



Configuring Ethernet, Fast Ethernet, and Gigabit Ethernet Switching

This chapter describes how to use the command-line interface (CLI) to configure Ethernet, Fast Ethernet, and Gigabit Ethernet switching on the Catalyst 6000 family switches. The configuration tasks in this chapter apply to Ethernet, Fast Ethernet, and Gigabit Ethernet switching modules, as well as to the uplink ports on the supervisor engine.



Note

For complete syntax and usage information for the commands used in this chapter, refer to the *Catalyst 6000 Family Command Reference* publication.

This chapter consists of these sections:

- Understanding How Ethernet Works, page 4-1
- Default Ethernet, Fast Ethernet, and Gigabit Ethernet Configuration, page 4-3
- Setting the Port Configuration, page 4-4

Understanding How Ethernet Works

The Catalyst 6000 family switches support simultaneous, parallel connections 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 6000 family 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 collisions are a major bottleneck in Ethernet networks, an effective solution is full-duplex communication, which is an option for any 10- or 100-Mbps port on a Catalyst 6000 family switch (Gigabit Ethernet ports are always 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 doubles to 20 Mbps for 10-Mbps ports and to 200 Mbps for Fast Ethernet ports. Gigabit Ethernet ports on Catalyst 6000 family switches are full-duplex only (2 Gbps effective bandwidth).

Switching Frames Between Segments

Each Ethernet port on a Catalyst 6000 family 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 switch treats 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 full bandwidth.

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

Building the Address Table

The Catalyst 6000 family switches build the address table by using the source address of the frames received. When the switch receives a frame for a destination address not listed in its address table, it floods the frame to all ports of the same 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 32K 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 Port Negotiation Works



Note

Port negotiation does not involve negotiating port speed. You cannot disable port negotiation with the **set port speed** command.

Port negotiation exchanges flow-control parameters, remote fault information, and duplex information. Configure port negotiation with the **set port negotiation** command. Port negotiation is enabled by default.

The ports on both ends of a 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 4-1 shows the four possible port negotiation configurations and the resulting link status for each configuration.

Table 4-1 Gigabit Ethernet Autonegotiation Configuration and Possible Link Status

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 port.
2. Far End refers to the port at the other end of the link.

Default Ethernet, Fast Ethernet, and Gigabit Ethernet Configuration

Table 4-2 shows the Ethernet, Fast Ethernet, and Gigabit Ethernet default configuration.

Table 4-2 Ethernet Default Configuration

Feature	Default Value
Port enable state	All ports are enabled
Port name	None
Duplex mode	<ul style="list-style-type: none"> • 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 • Full-duplex for 1000-Mbps Gigabit Ethernet ports
Flow control (Gigabit Ethernet)	Flow control set to off for receive (Rx) and desired for transmit (Tx)
Flow control (other Ethernet)	Flow control set to off for receive (Rx); transmit (Tx) not supported
Spanning-Tree Protocol (STP)	Enabled for VLAN 1
Native VLAN	VLAN 1
Port VLAN cost	<ul style="list-style-type: none"> • Port VLAN cost of 100 for 10-Mbps Ethernet ports • Port VLAN cost of 19 for 10/100-Mbps Fast Ethernet ports • Port VLAN cost of 19 for 100-Mbps Fast Ethernet ports • Port VLAN cost of 4 for 1000-Mbps Gigabit Ethernet ports
EtherChannel	Disabled on all Ethernet ports
Jumbo frames	Disabled on all Gigabit Ethernet ports

Setting the Port Configuration

These sections describe how to configure Ethernet, Fast Ethernet, and Gigabit Ethernet switching on the Catalyst 6000 family switches:

- Setting the Port Name, page 4-4
- Setting the Port Speed, page 4-5
- Setting the Port Duplex Mode, page 4-5
- Configuring IEEE 802.3Z Flow Control, page 4-6
- Enabling and Disabling Port Negotiation, page 4-7
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Setting the Port Name

You can set port names on Ethernet, Fast Ethernet, and Gigabit Ethernet switching modules to facilitate switch administration.

To set the port name, perform this task in privileged mode:

	Task	Command
Step 1	Set a port name.	set port name <i>mod_num/port_num</i> [<i>name_string</i>]
Step 2	Verify the port name is configured.	show port [<i>mod_num[/port_num]</i>]

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          Duplex Speed Type
-----
1/1  Router Connection    connected  trunk         full  1000 1000BaseSX
1/2  Server Link          connected  trunk         full  1000 1000BaseSX

<...output truncated...>

Last-Time-Cleared
-----
Wed Jun 16 1999, 16:25:57
Console> (enable)

```

Setting the Port Speed

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



Note If the port speed is set to **auto** on a 10/100-Mbps 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 <i>mod num/port num</i> { 10 100 auto }
Step 2	Verify that the speed of the port is configured correctly.	show port [<i>mod_num[/port_num]</i>]

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 neighboring 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 Gigabit Ethernet is full duplex only. You cannot change the duplex mode on Gigabit Ethernet ports.



Note If the port speed is set to **auto** on a 10/100-Mbps Ethernet port, both speed and duplex are autonegotiated. You cannot change the duplex mode of autonegotiation ports.

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 <i>mod num/port num</i> { full half }
Step 2	Verify that the duplex mode of the port is configured correctly.	show port [<i>mod_num[/port_num]</i>]

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 IEEE 802.3Z Flow Control

Gigabit Ethernet ports on the Catalyst 6000 family switches use flow control to inhibit the transmission of packets to the port for a period of time; other Ethernet ports use flow control to respond to flow-control requests.

If a Gigabit Ethernet port receive buffer becomes full, the port transmits a “pause” packet that tells remote ports to delay sending more packets for a specified period of time. All Ethernet ports (1000 Mbps, 100 Mbps, and 10 Mbps) can receive and act upon “pause” packets from other devices.

Enter the **set port flow control** command to configure flow control on ports. Table 4-3 lists the **set port flowcontrol** command keywords and describes their functions.

Table 4-3 Ethernet-Flow Control Keyword Functions

Keywords	Function
receive on	The port uses flow control dictated by the neighboring port.
receive desired	The port uses flow control if the neighboring 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 neighboring port.
send on ¹	The port sends flow-control frames to the neighboring port.
send desired ¹	The port sends flow-control frames to the port if the neighbor port asks to use flow control.
send off ¹	The port does not send flow-control frames to the neighboring port.

1. Supported only on Gigabit Ethernet ports.

To configure flow control, perform this task in privileged mode:

	Task	Command
Step 1	Set the flow-control parameters.	set port flowcontrol <i>mod_num/port_num</i> { receive send } { 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 3/1 send on
Port 3/1 will send flowcontrol to far end.
Console> (enable) set port flowcontrol 3/1 receive on
Port 3/1 will require far end to send flow control
```

```

Console> (enable) show port flowcontrol
Port  Send-Flowcontrol  Receive-Flowcntl  RxPause  TxPause
      Admin   Oper      Admin   Oper
-----
3/1   on     disagree  on     disagree  0       0
3/2   off    off       off    off       0       0
3/3   desired on     desired off     10      10
Console> (enable)

```

Enabling and Disabling Port Negotiation

To enable port negotiation, perform this task in privileged mode:

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

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, perform this task in privileged mode:

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

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.
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 is disabled at runtime by any process. For example, if 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.

Once a port is in the errdisable state, you have to manually reenabling it. 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 reenabling 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):

1. Channel misconfiguration
2. Duplex mismatch
3. BPDU port-guard
4. UDLD
5. Other (reasons other than the above)
6. All (apply errdisable timeout to all reasons)

You can enable or disable errdisable timeout for each of the above listed reasons. The ports in errdisable state for reasons other than 1 through 4 are considered “other.” If you specify “other,” all ports errdisabled by causes *other* than 1 through 4 are enabled for errdisable timeout. If you specify “all,” all ports errdisabled for any reason are enabled for errdisable timeout.

The errdisable 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 timeout for BPDU guard causes:

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

This example shows how to enable errdisable timeout for all causes:

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

Enabling and Disabling Jumbo Frames

Enabling the jumbo frames feature on a port allows the port to switch large frames or *jumbo* frames. This feature is useful in optimizing server-to-server performance. The default maximum transmission unit (MTU) frame size is 1548 bytes for all Ethernet, Fast Ethernet, and Gigabit Ethernet ports. Enabling the jumbo frames feature on a port increases the MTU to 9216 bytes.

Follow these guidelines to enable the jumbo frame feature on a per-port basis:

- The jumbo frame feature is supported on Gigabit Ethernet ports only.
- The trunking mode on the port must be set to off. Ports that have the jumbo frame feature enabled cannot be set to a trunking mode other than off.
- The channeling mode on the port must be set to off. Ports that have the jumbo frame feature enabled cannot form a channel with any other ports.
- Jumbo frames are not Layer-3 switched using Multilayer Switching (MLS).

- The Multilayer Switching Feature Card (MSFC) and Multilayer Switch Module (MSM) do not support jumbo frame routing; if jumbo frames are sent to these routers, router performance is significantly degraded. The Gigabit Switch Router (GSR) does support jumbo frames.

**Note**

In rare cases, you might see a *Jumbo frames error-disabled* state message for a port or multiple ports after entering the **show port jumbo** command. If this occurs, use the **set port jumbo** command to reenable the port(s).

To enable jumbo frames on a Gigabit Ethernet port, perform this task in privileged mode:

	Task	Command
Step 1	Enable jumbo frames.	set port jumbo <i>mod_num/port_num</i> enable
Step 2	Verify the port configuration.	show port jumbo

This example shows how to enable jumbo frames on a port and verify the configuration:

```
Console> (enable) set port jumbo 2/1 enable
Jumbo frames enabled on port 2/1
Console> (enable) show port jumbo
Jumbo frames MTU size is 9216 bytes
Jumbo frames enabled on port(s) 2/1
```

To disable jumbo frames on a Gigabit Ethernet port, perform this task in privileged mode:

	Task	Command
Step 1	Disable jumbo frames.	set port jumbo <i>mod_num/port_num</i> disable
Step 2	Verify the port configuration.	show port jumbo

This example shows how to disable jumbo frames on a port:

```
Console> (enable) set port jumbo 2/1 disable
Jumbo frames disabled on port 2/1
Console> (enable)
```

Checking Connectivity

Use the **ping** and **traceroute** commands to test connectivity.

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] <i>host</i> [<i>packet_size</i>] [<i>packet_count</i>]
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 <i>host</i>
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)
```

