



CHAPTER 28

Configuring LLDP, LLDP-MED, and Wired Location Service

Finding Feature Information

Your software release may not support all the features documented in this chapter. For the latest feature information and caveats, see the release notes for your platform and software release.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.

Restrictions for LLDP, LLDP-MED, and Wired Location Service

- To use the the following features, the switch must be running the LAN Base image:
 - LLDP-MED location 802.lab
 - LLDP-MED integration for CoS/DSCP
 - Network policy TLV and location TLV
 - Wired location service

Information About LLDP, LLDP-MED, and Wired Location Service

The Cisco Discovery Protocol (CDP) is a device discovery protocol that runs over Layer 2 (the data link layer) on all Cisco-manufactured devices (routers, bridges, access servers, and switches). CDP allows network management applications to automatically discover and learn about other Cisco devices connected to the network.

To support non-Cisco devices and to allow for interoperability between other devices, the switch supports the IEEE 802.1AB Link Layer Discovery Protocol (LLDP). LLDP is a neighbor discovery protocol that is used for network devices to advertise information about themselves to other devices on the network. This protocol runs over the data-link layer, which allows two systems running different network layer protocols to learn about each other.

LLDP supports a set of attributes that it uses to discover neighbor devices. These attributes contain type, length, and value descriptions and are referred to as TLVs. LLDP supported devices can use TLVs to receive and send information to their neighbors. This protocol can advertise details such as configuration information, device capabilities, and device identity.

The switch supports these basic management TLVs. These are mandatory LLDP TLVs.

- Port description TLV
- System name TLV
- System description TLV
- System capabilities TLV
- Management address TLV

These organizationally specific LLDP TLVs are also advertised to support LLDP-MED:

- Port VLAN ID TLV ((IEEE 802.1 organizationally specific TLVs)
- MAC/PHY configuration/status TLV(IEEE 802.3 organizationally specific TLVs)



Note

A switch stack appears as a single switch in the network. Therefore, LLDP discovers the switch stack, not the individual stack members.

LLDP-MED

LLDP for Media Endpoint Devices (LLDP-MED) is an extension to LLDP that operates between endpoint devices such as IP phones and network devices such as switches. It specifically provides support for voice over IP (VoIP) applications and provides additional TLVs for capabilities discovery, network policy, Power over Ethernet, inventory management and location information. By default, all LLDP-MED TLVs are enabled.

LLDP-MED supports these TLVs:

- LLDP-MED capabilities TLV

Allows LLDP-MED endpoints to determine the capabilities that the connected device supports and has enabled.
- Network policy TLV

Allows both network connectivity devices and endpoints to advertise VLAN configurations and associated Layer 2 and Layer 3 attributes for the specific application on that port. For example, the switch can notify a phone of the VLAN number that it should use. The phone can connect to any switch, obtain its VLAN number, and then start communicating with the call control.

By defining a network-policy profile TLV, you can create a profile for voice and voice-signalling by specifying the values for VLAN, class of service (CoS), differentiated services code point (DSCP), and tagging mode. These profile attributes are then maintained centrally on the switch and propagated to the phone.
- Power management TLV

Enables advanced power management between LLDP-MED endpoint and network connectivity devices. Allows switches and phones to convey power information, such as how the device is powered, power priority, and how much power the device needs.

- Inventory management TLV
Allows an endpoint to send detailed inventory information about itself to the switch, including information hardware revision, firmware version, software version, serial number, manufacturer name, model name, and asset ID TLV.
- Location TLV
Provides location information from the switch to the endpoint device. The location TLV can send this information:
 - Civic location information
Provides the civic address information and postal information. Examples of civic location information are street address, road name, and postal community name information.
 - ELIN location information
Provides the location information of a caller. The location is determined by the emergency location identifier number (ELIN), which is a phone number that routes an emergency call to the local public safety answering point (PSAP) and which the PSAP can use to call back the emergency caller.

Wired Location Service

The switch uses the wired location service feature to send location and attachment tracking information for its connected devices to a Cisco Mobility Services Engine (MSE). The tracked device can be a wireless endpoint, a wired endpoint, or a wired switch or controller. The switch notifies the MSE of device link up and link down events through the Network Mobility Services Protocol (NMSP) location and attachment notifications.

The MSE starts the NMSP connection to the switch, which opens a server port. When the MSE connects to the switch there are a set of message exchanges to establish version compatibility and service exchange information followed by location information synchronization. After connection, the switch periodically sends location and attachment notifications to the MSE. Any link up or link down events detected during an interval are aggregated and sent at the end of the interval.

When the switch determines the presence or absence of a device on a link-up or link-down event, it obtains the client-specific information such as the MAC address, IP address, and username. If the client is LLDP-MED- or CDP-capable, the switch obtains the serial number and UDI through the LLDP-MED location TLV or CDP.

Depending on the device capabilities, the switch obtains this client information at link up:

- Slot and port specified in port connection
- MAC address specified in the client MAC address
- IP address specified in port connection
- 802.1X username if applicable
- Device category is specified as a *wired station*
- State is specified as *new*
- Serial number, UDI
- Model number
- Time in seconds since the switch detected the association

Depending on the device capabilities, the switch obtains this client information at link down:

- Slot and port that was disconnected
- MAC address
- IP address
- 802.1X username if applicable
- Device category is specified as a *wired station*
- State is specified as *delete*
- Serial number, UDI
- Time in seconds since the switch detected the disassociation

When the switch shuts down, it sends an attachment notification with the state *delete* and the IP address before closing the NMSP connection to the MSE. The MSE interprets this notification as disassociation for all the wired clients associated with the switch.

If you change a location address on the switch, the switch sends an NMSP location notification message that identifies the affected ports and the changed address information.

Default LLDP Configuration

Table 28-1 Default LLDP Configuration

Feature	Default Setting
LLDP global state	Disabled.
LLDP holdtime (before discarding)	120 seconds.
LLDP timer (packet update frequency)	30 seconds.
LLDP reinitialization delay	2 seconds.
LLDP tlv-select	Disabled to send and receive all TLVs.
LLDP interface state	Disabled.
LLDP receive	Disabled.
LLDP transmit	Disabled.
LLDP med-tlv-select	Disabled to send all LLDP-MED TLVs. When LLDP is globally enabled, LLDP-MED-TLV is also enabled.

LLDP, LLDP-MED, and Wired Location Service Configuration Guidelines

- If the interface is configured as a tunnel port, LLDP is automatically disabled.
- If you first configure a network-policy profile on an interface, you cannot apply the **switchport voice vlan** command on the interface. If the **switchport voice vlan *vlan-id*** is already configured on an interface, you can apply a network-policy profile on the interface. This way the interface has the voice or voice-signaling VLAN network-policy profile applied on the interface.
- You cannot configure static secure MAC addresses on an interface that has a network-policy profile.
- You cannot configure a network-policy profile on a private-VLAN port.

- For wired location to function, you must first enter the **ip device tracking** global configuration command.

LLDP-MED TLVs

By default, the switch only sends LLDP packets until it receives LLDP-MED packets from the end device. It then sends LLDP packets with MED TLVs. When the LLDP-MED entry has been aged out, it only sends LLDP packets.

By using the **lldp** interface configuration command, you can configure the interface not to send the TLVs listed in this table.

Table 28-2 LLDP-MED TLVs

LLDP-MED TLV	Description
inventory-management	LLDP-MED inventory management TLV
location	LLDP-MED location TLV (only on LAN Base image)
network-policy	LLDP-MED network policy TLV (only on LAN Base image)
power-management	LLDP-MED power management TLV

How to Configure LLDP, LLDP-MED, and Wired Location Service

Enabling LLDP

	Command	Purpose
Step 1	configure terminal	Enters global configuration mode.
Step 2	lldp run	Enables LLDP globally on the switch.
Step 3	interface <i>interface-id</i>	Specifies the interface on which you are enabling LLDP, and enter interface configuration mode.
Step 4	lldp transmit	Enables the interface to send LLDP packets.
Step 5	lldp receive	Enables the interface to receive LLDP packets.
Step 6	end	Returns to privileged EXEC mode.

Configuring LLDP Characteristics

You can configure the frequency of LLDP updates, the amount of time to hold the information before discarding it, and the initialization delay time. You can also select the LLDP and LLDP-MED TLVs to send and receive.



Note

Steps 2 through 5 are optional and can be performed in any order.

	Command	Purpose
Step 1	configure terminal	Enters global configuration mode.
Step 2	lldp holdtime <i>seconds</i>	(Optional) Specifies the amount of time a receiving device should hold the information from your device before discarding it. The range is 0 to 65535 seconds; the default is 120 seconds.
Step 3	lldp reinit <i>delay</i>	(Optional) Specifies the delay time in seconds for LLDP to initialize on an interface. The range is 2 to 5 seconds; the default is 2 seconds.
Step 4	lldp timer <i>rate</i>	(Optional) Sets the sending frequency of LLDP updates in seconds. The range is 5 to 65534 seconds; the default is 30 seconds.
Step 5	lldp tlv-select	(Optional) Specifies the LLDP TLVs to send or receive.
Step 6	lldp med-tlv-select	(Optional) Specifies the LLDP-MED TLVs to send or receive.
Step 7	end	Returns to privileged EXEC mode.

Configuring LLDP-MED TLVs

	Command	Purpose
Step 1	configure terminal	Enters global configuration mode.
Step 2	interface <i>interface-id</i>	Specifies the interface on which you are configuring an LLDP-MED TLV, and enters interface configuration mode.
Step 3	lldp med-tlv-select <i>tlv</i>	Specifies the TLV to enable.
Step 4	end	Returns to privileged EXEC mode.

Configuring Network-Policy TLV

This task explains how to create a network-policy profile, configure the policy attributes, and apply it to an interface.

	Command	Purpose
Step 1	configure terminal	Enters global configuration mode.
Step 2	network-policy profile <i>profile number</i>	Specifies the network-policy profile number, and enters network-policy configuration mode. The range is 1 to 4294967295.

	Command	Purpose
Step 3	<code>{ voice voice-signaling } vlan [vlan-id { cos cvalue dscp dvalue }] [[dot1p { cos cvalue dscp dvalue }] none untagged]</code>	Configures the policy attributes: voice —Specifies the voice application type. voice-signaling —Specifies the voice-signaling application type. vlan —Specifies the native VLAN for voice traffic. <i>vlan-id</i> —(Optional) Specifies the VLAN for voice traffic. The range is 1 to 4096. cos cvalue —(Optional) Specifies the Layer 2 priority class of service (CoS) for the configured VLAN. The range is 0 to 7; the default is 0. dscp dvalue —(Optional) Specifies the differentiated services code point (DSCP) value for the configured VLAN. The range is 0 to 63; the default is 0. dot1p —(Optional) Configures the telephone to use IEEE 802.1p priority tagging and use VLAN 0 (the native VLAN). none —(Optional) Does not instruct the IP telephone about the voice VLAN. The telephone uses the configuration from the telephone key pad. untagged —(Optional) Configures the telephone to send untagged voice traffic. This is the default for the telephone.
Step 4	<code>exit</code>	Returns to global configuration mode.
Step 5	<code>interface interface-id</code>	Specifies the interface on which you are configuring a network-policy profile, and enter interface configuration mode.
Step 6	<code>network-policy profile number</code>	Specifies the network-policy profile number.
Step 7	<code>lldp med-tlv-select network-policy</code>	Specifies the network-policy TLV.
Step 8	<code>end</code>	Returns to privileged EXEC mode.

Configuring Location TLV and Wired Location Service

This task explains how to configure location information for an endpoint and to apply it to an interface.

	Command	Purpose
Step 1	<code>configure terminal</code>	Enters global configuration mode.
Step 2	<code>location { admin-tag string civic-location identifier id elin-location string identifier id }</code>	Specifies the location information for an endpoint. <ul style="list-style-type: none"> admin-tag—Specifies an administrative tag or site information. civic-location—Specifies civic location information. elin-location—Specifies emergency location information (ELIN). identifier id—Specifies the ID for the civic location. string—Specifies the site or location information in alphanumeric format.
Step 3	<code>exit</code>	Returns to global configuration mode.

	Command	Purpose
Step 4	interface <i>interface-id</i>	Specifies the interface on which you are configuring the location information, and enters interface configuration mode.
Step 5	location { additional-location-information <i>word</i> civic-location-id <i>id</i> elin-location-id <i>id</i> }	Enters location information for an interface: additional-location-information —Specifies additional information for a location or place. civic-location-id —Specifies global civic location information for an interface. elin-location-id —Specifies emergency location information for an interface. <i>id</i> —Specifies the ID for the civic location or the ELIN location. The ID range is 1 to 4095. <i>word</i> —Specifies a word or phrase with additional location information.
Step 6	end	Returns to privileged EXEC mode.
Step 7	nmsp enable	Enables the NMSP features on the switch.
Step 8	nmsp notification interval { attachment location } <i>interval-seconds</i>	Specifies the NMSP notification interval. attachment —Specifies the attachment notification interval. location —Specifies the location notification interval. <i>interval-seconds</i> —Duration in seconds before the switch sends the MSE the location or attachment updates. The range is 1 to 30; the default is 30.
Step 9	end	Returns to privileged EXEC mode.

Monitoring and Maintaining LLDP, LLDP-MED, and Wired Location Service

Command	Description
clear lldp counters	Resets the traffic counters to zero.
clear lldp table	Deletes the LLDP neighbor information table.
clear nmsp statistics	Clears the NMSP statistic counters.
show lldp	Displays global information, such as frequency of transmissions, the holdtime for packets being sent, and the delay time before LLDP initializes on an interface.
show lldp entry <i>entry-name</i>	Displays information about a specific neighbor. You can enter an asterisk (*) to display all neighbors, or you can enter the neighbor name.
show lldp interface [<i>interface-id</i>]	Displays information about interfaces with LLDP enabled. You can limit the display to a specific interface.

Command	Description
<code>show lldp neighbors [interface-id] [detail]</code>	Displays information about neighbors, including device type, interface type and number, holdtime settings, capabilities, and port ID. You can limit the display to neighbors of a specific interface or expand the display for more detailed information.
<code>show lldp traffic</code>	Displays LLDP counters, including the number of packets sent and received, number of packets discarded, and number of unrecognized TLVs.
<code>show location admin-tag string</code>	Displays the location information for the specified administrative tag or site.
<code>show location civic-location identifier id</code>	Displays the location information for a specific global civic location.
<code>show location elin-location identifier id</code>	Displays the location information for an emergency location.
<code>show network-policy profile</code>	Displays the configured network-policy profiles.
<code>show nmosp</code>	Displays the NMSP information.

Configuration Examples for Configuring LLDP, LLDP-MED, and Wired Location Service

Enabling LLDP: Examples

This example shows how to globally enable LLDP:

```
Switch# configure terminal
Switch(config)# lldp run
Switch(config)# end
```

This example shows how to enable LLDP on an interface:

```
Switch# configure terminal
Switch(config)# interface gigabitethernet1/1
Switch(config-if)# lldp transmit
Switch(config-if)# lldp receive
Switch(config-if)# end
```

Configuring LDP Parameters: Examples

This example shows how to configure LLDP parameters:

```
Switch# configure terminal
Switch(config)# lldp holdtime 120
Switch(config)# lldp reinit 2
Switch(config)# lldp timer 30
Switch(config)# end
```

Configuring TLV: Example

This example shows how to enable a TLV on an interface:

```
Switch# configure terminal
Switch(config)# interface gigabitethernet1/1
```

```
Switch(config-if)# lldp med-tlv-select inventory-management
Switch(config-if)# end
```

Configuring Network Policy: Example

This example shows how to configure VLAN 100 for voice application with CoS and to enable the network-policy profile and network-policy TLV on an interface:

```
Switch# configure terminal
Switch(config)# network-policy profile 1
Switch(config-network-policy)# voice vlan 100 cos 4
Switch(config-network-policy)# exit
Switch(config)# interface gigabitethernet1/1
Switch(config-if)# network-policy profile 1
Switch(config-if)# lldp med-tlv-select network-policy
```

Configuring Voice Application: Example

This example shows how to configure the voice application type for the native VLAN with priority tagging:

```
Switch(config-network-policy)# voice vlan dot1p cos 4
Switch(config-network-policy)# voice vlan dot1p dscp 34
```

Configuring Civic Location Information: Example

This example shows how to configure civic location information on the switch:

```
Switch(config)# location civic-location identifier 1
Switch(config-civic)# number 3550
Switch(config-civic)# primary-road-name "Cisco Way"
Switch(config-civic)# city "San Jose"
Switch(config-civic)# state CA
Switch(config-civic)# building 19
Switch(config-civic)# room C6
Switch(config-civic)# county "Santa Clara"
Switch(config-civic)# country US
Switch(config-civic)# end
```

Enabling NMSP: Example

This example shows how to enable NMSP on a switch and to set the location notification time to 10 seconds:

```
Switch(config)# nmosp enable
Switch(config)# nmosp notification interval location 10
```

Additional References

The following sections provide references related to switch administration:

Related Documents

Related Topic	Document Title
Cisco IE 2000 commands	<i>Cisco IE 2000 Switch Command Reference</i> , Release 15.0(2)EC
Cisco IOS basic commands Cisco IOS system management commands	<i>Cisco IOS Configuration Fundamentals Command Reference</i>

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

MIBs

MIBs	MIBs Link
—	To locate and download MIBs using Cisco IOS XR software, use the Cisco MIB Locator found at the following URL and choose a platform under the Cisco Access Products menu: http://cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

RFCs

RFCs	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

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

■ Additional References