Configuring Ethernet and Fast Ethernet Switching

This chapter describes how to configure Ethernet and Fast Ethernet switching on the Catalyst enterprise LAN switches. The configuration procedures in this chapter apply to Ethernet and Fast Ethernet switch ports on switching modules and fixed-configuration switches, as well as to supervisor engine Fast Ethernet uplink ports.

Note For complete information on installing Catalyst 4000 family Fast Ethernet modules, refer to the *Catalyst 4000 Family Installation Guide*.

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 How Ethernet Works

These sections describe how Ethernet switching works on the Catalyst enterprise LAN switches:

Overview of Ethernet

The Catalyst enterprise LAN switches support simultaneous, parallel conversations between Ethernet segments. Switched connections between Ethernet segments last only for the duration of the packet. New connections can be made between different segments for the next packet.

The Catalyst enterprise LAN switches solve congestion problems caused by high-bandwidth devices and a large number of users by assigning each device (for example, a server) to its own 10-, 100-, or 1000-Mbps segment. Because each Ethernet port on the switch represents a separate Ethernet segment, servers in a properly configured switched environment achieve full access to the bandwidth.

Because the major bottleneck in Ethernet networks is usually due to collisions, an effective solution is full-duplex communication, an option for each port on the switches (Gigabit Ethernet ports support *only* full duplex). Normally, Ethernet operates in half-duplex mode, which means that stations can either receive or transmit. In full-duplex mode, two stations can transmit and receive at the same time. When packets can flow in both directions simultaneously, effective Ethernet bandwidth for Ethernet ports is 20 Mbps, for Fast Ethernet ports it is 200 Mbps, and for Gigabit Ethernet ports it is 2 Gbps.

Switching Frames Between Segments

Each Ethernet port on the switch can connect to a single workstation or server, or to a hub through which workstations or servers connect to the network.

Ports on a typical Ethernet hub all connect to a common backplane within the hub, and the bandwidth of the network is shared by all devices attached to the hub. If two stations establish a session that uses a significant level of bandwidth, the network performance of all other stations attached to the hub is degraded.

To reduce degradation, the Catalyst enterprise LAN switches treat each port as an individual segment. When stations on different ports need to communicate, the switch forwards frames from one port to the other at wire speed to ensure that each session receives the full bandwidth available.

To switch frames between ports efficiently, the switch maintains an address table. When a frame enters the switch, it associates the Media Access Control (MAC) address of the sending station with the port on which it was received.

Building the Address Table

The switch builds the address table by using the source address of the frames received. When the switch receives a frame for a destination address not yet listed in its address table, it floods the frame to all ports of the same virtual LAN (VLAN) except the port that received the frame. When the destination station replies, the switch adds its relevant source address and port ID to the address table. The switch then forwards subsequent frames to a single port without flooding to all ports.

The address table can store at least 16,000 address entries without flooding any entries. The switch uses an aging mechanism, defined by a configurable aging timer, so if an address remains inactive for a specified number of seconds, it is removed from the address table.

Default Ethernet and Fast Ethernet Configurations

Table 4-1 lists the Ethernet and Fast Ethernet default configuration.

Table 4-1 Ethernet and Fast Ethernet Default Configuration

Feature	Default Value
Port enable state	All ports are enabled
Port name	None

Table 4-1 Ethernet and Fast Ethernet Default Configuration (continued)

Feature	Default Value
Port priority	Normal
Duplex mode	• Autonegotiate speed and duplex for 10/100-Mbps Fast Ethernet ports • Autonegotiate duplex for 100-Mbps Fast Ethernet ports
Native VLAN	VLAN 1
Spanning tree port cost	• Port cost of 100 for 10-Mbps Ethernet ports • Port cost of 19 for 10/100-Mbps Fast Ethernet ports • Port cost of 19 for 100-Mbps Fast Ethernet ports
Fast EtherChannel	Disabled on all Fast Ethernet ports (**auto** mode)

Configuring Ethernet and Fast Ethernet Ports

These sections describe how to configure Ethernet and Fast Ethernet switching ports on the Catalyst enterprise LAN switches:

Note For information on configuring Fast EtherChannel, see Chapter 6, "Configuring Fast EtherChannel and Gigabit EtherChannel."

Setting Ethernet and Fast Ethernet Port Names

You can assign names to the ports on Ethernet and Fast Ethernet modules to facilitate switch administration.

To assign a name to a port, perform this procedure in privileged mode:

	Task	Command
Step 1	Assign a name to a port.	**set port name** *mod_num/port_num* [*name_string*]
Step 2	Verify that the port name is configured.	**show port** [*mod_num*[*/port_num*]]

This example shows how to set the name for ports 1/1 and 1/2 and how to verify that the port names are configured correctly:

```
Console> (enable) set port name 1/1 Router Connection
Port 1/1 name set.
Console> (enable) set port name 1/2 Server Link
Port 1/2 name set.
Console> (enable) show port 1
Port  Name               Status     Vlan       Level  Duplex Speed Type
----- ------------------ ---------- ---------- ------ ------ ----- ------------
 1/1  Router Connection  connected  trunk      normal   half   100 100BaseTX
 1/2  Server Link        connected  trunk      normal   half   100 100BaseTX

<...output truncated...>

Last-Time-Cleared
--------------------------
Tue Jun 16 1998, 16:25:57
Console> (enable)
```

Setting Ethernet and Fast Ethernet Port Priority Levels

You can configure the priority level of each port. When ports request access to the switching bus simultaneously, the switch uses port priority level to determine the order in which to give ports access.

To set the port priority level, perform this procedure in privileged mode:

	Task	Command
Step 1	Configure the priority level for a port.	**set port level** *mod_num/port_num* {**normal** | **high**}
Step 2	Verify that port priority level is configured correctly.	**show port** [*mod_num* [*/port_num*]]

This example shows how to set the port priority level to high for port 1/1 and verify that the port priority is configured correctly:

```
Console> (enable) set port level 1/1 high
Port 1/1 level set to high.
Console> (enable) show port 1
Port  Name               Status     Vlan       Level  Duplex Speed Type
----- ------------------ ---------- ---------- ------ ------ ----- ------------
 1/1  Router Connection  connected  trunk      high     half   100 100BaseTX
 1/2  Server Link        connected  trunk      normal   half   100 100BaseTX

<...output truncated...>

Last-Time-Cleared
--------------------------
Tue Jun 16 1998, 16:25:57
Console> (enable)
```

Setting Ethernet and Fast Ethernet Port Speeds

You can configure the port speed on 10/100-Mbps Fast Ethernet modules. Use the **auto** keyword to have the port autonegotiate speed and duplex mode with the neighboring port.

Caution Make sure the device on the other end of the link is also configured for autonegotiation or a port speed or duplex mismatch will result.

Note If the port speed is set to **auto** on a 10/100-Mbps Fast Ethernet port, both speed and duplex are autonegotiated.

To set the port speed for a 10/100-Mbps port, perform this procedure in privileged mode:

	Task	Command
Step 1	Set the port speed of a 10/100-Mbps Fast Ethernet port.	**set port speed** *mod num/port num* {**10** | **100** | **auto**}
Step 2	Verify that the speed of the port is configured correctly.	**show port** [*mod_num* [*/port_num*]]

This example shows how to set the port speed to 100 Mbps on port 2/2:

```
Console> (enable) set port speed 2/2 100
Port 2/2 speed set to 100 Mbps.
Console> (enable)
```

This example shows how to make port 2/1 autonegotiate speed and duplex with the neighbor port:

```
Console> (enable) set port speed 2/1 auto
Port 2/1 speed set to auto-sensing mode.
Console> (enable)
```

Setting Ethernet and Fast Ethernet Port Duplex Modes

You can set the port duplex mode to full or half duplex for Ethernet and Fast Ethernet ports.

Note If the port speed is set to **auto** on a 10/100-Mbps Fast Ethernet port, both speed and duplex are autonegotiated. You cannot change the duplex mode of ports configured for autonegotiation. For information on enabling and disabling autonegotiation on 10/100 Fast Ethernet ports, see the "Setting Ethernet and Fast Ethernet Port Speeds" section on page 4-4.

To set the duplex mode of a port, perform this procedure in privileged mode:

	Task	Command
Step 1	Set the duplex mode of a port.	**set port duplex** *mod num/port num* {**full** | **half**}
Step 2	Verify that the duplex mode of the port is configured correctly.	**show port** [*mod_num* [*/port_num*]]

This example shows how to set the duplex mode to half duplex on port 2/1:

```
Console> (enable) set port duplex 2/1 half
Port 2/1 set to half-duplex.
Console> (enable)
```

Using Ethernet and Fast Ethernet Port Debounce Timers

You can set the port debounce timer on a per-port basis for Ethernet, Fast Ethernet, and Gigabit Ethernet ports. When you set the port debounce timer, the switch delays notifying the main processor of a link down; this delay in notification can decrease traffic loss due to network reconfiguration.

Caution Enabling the port debounce timer will delay link up and down detections, resulting in loss of data traffic during the debouncing period. This situation might delay the convergence and reconvergence of various Layer 2 and Layer 3 protocols.

Table 4-2 lists the time delay that occurs before the switch notifies the main processor of a link down before and after the switch enables the debounce timer.

Table 4-2 Switch Notification Delays for the Port Debounce Timer

	Delay Time	
Port Type	**With Debounce Timer Disabled**	**With Debounce Timer Enabled**
10/100 ports	0 ms	3.1 sec
100BASE-FX ports	0 ms	3.1 sec
10/100/1000BASE-TX ports	0 ms	3.1 sec
Gigabit TX ports	0 ms	3.1 sec
Fiber Gigabit ports	0 ms	3.1 sec **Note** The delay time is the time the port is physically down plus, once the port is up, the time the software needs to complete autonegotiation.

Setting the Port Debounce Timer

To set the debounce timer on a port, perform this procedure in privileged mode:

	Task	Command
Step 1	Enable the debounce timer for a port.	**set port debounce** *mod num/port num* {**enable** | **disable**}
Step 2	Verify that the debounce timer of the port is configured correctly.	**show port debounce** [*mod* | *mod_num/port_num*]

This example shows how to enable the debounce timer for module 2 on port 1:

```
Console> (enable) set port debounce 2/1 enable
Debounce is enabled on port 2/1
Warning: Enabling port debounce causes Link Up/Down detections to be delayed.
It results in loss of data traffic during debouncing period, which might
affect the convergence/reconvergence of various Layer 2 and Layer 3 protocols.
Use with caution.
Console> (enable)
```

This example shows how to display the per-port debounce timer settings:

```
Console> (enable) show port debounce
Port   Debounce link timer
-----  ---------------
 2/1   enable
 2/2   disable
Console> (enable)
```

Configuring errdisable State Ethernet and Fast Ethernet Port Timeout Periods

A port is in errdisable state if it has been enabled in NVRAM but disabled at runtime by any process. For example, if the UniDirectional Link Detection (UDLD) detects a unidirectional link, the port shuts down at runtime. However, because the NVRAM configuration for the port is enabled (you have not disabled the port), the port status is shown as errdisable.

Currently, if a port goes into an errdisable state for whatever reason, it will be reenabled automatically, after a selected time interval. With the new timeout enhancement, you can manually prevent a particular port from being enabled by setting the errdisable timeout for that particular port to disable; you can do this with the **set port errdisable-timeout mod/port disable** command.

Note The timeout enhancement does not have an effect on the *reason* value specified in the **set errdisable-timeout** command.

A global timer is maintained for all the ports. At every *t* seconds, where *t* is the user-configurable timeout, a process checks to see if any ports are in errdisable state. If so, only those ports that have the errdisable timeout set ("enabled") are reenabled through System Control Protocol (SCP) messages.

By default, all the errdisabled ports are reenabled when the global timer times out.

You can enable or disable errdisable timeout for any of the *reasons* available for the **set errdisable-timeout** command. If you specify a reason of **other**, only those ports that have been put in errdisable state due to causes *other* than those listed in the command syntax are enabled for errdisable timeout. If you specify a reason of **all**, all ports errdisabled for any reason are enabled for errdisable timeout.

This feature is disabled by default. The default interval for enabling a port is 300 seconds. The allowable interval range is 30 to 86,400 seconds (30 seconds to 24 hours).

This example shows how to prevent port 3/3 from being enabled when it goes into errdisable state:

```
Console> (enable) set port errdisable-timeout 3/3 disable
Successfully disabled errdisable-timeout for port 3/3.
Console> (enable)
```

This example shows how to enable errdisable timeout when the reason is BPDU guard (**bpdu-guard**):

```
Console> (enable) set errdisable-timeout enable bpdu-guard
Successfully enabled errdisable-timeout for bpdu-guard.
Console> (enable)
```

This example shows how to set the errdisable timeout interval to 450 seconds:

```
Console> (enable) set errdisable-timeout interval 450
Successfully set errdisable timeout to 450 seconds.
Console>(enable)
```

This example shows how to display the errdisable timeout configuration:

```
Console> (enable) show errdisable-timeout
ErrDisable Reason   Timeout Status
------------------- ------------
bpdu-guard          Enable
channel-misconfig   Disable
duplex-mismatch     Enable
udld                Enable
other               Disable

Interval: 300 seconds

Ports that will be enabled at the next timeout:
Port  ErrDisable Reason
----- -----------------
 3/1  udld
 3/8  bpdu-guard
 6/5  udld
 7/24 duplex-mismatch
Console> (enable)
```

Checking Ethernet and Fast Ethernet Port Connectivity

Note For more detailed information on checking connectivity, see Chapter 19, "Checking Port Status and Connectivity."

Use the **ping** and **traceroute** commands to test connectivity out Ethernet or Fast Ethernet ports.

To check connectivity out a port, perform this task in privileged mode:

	Task	Command
Step 1	Ping a remote host that is located out the port you want to test.	**ping** [**-s**] *host* [*packet_size*] [*packet_count*]
Step 2	Trace the hop-by-hop route of packets from the switch to a remote host located out the port you want to test.	**traceroute** *host*
Step 3	If the host is unresponsive, check the IP address and default gateway configured on the switch.	**show interface** **show ip route**

This example shows how to ping a remote host and how to trace the hop-by-hop path of packets through the network using **traceroute**:

```
Console> (enable) ping somehost
somehost is alive
Console> (enable) traceroute somehost
traceroute to somehost.company.com (10.1.2.3), 30 hops max, 40 byte packets
 1 engineering-1.company.com (173.31.192.206) 2 ms 1 ms 1 ms
 2 engineering-2.company.com (173.31.196.204) 2 ms 3 ms 2 ms
 3 gateway_a.company.com (173.16.1.201) 6 ms 3 ms 3 ms
 4 somehost.company.com (10.1.2.3) 3 ms * 2 ms
Console> (enable)
```