PROFINET Configuration Guide, Cisco Catalyst IE9300 Rugged Series Switches

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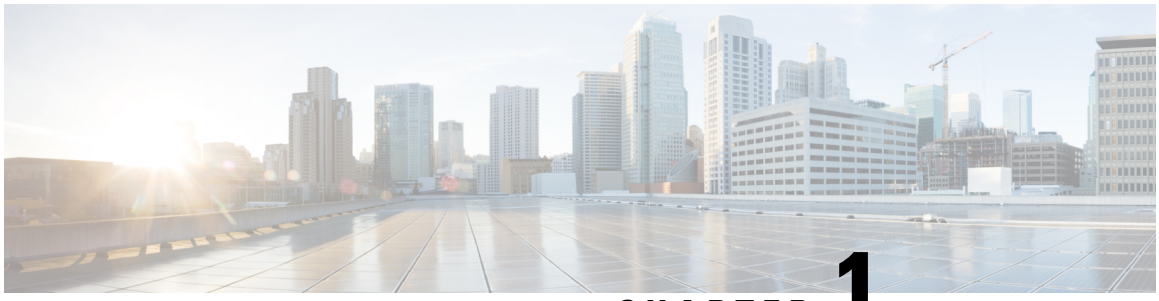

CHAPTER 1

Configure PROFINET

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Information about Configuring 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.

PROFINET I/O is a modular communication framework for distributed automation applications. PROFINET I/O 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 I/O recognizes three classes of devices:

1. I/O devices
2. I/O controllers
3. I/O supervisors

Restrictions and Guidelines for Configuring PROFINET

- PROFINET feature set is available with Network-Essentials license.
- The minimum Cisco IOS XE Release version required to configure PROFINET is:
  - IE-9310-26S2C & IE-9320-26S2C - Cisco IOS XE Release 17.8.1 and later versions
  - IE-9320-22S2C4X - Cisco IOS XE Release 17.11.1 and later versions
  - Rest of the PIDs - Cisco IOS XE Release 17.12.1 and later versions
- Cisco IE-9300 series switches support only PROFINET I/O, RT (Real-Time) but not IRT (isochronous real-time) communication.
- Profinet can be enabled only on standalone IE-9300 series switches. Profinet is not supported when IE-9300 series switches are stacked

PROFINET Device Roles

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

PROFINET is designed to be the sole or primary management system platform. Because the I/O controller detects the switch with the Discovery and Configuration Protocol (DCP), and sets the device name and IP address, you do not need to enter Cisco IOS commands for the basic configuration. 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 I/O supervisor is an engineering station, such as a human machine interface (HMI) or PC, used for commissioning, monitoring, and diagnostic analysis. The I/O supervisor exchanges diagnostic, status, control, and parameter information with the I/O device.

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

Note If Profinet DCP cannot detect the switch/PLC/IO mac addresses, temporarily disable the firewall/virus scan from the Window PC that installed the Siemens STEP7 or TIA Portal.

In a PROFINET I/O system, all the I/O 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 the tables.

Table 1: PROFINET I/O Switch Attributes

PROFINET I/O Switch Configuration Attributes	Value or Action
Device name	Configures a name for the device
TCP/IP	IP address, subnet mask, default gateway, SVI
Primary temperature alarm	Enables or disables monitoring for specified alarm
Secondary temperature alarm	Enables or disables monitoring for specified alarm
RPS failed alarm	Enables or disables monitoring for specified alarm
Relay major alarm	Enables or disables monitoring for specified alarm
Reset to factory defaults	Uses the PROFINET I/O controller to reset the switch to factory defaults. This action removes the startup configuration and reloads the switch.
Relay major configuration	Specifies 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.

Table 2: PROFINET I/O Port Attributes

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

PROFINET devices are integrated by using a general station description (GSD) file that contains the data for engineering and data exchange between the I/O controller, the I/O supervisor, and the I/O devices, including

the switch. Each PROFINET I/O 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
- Error text for diagnostic information
- Communication parameters for I/O devices, including the minimum cycle time, the reduction ratio, and the watch dog time
- Configuration data for the I/O device modules, including speed, duplex, VLAN, port security information, alarms, and broadcast-rate-limiting thresholds
- Parameters configured for I/O device modules for the attributes listed in the **Profinet I/O Port Attributes** table.

The GSD file is on the switch, but the I/O 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 I/O supervisor and the Cisco IOS software alert you to a mismatch between the GSD file and the switch Cisco IOS software version.

How to Configure PROFINET

Configuring PROFINET

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

After you enable PROFINET, LLDP is automatically enabled on the switch because PROFINET relies on LLDP to fully function. If you disable PROFINET, you can enable or disable LLDP as needed.

Default Configuration

PROFINET is enabled by default on all the standalone IE-9300 series switches. The default config is enabled on VLAN 1 but can be changed to another VLAN ID. If PROFINET has been disabled, follow the instructions in the Enabling PROFINET section.

Enabling PROFINET

Procedure

	Command or Action	Purpose
Step 1	configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 2	profinet	Enables PROFINET on the switch.
Step 3	profinet id *line*	(Optional) Sets 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, filename PN-AL-protocol_2722_V22_Oct07, available from PROFIBUS.
Step 4	profinet vlan *vlan id*	(Optional) Changes the VLAN number. The default VLAN number is 1. The VLAN ID range is 1-4096. Supports one VLAN per switch.
Step 5	interface <*x/y*>	Specifies the port to be configured for PROFINET, and enters interface configuration mode
Step 6	switchport mode access	Configure the port mode as access.
Step 7	switchport access vlan	Configure the access vlan required for the port.
Step 8	switchport voice vlan dot1p	Add the voice vlan dot1p command.
Step 9	end	Returns to privileged EXEC mode.
Step 10	show running-config	Verifies your entries.
Step 11	copy running-config startup-config	(Optional) Saves your entries in the configuration file.

Guidelines for the IE-9300

The IE-9300 does not behave same as other IE platforms when it comes to Vlan 0 tags. You need to add the **voice vlan dot1p** command to the interface to allow the vlan 0 tagged packets.

The following example shows the configuration:

```
Interface gi1/0/2
description connection to PLC device
switchport access vlan 10
switchport mode access
switchport voice vlan dot1p
```

The highlighted command above allows the vlan 0 tagged packets to be accepted on vlan 10 along with the COS values of ingress frames.

Monitoring and Maintaining PROFINET

Table 3: Commands for displaying the PROFINET Configuration

Command	Purpose
show profinet sessions	Displays the currently connected PROFINET sessions.
show profinet status	Displays the status of the PROFINET subsystem.
show lldp neighbor interface x/x detail	Displays information about the adjacent interface.

Example:

```
Switch#show profinet status
Profinet : Enabled
Connection Status : Connected
Vlan : 1
Profinet ID : Switch
GSD version : Match
Reduct Ratio : 128
```

Troubleshooting PROFINET

The PLC has LEDs that display red for alarms, and the I/O supervisor software monitors those alarms.

To troubleshoot PROFINET use the **debug profinet** privileged EXEC command with the keywords shown in Commands for Troubleshooting the PROFINET Configuration. 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 4: Commands for Troubleshooting the PROFINET Configuration

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

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

Additional References

The following sections provide references related to device administration:

Technical Assistance

Description	Link
The Cisco Technical Support website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/techsupport