

# Configuring Gigabit Ethernet Switching

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This chapter describes how to configure Gigabit Ethernet switching on the Catalyst 5000, 4000, 2948G, and 2926G series switches. The configuration tasks in this chapter apply to Gigabit Ethernet switch ports on switching modules and fixed-configuration switches, as well as to supervisor engine Gigabit Ethernet uplink ports.

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**Note** For complete information on installing Catalyst 5000 series Gigabit Ethernet modules, refer to the *Catalyst 5000 Series Module Installation Guide*. For complete information on installing Catalyst 4000 series Gigabit Ethernet modules, refer to the *Catalyst 4000 Series Installation Guide*.

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**Note** There are slot restrictions for the Catalyst 5000 series three-port Gigabit Ethernet module (WS-X5403) and the Catalyst 5000 series nine-port Gigabit EtherChannel switching module (WS-X5410). For complete information on slot restrictions for these modules, see the *Catalyst 5000 Series Module Installation Guide*.

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

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This chapter consists of these sections:

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

## Understanding How Gigabit Ethernet Works

These sections describes how features specific to Gigabit Ethernet function:

- Understanding How Flow Control Works on page 5-2
- Understanding How Link Negotiation Works on page 5-3
- Understanding How the Server Switching Module Works on page 5-3

## Understanding How Flow Control Works

All Gigabit Ethernet ports can respond to flow-control frames (pause frames) received from neighboring devices by inhibiting the transmission of packets from each port for a period of time. When a pause frame is received on a port, it is processed internally; pause frames are not switched through the system.

Except for ports on the Gigabit EtherChannel module (WS-X5410), Gigabit Ethernet ports on the Catalyst 5000 and 2926G series switches can transmit pause frames to neighboring devices. If the receive buffer for a port becomes full, the module transmits a pause packet on that port that tells remote devices to delay sending more packets for a specified period of time.

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**Note** The Catalyst 5000 series nine-port Gigabit EtherChannel module (WS-X5410) and the Catalyst 4000 and 2948G series switches never transmit pause frames. However, you might need to configure these devices to advertise the ability to send flow-control frames if the attached device refuses to complete negotiation unless it receives such advertisements. For more information on Gigabit Ethernet port negotiation, see the “Configuring Link Negotiation on Gigabit Ethernet Ports” section on page 5-8.

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

**Table 5-1 Gigabit Ethernet Flow-Control Keyword Functions**

Keywords	Gigabit Ethernet Ports	Gigabit EtherChannel Ports <sup>1</sup>
<b>receive on</b>	The port uses flow control dictated by the neighbor port.	The port operates with an attached device that is required to send flow-control packets, or with an attached device that is not required to but might send flow-control packets.
<b>receive desired</b>	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.	The port operates with an attached device that is required to send flow-control packets, or with an attached device that is not required to but might send flow-control packets.
<b>receive off</b>	The port does not use flow control, regardless of whether flow control is requested by the neighbor port.	The port discards received flow-control frames without processing them. If negotiation is enabled, the port advertises that it refuses to accept flow-control frames. This advertisement can cause the remote device not to send flow-control frames, or if the attached device is configured to send flow-control frames unconditionally, it can prevent the link from coming up.
<b>send on</b>	The port sends flow-control frames to the neighbor port.	The local port advertises that it will send flow-control frames.
<b>send desired</b>	The port sends flow-control frames to the neighbor port if the neighbor port asks to use flow control.	The local port advertises that it will send flow-control frames if the attached device elects to receive them.
<b>send off</b>	The port does not send flow-control frames to the neighbor port.	The local port advertises that it will never send flow-control frames.

<sup>1</sup> Catalyst 5000 series WS-X5410 module and Catalyst 4000 and 2948G series Gigabit Ethernet ports only.

## Understanding How Link Negotiation Works



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

With Gigabit Ethernet ports, autonegotiation 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 autonegotiation 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 (link negotiation enabled on one port and disabled on the other). Table 5-2 shows the four possible autonegotiation configurations for a Gigabit Ethernet link and the resulting link status for each configuration.

**Table 5-2 Gigabit Ethernet Autonegotiation Configuration and Possible Link States**

Autonegotiation State		Link Status	
Near End <sup>1</sup>	Far End <sup>2</sup>	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.

## Understanding How the Server Switching Module Works

The Catalyst 4000 series 18-port server switching 1000BaseX Gigabit Ethernet module (WS-X4418-GB) offers two dedicated 1000BaseX (GBIC) Gigabit Ethernet ports and 16 oversubscribed (possibly blocking) 1000BaseX (GBIC) Gigabit Ethernet ports. The module provides a Gigabit Ethernet network backbone connection for multiple servers or high-end workstations.

Ports 1 and 2 each have 1-Gbps dedicated bandwidth. These ports are typically used to connect to the network backbone.

The 16 oversubscribed ports (ports 3–18) are divided into four groups of four ports each. Each group of four ports shares 1-Gbps of bandwidth. Table 5-3 shows how the oversubscribed Gigabit Ethernet ports are grouped.

**Table 5-3 Server Switching Gigabit Ethernet Module Port Groups**

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

The oversubscribed Gigabit ports are typically used to connect to clients or servers equipped with Gigabit Ethernet NICs. 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 does not necessarily increase the total available bandwidth compared to using a single link. However, it does provide redundancy with quick failover for links to servers and hosts that support PAgP.

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**Note** The oversubscribed Gigabit ports (ports 3–18) are designed for end-station connections. We do not recommend connecting these ports to other network devices, such as switches or routers.

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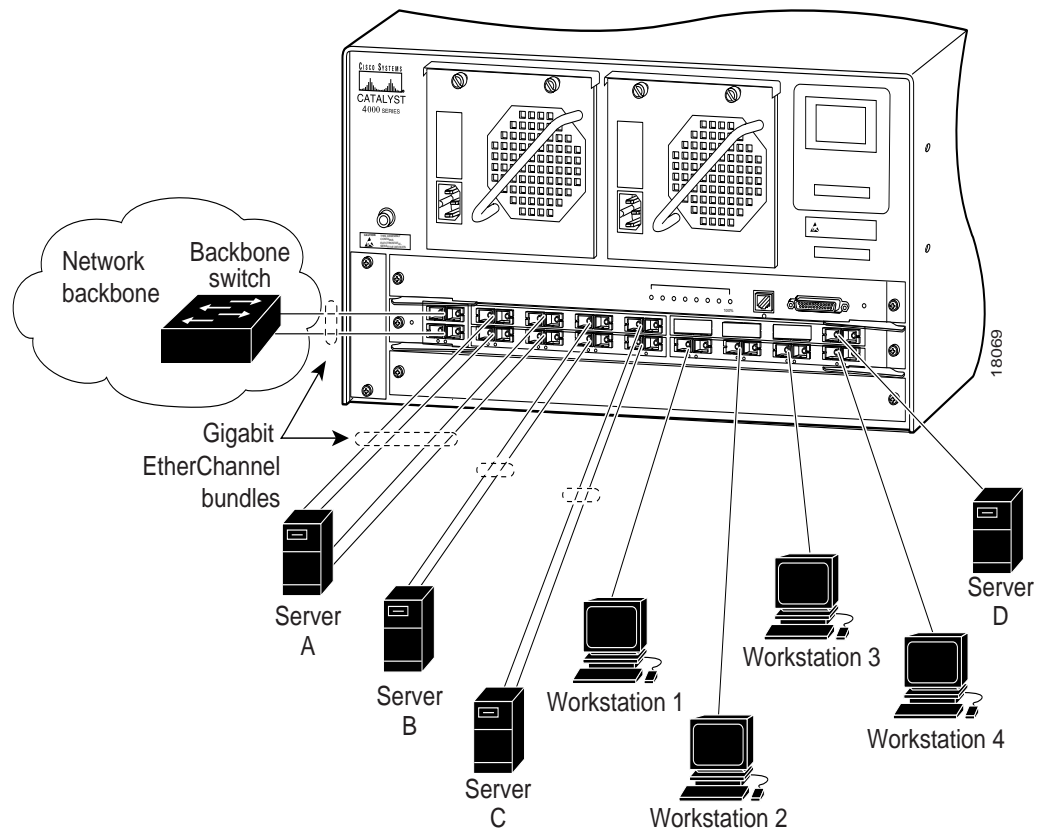
The average bandwidth required by clients and servers connected to ports in the same group of oversubscribed Gigabit ports should not exceed 1 Gbps.

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**.

Figure 5-1 shows an example of how the server switching module 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 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 1–4 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 5-4 shows the Gigabit Ethernet default configuration.

Table 5-4 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	<ul style="list-style-type: none"> <li>WS-X4418-GB: Flow control set to <b>desired</b> for receive (Rx) and <b>on</b> for transmit (Tx)</li> <li>All others: Flow control set to <b>off</b> for receive (Rx) and <b>desired</b> for transmit (Tx)</li> </ul>
Link autonegotiation	Enabled
Spanning-Tree Protocol	Enabled for VLAN 1
Native VLAN	VLAN 1
Port VLAN cost	4
Gigabit EtherChannel	Disabled on all Gigabit Ethernet ports ( <b>auto</b> mode)

## Configuring Gigabit Ethernet

These sections describe how to configure Gigabit Ethernet switching ports on the Catalyst 5000, 4000, 2948G, and 2926G series switches:

- Setting the Port Name on page 5-6
- Setting the Port Priority Level on page 5-7
- Configuring Flow Control on Gigabit Ethernet Ports on page 5-7
- Configuring Link Negotiation on Gigabit Ethernet Ports on page 5-8
- Checking Connectivity on page 5-9

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**Note** For information on configuring Gigabit EtherChannel, refer to Chapter 6, “Configuring Fast EtherChannel and Gigabit EtherChannel.”

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## 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
<b>Step 1</b> Assign a name to a port.	<b>set port name</b> <i>mod_num/port_num</i> [ <i>name_string</i> ]
<b>Step 2</b> Verify that the port name is configured.	<b>show port</b> [ <i>mod_num</i> [/ <i>port_num</i> ]]

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 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
<b>Step 1</b> Configure the priority level for a port.	<b>set port level</b> <i>mod_num/port_num</i> {normal   high}
<b>Step 2</b> Verify that the port priority level is configured correctly.	<b>show port</b> [ <i>mod_num/port_num</i> ]

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
<b>Step 1</b> Set the flow-control parameters on a Gigabit Ethernet port.	<b>set port flowcontrol</b> {receive   send} <i>mod_num/port_num</i> {off   on   desired}
<b>Step 2</b> Verify the flow-control configuration.	<b>show port flowcontrol</b>

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                -----
-----
 2/1     on     on                  on     on                  0       0       0
Console> (enable)

```

## Configuring Link Negotiation on Gigabit Ethernet Ports

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

Task	Command
<b>Step 1</b> Enable Gigabit Ethernet link negotiation.	<b>set port negotiation <i>mod_num/port_num</i> enable</b>
<b>Step 2</b> Verify the link negotiation configuration.	<b>show port negotiation [<i>mod_num/port_num</i>]</b>

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 link negotiation on a Gigabit Ethernet port, perform this task in privileged mode:

Task	Command
<b>Step 1</b> Disable Gigabit Ethernet link negotiation.	<b>set port negotiation <i>mod_num/port_num</i> disable</b>
<b>Step 2</b> Verify the link negotiation configuration.	<b>show port negotiation [<i>mod_num/port_num</i>]</b>

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) 1998 Dec 22 13:59:14 <+>00:00%DTP-5-NONTRUNKPORTON:Port 2/1 has
 become non-trunk
1998 Dec 22 13:59:14 <+>00:00%PAGP-5-PORTFROMSTP:Port 2/1 left bridge port 2/1

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

```

## Checking Connectivity

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**Note** For more detailed information on checking connectivity, see Chapter 13, “Checking Port Status and Connectivity.”

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

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)

```

