CHAPTER 5

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 tasks 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 5000 family Ethernet and Fast Ethernet modules, refer to the *Catalyst 5000 Family Module Installation Guide*. For complete information on installing Catalyst 4000 family Fast Ethernet modules, refer to the *Catalyst 4003 and 4006 Installation Guide*.

Note For complete syntax and usage information for the commands used in this chapter, refer to the *Command Reference* publication for your switch.

This chapter consists of these sections:

- Understanding How Ethernet Works, page 5-1
- Default Ethernet and Fast Ethernet Configuration, page 5-4
- Configuring Ethernet and Fast Ethernet Ports, page 5-5

Understanding How Ethernet Works

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

- Ethernet Overview, page 5-2
- Switching Frames Between Segments, page 5-2
- Building the Address Table, page 5-2
- Understanding How Fast Ethernet Flow Control Works, page 5-3
- Understanding How Fast Ethernet Port Negotiation Works, page 5-3

Ethernet Overview

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 *only* support 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.

Understanding How Fast Ethernet Flow Control Works

Some Fast Ethernet ports can transmit flow-control frames (pause frames) and can respond to pause frames received from neighboring devices. When a pause frame is received on a port, it is processed internally; pause frames are not switched through the system. Fast Ethernet ports that support flow control include:

- Some Catalyst 5000 family 10/100-Mbps and 100-Mbps Fast Ethernet switching modules
- All 10/100-Mbps Fast Ethernet ports on the Catalyst 2926G series switches

Note To determine whether your hardware supports flow control, check your hardware documentation or use the **show port capabilities** command.

If the receive buffer for a switch port becomes full, the switch transmits a pause frame on that port that tells neighboring devices to delay sending more packets for a specified period of time. Similarly, the switch can respond to pause frames received from a neighboring device by inhibiting the transmission of packets from a port for a period of time.

Use the **set port flow control** command to configure flow control on Fast Ethernet ports. Table 5-1 describes the flow-control behavior of a Fast Ethernet port depending on the **set port flowcontrol** command keywords used to configure the port.

Table 5-1 Fast Ethernet Flow-Control Keyword Functions

Keywords	Port Behavior
receive on	The port uses flow control dictated by the neighbor port.
receive desired	The port uses flow control if the neighbor port uses it, and does not use flow control if the neighbor port does not use it.
receive off	The port does not use flow control, regardless of whether flow control is requested by the neighbor port.
send on	The port sends flow-control frames to the neighbor port.
send desired	The port sends flow-control frames to the neighbor port if the neighbor port asks to use flow control.
send off	The port does not send flow-control frames to the neighbor port.

Understanding How Fast Ethernet Port Negotiation Works

Some 10/100-Mbps and 100-Mbps Fast Ethernet ports support port negotiation. Port negotiation is used to exchange flow-control parameters, remote fault information, and duplex information. You configure port negotiation using the **set port negotiation** command. Port negotiation is enabled by default.

Caution Unlike Fast Ethernet autonegotiation, Fast Ethernet port negotiation does not involve negotiating port speed. You *cannot* disable port negotiation on Fast Ethernet ports using the **set port speed** command.

The ports on both ends of a Fast Ethernet link must have the same port negotiation setting. The link will not come up if the ports at each end of the link are set inconsistently (port negotiation enabled on one port and disabled on the other). Table 5-2 shows the four possible port negotiation configurations for a Fast Ethernet link and the resulting link status for each configuration.

Table 5-2 Fast Ethernet Port Negotiation Configuration and Possible Link States

Port Negotiation State		Link Status	
Near End[1]	Far End[2]	Near End	Far End
Off	Off	Up	Up
On	On	Up	Up
Off	On	Up	Down
On	Off	Down	Up

1. Near End refers to the local Fast Ethernet module port.
2. Far End refers to the remote port at the other end of the Fast Ethernet link.

Default Ethernet and Fast Ethernet Configuration

Table 5-3 shows the Ethernet and Fast Ethernet default configuration.

Table 5-3 Ethernet and Fast Ethernet Default Configuration

Feature	Default Value
Port enable state	All ports are enabled
Port name	None
Port priority	Normal
Duplex mode	• Half duplex for 10-Mbps Ethernet ports • Autonegotiate speed and duplex for 10/100-Mbps Fast Ethernet ports • Autonegotiate duplex for 100-Mbps Fast Ethernet ports
Flow control (on supported modules only)	Flow control set to **off** for receive (Rx) and **on** for transmit (Tx)
Port negotiation (on supported modules only)	Enabled
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:

- Setting the Port Name, page 5-5
- Setting the Port Priority Level, page 5-6
- Setting the Port Speed, page 5-6
- Setting the Port Duplex Mode, page 5-7
- Configuring Flow Control on Fast Ethernet Ports, page 5-8
- Configuring Port Negotiation on Fast Ethernet Ports, page 5-8
- Changing the Default Port Enable State, page 5-9
- Configuring a Timeout Period for Ports in Errdisable State, page 5-10
- Checking Connectivity, page 5-11

Note For information on configuring Fast EtherChannel, refer to Chapter 7, "Configuring Fast EtherChannel and Gigabit EtherChannel."

Setting the Port Name

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 task 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 the Port Priority Level

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

To set the port priority level, perform this task 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 the 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 the Port Speed

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 task 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 the Port Duplex Mode

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 the Port Speed" section on page 5-6.

To set the duplex mode of a port, perform this task 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)
```

Configuring Flow Control on Fast Ethernet Ports

To configure flow control on a Fast Ethernet port, perform this task in privileged mode:

	Task	Command
Step 1	Set the flow-control parameters on a Fast Ethernet port.	**set port flowcontrol** {**receive** | **send**} *mod_num/port_num* {**off** | **on** | **desired**}
Step 2	Verify the flow-control configuration.	**show port flowcontrol**

This example shows how to turn transmit and receive flow control on and how to verify the flow-control configuration:

```
Console> (enable) set port flowcontrol 4/1 send on
Port 4/1 flow control send administration status set to on
(port will send flowcontrol to far end)
Console> (enable) set port flowcontrol 4/1 receive on
Port 4/1 flow control receive administration status set to on
(port will require far end to send flowcontrol)
Console> (enable) show port flowcontrol 4/1

Port   Send FlowControl    Receive FlowControl   RxPause TxPause Unsupported
       admin    oper       admin    oper                       opcodes
-----  -------- --------   -------- --------     ------- ------- -----------
 4/1   on       on         on       on           0       0       0
Console> (enable)
```

Configuring Port Negotiation on Fast Ethernet Ports

To enable port negotiation on a Fast Ethernet port, perform this task in privileged mode:

	Task	Command
Step 1	Enable Fast Ethernet port negotiation.	**set port negotiation** *mod_num/port_num* **enable**
Step 2	Verify the port negotiation configuration.	**show port negotiation** [*mod_num*/*port_num*]

This example shows how to enable port negotiation and verify the configuration:

```
Console> (enable) set port negotiation 2/1 enable
Port 2/1 negotiation enabled
Console> (enable) show port negotiation 2/1
Port   Link Negotiation
-----  ----------------
 2/1   enabled
Console> (enable)
```

To disable port negotiation on a Fast Ethernet port, perform this task in privileged mode:

	Task	Command
Step 1	Disable Fast Ethernet port negotiation.	**set port negotiation** *mod_num/port_num* **disable**
Step 2	Verify the port negotiation configuration.	**show port negotiation** [*mod_num*/*port_num*]

This example shows how to disable port negotiation and verify the configuration:

```
Console> (enable) set port negotiation 2/1 disable
Port 2/1 negotiation disabled
Console> (enable) show port negotiation 2/1
Port   Link Negotiation
-----  ----------------
 2/1   disabled
Console> (enable)
```

Changing the Default Port Enable State

Note Changing the default port enable state applies to all port types, not just Ethernet.

Note This feature is not supported on systems that do not have a chassis ID PROM.

When you enter the **clear config all** command or in the event of a configuration loss, all ports collapse into VLAN 1. This might cause a security and network instability problem. Entering the **set default portstatus** command puts all ports into a disable state and blocks the traffic flowing through the ports during a configuration loss. You can then manually configure the ports back to the enable state.

The default port status configuration is stored on the chassis. This means it is tied to a chassis and not the supervisor engine. The **clear config all** command uses this setting to determine whether ports should be enabled or disabled when returning to default configuration. The **clear config all** command does not change the default port status setting on the chassis. The output of the **show config** command shows the current default port status configuration.

To change the port enable state, perform this task in privileged mode:

	Task	Command
Step 1	Change the port enable state.	**set default portstatus** {**enable** | **disable**}
Step 2	Display the port enable state.	**show default**

This example shows how to change the default port enable state from enabled to disabled:

```
Console> (enable) set default portstatus disable
Default port status set to disable.
WARNING: Please reset the system to have new setup in effect.
Console> (enable)
```

This example shows how to display the port enable state:

```
Console> (enable) show default
portstatus: disable
Console> (enable)
```

Configuring a Timeout Period for Ports in Errdisable State

A port is in errdisable state if it is enabled in NVRAM, but disabled at runtime by any process. For example, if 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.

After a port goes into errdisable state, the port has to be manually reenabled. The errdisable timeout feature allows you to configure a timeout period for ports in errdisable state; the ports are reenabled automatically eliminating the need to manually reenable all the errdisabled ports.

A port enters errdisable state for the following reasons (these appear as configuration options with the set errdisable-timeout enable command):

- Channel misconfiguration
- Duplex mismatch
- BPDU port-guard
- UDLD
- Other

You can enable or disable errdisable timeout for each of the above listed reasons. Ports that are in errdisable state because of reasons other than the first four reasons have an errdisable cause of “other.” If you specify “other,” all ports that have been put in errdisable state because of causes *other* than the first four reasons 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 86400 seconds (30 seconds to 24 hours).

This example shows how to enable errdisable the timeout for BPDU guard causes:

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

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

```
Console>(enable) set errdisable-timeout interval 450
To be supplied.
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 Connectivity

Note For more detailed information on checking connectivity, see Chapter 21, "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)
```