CHAPTER 9

Configuring PROFINET

This chapter describes how to configure the PROFINET feature on the Cisco IE 3000 switch.

Understanding PROFINET

PROFINET is the PROFIBUS International (PI) open Industrial Ethernet Standard that uses TCP/IP and IT standards for automation control. PROFINET is particularly useful for industrial automation systems and process control networks, in which motion control and precision control of instrumentation and test equipment are important. It emphasizes data exchange and defines communication paths to meet speed requirements. PROFINET communication is scalable on three levels:

- Normal non-real-time communication uses TCP/IP and enables bus cycle times of approximately 100 ms.
- Real-time communication enables cycle times of approximately 10 ms.
- Isochronous real-time communication enables cycle times of approximately 1 ms.

Note The switch does not support isochronous real-time communication channels.

PROFINET IO is a modular communication framework for distributed automation applications. PROFINET IO uses cyclic data transfer to exchange data, alarms, and diagnostic information with programmable controllers, input/output (I/O) devices, and other automation controllers (for example, motion controllers).
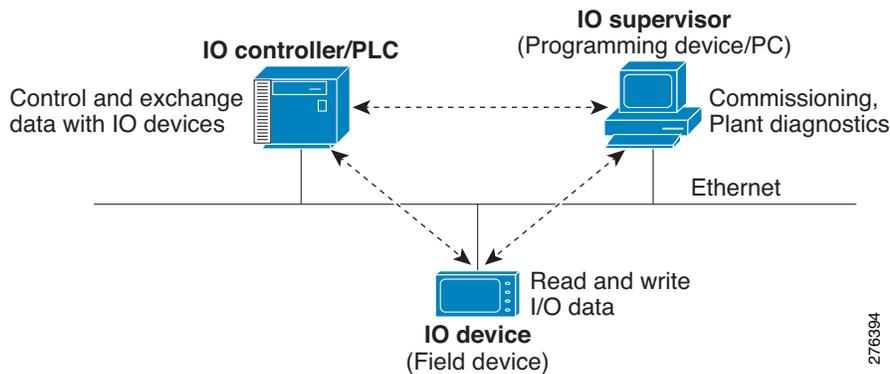
PROFINET IO recognizes three classes of devices:

- IO devices
- IO controllers
- IO supervisors

PROFINET Device Roles

Figure 9-1 illustrates the roles of the three types of devices.

Figure 9-1   *PROFINET Device Roles*

An IO controller is a programmable logic controller (PLC) that controls IO devices and exchanges data such as configuration, alarms, and IO data through an automation program. It and the IO supervisor exchange diagnostic information. The IO controller shares configuration and input/output information with the IO device and receives alarms from the IO device.

PROFINET is designed to be the sole or primary management system platform. Because the IO controller detects the switch with the Discovery and Configuration Protocol (DCP), and sets the device name and IP address, basic configuration requires no Cisco IOS commands. For advanced configurations (for example, QoS, DHCP, and similar features) you must use Cisco IOS commands on the switch because these features cannot be configured by using PROFINET.

An IO supervisor is an engineering station, such as a human machine interface (HMI) or PC, used for commissioning, monitoring, and diagnostic analysis. The IO supervisor exchanges diagnostic, status, control, and parameter information with the IO device.

An IO device is a distributed input/output device such as a sensor, an actuator or a motion controller.

Note   The switch acts as an IO device, providing a PROFINET management connection to the IO controllers.

In a PROFINET IO system, all the IO devices communicate over an Ethernet communication network to meet the automation industry requirement for bus cycle times of less than 100 ms. The network uses switches and full-duplex data exchange to avoid data collisions.

PROFINET Device Data Exchange

After PROFINET uses DCP to discover devices, including the switch, they establish application relationships (ARs) and communication relationships (CRs). After a connection is established and information about device parameters is exchanged, input and output data is exchanged. The switch uses non-real-time CRs to exchange the data attributes listed in Table 9-1 and Table 9-2.

Table 9-1   *PROFINET IO Switch Attributes*

PROFINET IO Switch Configuration Attributes	Value or Action
Device name	Configure a name for the device.
TCP/IP	IP address, Subnet mask, default gateway, SVI.
Primary temperature alarm	Enable or disable monitoring for the specified alarm.
Secondary temperature alarm	Enable or disable monitoring for the specified alarm.
RPS failed alarm	Enable or disable monitoring for the specified alarm.
CF failed alarm	Enable or disable monitoring for the specified alarm.
Relay major alarm	Enable or disable monitoring for the specified alarm.
Relay minor alarm	Enable or disable monitoring for the specified alarm.
Reset to factory defaults	Use the PROFINET IO controller to reset the switch to factory defaults. This action removes the startup configuration and reloads the switch.
Relay major configuration	Specify the type of port alarm (for example, link fault) that triggers the major relay. Any port configured with the specified alarm type can trigger the major relay.
Relay minor configuration	Specify the type of port alarm (for example, link fault) that triggers the minor relay. Any port configured with the specified alarm type can trigger the minor relay.

Table 9-2   *PROFINET IO Port Attributes*

PROFINET IO Port Configuration Attributes	Value or Action
Speed	10/100/1000/auto
Duplex	Half/full/auto
Port mode	Access/trunk
VLAN	VLAN information
Link status	Shut down / no shut down
Configure rate limiting	Broadcast, unicast, multicast threshold exceeds configured levels.
Port link fault alarm	Enable or disable monitoring for specified alarm.
Port not forwarding alarm	Enable or disable monitoring for specified alarm.
Port not operating alarm	Enable or disable monitoring for specified alarm.
Port FCS threshold alarm	Enable or disable monitoring for specified alarm.

PROFINET devices are integrated by using a general station description (GSD) file that contains the data for engineering and data exchange between the IO controller, the IO supervisor, and the IO devices, including the switch. Each PROFINET IO field device must have an associated GSD file that describes the properties of the device and contains all this information required for configuration:

- Device identification information (device ID, vendor ID and name, product family, number of ports)
- Number and types of pluggable modules

- The Cisco IE 3000 8-port expander modules are not hot-swappable. Turn off the switch before connecting or disconnecting expander modules.

- Error text for diagnostic information

- Communication parameters for IO devices, including the minimum cycle time, the reduction ratio, and the watch dog time

✎ **Note**   Although the Cisco IE 3000 switch has a default reduction ratio of 128 ms, we recommend a reduction ratio of 256 ms or 512 ms to reduce the load on the switch CPU when the switch uses a complex configuration.

- Configuration data for the IO device modules, including speed, duplex, VLAN, port security information, alarms, and broadcast-rate-limiting thresholds

- Parameters configured for IO device modules for the attributes listed in Table 9-2

The GSD file is on the switch, but the IO supervisor uses this file.

✎ **Note**   You must use the GSD file that is associated with the Cisco IOS release on the switch to manage your PROFINET network. Both the IO supervisor and the Cisco IOS software alert you to a mismatch between the GSD file and the switch Cisco IOS software version.

Configuring PROFINET

You can use either the PROFINET software on the IO supervisor or the Cisco IOS software for basic switch configuration.

- Default Configuration, page 9-4
- Enabling PROFINET, page 9-4

Default Configuration

Beginning with Cisco IOS software release 12.2(52)SE, PROFINET is enabled by default on all the base switch module and expansion-unit Ethernet ports. If PROFINET has been disabled, follow the instructions in the "Enabling PROFINET" section on page 9-4.

Enabling PROFINET

Beginning in privileged EXEC mode, follow these steps:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**profinet**	Enable PROFINET on the switch.

	Command	Purpose
Step 3	**profinet id** *line*	(Optional) Set the PROFINET device identifier (ID) by using the Cisco IOS software.
		The maximum length is 240 characters. The only special characters allowed are the period (.) and hyphen (-), and they are allowed only in specific positions within the ID string. It can have multiple labels within the string. Each label can be from 1 to 63 characters, and labels must be separated by a period (.). The final character in the string must not be zero (0).
		For more details about configuring the PROFINET ID, see the PROFINET specification, document number TC2-06-0007a, file name PN-AL-protocol_2722_V22_Oct07, available from PROFIBUS.
Step 4	**profinet vlan** *vlan id*	(Optional) Change the VLAN number. The default VLAN number is 1. The VLAN ID range is 1-4094.
Step 5	**end**	Return to privileged EXEC mode.
Step 6	**show running-config**	Verify your entries.
Step 7	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To disable PROFINET on the switch, use the **no profinet** global configuration command.

Displaying the PROFINET Configuration

Use the **show profinet** privileged EXEC command with one of the keywords shown in Table 9-3.

Table 9-3   Commands for Displaying the PROFINET Configuration

Command	Purpose
show profinet sessions	Display the currently connected PROFINET sessions.
show profinet status	Display the status of the PROFINET subsystem.

Troubleshooting PROFINET

The PLC has LEDs that turn red for alarms, and the IO supervisor software reflects those alarms.

To troubleshoot PROFINET use the **debug profinet** privileged EXEC command with the keywords shown in Table 9-4. Be aware that the output of a **debug** command might cause a serial link to fail. You should use these commands only under the guidance of a Cisco Technical Support engineer. When you use this command, use Telnet to access the Cisco IOS command-line interface (CLI) by using Ethernet rather than a serial port.

Table 9-4   Commands for Troubleshooting the PROFINET Configuration

Command	Purpose
debug profinet alarm	Display the alarm status (on or off) and content of PROFINET alarms.
debug profinet cyclic	Display information about the time-cycle-based PROFINET Ethernet frames.

Table 9-4   ***Commands for Troubleshooting the PROFINET Configuration (continued)***

Command	Purpose
debug profinet error	Display the PROFINET session errors.
debug profinet packet ethernet	Display information about the PROFINET Ethernet packets.
debug profinet packet udp	Display information about the PROFINET Upper Layer Data Protocol (UDP) packets.
debug profinet platform	Display information about the interaction between the Cisco IOS software and PROFINET.
debug profinet topology	Display the PROFINET topology packets received.
debug profinet trace	Display a group of traced debug output logs.