2.37	+2.62	+2.75
+12.25V	+11.03	+11.65	+12.87	+13.49
+5.00V	+4.50	+4.74	+5.24	+5.50
−12.00V	−10.82	−11.39	−12.58	−13.20
+5.20V	+4.68	+4.94	+5.46	+5.72
+1.50V	+1.34	+1.41	+1.58	+1.65
+1.20V	+1.07	+1.15	+1.26	+1.32
+1.25V	+1.12	+1.18	+1.30	+1.37

Reporting Functions

The Cisco 7301 router displays warning messages on the console if chassis interface-monitored parameters exceed a desired threshold. You can also retrieve and display environmental status reports with the **show environment**, **show environment all**, **show environment last**, and **show environment table** commands. Parameters are measured and reporting functions are updated every 60 seconds. A brief description of each of these commands follows.

Caution   To prevent overheating the chassis, ensure that your system is drawing cool inlet air. Overtemperature conditions can occur if the system is drawing in the exhaust air of other equipment. Ensure adequate clearance around the sides of the chassis so that cooling air can flow through the chassis interior unimpeded and exhaust air exits the chassis and is not drawn into the inlet vent of another device.

The **show environment** command displays reports of the current environmental system status. The report displays parameters that are out of the normal values. No parameters are displayed if the system status is normal. The example that follows shows the display for a system in which all monitored parameters are within normal range:

```
Router# show environment

All measured values are normal
```

If the environmental status is *not* normal, the system reports the worst-case status level. Following is a sample overvoltage warning:

```
Router# show environment

Warning:+3.45 V measured at +3.27 V
```

The **show environment last** command retrieves and displays the NVRAM log, which shows the reason for the last system shutdown (if the shutdown was related to voltage or temperature) and the environmental status at that time. Air temperature is measured and displayed, and the DC voltage supplied by the power supply is also displayed.

Following is sample output of the **show environment last** command:

```
Router# show environment last
  chassis inlet     previously measured at 30C/86F
  chassis outlet 1  previously measured at 28C/82F
  chassis outlet 2  previously measured at -1C/31F
  chassis outlet 3  previously measured at -1C/31F
  +3.45 V           previously measured at +3.27
  +5.15 V           previously measured at +5.01
  +12.15 V          previously measured at +12.34
  -11.95 V          previously measured at -12.41
  last shutdown reason - power supply shutdown
```

The **show environment table** command displays the temperature and voltage thresholds for each temperature sensor and for each monitored status level. These thresholds are related to those listed in Table 3-1 and Table 3-2. The display also lists the shutdown threshold for the system.

Following is sample output of the **show environment table** command for a Cisco 7301 router:

```
Router# show environment table

Sample Point       LowCritical      LowWarning      HighWarning      HighCritical
Thermal Sensor 1                                    45C/113F         50C/122F
Thermal Sensor 2                                    50C/122F         55C/131F
+3.30 V            +2.96            +3.12           +3.46            +3.62
+2.50 V            +2.24            +2.37           +2.62            +2.75
+12.25 V           +11.03           +11.65          +12.87           +13.49
+5.00 V            +4.50            +4.74           +5.24            +5.50
-12.00             -10.82           -11.39          -12.58           -13.20
+5.20 V            +4.68            +4.94           +5.46            +5.72
+1.50 V            +1.34            +1.41           +1.58            +1.65
+1.20 V            +1.07            +1.15           +1.26            +1.32
+1.25 V            +1.12            +1.18           +1.30            +1.37
System shutdown for Thermal Sensor 1 is 55C/131F
System shutdown for Thermal Sensor 2 is 60C/140F
```

> **Note**   Temperature ranges and values are subject to change.

The **show environment all** command displays an extended report that includes temperature readings and voltage readings. The **show environment all** command also displays a report showing which power supply slots are occupied and which are empty.

Following is sample output of the **show environment all** command.

With AC power supply installed:

```
Router# sh environment all
Power Supplies:
        Power Supply is Internal AC Power Supply. Unit is on.

Temperature readings:
        Thermal Sensor 1 measured at 28C/82F
        Thermal Sensor 2 measured at 33C/91F

Voltage readings:
        +3.30 V       measured at +3.27 V
        +2.50 V       measured at +2.46 V
        +12.25 V      measured at +12.17 V
        +5.00 V       measured at +4.94 V
        -12.00 V      measured at -12.01 V
        +5.20 V       measured at +5.20 V
        +1.50 V       measured at +1.48 V
```

```
               +1.20 V        measured at +1.20 V
               +1.25 V        measured at +1.23 V

Fans:
         Fan 1 is believed to be working
         Fan 2 is believed to be working
         Fan 3 is believed to be working
         Fan 4 is believed to be working
         Fan 5 is believed to be working

Envm stats saved 0 time(s) since reload
```

Fan Failures

When the system power is on, all five fans should be operational. The system continues to operate if a fan fails. When a fan fails, the system displays the following message:

```
router: 00:03:46:%ENVM-3-BLOWER:Fan 2 may have failed
```

If the air temperature exceeds a defined threshold, the system controller displays warning messages on the console terminal, and if the temperature exceeds the shutdown threshold, the system controller shuts down the system.

If the system does shut down because the temperature exceeded the shutdown threshold, the system displays the following message on the console screen and in the environment display when the system restarts:

```
Queued messages:
%ENVM-1-SHUTDOWN: Environmental Monitor initiated shutdown
```

For complete descriptions and instructions for the environmental monitor commands, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* publications, which are available online.

Checking Conditions Prior to System Startup

Check the following conditions before you start your router:

- The port adapter is inserted in its slot and the port adapter latch is in the locked position.
- The network interface cable is connected to the port adapter.
- A CompactFlash Disk is installed.
- The console terminal is turned on.

You are now ready to start your router. Proceed to the section "Starting the System and Observing Initial Conditions."

Starting the System and Observing Initial Conditions

After installing your Cisco 7301 router and connecting cables, start the router as follows:

Step 1   At the front of the router, place the power switch on the power supply in the on (|) position.

Step 2   Listen for the fans; you should immediately hear them operating.

Step 3   During the boot process, observe the system LEDs. The LEDs on the port adapter go on and off in irregular sequence. They may go on, go out, and go on again for a short time. On the router, the green STATUS LED comes on and stays on.

Step 4   Observe the initialization process. When the system boot is complete (a few seconds), the processor begins to initialize the port adapter and the I/O subsystem. During this initialization, the LEDs on the port adapter probably will flash on and off.

The enabled LED on the port adapter goes on when initialization is completed, and the console screen displays a script and system banner similar to the following:

```
Cisco Internetwork Operating System Software
IOS (tm) 7301 Software (C7301-JS-M), Version 12.2(V99.1)Copyright (c) 1986-2001 by cisco
Systems, Inc.
Compiled Sat 19-May-01 11:31 by
Image text-base:0x60008960, data-base:0x617CA000
```

Step 5   When you start up the router for the first time, the system automatically enters the setup facility, which determines which port adapter is installed and prompts you for configuration information. On the console terminal, after the system displays the system banner and hardware configuration, you will see the following System Configuration Dialog prompt:

```
        --- System Configuration Dialog ---

At any point you may enter a questions mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.

continue with configuration dialog? [yes]:
```

You have the option of proceeding with the setup facility to configure the interfaces, or exiting from setup and using configuration commands to configure global (system-wide) and interface-specific parameters. You do not have to configure the interfaces immediately; however, you cannot enable the interfaces or connect them to any networks until you have configured them.

Many of the port adapter LEDs do not go on until you have configured the interfaces. To verify correct operation of each interface, complete the first-time startup procedures and configuration, and then refer to the configuration note for the port adapter for LED descriptions and to check the status of the interfaces.

If the system does not complete each of the steps in the startup procedure, proceed to Chapter 5, "Troubleshooting Initial Startup Problems" for troubleshooting recommendations and procedures.

Configuring a Cisco 7301 Router

Before configuring the router, determine whether or not you want to use a management tool such as Cisco Security Device Manager.

Cisco Security Device Manager (SDM), version 1.1, is an optional Java-based device-management tool that allows you to configure LAN interfaces, routing, Network Address Translation (NAT), firewalls, Virtual Private Networks (VPNs), and other features without knowledge of the Cisco command-line interface (CLI). You can configure features such as Access Control Lists (ACLs), routing protocols, and other options using the advanced mode SDM.

Note   You will need to use CLI commands to configure several features that SDM does not support. SDM does not support the following features: WAN configuration, Gigabit Ethernet (GE) interfaces, AA client, EZ VPN server, QoS, SSHv2, DHCP server configuration options, and usability enhancements.

SDM is preinstalled on your router's flash disk or compactflash disk when it is ordered as part of a VPN bundle or as part of a 7xxx VPN bundle. If your router did not ship with SDM preinstalled, you can download a free copy from the Software Center at Cisco.com at http://ww.cisco.com/kobayashi/sw-center/index.shtm. Because SDM uses a GUI, it requires that you access it from a PC using a supported web browser. Go to the *Cisco Router and Security Device Manager (SDM) User Guide for the Cisco 7200 VXR and Cisco 7301 Routers* documentation for more information.

You can configure your Cisco 7301 router using one of the procedures described in the following sections:

- Performing a Basic Configuration Using AutoInstall, page 3-10
- Performing a Basic Configuration Using the Setup Facility, page 3-11
- Performing a Basic Configuration Using Global Configuration Mode, page 3-20

Follow the procedure that best fits the needs of your network configuration.

Note   You need to acquire the correct network addresses from your system administrator or consult your network plan to determine correct addresses before you can complete the router configuration.

Before continuing the configuration process, check the current state of the router by entering the **show version** command. The **show version** command displays the release of Cisco IOS software that is available on the router. Sample output of the **show version** command appears in the "Viewing Your System Configuration" section on page 3-34.

Performing a Basic Configuration Using AutoInstall

The AutoInstall process is designed to configure the Cisco 7301 router automatically after connection to your WAN. For AutoInstall to work properly, a TCP/IP host on your network must be preconfigured to provide the required configuration files. The TCP/IP host may exist anywhere on the network as long as the following two conditions are maintained:

1. The host must be on the remote side of the router synchronous serial connection to the WAN.

2. User Datagram Protocol (UDP) broadcasts to and from the router and the TCP/IP host are enabled.

This functionality is coordinated by your system administrator at the site where the TCP/IP host is located. You should not use AutoInstall unless the required files are available on the TCP/IP host. Refer to the *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* publications for information about how AutoInstall works.

Complete the following steps to prepare your Cisco 7301 router for the AutoInstall process:

Step 1   Attach the appropriate synchronous serial cable to synchronous serial interface 0 on the router.

Step 2   Turn the power switch on the power supply to the on (|) position. (This action turns on AC power to the router.)

The router loads the operating system image from Flash memory. If the remote end of the WAN connection is connected and properly configured, the AutoInstall process begins.

Once the AutoInstall process is completed, use the **copy running-config startup-config** command to write the configuration data to the router's nonvolatile random-access memory (NVRAM). Perform the following step to complete this task.

Step 3   At the # prompt, enter the following command:

```
Hostname# copy running-config startup-config
```

Note   Completing Step 3 saves the configuration settings that the AutoInstall process created to NVRAM. If you fail to do this, your configuration will be lost the next time you reload the router.

Performing a Basic Configuration Using the Setup Facility

If you do not plan to use AutoInstall, do not connect the router's serial (WAN) cable to the channel service unit/data service unit (CSU/DSU). If the WAN cable is not connected, the router boots from Flash memory and goes automatically into the setup facility.

Note   You can run the setup facility any time you are at the enable prompt (#) by entering the **setup** command.

If the serial (WAN) cable is connected to the CSU/DSU and the router does not have a configuration stored in NVRAM, the router attempts to run AutoInstall at startup. The router may take several minutes to determine that AutoInstall is not set up to a remote TCP/IP host. Once the router determines that AutoInstall is not configured, it defaults to the setup facility.

Configuring Global Parameters

When you first start the setup program, you must configure the global parameters. These parameters are used for controlling system-wide settings. Complete the following steps to enter the global parameters:

Step 1   Connect a console terminal to the console port, and then boot the router.

The system boots from flash memory. The following information appears after about 30 seconds. When you see this information, you have successfully booted your router:

```
Restricted Rights Legend
```

```
Use, duplication, or disclosure by the Government is
subject to restrictions as set forth in subparagraph
(c) of the Commercial Computer Software - Restricted
Rights clause at FAR sec. 52.227-19 and subparagraph
(c) (1) (ii) of the Rights in Technical Data and Computer
Software clause at DFARS sec. 252.227-7013.

          cisco Systems, Inc.
          170 West Tasman Drive
          San Jose, California 95134-1706

Cisco Internetwork Operating System Software
IOS (tm) 7301 Software (C7301-JS-M), Experimental Version 12.2(20030103:230909) [biff 100]
Copyright (c) 1986-2003 by cisco Systems, Inc.
Compiled Fri 03-Jan-03 16:03 by biff
Image text-base:0x600088F4, data-base:0x617F6000

cisco 7301 (NPE-G1) processor (revision A) with 245760K/16384K bytes of memory.
Processor board ID 0
SB-1 CPU at 650Mhz, Implementation 1, Rev 0.2, 512KB L2 Cache
1 slot midplane, Version 2.0

Last reset from power-on
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
3 Gigabit Ethernet/IEEE 802.3 interface(s)
509K bytes of non-volatile configuration memory.

125440K bytes of ATA PCMCIA card at slot 2 (Sector size 512 bytes).
32768K bytes of Flash internal SIMM (Sector size 256K).

Press RETURN to get started!
```

The first two sections of the configuration script (the banner and the installed hardware) appear only at initial system startup. On subsequent uses of the setup facility, the script begins with a System Configuration Dialog as shown in the following example.

```
--- System Configuration Dialog ---

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 '[]'.
```

Step 2   When asked if you want to enter the initial configuration dialog and see the current interface summary, enter **yes** or press **Return**:

```
Would you like to enter the initial configuration dialog? [yes]:

First, would you like to see the current interface summary? [yes]:
```

In the following example, the summary shows a Cisco 7301 router at first-time startup; that is, nothing is configured.

```
Any interface listed with OK? value "NO" does not have a valid configuration

Interface        IP-Address  OK? Method Status  Protocol
ATM1/0           unassigned  NO  unset  down    down
FastEthernet2/0  unassigned  NO  unset  down    down
```

Step 3 Choose which protocols to support on your interfaces. For Internet Protocol (IP)-only installations, you can accept the default values for most of the questions. A typical configuration using IP, IPX, and AppleTalk follows and continues through Step 8:

```
Configuring global parameters:

  Enter host name [Router]:
```

Step 4 Enter enable secret, enable, and virtual terminal passwords:

```
The enable secret password is a one-way cryptographic secret
password used instead of the enable password when it exists.

  Enter enable secret: barney

The enable password is used when there is no enable secret
password and when using older software and some boot images.

  Enter enable password: betty

    Enter virtual terminal password: fred
```

Step 5 The Simple Network Management Protocol (SNMP) is the most widely supported open standard for network management. It provides a means to access and set configuration and run-time parameters of routers and communication servers. SNMP defines a set of functions that can be used to monitor and control network elements.

Enter **yes** or press **Return** to accept SNMP management; enter **no** to refuse it:

```
Configure SNMP Network Management? [yes]:
    Community string [public]:
```

Step 6 For the following queries, do not enable VINES, LAT, DECnet, CLNS, bridging, XNS, or Apollo:

```
Configure Vines? [no]:
Configure LAT? [no]:
Configure DECnet? [no]:
Configure CLNS? [no]:
Configure bridging? [no]:
Configure XNS? [no]:
Configure Apollo? [no]:
```

Step 7 For the following queries, enable routing on AppleTalk and IPX:

```
Configure AppleTalk? [no]: yes
    Multizone networks? [no]: yes

Configure IPX? [no]: yes
```

Step 8 In most cases you use IP routing. If you are using IP routing, you must also select an interior routing protocol. You can specify only one of two interior routing protocols to operate on your system using the setup facility: Interior Gateway Routing Protocol (IGRP) or Routing Information Protocol (RIP).

To configure IP routing, enter **yes** (the default) or press **Return**, and then select an interior routing protocol:

```
Configure IP? [yes]:
    Configure IGRP routing? [yes]:
        Your IGRP autonomous system number [1]: 15
```

The following sample display includes a continuous listing of all configuration parameters selected in Step 3 through Step 8. Only IP, IPX, and AppleTalk are the selected protocols for this example.

```
Configuring global parameters:

  Enter host name [Router]: router

The enable secret is a one-way cryptographic secret used
instead of the enable password when it exists.

  Enter enable secret: barney

The enable password is used when there is no enable secret
and when using older software and some boot images.
  Enter enable password: betty
  Enter virtual terminal password: fred
  Configure SNMP Network Management? [yes]:
    Community string [public]:
  Configure Vines? [no]:
  Configure LAT? [no]:
  Configure AppleTalk? [no]: yes
    Multizone networks? [no]: yes
  Configure DECnet? [no]:
  Configure IP? [yes]:
  Configure IGRP routing? [yes]:
  Your IGRP autonomous system number [1]: 15
    Configure RIP routing? [no]:
  Configure CLNS? [no]: n
  Configure bridging? [no]:
  Configure IPX? [no]: yes
  Configure XNS? [no]:
  Configure Apollo? [no]:
```

Step 9   Save your settings to NVRAM. (See the "Saving the Running Configuration to NVRAM" section on page 3-27.) If you do not save the configuration settings that you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you reload the router.

Configuring the Native Gigabit Ethernet Interfaces

The Cisco 7301 router reports the Gigabit Ethernet RJ-45 and SFP GBIC ports as GigabitEthernet 0/0, GigabitEthernet 0/1, and GigabitEthernet0/2. Before configuring any of the three interfaces, you must first use the **media-type** interface command to select the media type, either **gbic** or **rj45**.

Changing the Media Type

To be able to use a particular media type, use Cisco IOS to select the media type. This is done by using the **media-type** interface command:

media-type { gbic | rj45 }

Example:

```
interface GigabitEthernet 0/0
   media-type rj45
end
```

Configuring the Interface Transmission and Speed Modes

Step 1   After changing the media type, configure the speed and duplex transmission modes to appropriately match the new interface characteristics. Changing the speed and duplex of a Cisco 7301 router Gigabit Ethernet interface is done using the **speed** and **duplex** interface commands.

✎
Note   These commands are only applicable when using the RJ-45 media.

speed { 10 | 100 | 1000 | auto }

duplex { full | half | auto }

The following speed/duplex settings are supported:

```
Media Type        Speed              Duplex
--------------------------------------------------------------
RJ45              10, 100, 1000, auto    full, half, auto
GBIC(1)           1000, auto(2)          full, half, auto
--------------------------------------------------------------
```

   a.   If you are using the **no negotion auto** command, the speed and duplex should be set to a value other than **auto** for correct operation.

   b.   The only available speed in this mode is 1000 Mbps; there is no difference whether **1000** or **auto** is selected.

   When using the SFP GBIC media, there is also the additional **negotiation auto** command that is used to enable the IEEE 802.1z Gigabit Ethernet (1000 Mbps) autonegotiation protocol.

Step 2   To turn this autonegotiation feature off (it is on by default), issue the interface command **no negotiation auto**. This is useful for connecting to other Gigabit Ethernet equipment that does not support IEEE 802.1z autonegotiation.

✎
Note   The **negotiation auto** feature is not supported when using the media type **rj-45** and will be ignored if implementation is attempted.

The media-type gbic mode will always default to 1000-Mbps, full-duplex operation as this is the only configuration that is supported in this mode. Any **speed** or **duplex** commands are ignored while using this media-type mode, even if present in the configuration (for an example, see output from **show running-config**).

Debugging

Cisco IOS provides two commands to provide information on your interfaces: **show interface GigabitEthernet 0/X** (where X is 0, 1, or 2) and **show controllers GigabitEthernet 0/X** (where X is 0, 1, or 2).

The output of the **show interface** command is useful for determining the current operating mode of the interface (speed/duplex/media-type) and the current interface statistics.

The output of the **show controller** command displays more information specific to the Cisco 7301 router Gigabit Ethernet interface. For example, it shows the detected link status, speed, and duplex, and also determines the current status of autonegotiation and the link partners' abilities (if it is an autonegotiation-capable interface).

The **show controller** command also displays the current operating state of the driver and the Ethernet controller hardware. The **show controller** command is a very powerful debugging aid, especially for Cisco engineers should you need help in debugging a problem. If you have any problems with your Gigabit Ethernet interfaces, you will need to provide this information to Cisco for analysis.

Resetting the Interface

Should you have a problem with your interface and you want to try and reset it, use the command:

clear interface GigabitEthernet 0/X   (where X is 0, 1, or 2)

Clearing Counters

Interface counters may be cleared (reset) by using the command:

clear counters GigabitEthernet 0/X   (where X is 0, 1, or 2)

Note   Using this command will not reset the interface.

Configuring Port Adapter Interfaces

Following are the steps for configuring interfaces to allow communication over a LAN or WAN. To configure the interface parameters, you need your interface network addresses and subnet mask information. Consult with your network administrator for this information.

Note   Only one port adapter can be installed in the Cisco 7301 at one time. Following are three examples of three different interfaces that might be used.

Configuring ATM Interfaces

In the following example, an ATM interface in slot 1 is configured for an ATM LAN using IP. Follow these steps to configure an ATM interface:

Step 1   Using your own addresses and mask at the setup prompts, respond to the prompts as follows:

```
Configuring interface parameters:

Configuring interface ATM1/0:
  Is this interface in use? [yes]:
  Configure IP on this interface? [yes]:
    IP address for this interface: 1.1.1.10
    Number of bits in subnet field [0]:
    Class C network is 1.1.1.0, 0 subnet bits; mask is /24
```

Step 2   Determine if you are going to enable IPX on this interface; if you are, enter the unique IPX network number:

```
Configure IPX on this interface? [no]: yes
    IPX network number [2]:
```

Step 3   If you are using AppleTalk on the interface, enter **yes**. Enter **yes** to configure for extended AppleTalk networks, and then enter the cable range number. Enter the zone name and any other additional zones that are associated with your local zone:

```
Configure AppleTalk on this interface? [no]: yes
Extended AppleTalk network? [no]: yes
AppleTalk starting cable range [0]:
```

Step 4   Save your settings to NVRAM. (See the "Saving the Running Configuration to NVRAM" section on page 3-27.) If you do not save the configuration settings that you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you reload the router.

> ✎
> **Note**   If additional ATM interfaces are available in your system, you are prompted for their configurations as well.

Configuring Fast Ethernet Interfaces

In the following example, a Fast Ethernet interface in slot 1 is configured for a Fast Ethernet LAN using IP. Follow these steps to configure Fast Ethernet interfaces:

Step 1   Using your own addresses and mask at the setup prompts, respond to the prompts as follows:

```
Configuring interface parameters:

Configuring interface FastEthernet1/0:
  Is this interface in use? [yes]:
  Use the 100 Base-TX (RJ-45) connector? [yes]:
  Operate in full-duplex mode? [no]:
  Configure IP on this interface? [yes]:
    IP address for this interface: 1.1.1.20
    Number of bits in subnet field [0]:
    Class C network is 1.1.1.0, 0 subnet bits; mask is /24
```

Step 2   Determine if you are going to enable IPX on this interface; if you are, enter the unique IPX network number:

```
Configure IPX on this interface? [no]: yes
    IPX network number [2]:
```

Step 3   If you are using AppleTalk on the interface, enter **yes**. Enter **yes** to configure for extended AppleTalk networks, and then enter the cable range number. Enter the zone name and any other additional zones that are associated with your local zone:

```
Configure AppleTalk on this interface? [no]: yes
Extended AppleTalk network? [no]: yes
AppleTalk starting cable range [0]:
```

Step 4   Save your settings to NVRAM. (See the "Saving the Running Configuration to NVRAM" section on page 3-27.) If you do not save the configuration settings that you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you reload the router.

Note If additional Fast Ethernet interfaces are available in your system, you are prompted for their configurations as well.

Configuring Synchronous Serial Interfaces

Synchronous serial interfaces are configured to allow connection to WANs through a CSU/DSU. In the following example, a synchronous serial interface in slot 1 is configured for a WAN connection using IP. Follow these steps to configure synchronous serial interfaces:

Step 1   Using your own addresses and mask at the setup prompts, respond to the prompts as follows:

```
Configuring interface parameters:

Configuring interface serial 1/0:
  Is this interface in use? [yes]:
  Configure IP on this interface? [yes]:
    IP address for this interface: 1.1.1.30
    Number of bits in subnet field [0]:
    Class A network is 1.1.1.0, 0 subnet bits; mask is /24
```

Step 2   Determine if you are going to enable IPX on this interface; if you are, enter the unique IPX network number:

```
Configure IPX on this interface? [no]: yes
    IPX network number [2]:
```

Step 3   If you are using AppleTalk on the interface, enter **yes**. Enter **yes** to configure for extended AppleTalk networks, and then enter the cable range number. Enter the zone name and any other additional zones that are associated with your local zone:

```
Configure AppleTalk on this interface? [no]: yes
Extended AppleTalk network? [no]: yes
AppleTalk starting cable range [0]:
```

Step 4   Save your settings to NVRAM. (See the "Saving the Running Configuration to NVRAM" section on page 3-27.) If you do not save the configuration settings that you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you reload the router.

Note If additional synchronous serial interfaces are available in your system, you are prompted for their configurations as well.

The following example display lists the ATM configuration parameters:

```
Configuring interface ATM1/0:
  Is this interface in use? [yes]:
  Configure IP on this interface? [yes]:
    IP address for this interface: 1.1.1.10
    Number of bits in subnet field [0]: 0
    Class C network is 1.1.1.0, 0 subnet bits; mask is /24
  Configure IPX on this interface? [yes]:
    IPX network number [2]:
  Configure AppleTalk on this interface? [no]: yes
    Extended AppleTalk network? [no]: yes
    AppleTalk starting cable range [0]:


The following configuration command script was created:

hostname Router
enable secret 5 $1$u8z3$PMYY8em./8sszhzk78p/Y0
enable password betty
line vty 0 4
password fred
snmp-server community public
!
ip routing
no vines routing
ipx routing
appletalk routing
no apollo routing
no decnet routing
no xns routing
no clns routing
no bridge 1
! Turn off IPX to prevent network conflicts.

interface ATM1/0
ip address 1.1.1.10 255.0.0.1
appletalk cable-range 0-0 0.0
appletalk discovery
!
router igrp 15
network 1.0.0.0
!
end

Use this configuration? [yes/no]: yes
Building configuration...
Use the enabled mode 'configure' command to modify this configuration.

Press RETURN to get started!
```

Your router is now minimally configured and ready to use. You can use the **setup** command if you want to modify the parameters after the initial configuration. To perform more complex configurations, use the **configure** command.

For information on additional interface configuration and specific system configurations, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.

Performing a Basic Configuration Using Global Configuration Mode

You can configure a Cisco 7301 router manually if you prefer not to use the setup facility or AutoInstall. Complete the following steps to configure the router manually:

Step 1   Connect a console terminal to the console port.

Step 2   When asked if you want to enter the initial dialog, answer **no** to go into the normal operating mode of the router:

```
Would you like to enter the initial dialog? [yes]: no
```

Step 3   After a few seconds the user EXEC prompt (Router>) is displayed. Type **enable** to enter enable mode (configuration changes can only be made in enable mode):

```
Router> enable
```

The prompt changes to the privileged EXEC prompt:

```
Router#
```

Step 4   Enter the **config terminal** command at the enable prompt to enter configuration mode from the terminal:

```
Router# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
```

At the Router(config)# prompt, enter the **interface** *type slot/port* command to enter the interface configuration mode:

```
Router(config)# interface serial slot/port
Router(config-int)#
```

In either configuration mode, you can now enter any changes to the configuration. Press **Ctrl-Z** (hold down the **Control** key while you press **Z**) or enter **end** to exit configuration mode and return to the EXEC command interpreter.

Step 5   Save your settings to NVRAM, or if you are enabling the second processor, see "Enabling the Second Processor" section on page 3-20. (See the "Saving the Running Configuration to NVRAM" section on page 3-27.) If you do not save the configuration settings that you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you reload the router.

Your router is now minimally configured and will boot with the configuration you have entered. To see a list of the configuration commands available to you, enter **?** at the prompt while in configuration mode.

Enabling the Second Processor

The Cisco 7301 includes a dual-CPU-core BCM 1250. All Cisco IOS images for the Cisco 7301 platform use CPU-core 0. CPU-core 1 allows acceleration of specific feature sets via separately purchased special software. As of Cisco IOS Release 12.3(14)YM, multi-processor forwarding (MPF) accelerates the following broadband features: L2TP Access Concentrator (LAC), L2TP Network Server (LNS), and PPP Terminated Aggregation (PTA). Port adapters are not supported in the multi-processor forwarding (MPF) path on processor 1.

Only the following port adapters are supported in the punt path (Processor 0, processing Cisco IOS) on Cisco IOS Release 12.3(14)YM and later releases of Cisco IOS Release 12.3YM:

- PA-A3-OC3 (SMI/SML/MM)
- PA-A3-T3
- PA-A3-E3
- PA-A6-OC3 (SMI/SML/MM)
- PA-A6-T3
- PA-A6-E3
- PA-FE-TX
- PA-2FE-TX
- PA-2FE-FX

You may have purchased the enabling software when you purchased a new chassis or you may have purchased the software as an upgrade.

If you are purchasing the software as an upgrade, you must:

- Upgrade the ROMmon if you do not have the minimum ROMmon version.
    - The minimum ROMmon version is 12.3-4r.T2.
    - The recommended ROMmon version is 12.3-4r.T4 or higher.
- Install the enabling software.

Instructions for upgrading ROMmon are in the "Upgrading ROMmon on the Cisco 7301" section on page 3-27.

The software releases associated with enabling the second processor are listed in Table 3-3.

Table 3-3   Cisco IOS Release Information

Features	Cisco IOS Release
Broadband L2TP Access Concentrator (LAC)	Cisco IOS Release 12.3(7)XI
Broadband L2TP Access Concentrator (LAC), L2TP Network Server (LNS) and PPP Terminated Aggregation (PTA)	Cisco IOS Release 12.3(14)YM

Also see the *Multi-Processor Forwarding (MPF) for Broadband LAC* document for minimum memory requirements and configuration information.

Note   Before enabling the second processor, you must have IP routing turned on.

Processor 1 is enabled by default after you install the enabling software. To have all packets forwarded by processor 0, use the **no ip mpf** command. To enable processor 1, use the **ip mpf** command.

```
hostname: (config)# [no] ip mpf
```

Save the running configuration to NVRAM. See the "Saving the Running Configuration to NVRAM" section on page 3-27. If you do not save the configuration settings that you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you reload the router.

Error Messages

The following error messages are displayed if a feature is configured that is not supported in the MPF path:

```
Router#%MPF-4-IGNOREDFEATURES: Interface Gi0/3: Input "PBR" configurations are not MPF
supported and are IGNORED. %SYS-5-CONFIG_I: Configured from console by console

Router# (config-if)# %MPF-4-IGNOREDFEATURES: Interface Gi0/3: Input "PBR" configurations
are not MPF supported and are IGNORED.
%MPF-4-IGNOREDFEATURES: Interface Gi0/3: Output "NetFlow" configurations
are not MPF supported and are IGNORED.
```

Using show Commands to Check the Installation

There are a variety of **show** commands associated with the **mpf** command. They are listed below along with sample output. Use these commands to verify the MPF installation.

Using the show interface stats Command

Use the **show interface stats** command for information about the interface.

```
Router# show interface stats

GigabitEthernet0/1
        Switching path    Pkts In   Chars In   Pkts Out  Chars Out
             Processor      33090    6424353      86353    8645650
           Route cache          2        116          0          0
 Multi-Processor Fwding       1004     158632       5004     790632  <==
                 Total      34096    6583101      91357    9436282
```

Using the show ip interface Command

Use the **show ip interface** command to get information about the specific interface port.

```
Router# show ip interface g0/3
GigabitEthernet0/3 is up, line protocol is up
Internet address is 155.1.1.1/16
Broadcast address is 255.255.255.255
Address determined by setup command
MTU is 1500 bytes
Helper address is not set
Directed broadcast forwarding is disabled
Outgoing access list is not set
```

```
Inbound access list is not set
Proxy ARP is enabled
Local Proxy ARP is disabled
Security level is default
Split horizon is enabled
ICMP redirects are always sent
ICMP unreachables are always sent
ICMP mask replies are never sent
IP fast switching is enabled
IP fast switching on the same interface is disabled
IP Flow switching is disabled
IP CEF switching is enabled
IP Feature Fast switching turbo vector
IP VPN Flow CEF switching turbo vector
IP multicast fast switching is enabled
IP multicast distributed fast switching is disabled
IP route-cache flags are Fast, CEF
Router Discovery is disabled
IP output packet accounting is disabled
IP access violation accounting is disabled
TCP/IP header compression is disabled
RTP/IP header compression is disabled
Policy routing is enabled, using route map PBR
Network address translation is disabled
BGP Policy Mapping is disabled
IP Multi-Processor Forwarding is enabled
IP Input features, "PBR",
are not supported by MPF and are IGNORED
IP Output features, "NetFlow",
are not supported by MPF and are IGNORED
```

Using the show mpf cpu Command

Use the **show mpf cpu** command to display the average second CPU utilization in the last five seconds, one minute, and five minutes.

```
hostname: show mpf cpu
CPU utilization for five seconds: 33%; one minute: 25%; five minutes: 30%
```

Using the show mpf cpu history Command

Use the **show mpf cpu history** command to graph output of the second CPU utilization for the last 60 seconds, 60 minutes, and 72 hours.

```
Router# show mpf cpu history
slns 12:12:40 AM Saturday Nov 18 2000 UTC
3333333333333333333333333333333333333333333333333333333333333
3333333333333333333333333333333333333333333333333333333333333
100
90
80
70
60
50
40
30 **************************
20 **************************
10 **************************
0....5....1....1....2....2....3....3....4....4....5....5....
```

```
               0    5    0    5    0    5    0    5    0    5
                 CPU% per second (last 60 seconds)
3333333333333333333333333333333333333333333333333333333333
3333333333333333333333333333333333333333333333333333333333
100
90
80
70
60
50
40
30 ################
20 ################
10 ################
0....5....1....1....2....2....3....3....4....4....5....5....
         0    5    0    5    0    5    0    5    0    5
                 CPU% per minute (last 60 minutes)
                 * = maximum CPU% # = average CPU%
1
60
80
100 *
90 *
80 *
70 **
60 **
50 **
40 ##
30 ##
20 ##
10 ##
0....5....1....1....2....2....3....3....4....4....5....5....6....6....7.
         0    5    0    5    0    5    0    5    0    5    0    5    0
                 CPU% per hour (last 72 hours)
                 * = maximum CPU% # = average CPU%
```

Using the show mpf interface Command

Using the **show mpf interface** command without arguments shows the interface information for all Gigabit Ethernet interfaces and subinterfaces. This command is supported only for physical interfaces. There is no support for virtual access interface.

```
Router# show mpf interface
Name        Index  State  Counter      Count
Gi0/1       0      up     RX packets    1004
                          RX bytes      158632
                          TX packets    5004
                          TX bytes      790632
                          RX punts      32961
                          TX punts      85972
Gi0/1       1      up
Gi0/1.100   100    up     RX packets    1004
                          RX bytes      158632
                          TX packets    5004
                          TX bytes      790632
                          RX punts        25
Gi0/1.101   101    up
Gi0/1.102   102    up
Gi0/1.105   105    up
Gi0/1.106   106    up
Gi0/1.107   107    up
```

```
Gi0/1.200   200    up
Gi0/1.201   201    up       RX punts        29
Gi0/1.202   202    up
Gi0/1.206   206    up
Gi0/1.2002 602     up       RX punts     26114
Gi0/1.2004 604     up
```

Using the show mpf interface GigabitEthernet 0/1 Command

The following example displays the interface information for GigabitEthernet 1/0, subinterface number 100. However, all GigabitEthernet interface and subinterface information are displayed because MPF does not recognize the subinterface number, unless it is a VLAN number.

```
Router# show mpf interface Gigabit Ethernet 0/1.100
Name           Index   State     Counter            Count
Gi0/1          0       up        RX packets         1004
                                 RX bytes           158632
                                 TX packets         5004
                                 TX bytes           790632
                                 RX punts           32996
                                 TX punts           86062
Gi0/1          1       up
Gi0/1.100      100     up        RX packets         1004
                                 RX bytes           158632
                                 TX packets         5004
                                 TX bytes           790632
                                 RX punts           25
Gi0/1.101      101     up
Gi0/1.102      102     up
Gi0/1.105      105     up
Gi0/1.106      106     up
Gi0/1.107      107     up
Gi0/1.200      200     up
Gi0/1.201      201     up        RX punts           29
Gi0/1.202      202     up
Gi0/1.206      206     up
Gi0/1.2002     602     up        RX punts           26142
Gi0/1.2004     604     up
```

Using the show mpf interface GigabitEthernet 01/100 Command

The following example displays the interface information for VLAN number 100 on GigabitEthernet 0/1 interface, including up state, receiving packet count, receiving bytes count, transmitting packet count, transmitting bytes count, and receiving punts count.

```
Router# show mpf interface GigabitEthernet 0/1 100
Name    Index      State     Counter      Packets      Bytes
Gi0/1.100 100        up      RX total       963        151050
                             RX punt          5           475
                             TX total       956        150449

IP Multi-Processor Forwarding is enabled
```

Using the show mpf ip exact-route Command

Use the **show ip mpf exact-route** command to show which routing decision is made for a given IP address pair.

```
hostname: show mpf ip exact-route [vrf vrf_name] src-ip-addr dst-ip-addr

1.1.1.1 -> 192.168.255.255 :Gi2/0/0 (next hop 10.1.255.10)
```

Using the show mpf punt Command

Use the **show mpf punt** command to display the per-box punt reason and punt packet counts.

```
Router# show mpf punt
      slns#show mpf punt
      Type            Message                    Count
      l2tp            unknown session errors       7
      l2tp            L2TP control                 6
      ipv4/verify     adjacency punt               1
      ethernet        unknown ethernet type      542
      ppp             punts due to unknown protocol 333
      arp             ARP request                  6
```

Using the show version Command

Following is output from the **show version** command with the second processor enabled. Note that the **show version** output provides "SB-1 CPU" when processor 1 is enabled.

```
Router# show version
Cisco IOS Software, 7301 Software (C7301-I12S-M), Experimental Version
12.3(20040524:050554) [REL-v123_7_xi_throttle.ios-weekly 114]
Copyright (c) 1986-2004 by Cisco Systems, Inc.
Compiled Mon 24-May-04 06:26

ROM:System Bootstrap, Version 12.3(4r)T2, RELEASE SOFTWARE (fc1)
BOOTLDR:Cisco IOS Software, 7301 Software (C7301-BOOT-M), Experimental Version
12.3(20040514:051116) [biff-v123_7_xi_throttle-ios-nightly-task 117]

lac7301_256M uptime is 1 hour, 50 minutes
System returned to ROM by reload at 18:05:37 UTC Wed Mar 22 2000
System image file is
"tftp://223.255.254.253//auto/tftpboot-users/biff/c7301-i12s-mz.v123_7_xi_throttle"

Cisco 7301 (NPE) processor (revision C) with 229376K/32768K bytes of memory.
Processor board ID 74806813
SB-1 CPU at 700MHz, Implementation 1, Rev 0.2, 512KB L2 Cache
1 slot midplane, Version 3.0

Last reset from watchdog nmi
CPU 1 Multi-Processor Forwarding, Fri May 21 14:21:57 2004 [rtang 119]
1 FastEthernet interface
3 Gigabit Ethernet interfaces
509K bytes of NVRAM.

62976K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
32768K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x0
```

Saving the Running Configuration to NVRAM

To store the configuration or changes to your startup configuration in NVRAM, enter the **copy running-config startup-config** command at the `Router#` prompt:

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

Using this command saves the configuration settings that you created in the router using configuration mode and the setup facility. If you fail to do this, your configuration will be lost the next time you reload the router.

Checking the Running Configuration Settings

To check the value of the settings you have entered, enter the **show running-config** command at the `Router#` prompt:

`Router#` **`show running-config`**

To review changes you make to the configuration, use the EXEC mode **show startup-config** command to display the information stored in NVRAM.

Performing Other Configuration Tasks

To make advanced configuration changes after you establish the basic startup configuration for your router, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware. These publications contain additional information on using the **configure** command.

The configuration publications also provide information about the following tasks:

- Understanding and working with the user interface on your router
- Booting and rebooting the router
- Setting the configuration register
- Loading configuration files or system images using remote copy protocol (rcp) or Trivial File Transfer Protocol (TFTP)
- Reloading the operating system

Upgrading ROMmon on the Cisco 7301

Upgrading the rewriteable ROM monitor (ROMmon) allows you to download a new ROMmon image instead of having to replace hardware (Cisco 7301) to get a new image.

There are two ROMmon images: the ReadOnly image that ships with your system (and is always available if you have Cisco 7301 hardware EPROM Version 1.4 and software C7301:Rommon version is 12.3(4r)T2 or later), and the upgradable ROMmon image that is downloaded from a specified TFTP file location. You can choose to configure the system to point to the upgradable ROMmon image. At bootup, the system starts with the ReadOnly image and then, if configured, jumps to the upgradeable ROMmon image. If the upgradeable ROMmon image fails to boot, the router will mark this ROMmon image as invalid and reverts to the ReadOnly ROMmon image.

The first time a new ROMmon image is executed, you must allow the system to boot ROMmon before doing any additional resets or power cycling. If the ROMmon-executing process is interrupted, the system interprets this as a bootup failure of the new ROMmon image. The router reverts to the ReadOnly image.

Note The ROMmon upgradeable image is marked as invalid if it fails to boot. Do not reset the router when it is doing an initial bootup.

Using the show rom-monitor Command and showmon Commands

Use the **show rom-monitor** command if you are in Cisco IOS, or the **showmon** command if you are in ROMmon, to determine which ROMmon images are available. See the following examples for information shown in the output of the **show rom-monitor** or **showmon** commands:

- If you are in Cisco IOS, use the **show rom-monitor** command:

```
Router> show rom-monitor
ReadOnly ROMMON version:

System Bootstrap, Version 12.2(20031011:151758)
Copyright (c) 1994-2003 by cisco Systems, Inc.

Upgrade ROMMON version:

System Bootstrap, Version 12.2(20031011:151758)
Copyright (c) 1994-2003 by cisco Systems, Inc.

Currently running ROMMON from Upgrade region
ROMMON from Upgrade region is selected for next boot
```

- If you are in ROMmon, use the **showmon** command:

```
rommon 1 > rommon CLI showmon

ReadOnly ROMMON version is:
System Bootstrap, Version 12.2(20031011:151758) [biff]
Copyright (c) 1994-2003 by cisco Systems, Inc.

Upgrade ROMMON version is:
System Bootstrap, Version 12.2(20031011:151758) [biff]
Copyright (c) 1994-2003 by cisco Systems, Inc.

Upgrade ROMMON currently running
Upgrade ROMMON is selected for next boot
rommon 2 >
```

Using the upgrade rom-monitor Command

Use the **upgrade rom-monitor file** *file_id* command to program the ROMmon.

See the following example of the **upgrade rom-monitor** command:

```
Router# upgrade rom-monitor file tftp://00.0.00.0/biff/C7301_c7301-is-mz
Loading pgettner/C7200_NPEG1_RMFUR.srec from 00.0.00.0 (via GigabitEthernet0/1):
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 392348 bytes]
```

```
This command will reload the router. Continue? [yes/no]:yes
ROMMON image upgrade in progress.
Erasing boot flash eeeeeeeeeeeeeeeeee
Programming boot flash ppppp
Now Reloading via hard watchdog timeout

Unexpected exception, CP
System Bootstrap, Version 12.2(20031011:151758) [biff]
Copyright (c) 1994-2003 by cisco Systems, Inc.

 Running new upgrade for first time

System Bootstrap, Version 12.2(20031011:151758) [biff]
Copyright (c) 1994-2003 by cisco Systems, Inc.

ROM:Rebooted by watchdog hard reset
C7301 platform with 1048576 Kbytes of main memory


Upgrade ROMMON initialized
rommon 1 >
```

Note   It is advisable to load a known good Cisco IOS image after a ROMmon upgrade.

Changing Preferences to Choose the Other ROMmon Image

To use the other ROMmon image, use one of the following commands to make the change depending on whether you are in Cisco IOS or in ROMmon:

- In Cisco IOS, use the **upgrade rom-monitor preference** command to change to the other ROMmon image:

  upgrade rom-monitor preference [readonly | upgrade]

  Example:

  ```
  Router: upgrade rom-monitor preference readonly
  You are about to mark ReadOnly region of ROMMON for the highest boot preference.
  Proceed? [confirm]
  Done! Router must be reloaded for this to take effect.
  ```

- In ROMmon, use the ROMmon CLI **rommon-pref** command to change to the other ROMmon image:

  rommon-pref [readonly|upgrade]

  Example:

  ```
  rommon 2 > rommon-pref readonly
  ```

Troubleshooting the Upgrade

This section contains sample error messages that appear if an upgrade fails, or if an upgrade is successful but the upgrade image is corrupted.

ROMmon Upgrade Error Messages

One if these error message appears when the upgrade has failed or if the upgrade image is corrupted:

- ROMmon image is not compatible with ReadOnly image:

```
Router: upgrade rom-monitor file tftp://00.0.00.0/biff/c7301-is-mz
Loading biff/C7200_NPEG1_RMFUR.srec from 00.0.00.0 (via GigabitEthernet0/1):
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 392348 bytes]

ROMMON upgrade aborted; new ROMMON image version is not compatible with ReadOnly
```

- ROMmon upgrade image is too big:

```
Router: upgrade rom-monitor file tftp://00.0.00.0/biff/c7301-is-mz
Loading biff/C7200_NPEG1_RMFUR.srec from 00.0.00.0 (via GigabitEthernet0/1):
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 392348 bytes]

ROMMON upgrade aborted; new ROMMON is too big
```

- Hardware does not support ROMmon upgrade:

```
Router: upgrade rom-monitor file tftp://00.0.00.0/biff/c7301-is-mz
Loading biff/C7200_NPEG1_RMFUR.srec from 00.0.00.0 (via GigabitEthernet0/1):
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 392348 bytes]

ROMMON upgrade aborted; Current ROMMON does not support upgrade capability
```

- Upgrade command with incorrect file type:

```
NPEG1-10# upgrade rom-monitor file tftp://00.0.00.0/biff/c7301-is-mz
from 00.0.00.0 (via GigabitEthernet0/1):!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 524288 bytes]

%Error:not srec file
NPEG1-10#
```

- A boot of a corrupted upgrade image:

```
System Bootstrap, Version 12.2(20031011:151758) [pgettner-npeg1-fur 135], DEVELOPMENT
SOFTWARE
Copyright (c) 1994-2003 by cisco Systems, Inc.

 Upgrade ROMMON corrupted.
 Falling to ReadOnly ROMMON

ROM:Rebooted by watchdog hard reset
C7301 platform with 1048576 Kbytes of main memory

Readonly ROMMON initialized
rommon 1 >
```

Replacing or Recovering a Lost Password

This section describes how to recover a lost enable or console login password, and how to replace a lost enable secret password on your Cisco 7301 router.

Note   It is possible to recover the enable or console login password. The enable secret password is encrypted, however, and must be replaced with a new enable secret password.

Overview of the Password Recovery Procedure

Following is an overview of the steps in the password recovery procedure:

Step 1   If you can log in to the router, enter the **show version** command to determine the existing configuration register value.

Step 2   Press the **Break** key to get to the bootstrap program prompt (ROM monitor). You might need to reload the system image by power cycling the router.

Step 3   Change the configuration register so the following functions are enabled:

   a. Break

   b. Ignore startup configuration

   c. Boot from Flash memory

Note   The key to recovering a lost password is to set the configuration register bit 6 (0x0040) so that the startup configuration (usually in NVRAM) is ignored. This allows you to log in without using a password and to display the startup configuration passwords.

Note   When powering off the router, wait 30 seconds before powering it on again.

Step 4   Power cycle the router by turning power off and then back on.

Step 5   Log in to the router and enter the privileged EXEC mode.

Step 6   Enter the **show startup-config** command to display the passwords.

Step 7   Recover or replace the displayed passwords.

Step 8   Change the configuration register back to its original setting.

Note   To recover a lost password if the Break function is disabled on the router, you must have physical access to the router.

Details of the Password Recovery Procedure

Complete the following steps to recover or replace a lost enable, enable secret, or console login password:

Step 1   Attach an ASCII terminal to the console port on your router.

Step 2   Configure the terminal to operate at 9600 baud, 8 data bits, no parity, and 1 stop bit (9600 8N1).

Step 3   If you can log in to the router as a nonprivileged user, enter the **show version** command to display the existing configuration register value. Note the value for use later and proceed to Step 6. If you cannot log in to the router at all, go to the next step.

Step 4   Press the **Break** key or send a Break from the console terminal. If Break is enabled, the router enters the ROM monitor, indicated by the ROM monitor prompt (`rommon1>`). Proceed to Step 6. If Break is disabled, power cycle the router (turn the router off or unplug the power cord, and then restore power after waiting 30 seconds). Then proceed to Step 5.

Step 5   Within 60 seconds of restoring the power to the router, press the **Break** key or send a Break. This action causes the router to enter the ROM monitor and display the ROM monitor prompt (`rommon1>`).

Step 6   Set the configuration register using the configuration register utility; enter the **confreg** command at the ROM monitor prompt as follows:

```
rommon1> confreg
```

Step 7   Answer **yes** to the enable "ignore system config info?" question, and note the current configuration register settings.

Step 8   Initialize the router by entering the **reset** command as follows:

```
rommon2> reset
```

The router initializes, the configuration register is set to 0x142, and the router boots the system image from Flash memory and enters the System Configuration Dialog prompt as follows:

```
--- System Configuration Dialog --
```

Step 9   Enter **no** in response to the System Configuration Dialog prompts until the following message is displayed:

```
Press RETURN to get started!
```

Step 10   Press **Return.** The user EXEC prompt is displayed as follows:

```
Router>
```

Step 11   Enter the **enable** command to enter privileged EXEC mode. Then enter the **show startup-config** command to display the passwords in the configuration file as follows:

```
Router# show startup-config
```

Step 12   Scan the configuration file display looking for the passwords (the enable passwords are usually near the beginning of the file, and the console login or user EXEC password is near the end). The passwords displayed look something like this:

```
enable secret 5 $1$ORPP$s9syZt4uKn3SnpuLDrhuei
enable password 23skiddoo
.
.
line con 0
 password onramp
```

The enable secret password is encrypted and cannot be recovered; it must be replaced. The enable and console login passwords may be encrypted or clear text. Proceed to the next step to replace an enable secret, console login, or enable password. If there is no enable secret password, note the enable and console login passwords, if they are not encrypted, and proceed to Step 17.

> ⚠️
> **Caution**   *Do not* execute the next step unless you have determined you must change or replace the enable, enable secret, or console login passwords. Failure to follow the steps as shown might cause you to erase your router configuration.

Step 13   Enter the **configure memory** command to load the startup configuration file into running memory. This action allows you to modify or replace passwords in the configuration.

```
Router# configure memory
```

Step 14   Enter the privileged EXEC command **configure terminal** to enter configuration mode:

```
Hostname# configure terminal
```

Step 15   Change all three passwords using the following commands:

```
Hostname(config)# enable secret newpassword1
Hostname(config)# enable password newpassword2
Hostname(config)# line con 0
Hostname(config-line)# password newpassword3
```

Change only the passwords necessary for your configuration. You can remove individual passwords by using the **no** form of the above commands. For example, entering the **no enable secret** command removes the enable secret password.

Step 16   You must configure all interfaces to be *not* administratively shut down as follows:

```
Hostname(config)# interface gigabitethernet 0/0
Hostname(config-int)# no shutdown
```

Enter the equivalent commands for all interfaces that were originally configured. If you omit this step, all interfaces are administratively shut down and unavailable when the router is restarted.

Step 17   Use the **config-registe**r command to set the configuration register to the original value noted in Step 3 or Step 8, or to the factory default value 0x2102 as follows:

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

Step 18   Press **Ctrl-Z** (hold down the **Control** key while you press **Z**) or enter **end** to exit configuration mode and return to the EXEC command interpreter.

> ⚠️
> **Caution**   *Do not* execute the next step unless you have changed or replaced a password. If you skipped Step 13 through Step 16, skip to Step 20. Failure to observe this caution causes you to erase your router configuration file.

Step 19   Enter the **copy running-config startup-config** command to save the new configuration to NVRAM.

Step 20   Enter the **reload** command to reboot the router.

Step 21   Log in to the router with the new or recovered passwords.

This completes the steps for recovering or replacing a lost enable, enable secret, or console login password.

Viewing Your System Configuration

You can use the **show version**, **show hardware,** and the **show diag** commands to view information specific to the hardware configuration of your Cisco 7301 router.

Use the **show version** (or **show hardware**) command to display the system hardware, processor and the number of interfaces installed, the software version, the names and sources of configuration files, and the boot images.

The following is Cisco 7301 sample output of the **show version** command:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 7301 Software (C7301-JS-M), Experimental Version 12.2(20020904:004736) [biff 107]
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Mon 09-Sep-02 18:02 by biff
Image text-base:0x600088F8, data-base:0x61A94000

ROM:System Bootstrap, Version 12.2(20020730:200705) [biff-TAZ2_QA_RELEASE_16B 101],
DEVELOPMENT SOFTWARE
BOOTLDR:7301 Software (C7301-BOOT-M), Experimental Version 12.2(20020813:014224)
[biff-TAZ2_QA_RELEASE_17B 101]

7301p2b uptime is 0 minutes
System returned to ROM by reload at 00:01:51 UTC Sat Jan 1 2000
System image file is "tftp://10.1.8.11/tazii/images/c7301-js-mz"

cisco 7301 (NPE-G1) processor (revision A) with 491520K/32768K bytes of memory.
Processor board ID 0
BCM1250 CPU at 700Mhz, Implementation 1, Rev 0.2, 512KB L2 Cache
1 slot midplane, Version 2.0

Last reset from power-on
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
3 Gigabit Ethernet/IEEE 802.3 interface(s)
509K bytes of non-volatile configuration memory.

62976K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
32768K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x102
```

Use the **show diag** command to determine what type of Gigabit Ethernet port is active or what type of port adapter is installed in your Cisco 7301 router. You can also use the **show diag** *slot* command to display information about the port adapter slot.

The following example shows the **show diag** command output from a Cisco 7301 router. Note that slot 0 is reserved for the native Gigabit Ethernet ports:

Note   Both native SFP GBIC and RJ-45 Gigabit Ethernet ports are reported as Gigabit Ethernet ports. To select either optical Gigabit Ethernet or copper Gigabit Ethernet ports, use the **media-type** command. See the "Configuring the Native Gigabit Ethernet Interfaces" section on page 3-14.

Note   Input/output data for the console port, auxiliary port, Gigabit Ethernet ports, and CompactFlash Disk are listed in the output of the **show c7301** command, rather than in the output of the **show diag** command. Use the **show diag** command for port adapter information.

```
Router# show diag

Slot 1:
        POS Single Width, Multi Mode Port adapter, 1 port
        Port adapter is analyzed
        Port adapter insertion time 01:38:29 ago
        EEPROM contents at hardware discovery:
        Hardware revision 2.2          Board revision A0
        Serial number    28672741      Part number    73-3192-06
        FRU Part Number: PA-POS-OC3MM=

        Test history      0x0          RMA number      00-00-00
        EEPROM format version 1
        EEPROM contents (hex):
          0x20:01 96 02 02 01 B5 82 E5 49 0C 78 06 00 00 00 00
          0x30:50 00 00 00 02 08 19 00 00 00 FF FF FF FF FF FF
```

For specific information on the **show version**, **show hardware**, **show diag**, and other software commands, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.

Performing Complex Configurations

After you have installed your Cisco 7301 router hardware, checked all external connections, turned on the system power, allowed the system to boot up, and minimally configured the system, you might need to perform more complex configurations, which are beyond the scope of this publication.

For specific information on system and interface configuration, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.