Configuring IPv4

This chapter describes how to configure IPv4 information on the Cisco 910 Industrial Routers (*hereafter* referred to as the router).

This chapter consists of these sections:

- About IPv4, page 1
- Configuring IPv4 Address, page 2
- Configuring IPv4 Static and Default Route, page 4
- Diagnosing IPv4 Connectivity, page 5
- Monitoring and Maintaining IPv4 Host Information, page 6

Information in this chapter about configuring IP addresses is specific to IP Version 4 (IPv4). If you plan to enable IP Version 6 (IPv6) forwarding on your router, see Chapter 15, "Configuring IPv6" for information specific to IPv6 address format and configuration.

About IPv4

You can configure IP on the router to assign IP addresses to network interfaces. When you assign IP addresses, you enable the interfaces and allow communication with the hosts on those interfaces. The router supports the following interfaces: cellular (3G), Wi-Fi, and Gigabit Ethernet.

You can use a subnet to mask the IP addresses. A mask determines to which subnet an IP address belongs. An IP address contains the network address and the host address. A mask identifies the bits that denote the network number in an IP address. When you use the mask to subnet a network, the mask is then referred to as a subnet mask. Subnet masks are 32-bit values that allow the recipient of IP packets to distinguish the network ID portion of the IP address from the host ID portion of the IP address.

This section includes the following topics:

- Address Resolution Protocol
- ICMP

Address Resolution Protocol

Networking devices and Layer 3 switches and routers use Address Resolution Protocol (ARP) to map IP (network layer) addresses to (Media Access Control [MAC]-layer) addresses which enables IP packets to be sent across networks. Before a device sends a packet to another device, it looks in its own ARP cache to see if there is a MAC address and corresponding IP address for the destination device. If there is no entry, then the source device sends a broadcast message to every device on the network.

Each device compares the IP address to its own. Only the device with the matching IP address replies to the device that sends the data with a packet that contains the MAC address for the device. The source device adds the destination device MAC address to its ARP table for future reference, creates a data-link header and trailer that encapsulates the packet, and proceeds to transfer the data.

When the destination device lies on a remote network that is beyond another device, the process is the same except that the device that sends the data sends an ARP request for the MAC address of the default gateway. After the address is resolved and the default gateway receives the packet, the default gateway broadcasts the destination IP address over the networks connected to it. The device on the destination device network uses ARP to obtain the MAC address of the destination device and delivers the packet. ARP is enabled by default.

To display the ARP table on the router, use the **show ip arp** EXEC command.

This is an example to show IPv4 arp table discovered by the router.

```
Router# show ip arp
Protocol   Address          Hardware Addr        Interface          state
Internet   172.18.60.254    9c:4e:20:bf:a1:d1    GibitEthernet0/1   REACHABLE
Internet   172.18.60.128    00:22:bd:d8:1e:28    GibitEthernet0/1   REACHABLE
```

ICMP

You can use the Internet Control Message Protocol (ICMP) to provide message packets that report errors and other information that is relevant to IP processing. ICMP generates error messages, such as ICMP destination unreachable messages, ICMP Echo Requests (which send a packet on a round trip between two hosts), and Echo Reply messages. ICMP also provides many diagnostic functions and can send and redirect error packets to the host. By default, ICMP is enabled on the router.

Some of the ICMP message types are as follows:

- Network error messages
- Network congestion messages
- Troubleshooting information
- Timeout announcements

Configuring IPv4 Address

This section includes the following topics:

- Assigning IP Address to a VLAN Interface
- Assigning IP Address to the GE Interface
- Assigning IP Address to the Dot11Radio Interface

Assigning IP Address to a VLAN Interface

Beginning in privileged EXEC mode, follow these steps to manually assign IP information to a VLAN interface:

	Command	Purpose
1.	**configure terminal**	Enter global configuration mode.
2.	**interface vlan** *vlan-id*	Enter interface configuration mode, and enter the VLAN to which the IP information is assigned. The VLAN range is 1 to 4094.
3.	**ip address** *ip-address subnet-mask*	Enter the IP address and subnet mask.
4.	**exit**	Return to global configuration mode.
5.	**show interfaces vlan** *vlan-id*	Verify the configured IP address.
6.	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To remove the router IP address, use the **no ip address** interface configuration command. If you are removing the address through a Telnet session, your connection to the router will be lost.

The following example shows a VLAN interface status and configuration:

```
Router# show ip interface vlan 1
vlan1 is up, line protocol is up
Internet address is 172.18.60.209
Mask is 255.255.0.0
Broadcast address is 172.18.255.255
MTU is 1500 bytes
ICMP redirects are enabled
Proxy ARP is disabled
```

Assigning IP Address to the GE Interface

Beginning in privileged EXEC mode, follow these steps to manually assign IP information to the Gigabit Ethernet interface:

	Command	Purpose
1.	**configure terminal**	Enter global configuration mode.
2.	**interface GigabitEthernet** *interface_number*	Enter GE interface configuration mode, and enter interface number.
3.	**ip address** *ip-address subnet-mask*	Enter the IP address and subnet mask.
4.	**exit**	Return to global configuration mode.
5.	**show ip interfaces GigabitEthernet** *interface_number*	Verify the configured IP address.
6.	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To remove the router IP address, use the **no ip address** interface configuration command.

The following example shows a Gigabit Ethernet interface status and configuration:

```
Router# show ip interface GigabitEthernet 0/1
GigabitEthernet0/1 is up, line protocol is up
Internet address is 172.18.60.202
Mask is 255.255.0.0
Broadcast address is 172.18.255.255
MTU is 1500 bytes
ICMP redirects are enabled
Proxy ARP is disabled
```

Assigning IP Address to the Dot11Radio Interface

Beginning in privileged EXEC mode, follow these steps to manually assign IP information to a dot11radio interface:

	Command	Purpose
1.	**configure terminal**	Enter global configuration mode.
2.	**interface dot11radio** *interface_number*	Enter dot11radio interface configuration mode, and enter interface number.
3.	**ip address** *ip-address subnet-mask*	Enter the IP address and subnet mask.

	Command	Purpose
4.	**exit**	Return to global configuration mode.
5.	**show ip interfaces dot11radio** *interface_number*	Verify the configured IP address.
6.	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To remove the router IP address, use the **no ip address** interface configuration command.

The following example shows a dot11radio interface status and configuration:

```
Router# show ip interface dot11radio 0
line protocol is up
Internet address is 172.18.60.204
Mask is 255.255.0.0
Broadcast address is 172.18.255.255
MTU is 1500 bytes
ICMP redirects are enabled
Proxy ARP is disabled
```

Configuring IPv4 Static and Default Route

This chapter includes the following sections:

- Information About Static Routing
- Configuring Default Static Route

Information About Static Routing

Routers forward packets using either route information from route table entries that you manually configure or the route information that is calculated using dynamic routing algorithms.

Static routes, which define explicit paths between two routers, cannot be automatically updated. Static routes must be manually configured when network changes occur. Static routes use less bandwidth than dynamic routes. Additionally, the router uses no CPU cycles when calculating and analyzing routing updates.

Configuring Default Static Route

A default route identifies the gateway IP address to which the router sends all IP packets for which it does not have a learned or static route. A default static route is simply a static route with 0.0.0.0/0 as the destination IP address. Routes that identify a specific destination take precedence over the default route.

Beginning in privileged EXEC mode, follow these steps to configure an IPv4 default router for an interface:

	Command	Purpose
1.	**configure terminal**	Enter global configuration mode.
2.	**ip route 0.0.0.0 0.0.0.0** *interface_type interface_number* [*gateway_ip*] [**Metric** *metric_value*]	Configures a default static route and the interface for this route. You can optionally configure the default gateway address. ■ For *interface_type interface_number,* choose the default route interface. ■ For *gateway_ip,* specify default gateway. ■ For *metric_value,* specify the default route metric. Default value is 1. The metric value can be from 1 to 254.
3.	**exit**	Return to global configuration mode.
4.	**show ip route**	Verify the configuration.
5.	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To remove the default router, use the **no ip route** privileged EXEC command.

The following example configures a default route for the GigabitEthernet interface 0/1 when the IP address of the interface is static IP address:

```
Router(config)# ip route 0.0.0.0 0.0.0.0 GigabitEthernet 0/1 172.18.60.254 Metric 1
```

The following example configures a default route for the GigabitEthernet interface 0/1 when the IP address of the interface is obtained by DHCP:

```
Router(config)# ip route 0.0.0.0 0.0.0.0 GigabitEthernet 0/1 Metric 1
```

The following example deletes a default route from the GigabitEthernet interface 0/1:

```
Router(config)# no ip route 0.0.0.0 0.0.0.0 GigabitEthernet 0/1
```

The following example sets the cellular interface as a backup route and VLAN interface as a primary route:

```
Router(config)# ip route 0.0.0.0 0.0.0.0 cellular 0 Metric 2
Router(config)# ip route 0.0.0.0 0.0.0.0 Vlan 1 172.18.60.254 Metric 1
```

Diagnosing IPv4 Connectivity

Table 17 shows the privileged EXEC commands for diagnosing IPv4 network connectivity on the router.

Table 17 Commands for Monitoring IPv4

Command	Purpose
ping [**ip**] [*hostname* | *ip_address*] [**repeat** *repeat-count* | **size** *datagram-size* **| source** [*interface-name* | *source-address*]	Ping a remote host through IPv4. ■ (Optional) Specify repeat count. Default is 5 times. ■ (Optional) Specify datagram size. Default is 56 bytes. ■ (Optional) Specify source address. Default is none.
traceroute [**ip**] [*hostname* | *ip_address*]	Traceroute a remote host through IPv4.

Monitoring and Maintaining IPv4 Host Information

You can display specific statistics, such as the contents of IP routing tables, caches, and databases; the reachability of nodes; and the routing path that packets are taking through the network. Table 18 lists the privileged EXEC commands for displaying IPv4 statistics.

Table 18 Commands to Monitor IPv4 Host Information

Command	Purpose
show hosts	Display the default domain name, style of lookup service, name server hosts, and the cached list of hostnames and addresses.
show ip arp	Display the IP ARP cache.
show ip interface *interface-type interface-id*	Display the IP status of interfaces.
show ip route [*address* [*mask*]] | [*protocol*]	Display the current state of the routing table.
show ip traffic	Display IP traffic statistics.
show interfaces	Display interface status and configuration.

The following example shows the output of the **show interfaces** command:

```
Router# show interfaces
Vlan is administratively down, line protocol is down
        Hardware address is  ,Internet address is
        MTU is 1500 bytes
        RX packets:0 errors:0 dropped:0 overruns:0 frame:0
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
dot11radio0 line protocol is down
        Hardware address is 00:22:58:2E:CE:74 ,Internet address is
        MTU is 1500 bytes
        RX packets:0 errors:0 dropped:0 overruns:0 frame:0
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
GigabitEthernet0/1 is up, line protocol is up
        Hardware is Combo Gigabit Ethernet and SFP Slot, address is 3C:CE:73:A4:E6:00
        MTU is 1500 bytes
        duplex 1000M, speed full, media type is Combo
        RX packets:4314 errors:0 dropped:0 overruns:0 frame:0
        TX packets:2814 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:532
        RX bytes:672661 (656.8 KiB) TX bytes:2894793 (2.7 MiB)
```

The following example shows the output of the **show ip traffic** command:

```
Router# show ip traffic
IP statistics:
  Rcvd:  75586 total, 0 format errors,
         0 bad hop count 1639 unknown protocol
  Frags: 0 reassembled, 0  timeouts, 0  couldn't reassemble
         0 fragmented, 0  couldn't fragment
  Sent:  2929 generated, 0 forwarded

ICMP statistics:
  Rcvd:  0 input, 0 checksum errors
         211 unreach
         0 echo request, 288 echo reply
  Sent:  0 redirects, 0 unreachable
         0 echo request, 25 echo reply
```

```
         0 mask requests, 0 mask replies
         0 quench,288 timestamp
         548 time exceeded,0 parameter problem

TCP statistics:
  Rcvd:  6 total
  Sent:  111 total

UDP statistics:
  Rcvd:  1495 input, 0 errors
         212 no port
  Sent:  1749 output
```

The following example shows the output of the **show hosts** command:

```
Router# show hosts
Host Address
nameserver 172.18.32.5
nameserver 172.18.32.219
…
```