CHAPTER 3

Configuring the Switch IP Address and Default Gateway

This chapter describes how to configure the IP address, subnet mask, and default gateway on the Catalyst enterprise LAN switches.

Note For complete syntax and usage information for the commands used in this chapter, refer to the *Command Reference—Catalyst 4000 Family, Catalyst 2948G, and Catalyst 2980G Switches*.

This chapter consists of these major sections:

Understanding the Switch Management Interfaces

The Catalyst 4000 family, the Catalyst 2948G, and the Catalyst 2980G switches have three management interfaces:

- In-band interface (sc0)
- SLIP interface (s10)
- Management Ethernet interface (me1)

The in-band (sc0) management interface is connected to the switching fabric and participates in all of the functions of a normal switch port, such as spanning tree, Cisco Discovery Protocol (CDP), and VLAN membership. The out-of-band management interfaces (me1 and sl0) are not connected to the switching fabric and do not participate in any of these functions.

When you configure the IP address, subnet mask, and broadcast address (and, on the sc0 interface, VLAN membership) of the sc0 or me1 interface, you can access the switch through Telnet or SNMP. When you configure the SLIP (sl0) interface, you can open a point-to-point connection to the switch through the console port from a workstation.

All IP traffic generated by the switch (for example, a Telnet session opened from the switch to a host) is forwarded according to the entries in the switch IP routing table. For intersubnetwork communication to occur, you must configure at least one default gateway for the sc0 or me1 interface. The switch IP routing table is used to forward traffic originating on the switch only, not for forwarding traffic sent by devices connected to the switch.

Because sc0 and me1 are two distinct interfaces, they potentially can have duplicate IP addresses or overlapping subnets. Therefore, when you enter a command that causes sc0 and me1 to have the same IP address or occupy the same subnet, the switch software brings one of the interfaces down.

In most cases, the switch software brings down the sc0 interface after you confirm the change. However, when the switch boots with the IP address 0.0.0.0 configured on both the sc0 and me1 interfaces, the me1 interface is brought down to allow BOOTP and RARP requests to broadcast out the sc0 interface.

Note When the switch boots with the IP address 0.0.0.0 configured on both the sc0 and me1 interfaces, the me1 interface is automatically brought down by the switch software. You are not asked to confirm the change, and no console messages or traps are generated in this case.

Duplicate IP addresses and equal subnets are allowed on the sc0 and me1 interfaces provided that one of the interfaces is configured down. Non-equal subnets are not allowed (for example, sc0 with IP address 10.1.1.1 and subnet mask 255.0.0.0 and me1 with IP address 10.1.1.2 and subnet mask 255.255.255.0).

Understanding Automatic IP Configuration

These sections describe how the switch can obtain its IP configuration automatically:

Overview of Automatic IP Configuration

The switch can obtain its IP configuration automatically using one of the following protocols:

- Dynamic Host Configuration Protocol (DHCP)
- Reverse Address Resolution Protocol (RARP)

The switch makes DHCP and RARP requests only if the sc0 interface IP address is set to 0.0.0.0 when the switch boots up. This address is the default for a new switch or a switch whose configuration file has been cleared using the **clear config all** command. DHCP and RARP requests are only broadcast out the sc0 interface.

Note If the CONFIG_FILE environment variable is set, all configuration files are processed before the switch determines whether to broadcast DHCP and RARP requests. For more information about the CONFIG_FILE environment variable, see Chapter 29, "Modifying the Switch Boot Configuration."

If both the sc0 and me1 interfaces are unconfigured (IP address 0.0.0.0), the me1 interface is brought down to allow the switch to broadcast requests on the sc0 interface. If the me1 interface is configured and the sc0 interface is not, requests are not sent. Similarly, if the sc0 interface is not configured but the interface is configured down, requests are not sent.

Understanding How DHCP Works

In software release 5.2 and later releases, the switch can obtain an IP address and other IP configuration information using DHCP.

There are three methods for obtaining an IP address from the DHCP server:

- Manual allocation—The network administrator maps the switch MAC address to an IP address at the DHCP server.
- Automatic allocation—The switch obtains an IP address when it first contacts the DHCP server. The address is permanently assigned to the switch.
- Dynamic allocation—The switch obtains a "leased" IP address for a specified period of time. The IP address is revoked at the end of this period, and the switch surrenders the address. The switch must request another IP address.

In addition to the sc0 interface IP address, the switch can obtain the subnet mask, broadcast address, default gateway address, as well as other information. DHCP-learned values are not used if user-configured values are present.

The switch broadcasts a DHCPDISCOVER message one to ten seconds after all of the switch ports are online. The switch always requests an infinite lease time in the DHCPDISCOVER message.

If a DHCP or Bootstrap Protocol (BOOTP) server responds to the request, the switch takes appropriate action. If a DHCPOFFER message is received from a DCHP server, the switch processes all supported options contained in the message. Table 3-1 shows the supported DHCP options. Other options specified in the DHCPOFFER message are ignored.

Table 3-1 Supported DHCP Options

Code	Option
1	Subnet mask
2	Time offset
3	Router
6	Domain name server
12	Hostname
15	Domain name
28	Broadcast address
33	Static route
42	NTP servers

Table 3-1 Supported DHCP Options (continued)

Code	Option
51	IP address lease time
52	Option overload
61	Client-identifier
66	TFTP server name

If a BOOTP response is received from a BOOTP server, the switch sets the in-band (sc0) interface IP address to the address specified in the BOOTP response.

If no DHCPOFFER message or BOOTP response is received in reply, the switch rebroadcasts the request using an exponential backoff algorithm (the amount of time between requests increases exponentially). If no response is received after ten minutes, the sc0 interface IP address remains set to 0.0.0.0 (provided that RARP requests fail as well).

If you reset or power cycle a switch with a DHCP- or BOOTP-obtained IP address, the information learned from DHCP or BOOTP is retained. At boot up, the switch attempts to renew the lease on the IP address. If no reply is received, the switch retains the current IP address.

Understanding How RARP Works

With RARP, you map the switch MAC address to an IP address on the RARP server. The switch retrieves its IP address from the server automatically when it boots up.

The switch broadcasts 10 RARP requests after all of the switch ports are online. If a response is received, the switch sets the in-band (sc0) interface IP address to the address specified in the RARP response.

If no reply is received, the sc0 interface IP address remains set to 0.0.0.0 (provided that DHCP requests fail as well).

If you reset or power cycle a switch with a RARP-obtained IP address, the information learned from RARP is retained.

Preparing to Configure the IP Address and Default Gateway

Before you configure the switch IP address and default gateway, obtain the following information, as appropriate:

- IP address for the switch (sc0 and me1 interfaces only)
- Subnet mask/number of subnet bits (sc0 and me1 interfaces only)
- (Optional) Broadcast address (sc0 and me1 interfaces only)
- VLAN membership (sc0 interface only)
- SLIP and SLIP destination addresses (sl0 interface only)
- Interface connection type:
  - In-band (sc0) interface

    Configure this interface when assigning an IP address, subnet mask, and VLAN to the in-band management interface on the switch.

– Out-of-band management Ethernet (me1) interface

  Configure this interface when assigning an IP address and subnet mask to the out-of-band management Ethernet interface on the switch.

– SLIP (sl0) interface

  Configure this interface when setting up a point-to-point SLIP connection between a terminal and the switch.

Default IP Address and Default Gateway Configuration

Table 3-2 shows the default IP address and default gateway configuration.

Table 3-2 Switch IP Address and Default Gateway Default Configuration

Feature	Default Value
In-band (sc0) interface	• IP address, subnet mask, and broadcast address set to 0.0.0.0 • Assigned to VLAN 1
Management Ethernet (me1) interface	• IP address, subnet mask, and broadcast address set to 0.0.0.0
Default gateway address	• Set to 0.0.0.0 with a metric of 0
SLIP (sl0) interface	• IP address and SLIP destination address set to 0.0.0.0 • SLIP for the console port is not active (set to **detach**)

Setting the In-Band (sc0) Interface IP Address

Before you can Telnet to the switch or use Simple Network Management Protocol (SNMP) to manage the switch, you must assign an IP address to either the in-band (sc0) logical interface or the management Ethernet (me1) interface.

You can specify the subnet mask (*netmask*) using the number of subnet bits or using the subnet mask in dotted decimal format.

To set the IP address and VLAN membership of the in-band (sc0) management interface, perform this task in privileged mode:

	Task	Command
Step 1	Assign an IP address, subnet mask (or number of subnet bits), and (optional) broadcast address to the in-band (sc0) interface.	**set interface sc0** [*ip_addr*[**/***netmask*] [*broadcast*]]
Step 2	Assign the in-band interface to the proper VLAN (make sure the VLAN is associated with the network to which the IP address belongs).	**set interface sc0** [*vlan*]
Step 3	If necessary, bring the interface up.	**set interface sc0 up**
Step 4	Verify the interface configuration.	**show interface**

This example shows how to assign an IP address, specify the number of subnet bits, and specify the VLAN assignment for the in-band (sc0) interface:

```
Console> (enable) set interface sc0 172.20.52.124/29
Interface sc0 IP address and netmask set.
Console> (enable) set interface sc0 5
Interface sc0 vlan set.
Console> (enable)
```

This example shows how to specify the VLAN assignment, assign an IP address, specify the subnet mask in dotted decimal format, and verify the configuration:

```
Console> (enable) set interface sc0 5 172.20.52.124/255.255.255.248
Interface sc0 vlan set, IP address and netmask set.
Console> (enable) show interface
sl0: flags=51<UP,POINTOPOINT,RUNNING>
        slip 0.0.0.0 dest 0.0.0.0
sc0: flags=63<UP,BROADCAST,RUNNING>
        vlan 5 inet 172.20.52.124 netmask 255.255.255.248 broadcast 172.20.52.17
Console> (enable)
```

Setting the Management Ethernet (me1) Interface IP Address

Before you can Telnet to the switch or use SNMP to manage the switch, you must assign an IP address to either the in-band (sc0) logical interface or the management Ethernet (me1) interface. The me1 interface is present only on the Catalyst 4000 family, Catalyst 2948G, and Catalyst 2980G switches.

You can specify the subnet mask (*netmask*) using the number of subnet bits or using the subnet mask in dotted decimal format.

To set the management Ethernet (me1) interface IP address, perform this task in privileged mode:

	Task	Command
Step 1	Assign an IP address and subnet mask to the management Ethernet (me1) interface.	**set interface me1** [*ip_addr*[*/netmask*]]
Step 2	If necessary, bring the interface up.	**set interface me1 up**
Step 3	Verify the interface configuration.	**show interface**

This example shows how to assign an IP address and subnet mask to the management Ethernet (me1) interface and how to verify the interface configuration:

```
Console> (enable) set interface me1 172.20.52.12/255.255.255.224
Interface me1 IP address and netmask set.
Console> (enable) show interface
sl0: flags=51<UP,POINTOPOINT,RUNNING>
        slip 0.0.0.0 dest 0.0.0.0
sc0: flags=63<UP,BROADCAST,RUNNING>
        vlan 1 inet 0.0.0.0 netmask 0.0.0.0 broadcast 0.0.0.0
me1: flags=63<UP,BROADCAST,RUNNING>
        inet 172.20.52.12 netmask 255.255.255.224 broadcast 172.20.52.31
Console> (enable)
```

Configuring Default Gateways

The supervisor engine sends IP packets destined for other IP subnets to the default gateway (typically a router interface in the same network or subnet as the switch IP address). The switch does not use the IP routing table to forward traffic from connected devices, only IP traffic generated by the switch itself (for example, Telnet, TFTP, and ping).

Note In some cases, you might want to configure static IP routes in addition to default gateways. For information on configuring static routes, see the "Configuring Static Routes" section on page 27-9.

You can define up to three default IP gateways. Use the **primary** keyword to make a gateway the primary gateway. If you do not specify a primary default gateway, the first gateway configured is the primary gateway. If more than one gateway is designated as primary, the last primary gateway configured is the primary default gateway.

The switch sends all off-network IP traffic to the primary default gateway. If connectivity to the primary gateway is lost, the switch attempts to use the backup gateways in the order they were configured. The switch sends periodic ping messages to determine whether each default gateway is up or down. If connectivity to the primary gateway is restored, the switch resumes sending traffic to the primary.

If both the in-band (sc0) and management Ethernet (me1) interfaces are configured when you specify default gateways when, then the switch software automatically determines through which interface each default gateway can be reached.

To specify one or more default gateways, perform this task in privileged mode:

	Task	Command
Step 1	Configure a default IP gateway address for the switch.	**set ip route default** *gateway* [*metric*] [**primary**]
Step 2	(Optional) Configure additional default gateways for the switch.	**set ip route default** *gateway* [*metric*] [**primary**]
Step 3	Verify that the default gateways appear correctly in the IP routing table.	**show ip route**

To remove default gateway entries, perform one of these tasks in privileged mode:

Task	Command
Clear an individual default gateway entry.	**clear ip route default** *gateway*
Clear all default gateways and static routes.	**clear ip route all**

This example shows how to configure three default gateways on the switch and how to verify the default gateway configuration:

```
Console> (enable) set ip route default 10.1.1.10
Route added.
Console> (enable) set ip route default 10.1.1.20
Route added.
Console> (enable) set ip route default 10.1.1.1 primary
Route added.
Console> (enable) show ip route
Fragmentation   Redirect   Unreachable
```

```
-------------   --------   -----------
enabled         enabled    enabled

The primary gateway: 10.1.1.1
Destination      Gateway          RouteMask    Flags   Use       Interface
---------------  ---------------  ----------   -----   --------  ---------
default          10.1.1.1         0x0          UG      6           sc0
default          10.1.1.20        0x0          G       0           sc0
default          10.1.1.10        0x0          G       0           sc0
10.0.0.0         10.1.1.100       0xff000000   U       75          sc0
default          default          0xff000000   UH      0           sl0
Console> (enable)
```

This example shows how to configure two default gateways on a Catalyst 4000 family, Catalyst 2948G, or Catalyst 2980G switch, with one default gateway reachable through the sc0 interface and one reachable through the me1 interface:

```
Console> (enable) show interface
sl0: flags=50<DOWN,POINTOPOINT,RUNNING>
        slip 0.0.0.0 dest 0.0.0.0
sc0: flags=63<UP,BROADCAST,RUNNING>
        vlan 5 inet 172.20.52.38 netmask 255.255.255.240 broadcast 172.20.52.47
me1: flags=63<UP,BROADCAST,RUNNING>
        inet 10.1.1.100 netmask 255.255.255.0 broadcast 10.1.1.255
Console> (enable) set ip route default 172.20.52.33
Route added.
Console> (enable) set ip route default 10.1.1.1
Route added.
Console> (enable) show ip route
Fragmentation   Redirect   Unreachable
-------------   --------   -----------
enabled         enabled    enabled

The primary gateway: 172.20.52.33
Destination      Gateway          RouteMask    Flags   Use       Interface
---------------  ---------------  ----------   -----   --------  ---------
default          10.1.1.1         0x0          G       0           me1
default          172.20.52.33     0x0          UG      12          sc0
172.20.52.32     4000-2           0xffffffff   U       180         sc0
10.1.1.0         10.1.1.100       0xffffff00   U       22          me1
Console> (enable)
```

Configuring the SLIP (sl0) Interface on the Console Port

Use the SLIP (sl0) interface for point-to-point SLIP connections between the switch and an IP host.

Caution You *must* use the console port for the SLIP connection. When the SLIP connection is enabled and SLIP is attached on the console port, an EIA/TIA-232 terminal cannot connect through the console port. If you are connected to the switch CLI through the console port and you enter the **slip attach** command, you will lose the console port connection. Use Telnet to access the switch, enter privileged mode, and enter the **slip detach** command to restore the console port connection.

To enable and attach SLIP on the console port, perform this task:

	Task	Command
Step 1	Access the switch from a remote host with Telnet.	**telnet** {*host_name* | *ip_addr*}
Step 2	Enter privileged mode on the switch.	**enable**
Step 3	Set the console port SLIP address and the destination address of the attached host.	**set interface sl0** *slip_addr dest_addr*
Step 4	Verify the SLIP interface configuration.	**show interface**
Step 5	Enable SLIP for the console port.	**slip attach**

To disable SLIP on the console port, perform this task:

	Task	Command
Step 1	Access the switch from a remote host with Telnet.	**telnet** {*host_name* | *ip_addr*}
Step 2	Enter privileged mode on the switch.	**enable**
Step 3	Disable SLIP for the console port.	**slip detach**

This example shows how to configure SLIP on the console port and verify the configuration:

```
sparc20% telnet 172.20.52.38
Trying 172.20.52.38 ...
Connected to 172.20.52.38.
Escape character is '^]'.

Cisco Systems, Inc. Console

Enter password:
Console> enable

Enter password:
Console> (enable) set interface sl0 10.1.1.1 10.1.1.2
Interface sl0 slip and destination address set.
Console> (enable) show interface
sl0: flags=51<UP,POINTOPOINT,RUNNING>
        slip 10.1.1.1 dest 10.1.1.2
sc0: flags=63<UP,BROADCAST,RUNNING>
        vlan 522 inet 172.20.52.38 netmask 255.255.255.240 broadcast 172.20.52.7
me1: flags=62<DOWN,BROADCAST,RUNNING>
        inet 10.1.1.100 netmask 255.255.255.0 broadcast 10.1.1.255
Console> (enable) slip attach
Console Port now running SLIP.

Console> (enable) slip detach
SLIP detached on Console port.
Console> (enable)
```

Using DHCP or RARP to Obtain an IP Address Configuration

Note For complete information on how the switch uses DHCP or RARP to obtain its IP configuration, see the "Understanding Automatic IP Configuration" section on page 3-2.

To use DHCP or RARP to obtain an IP address for the switch, perform this task:

	Task	Command
Step 1	Make sure that there is a DHCP, BOOTP, or RARP server on the network.	—
Step 2	Obtain the last address in the MAC address range for module 1 (the supervisor engine). This address is displayed under the MAC-Address(es) heading. (With DHCP, this step is necessary only if using the manual allocation method.)	**show module**
Step 3	Add an entry for each switch in the DHCP, BOOTP, or RARP server configuration, mapping the MAC address of the switch to the IP configuration information for the switch. (With DHCP, this step is necessary only with the manual or automatic allocation methods.)	—
Step 4	Set the sc0 interface IP address to 0.0.0.0.	**set interface sc0 0.0.0.0**
Step 5	Reset the switch. The switch broadcasts DHCP and RARP requests only when the switch boots up.	**reset system**
Step 6	When the switch reboots, confirm that the sc0 interface IP address, subnet mask, and broadcast address are set correctly.	**show interface**
Step 7	For DHCP, confirm that other options (such as default gateway address) are set correctly.	**show ip route**

This example shows the switch broadcasting a DHCP request, receiving a DHCP offer, and configuring the IP address and other IP parameters according to the contents of the DHCP offer:

```
Console> (enable) Sending RARP request with address 00:90:0c:5a:8f:ff
Sending DHCP packet with address: 00:90:0c:5a:8f:ff
dhcpoffer
Sending DHCP packet with address: 00:90:0c:5a:8f:ff
Timezone set to '', offset from UTC is 7 hours 58 minutes
Timezone set to '', offset from UTC is 7 hours 58 minutes
172.16.30.32 added to DNS server table as primary server.
172.16.31.32 added to DNS server table as backup server.
172.16.32.32 added to DNS server table as backup server.
NTP server 172.16.25.253 added
NTP server 172.16.25.252 added
%MGMT-5-DHCP_S:Assigned IP address 172.20.25.244 from DHCP Server 172.20.25.254
Console> (enable) show interface
sl0: flags=51<UP,POINTOPOINT,RUNNING>
        slip 0.0.0.0 dest 0.0.0.0
sc0: flags=63<UP,BROADCAST,RUNNING>
        vlan 1 inet 172.20.25.244 netmask 255.255.255.0 broadcast 172.20.25.255
dhcp server: 172.20.25.254
Console>
```

Renewing and Releasing a DHCP-Assigned IP Address

If you are using DHCP for IP address assignment, you can perform either of these tasks:

- Renew—Renew the lease on a DHCP-assigned IP address.
- Release—Release the lease on a DHCP-assigned IP address.

To renew or release a DHCP-assigned IP address on the in-band (sc0) management interface, perform one of these tasks in privileged mode:

Task	Command
Renew the lease on a DHCP-assigned IP address.	**set interface sc0 dhcp renew**
Release the lease on a DHCP-assigned IP address.	**set interface sc0 dhcp release**

This example shows how to renew the lease on a DHCP-assigned IP address:

```
Console> (enable) set interface sc0 dhcp renew
Renewing IP address...
Console> (enable) Sending DHCP packet with address: 00:90:0c:5a:8f:ff
<...output truncated...>
```

This example shows how to release the lease on a DHCP-assigned IP address:

```
Console> (enable) set interface sc0 dhcp release
Releasing IP address...
Console> (enable) Sending DHCP packet with address: 00:90:0c:5a:8f:ff
Done

Console> (enable)
```