CHAPTER 5

Configuring Gigabit Ethernet Switching

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

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 sections:

- Understanding How Gigabit Ethernet Works, page 5-1
- Default Gigabit Ethernet Configuration, page 5-6
- Configuring Gigabit Ethernet, page 5-6

Understanding How Gigabit Ethernet Works

These sections describe how Gigabit Ethernet works:

- Understanding How Gigabit Ethernet Flow Control Works, page 5-1
- Understanding How Port Negotiation Works, page 5-3
- Understanding How Oversubscribed Gigabit Ethernet Works, page 5-3

Understanding How Gigabit Ethernet Flow Control Works

These sections describe how flow control works:

- Flow-Control Overview, page 5-1
- Sending and Receiving Pause Frames, page 5-2
- Using Flow-Control Keywords, page 5-2

Flow-Control Overview

Flow-control is a feature that Gigabit Ethernet ports use to inhibit the transmission of incoming packets. If a buffer on a Gigabit Ethernet port runs out of space, the port transmits a special packet that requests remote ports to delay sending packets for a period of time. This special packet is called a *pause frame*.

Sending and Receiving Pause Frames

All Catalyst Gigabit Ethernet ports can receive and process pause frames from other devices. However, not all Catalyst Gigabit Ethernet ports can transmit pause frames to other devices.

Table 5-1 identifies the Catalyst Gigabit Ethernet switches, modules, and ports that can transmit pause frames to other devices.

Table 5-1 Send Capability by Switch Type, Module, and Ports

Switch Type	Module	Ports	Send
Catalyst 4000	All modules except WS-X4418-GB, WS-X4412-2GB-T, and WS-X4416-2GB-TX	All ports except for the oversubscribed ports listed below	No
Catalyst 4000	WS-X4418-GB	Uplink ports (1–2)	No
Catalyst 4000	WS-X4418-GB	Oversubscribed ports (3–18)	Yes
Catalyst 4000	WS-X4412-2GB-T	Uplink ports (13–14)	No
Catalyst 4000	WS-X4412-2GB-T	Oversubscribed ports (1–12)	Yes
Catalyst 2948G	All ports	All ports	No
Catalyst 2980	All modules	All ports	No

Using Flow-Control Keywords

Table 5-2 describes guidelines for using different configurations of the **send** and **receive** keywords with the **set port flowcontrol** command.

Table 5-2 Send and Receive Keyword Configurations

Configuration	Description
send on	Enables a local port to send pause frames to a remote port. Use **send on** when a remote port is set to **receive on** or **receive desired**.
send off	Prevents a local port from sending pause frames to a remote port. Use **send off** when a remote port is set to **receive off** or **receive desired**.
send desired	Indicates preference to send pause frames, but autonegotiates flow control. You can use **send desired** when a remote port is set to **receive on**, **receive off**, or **receive desired**.
receive on	Enables a local port to process pause frames that a remote port sends. Use **receive on** when a remote port is set to **send on** or **send desired**.
receive off	Prevents a local port from processing pause frames. Use **receive off** when a remote port is set to **send off** or **send desired**.
receive desired	Indicates preference to process pause frames, but autonegotiates flow control. You can use **receive desired** when a remote port is set to **send on**, **send off**, or **send desired**.

Understanding How Port Negotiation Works

Caution Unlike autonegotiation with 10/100 Fast Ethernet, Gigabit Ethernet port negotiation does not involve negotiating port speed. You *cannot* disable port negotiation on Gigabit Ethernet ports using the **set port speed** command.

Note Port negotiation is not supported on 1000BASE-T Gigabit Ethernet ports.

With Gigabit Ethernet ports, port negotiation is used to exchange flow-control parameters, remote fault information, and duplex information (even though Cisco Gigabit Ethernet ports only support full-duplex mode). With Gigabit Ethernet ports, you configure port negotiation using the **set port negotiation** command. Gigabit Ethernet port negotiation is enabled by default.

The ports on both ends of a Gigabit Ethernet link must have the same 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 5-3 shows the four possible port negotiation configurations for a Gigabit Ethernet link and the resulting link status for each configuration.

Table 5-3 Gigabit 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 Gigabit EtherChannel module port.
2. Far End refers to the remote port at the other end of the Gigabit link.

Note On 1000BASE-T Gigabit Ethernet ports, you cannot configure speed or duplex mode. At this time, 1000BASE-T ports only operate in the default configuration where the speed is 1000 and duplex mode is full. You cannot disable autonegotiation at this time. On a 1000BASE-T port, you can configure flow control and enable or disable a port. To determine which features a 1000BASE-T Gigabit Ethernet port supports, enter the **show port capabilities** *mod_num* command.

Understanding How Oversubscribed Gigabit Ethernet Works

These sections describe how the Catalyst 4000 family oversubscribed Gigabit Ethernet modules work:

- Oversubscribed Gigabit Ethernet Overview, page 5-4
- Oversubscribed Gigabit Ethernet Example, page 5-5

Oversubscribed Gigabit Ethernet Overview

The Catalyst 4000 family Gigabit Ethernet modules provide a network-backbone connection for multiple servers or high-end workstations. The following modules are supported:

- WS-X4412-2GB-T

  This 1000BASE-T 14-port module provides 2 dedicated uplink module ports (GBIC) and 12 oversubscribed ports (possible blocking).

- WS-X4418-GB

  This 1000BASE-X 18-port module provides 2 dedicated uplink module ports (GBIC) and 16 oversubscribed ports (possible blocking).

On all modules, each uplink module port has 1-Gbps dedicated bandwidth. These ports typically connect to the network backbone.

Table 5-4 lists the uplink module port IDs for each module.

Table 5-4 Uplink Port Module IDs for Gigabit Ethernet Modules

Module	Port ID
WS-X4412-2GB-T	13 14
WS-X4418-GB	1 2

On all modules, the oversubscribed ports are segmented into groups of four ports each. Each group of four ports shares 1 Gbps of bandwidth. The average bandwidth that clients and servers need to connect to ports in the same group should not exceed 1 Gbps.

Table 5-5 shows how the oversubscribed ports are grouped for module WS-4412-2GB-TX.

Table 5-5 Oversubscribed Port Groupings for Module WS-4412-2GB-TX

			Uplink Ports
1 2 3 4	5 6 7 8	9 10 11 12	13 14

Table 5-6 shows how the oversubscribed ports are grouped for module WS-4418-2GB.

Table 5-6 Oversubscribed Port Groupings for Module WS-4418-2GB

Uplink Ports	3 5 7 9	11 13 15 17
1 2	4 6 8 10	12 14 16 18

The oversubscribed Gigabit Ethernet ports are designed for end-station connections. We do not recommend connecting these ports to switches or routers.

Each group of four oversubscribed ports has a buffer for incoming frames to allow connected devices to transmit traffic simultaneously. Because the inbound buffer is small, the default (and recommended) flow-control configuration for the oversubscribed ports is **receive desired** and **transmit on**.

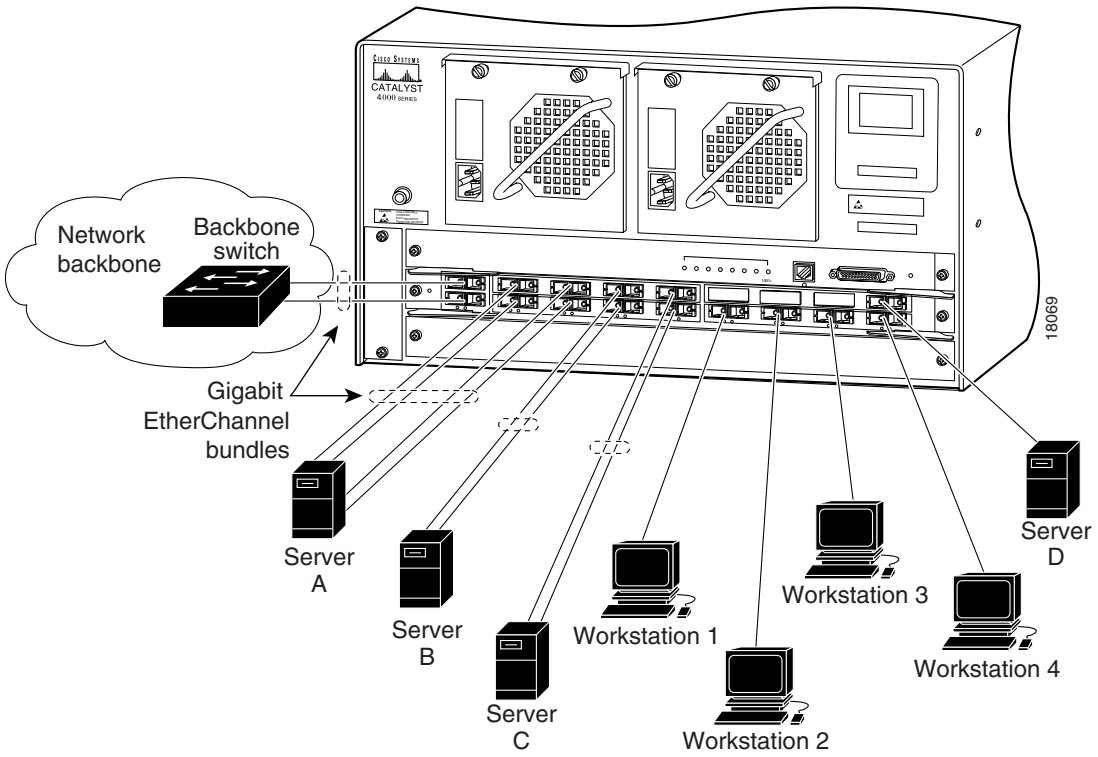
You can bundle multiple oversubscribed ports into a Gigabit EtherChannel link to connect to channel-capable servers. Bundling multiple oversubscribed ports in the same port group increases the total available bandwidth and provides redundancy with quick failover for links to servers and hosts that support the Port Aggregation Protocol (PAgP).

Oversubscribed Gigabit Ethernet Example

Figure 5-1 shows an example of how the 18-port server switching module (WS-X4418-GB) can connect multiple network servers and high-end workstations to the Gigabit Ethernet network backbone. These configurations are shown:

- Server A, equipped with channel- and trunk-capable network interface cards (NICs), connects to the switch through a four-port Gigabit EtherChannel trunk link. Two ports are in one oversubscribed port group and two are in another. The switch can burst up to 2-Gbps bandwidth in each direction while averaging 250 Mbps per connected port (1 Gbps total).
- Servers B and C, also with channel- and trunk-capable NICs, share the oversubscribed port groups used by Server A. Each server has one port in each oversubscribed port group and can burst up to 2 Gbps of traffic over channeled connections to and from the switch while maintaining an average of 250 Mbps per connected port (500 Mbps total) in each direction.
- Server D is the only device connected to the oversubscribed port group and can use the full 1-Gbps bandwidth.
- Workstations 1 through 4 are high-end workstations. Each connects to a port in one oversubscribed port group. Each workstation can burst up to 1-Gbps bandwidth while averaging 250 Mbps in each direction.
- The network backbone connection is through a two-port Gigabit EtherChannel trunk link providing 2-Gbps bandwidth.

Figure 5-1 Example Server Switching Network Topology



Default Gigabit Ethernet Configuration

Table 5-7 shows the Gigabit Ethernet default configuration.

Table 5-7 Gigabit Ethernet Default Configuration

Feature	Default Value
Port enable state	All ports are enabled
Port name	None
Port priority	Normal
Duplex mode	Full duplex
Flow control	• Oversubscribed Gigabit Ethernet ports (ports 3–18 on WS-X4418-GB): Flow control set to **desired** for receive (Rx) and **on** for transmit (Tx) • All others: Flow control set to **off** for receive (Rx) and **desired** for transmit (Tx)
Port negotiation	Enabled
Spanning Tree Protocol	Enabled for VLAN 1
Native VLAN	VLAN 1
Spanning tree port cost	4
Gigabit EtherChannel	Disabled on all Gigabit Ethernet ports (**auto** mode)

Configuring Gigabit Ethernet

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

- Setting the Port Name, page 5-7
- Setting the Port Priority Level, page 5-7
- Configuring Flow Control on Gigabit Ethernet Ports, page 5-8
- Configuring Port Negotiation on Gigabit Ethernet Ports, page 5-8
- Configuring a Timeout Period for Ports in errdisable State, page 5-9
- Checking Connectivity, page 5-9

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

Setting the Port Name

You can assign names to the ports on Gigabit 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 2/1 and 2/2 and how to verify that the port names are configured correctly:

```
Console> (enable) set port name 2/1 Backbone Connection
Port 2/1 name set.
Console> (enable) set port name 2/2 Wiring Closet
Port 2/2 name set.
Console> (enable) show port 2
Port  Name               Status     Vlan       Level  Duplex Speed Type
----- ------------------ ---------- ---------- ------ ------ ----- ------------
 2/1  Backbone Connectio connected  trunk      normal   full  1000 1000BASESX
 2/2  Wiring Closet      notconnect 1          normal   full  1000 1000BASESX

<...output truncated...>

Last-Time-Cleared
--------------------------
Tue Dec 22 1998, 13:42:04
Console> (enable)
```

Setting the Port Priority Level

You can configure the priority level for each port. When two ports simultaneously request access to the switching bus, the switch uses the priority level to determine the order in which the ports get 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 2/1 and verify that the port priority is configured correctly:

```
Console> (enable) set port level 2/1 high
Port 2/1 level set to high.
Console> (enable) show port 2/1
Port  Name               Status     Vlan       Level  Duplex Speed Type
----- ------------------ ---------- ---------- ------ ------ ----- ------------
 2/1  Backbone Connectio connected  trunk      high     full  1000 1000BASESX
```

```
<...output truncated...>

Last-Time-Cleared
--------------------------
Tue Dec 22 1998, 13:42:04
Console> (enable)
```

Configuring Flow Control on Gigabit Ethernet Ports

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

	Task	Command
Step 1	Set the flow-control parameters on a Gigabit 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 send 2/1 on
Port 2/1 flow control send administration status set to on
(port will send flowcontrol to far end)
Console> (enable) set port flowcontrol receive 2/1 on
Port 2/1 flow control receive administration status set to on
(port will require far end to send flowcontrol)
Console> (enable) show port flowcontrol 2/1

Port   Send FlowControl    Receive FlowControl   RxPause TxPause Unsupported
       admin    oper       admin    oper                       opcodes
-----  -------- --------   -------- --------     ------- ------- -----------
 2/1   on       on         on       on           0       0       0
Console> (enable)
```

Configuring Port Negotiation on Gigabit Ethernet Ports

Note You cannot configure port negotiation on 1000BASE-T Gigabit Ethernet ports in this release.

To enable port negotiation on a 1000BASE-X Gigabit Ethernet port, perform this task in privileged mode:

	Task	Command
Step 1	Enable Gigabit 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 1000BASE-X Gigabit Ethernet port, perform this task in privileged mode:

	Task	Command
Step 1	Disable Gigabit 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)
```

Configuring a Timeout Period for Ports in errdisable State

For information on configuring a timeout period for ports in errdisable state, see Chapter 4, "Configuring Ethernet and Fast Ethernet Switching."

Checking 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 Gigabit 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)
```