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1 Configuring LLDP

1.1 Introduction

1.1.1 Overview

The Link Layer Discovery Protocol (LLDP) is a L2 discovery protocol defined in the IEEE 802.1AB standard. It is used to discover a topology and identify topological changes. LLDP encapsulates local information of a device into LLDP data units (LLDPDUs) in the type length value (TLV) format and then sends the LLDPDUs to neighbors. It also stores LLDPDUs from neighbors in the management information base (MIB) to be accessed by the network management system (NMS).

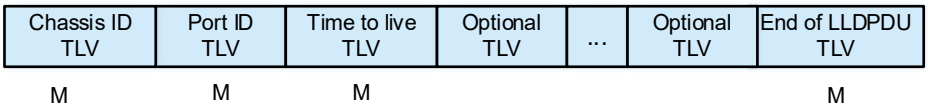
With LLDP, the NMS can learn about topology connections, for example, interfaces of a device connected to other devices, as well as the rates and duplex modes of interfaces at both ends of a link. Administrators can quickly locate and eliminate a fault based on the information. An LLDP-compliant device is capable of discovering neighbors when its peer is either an LLDP-compliant device or a device supporting the Link Layer Discovery Protocol-Media Endpoint Discovery (LLDP-MED).

1.1.2 LLDP Packet

An LLDP-compliant device advertises its status information by using different TLV combinations, and obtains status information of neighbors. A series of TLV combinations are encapsulated into LLDPDUs, which then are encapsulated in LLDP packets for transmission.

Figure 1-1 shows the format of an LLDPDU, wherein M indicates a mandatory TLV. As specified in LLDP, each LLDPDU can contain 28 types of TLVs, and always starts with the chassis ID TLV, port ID TLV, and Time To Live (TTL) TLV, and ends with the end of LLDPDU TLV. Other types of TLVs are optional.

Figure 1-1LLDPDU Format



LLDP packets can be encapsulated in two formats: Ethernet II and Sub Network Access Protocols (SNAP).

Figure 1-2 shows an LLDP packet encapsulated in Ethernet II format. Table 1-1 describes the related fields.

Figure 1-2LLDP Packet Encapsulated in Ethernet II Format

Table 1-1Description of Fields in an LLDP Packet Encapsulated in Ethernet II Format

Field	Description
Destination Address	Destination address, which is a fixed multicast address: 0180.c200.000e.

Field	Description
Source Address	Source MAC address, which is the interface MAC address of the device.
Ether type	Ethernet type, which is 0x88CC.
LLDPDU	LLDP data unit.
FCS	Frame check sequence.

Figure 1-3 shows an LLDP packet encapsulated in SNAP format. Table 1-1 describes the related fields.

Figure 1-3LLDP Packet Encapsulated in SNAP Format

Table 1-1Description of Fields in an LLDP Packet Encapsulated in SNAP Format

Field	Description
Destination Address	Destination address, which is a fixed multicast address: 0180.c200.000e.
Source Address	Source MAC address, which is the interface MAC address of the device.
SNAP-encoded Ether type	SNAP-encapsulated Ethernet type, which is AA-AA-03-00-00-00-88-CC.
LLDPDU	LLDP data unit.
FCS	Frame check sequence.

1.1.3 TLV Type

TLVs encapsulated in LLDPDUs are classified into basic management TLVs and organizationally specific TLVs.

1. Basic Management TLVs

Basic management TLVs are a collection of basic TLVs used for network management. This collection consists of two types of TLVs: mandatory TLVs and optional TLVs. A mandatory TLV must be contained in an LLDPDU for advertisement and an optional TLV is contained selectively. Table 1-1 describes the types of basic management TLVs.

Table 1-1Basic Management TLVs

TLV Type	Description	Mandatory/Optional
End Of LLDPDU TLV	End flag of an LLDPDU, occupying two bytes.	Mandatory
Chassis ID TLV	Device ID, represented using a MAC address.	Mandatory
Port ID TLV	Interface sending an LLDPDU.	Mandatory
Time To Live TLV	TTL of local information on a neighbor. When a device receives a TLV with TTL of 0, it deletes the neighbor	Mandatory

TLV Type	Description	Mandatory/Optional
	information.	
Port Description TLV	Descriptor of the interface sending an LLDPDU.	Optional
System Name TLV	Device name.	Optional
System Description TLV	Device description, including the hardware version, software version, and operating system.	Optional
System Capabilities TLV	Main functions supported by the device, such as the bridge, routing, and relay functions.	Optional
Management Address TLV	Management address, which contains the interface ID and object identifier (OID).	Optional

Note

This LLDP-compliant device supports advertisement of basic management TLVs.

2. Organizationally Specific TLVs

Organizationally specific TLVs are defined by standard organizations and other institutions, for example, the IEEE 802.1 working group, the IEEE 802.3 working group, Internet Engineering Task Force (IETF), and equipment suppliers define their own TLV collections. Different organizations define specific TLVs to advertise specific information about devices. The organizationally unique identifier (OUI) field in a TLV is used to distinguish different organizations.

Organizationally specific TLVs are optional and are advertised in an LLDPDU selectively. Currently, there are three types of common organizationally specific TLVs: IEEE 802.1 organizationally specific TLVs, IEEE 802.3 organizationally specific TLVs, and LLDP-MED TLVs.

- Table 1-1 describes IEEE 802.1 organizationally specific TLVs.

Table 1-1IEEE 802.1 Organizationally Specific TLVs

TLV Type	Description
Port VLAN ID TLV	Virtual local area network (VLAN) identifier of an interface.
Port And Protocol VLAN ID TLV	Protocol VLAN identifier of an interface.
VLAN Name TLV	VLAN name of an interface.
Protocol Identity TLV	Protocol type supported by an interface.

Note

This LLDP-compliant device does not send the protocol identity TLV but receives this TLV.

- Table 1-2 describes IEEE 802.3 organizationally specific TLVs.

Table 1-2IEEE 802.3 Organizationally Specific TLVs

TLV Type	Description
MAC/PHY Configuration//Status TLV	Rate and duplex mode of an interface, and whether auto-negotiation is supported and enabled.
Power Via MDI TLV	Power supply capacity of an interface.
Link Aggregation TLV	Link aggregation capacity of an interface and the current aggregation state.
Maximum Frame Size TLV	Maximum size of the frame that can be transmitted by an interface.

Note

This LLDP-compliant device supports advertisement of IEEE 802.3 organizationally specific TLVs.

- LLDP-MED TLV

LLDP-MED is an extension to LLDP based on IEEE 802.1AB LLDP. It enables users to conveniently deploy the Voice over IP (VoIP) network and detect faults. It provides applications including the network configuration policies, device discovery, Power over Ethernet (PoE) management, and inventory management, which can meet requirements for low cost, effective management, and easy deployment and help simplify deployment of audio devices. Table 1-3 describes LLDP-MED TLVs.

Table 1-3LLDP-MED TLV

TLV Type	Description
LLDP-MED Capabilities TLV	Whether the device supports LLDP-MED, the type of the LLDP-MED TLV encapsulated into an LLDPDU, and device type (network connectivity device or endpoint device).
Network Policy TLV	Interface VLAN configuration, supported application type (such as voice or video services), and L2 priority information.
Location Identification TLV	Endpoint device ID. An endpoint device can be accurately located in network topology collection and other applications.
Extended Power-via-MDI TLV	More advanced power supply management.
Inventory – Hardware Revision TLV	Hardware version of a MED device.
Inventory – Firmware Revision TLV	Firmware version of a MED device.
Inventory – Software Revision TLV	Software version of a MED device.
Inventory – Serial Number TLV	Serial number of a MED device.
Inventory – Manufacturer Name TLV	Name of the manufacturer of a MED device.

TLV Type	Description
Inventory – Model Name TLV	Module name of a MED device.
Inventory – Asset ID TLV	Asset identifier of a MED device, used for inventory management and asset tracking.

Note

This LLDP-compliant device supports advertisement of LLDP-MED TLVs.

1.1.4 LLDP Work Mode

LLDP supports three work modes.

- TxRx: Transmits and receives LLDPDUs.
- Rx Only: Only receives LLDPDUs.
- Tx Only: Only transmits LLDPDUs.

Caution

When the LLDP work mode of an interface is changed, the interface initializes the protocol state machine. You can set an interface initialization delay to prevent repeated initialization of an interface due to frequent changes of the LLDP work mode.

1.1.5 LLDP Packet Transmission Mechanism

LLDP-compliant devices can send LLDP packets to peers. LLDP packets are used to inform peers of their neighbors. When the LLDP transmission mode is canceled or the interface is disabled, LLDP packets can inform peers that their neighbors are no longer valid.

LLDP periodically transmits LLDP packets when working in TxRx or Tx Only mode. When information about the local device changes, LLDP immediately transmits LLDP packets. You can configure an LLDP packet transmission delay to avoid frequent transmission of LLDP packets caused by frequent changes of local information. This delay can be manually configured.

LLDP provides two types of packets:

- Standard LLDP packet: It contains management and configuration information of the local device.
- Shutdown packet: When the LLDP work mode is disabled or the interface is shut down, LLDP shutdown packets will be transmitted. A shutdown packet consists of the chassis ID TLV, port ID TLV, TTL TLV, and end of LLDP TLV. TTL in the TTL TLV is 0. When a device receives an LLDP shutdown packet, it considers the neighbor information invalid and immediately deletes it.

When the LLDP work mode is changed from disabled or Rx to TxRx or Tx, or LLDP discovers a new neighbor (that is, a device receives a new LLDP packet and the neighbor information is not stored locally), the fast transmission mechanism is started so that the neighbor quickly learns the device information. The fast transmission mechanism enables a device to transmit a certain number of LLDP packets at an interval of 1 second.

1.1.6 LLDP Packet Receiving Mechanism

LLDP-compliant devices can receive LLDP packets from the peers. A device can discover its neighbors and determine when to age the neighbor information according to received LLDP packets.

A device can receive LLDP packets when working in TxRx or Rx Only mode. After receiving an LLDP packet, a device conducts a validity check. After the packet passes the check, the device checks whether the packet provides information about a new neighbor or information update of an existing neighbor and stores the neighbor information locally. The device sets the TTL of neighbor information according to the value of TTL TLV in the packet. If the value of TTL TLV is 0, the neighbor information needs to be aged immediately.

1.1.7 Protocols and Standards

- IEEE 802.1AB 2005:IEEE Standard for Local and metropolitan area networks - Station and Media Access Control Connectivity Discovery
- ANSI/TIA-1057: Link Layer Discovery Protocol for Media Endpoint Devices

1.2 Configuration Task Summary

The following tasks are optional:

(1) Enabling the LLDP Function

(2) Configuring the LLDP Work Mode

(3) Configuring an Interface Initialization Delay

(4) Configure parameters related to LLDP packets.

- Configuring the TLVs to Be Advertised
- Configuring the Management Address to Be Advertised in LLDP Packets
- Configuring the LLDP Packet Encapsulation Format
- Configuring the Number of LLDP Packets That Can Be Transmitted Rapidly
- Configuring the TTL Multiplier and LLDP Packet Transmission Interval
- Configuring an LLDP Packet Transmission Delay

(5) Configuring the Function of Ignoring PVID Detection

(6) Configuring the Function of Being Compatible with the Neighbor Discovery of Vendors' Devices

(7) Configuring the LLDP Trap Function

(8) Configuring the LLDP Error Detection Function

(9) Configuring the Civic Address

(10) Configuring the Emergency Telephone Number

(11) Configuring an LLDP Network Policy

1.3 Enabling the LLDP Function

1.3.1 Overview

This section describes how to enable or disable the LLDP function globally and on an interface. The LLDP function is enabled globally and on an interface by default. The function configuration is optional.

1.3.2 Restrictions and Guidelines

- To make the LLDP function take effect on an interface, you need to enable the LLDP function globally and on the interface.
- Configuring the LLDP function in global configuration mode will enable the LLDP function globally. Configuring the LLDP function in interface configuration mode will enable the LLDP function on the interface.
- The **lldp enable** command is used to enable the LLDP function. The LLDP function is enabled by default. Therefore, no configuration is required to enable the function. The **no lldp enable** command is used to disable the LLDP function.
- When a neighbor does not support LLDP but it is connected to an LLDP-supported device in downlink direction, an interface may learn information about the device that is not directly connected to the interface because the neighbor may forward LLDP packets.

1.3.3 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure the global LLDP function.

[**no**] **lldp enable**

The global LLDP function is enabled by default.

(4) Enter the interface configuration mode.

interface *interface-type interface-number*

(5) Configure the LLDP function for the interface.

[**no**] **lldp enable**

The LLDP function is enabled on interfaces by default.

1.4 Configuring the LLDP Work Mode

1.4.1 Overview

This section describes how to configure the LLDP packet transmission and receiving mode. The device has default configuration and the configuration command of this function is optional.

1.4.2 Restrictions and Guidelines

- LLDP only runs on physical ports. It runs on member ports for an aggregation port. Stacked ports and VSL

ports do not support LLDP.

- The default LLDP work mode is **TxRx**, indicating that an interface can transmit and receive LLDPDUs. You can set the LLDP work mode to **Tx** or **Rx** as required. When the **no lldp mode** command is used to disable the LLDP work mode of an interface, the interface neither transmits nor receives LLDP packets.
- When you set the LLDP work mode of an interface to **Tx**, the interface can only transmit packets but cannot receive packets.
- When you set the LLDP work mode of an interface to **Rx**, the interface can only receive packets but cannot transmit packets.

1.4.3 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enter the interface configuration mode.

interface *interface-type interface-number*

(4) Configure the LLDP work mode.

lldp mode { **rx** | **tx** | **txrx** }

The default LLDP work mode is **TxRx**, indicating that an interface can transmit and receive LLDPDUs.

1.5 Configuring an Interface Initialization Delay

1.5.1 Overview

You can configure an interface initialization delay in global configuration mode to prevent frequent initialization of the state machine caused by frequent changes of the interface work mode.

1.5.2 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure an interface initialization delay.

lldp timer reinit-delay *reinit*

The default LLDP interface initialization delay is 2 seconds.

1.6 Configuring the TLVs to Be Advertised

1.6.1 Overview

You can configure the type of TLVs to be advertised to specify the LLDPDUs in LLDP packets.

By default, an interface is allowed to advertise TLVs of all types except the Location Identification TLV.

1.6.2 Restrictions and Guidelines

- You can run the **lldp tlv-enable** *tlv-type subtype* command on an interface to configure the type of TLVs to be advertised as required.

  Run the **no lldp tlv-enable** *tlv-type subtype* command to cancel the advertisement of TLVs of the specified types.

- *tlv-type* indicates the TLV type, and one type must be configured; *subtype* indicates the sub-type and one sub-type must be configured. Sub-type varies with *tlv-type*.

  - The value range of the *subtype* parameter for **basic-tlv** (basic management TLVs) is as follows:

    all: Advertises all optional TLVs of this type.

    port-description: Indicates the Port Description TLV.

    system-capability: Indicates the System Capabilities TLV.

    system-description: Indicates the System Description TLV.

    system-name: Indicates the System Name TLV.

  - The value range of the *subtype* parameter for **dot1-tlv** (IEEE 802.1 organizationally specific TLVs) is as follows:

    all: Advertises all optional TLVs of this type.

    port-vlan-id: Indicates the Port VLAN ID TLV.

    protocol-vlan-id [*vlan-id*]: Indicates the Port And Protocol VLAN ID TLV. Where, *vlan-id* indicates the port protocol VLAN ID. The value range is from 1 to 4094.

    vlan-name [*vlan-id*]: Indicates the VLAN Name TLV. Where, *vlan-id* indicates the VLAN ID. The value range is from 1 to 4094.

  - The value range of the *subtype* parameter for **dot3-tlv** (IEEE 802.3 organizationally specific TLVs) is as follows:

    all: Advertises all optional TLVs of this type.

    link-aggregation: Indicates the Link Aggregation TLV.

    mac-physic: Indicates the MAC/PHY Configuration/Status TLV.

    max-frame-size: Indicates the Maximum Frame Size TLV.

    power: Indicates the Power Via MDI TLV.

  - The value range of the *subtype* parameter for **med-tlv** (LLDP-MED TLV) is as follows:

    all: Advertises all types of LLDP-MED TLVs other than the **Location** Identification TLV.

    capability: Indicates the LLDP-MED Capabilities TLV.

    inventory: Indicates the inventory management TLV, which contains the hardware version, firmware version, software version, SN, manufacturer name, module name, and asset identifier.

    location { **civic-location | elin** } **identifier** *id*: Indicates the Location Identification TLV. Where, **civic-location** encapsulates the civic address information of the network connection device, **elin** encapsulates the emergency telephone number, and **identifier** *id* indicates the policy ID, with the value range from 1 to 1024.

network-policy profile [*profile-num*]: Indicates the Network Policy TLV. Where, *profile-num* indicates the network policy ID. The value range is from 1 to 1024.

power-over-ethernet: Indicates the Extended Power-via-MDI TLV.

- Before configuring the advertisement of the LLDP-MED **capability** TLV, configure the device to allow the advertisement of the LLDP IEEE 802.3 **mac-physic** TLV.

  Before canceling the advertisement of the LLDP IEEE 802.3 **mac-physic** TLV, first cancel the advertisement of the LLDP-MED **capability** TLV.

- If you want to configure LLDP-MED TLVs, configure the LLDP-MED **capability** TLV before configuring other types of LLDP-MED TLVs. If you want to cancel the advertisement of LLDP-MED TLVs, cancel the LLDP-MED **capability** TLV before canceling other types of LLDP-MED TLVs. If a device is connected to an IP phone in the downlink direction and the IP phone supports LLDP-MED, you can configure the Network Policy TLV to deliver policies to the IP phone.

1.6.3 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enter the interface configuration mode.

interface *interface-type interface-number*

(4) Configure the TLVs to be advertised.

lldp tlv-enable *tlv-type subtype*

By default, if a device supports the Data Center Bridging Capability Exchange protocol (DCBX), interfaces are allowed to transmit all types of TLVs except IEEE 802.3 organizationally specific TLVs and LLDP-MED TLVs. If a device does not support DCBX, interfaces are allowed to transmit all types of TLVs except the Location Identification TLV. The default transmission policy is **none** for the Network Policy TLV in LLDP-MED TLVs.

1.7 Configuring the Management Address to Be Advertised in LLDP Packets

1.7.1 Overview

You can configure the management address to be advertised in LLDP packets in global or interface configuration mode.

After the management address to be advertised is canceled, the management address in LLDP packets is set to the default value.

1.7.2 Restrictions and Guidelines

- LLDP runs on physical ports (member ports for an aggregation port). Stacked ports and VSL ports do not support LLDP.
- The management address to be advertised in LLDP packets can be configured in either global

configuration mode or interface configuration mode. The management address configured in global configuration mode takes priority over that configured in interface configuration mode. No LLDP management address can be configured for a specific interface if a global LLDP management address is available.

1.7.3 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure the management address to be advertised in LLDP packets.

lldp management-address-tlv { *ip-address* | *ipv6-address* }

A management address is advertised through LLDP packets according to the following policy by default: The management address is the IPv4 address of the minimum VLAN supported by an interface. If no IPv4 address is configured for the VLAN, LLDP keeps searching for the next allowed minimum VLAN until a qualified IP address is found. If no IPv4 address is found, LLDP searches for the IPv6 address of the minimum VLAN supported by an interface. If no IPv6 address is found, the local address 127.0.0.1 is used as the management address.

1.8 Configuring the LLDP Packet Encapsulation Format

1.8.1 Overview

The same LLDP packet encapsulation format needs to be configured on the local device and its neighbors in interface configuration mode to ensure their normal communication.

1.8.2 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enter the interface configuration mode.

interface *interface-type interface-number*

(4) Set the LLDP packet encapsulation format to SNAP.

lldp encapsulation snap

The default LLDP packet encapsulation format is Ethernet II.

1.9 Configuring the Number of LLDP Packets That Can Be Transmitted Rapidly

1.9.1 Overview

You can configure the number of LLDP packets that can be transmitted rapidly for the fast transmission mechanism.

1.9.2 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure the number of LLDP packets that can be transmitted rapidly.

lldp fast-count *fast-count-value*

By default, three LLDP packets can be transmitted rapidly.

1.10 Configuring the TTL Multiplier and LLDP Packet Transmission Interval

1.10.1 Overview

In LLDP packets, TTL TLV indicates the TTL of local information on a neighbor.

The value of TTL TLV is calculated using the following formula: TTL TLV = TTL multiplier × Packet transmission interval + 1. The TTL TLV value can be modified by configuring the TTL multiplier and LLDP packet transmission interval. For example, set the TTL multiplier to 2 and the packet transmission interval to 30 seconds. The TTL of local information on a neighbor is 61 seconds (that is, 2 × 30 + 1).

1.10.2 Restrictions and Guidelines

- You can run the **lldp hold-multiplier** *ttl-value* command to configure the TTL multiplier, so as to control the TTL of local information on a neighbor.
- You can run the **lldp timer tx-interval** *txinterval* command to configure the LLDP packet transmission interval. *txinterval* indicates the time interval, in seconds. The value range is from 1 to 32768, and the default value is **30**. For the standard MIB, the LLDP packet transmission interval is 5–32768 seconds. The range is wider on this device to meet the requirements of more scenarios.
- If the interval is set to a very small value, LLDP packets may be transmitted frequently. If the interval is set to a very large value, the peer may not discover the local device in time.

1.10.3 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure the TTL multiplier.

lldp hold-multiplier *ttl-value*

The default TTL multiplier of LLDP packets is **4**.

(4) Configure the LLDP packet transmission interval.

lldp timer tx-interval *txinterval*

The default LLDP packet transmission interval is **30** seconds.

1.11 Configuring an LLDP Packet Transmission Delay

1.11.1 Overview

When local information of a device changes, the device immediately transmits LLDP packets to its neighbors. You can configure a transmission delay to prevent frequent transmission of LLDP packets caused by frequent changes of local information.

1.11.2 Restrictions and Guidelines

- The default LLDP packet transmission delay is **2** seconds. The **txdelay** parameter is used to configure an LLDP packet transmission delay. The value range is from 1 to 8192.
- If the delay is set to a very small value, frequent change of the local information will cause frequent transmission of LLDP packets. If the delay is set to a very large value, no LLDP packet may be transmitted even if local information is changed. Set an appropriate delay according to actual conditions.

1.11.3 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure an LLDP packet transmission delay.

lldp timer tx-delay *txdelay*

The default LLDP packet transmission delay is **2** seconds.

1.12 Configuring the Function of Ignoring PVID Detection

1.12.1 Overview

This section describes how to configure the function of ignoring port VLAN ID (PVID) detection.

1.12.2 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure the function of ignoring PVID detection.

lldp ignore pvid-error-detect

The function of ignoring PVID detection is disabled by default.

1.13 Configuring the Function of Being Compatible with the Neighbor Discovery of Vendors' Devices

1.13.1 Overview

This section describes how to configure the function of being compatible with the neighbor discovery of vendors' devices on the device.

1.13.2 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enable the function of being compatible with the neighbor discovery of vendors' devices.

lldp compliance vendor

The function of being compatible with the neighbor discovery of vendors' devices is disabled by default.

1.14 Configuring the LLDP Trap Function

1.14.1 Overview

The LLDP trap function enables a device to send its local LLDP information (such as neighbor discovery and communication link fault) to the NMS server so that administrators learn about the network performance.

You can configure an LLDP trap transmission interval in global configuration mode to prevent frequent transmission of LLDP trap messages. LLDP changes detected within this interval will be transmitted to the NMS server through traps.

1.14.2 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) (Optional) Configure an LLDP trap transmission interval.

lldp timer notification-interval *trap*

The default LLDP trap transmission interval is 5 seconds.

(4) Enter the interface configuration mode.

interface *interface-type interface-number*

(5) Enable the LLDP trap function.

lldp notification remote-change enable

The LLDP trap function is disabled by default.

1.15 Configuring the LLDP Error Detection Function

1.15.1 Overview

After the LLDP error detection function is enabled, when LLDP detects an error, the error is logged.

Error detection includes detecting VLAN configuration at both ends of a link, interface status, aggregation port configuration, maximum transmission unit (MTU) configuration, and loops.

1.15.2 Restrictions and Guidelines

The LLDP error detection function relies on specific TLVs in LLDP packets exchanged between devices at both ends of a link. Therefore, a device needs to advertise correct TLVs to ensure normal operation the LLDP error detection function.

1.15.3 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enter the interface configuration mode.

interface *interface-type interface-number*

(4) Enable the LLDP error detection function.

lldp error-detect

The LLDP error detection function is enabled by default.

1.16 Configuring the Civic Address

1.16.1 Overview

This section describes how to configure a civic address for a device in LLDP civic address configuration mode.

1.16.2 Restrictions and Guidelines

- Run the **lldp location civic-location identifier** *id* command to enter the LLDP civic address configuration mode.
- In LLDP civic address configuration mode, run the **civic-location** command to configure a civic address for a device. Parameters of this command consist of two parts: address type indicated by *ca-type* and address information indicated by *ca-word*. The **civic-location** keyword is not reflected in the configuration command. The configuration starts directly with the *ca-type* parameter. Run the *ca-type ca-word* command to configure the device address, or run the **no** form of this command to delete the corresponding address

information.

- Optional parameters for *ca-type* include the following: **country** (country), **state** (state)**, county** (county), **city** (city), **division** (district), **neighborhood** (community), **street-group** (street), **leading-street-dir (street No.), trailing-street-suffix** (street No.), **street-suffix** (street No.), **number** (street No.), **street-number-suffix**(street No.), **landmark** (landmark),**additional-location-information** (additional address), **name** (name), **postal-code** (postal code), **building** (building), **unit** (unit), **floor** (floor), **room** (room), **type-of-place** (type of place), **postal-community-name** (post office), **post-office-box** (post-office box), and **additional-code** (additional code).
- The *ca-word* parameter is used to configure address information. When the address type is **country**, address information can use only two characters to represent a country.
- In LLDP civic address configuration mode, run the **device-type** *device-type* command to configure the device type. The default value of *device-type* is 1. The parameter can be set to **0** to indicate a DHCP server, **1** to indicate a switch, and **2** to indicate an LLDP-MED device.Run the **no device-type** to restore the default configuration.

1.16.3 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enter the civic address configuration mode of LLDP-MED TLVs.

lldp location civic-location identifier *id*

(4) Configure the address information.

{ **country** | **state** | **county** | **city** | **division** | **neighborhood** | **street-group** | **leading-street-dir** | **trailing-street-suffix** | **street-suffix** | **number** | **street-number-suffix** | **landmark** | **additional-location-information** | **name** | **postal-code** | **building** | **unit** | **floor** | **room** | **type-of-place** | **postal-community-name** | **post-office-box** | **additional-code** } *ca-word*

No address information is configured by default.

(5) Configure the device information.

device-type *device-type*

No device type is configured by default.

1.17 Configuring the Emergency Telephone Number

1.17.1 Overview

You can configure the emergency telephone number information for a device as needed.

1.17.2 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure the emergency telephone number for the device.

lldp location elin identifier *id* **elin-location** *tel-number*

1.18 Configuring an LLDP Network Policy

1.18.1 Overview

If the downlink IP phone supports LLDP, the IP phone will actively transmit LLDP packets when it goes online. If the device is configured with the LLDP network policy TLV, it can capture LLDP packets sent from the IP phone and transmit a voice VLAN policy to the IP phone. If the policy requires the IP phone to send tagged frames and the IP phone supports tagged packets, it will add VLAN tags when transmitting voice packets as per the policy. If the policy requires the IP phone to send untagged frames, the IP phone will transmit untagged packets.

1.18.2 Restrictions and Guidelines

In addition to creating an LLDP network policy on a device, you also need to:

- Enable the voice VLAN function, and add the interface connected to the IP phone to the voice VLAN statically. If the downlink IP phone does not support LLDP-MED, manually add the MAC address of the IP phone to the voice VLAN OUI list. For details, see the *Configuring Voice VLAN*.
- Configure the QoS module to trust the priority modified by the port. For details, see "Configuring QoS" in "ACL and QoS."
- If 802.1x authentication is also enabled on this port, you also need to configure a secure channel to allow packets in the voice VLAN to pass. For details, see "Configuring ACL" in "ACL and QoS".

1.18.3 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Create an LLDP network policy and enter the configuration mode.

lldp network-policy profile *profile-num*

No LLDP network policy is configured by default.

(4) Configure a voice VLAN policy. Select at least one of the following to configure:

- Configure the IP phone to transmit tagged frames.

  { **voice** | **voice-signaling** } **vlan** { *voice-vlan-id* | **dot1p** } [**cos** *cos* | **dscp** *dscp*]

  No voice VLAN policy is configured by default.

- Configure the IP phone to transmit untagged frames. In this case, you can only manually add the interface to the voice VLAN.

  { **voice** | **voice-signaling** } **vlan untagged**

  No voice VLAN policy is configured by default.

(5) Configure the user interface to allow the advertisement of the Network Policy TLV.

a Return to the global configuration mode.

exit

b Enter the interface configuration mode.

interface *interface-type interface-number*

c Configure the interface to allow the advertisement of the Network Policy TLV.

lldp tlv-enable med-tlv network-policy profile *profile-num*

No network policy is configured by default.

1.19 Monitoring

Run the **show** commands to check the running status of a configured function to verify the configuration effect.

Run the **debug** commands to output debugging information.

Caution

The output debugging information occupies system resources. Therefore, disable the debugging function immediately after use.

Run the **clear** commands to clear information.

Caution

Running the clear commands may lose vital information and thus interrupt services.

Table 1-1Monitoring

Command	Purpose
clear lldp statistics [**interface** *interface-type interface-number*]	Clears LLDP statistics.
clear lldp table [**interface** *interface-type interface-number*]	Clears LLDP neighbor information.
show lldp local-information [**global** | **interface** interface-type interface-number]	Displays LLDP information on the local device, which will be organized as TLVs and sent to neighbors.
show lldp location { **civic-location | elin-location** } { **identifier** *id* **| interface** *interface-type interface-number* **| static** }	Displays the LLDP civic address or emergency telephone number of the local device.
show lldp neighbors [interface *interface-type interface-number*] [**detail**]	Displays the LLDP information of a neighbor.
show lldp network-policy { **profile** [*profile-num*] | **interface** *interface-type interface-number* }	Displays the LLDP network policy configuration of the local device.

Command	Purpose
show lldp statistics [**global** | **interface** *interface-type interface-number*]	Displays LLDP statistics.
show lldp status [**interface** *interface-type interface-number*]	Displays the LLDP status information.
show lldp tlv-config [**interface** *interface-type interface-number*]	Displays the configuration of TLVs to be advertised by an interface.
debug lldp error	Debugs LLDP error processing.
debug lldp event	Debugs LLDP event processing.
debug lldp ha	Debugs LLDP hot backup processing.
debug lldp packet	Debugs the LLDP packet receiving.
debug lldp stm	Debugs the LLDP state machine.

1.20 Configuration Examples

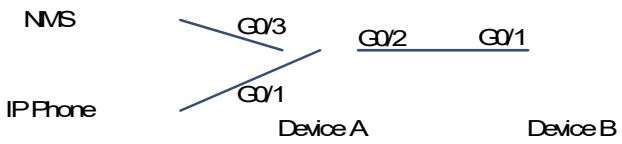
1.20.1 Checking the Neighbors Connected to the Device by Using the LLDP Function

1. Requirements

As shown in Figure 1-1, GigabitEthernet 0/1 of Device A is connected to the neighbor IP phone (MED device), and GigabitEthernet 0/2 is connected to the neighbor Device B. One NMS is connected to GigabitEthernet 0/3 of Device A. Check neighbor information on Device A by using the LLDP function.

2. Topology

Figure 1-1Typical Topology of LLDP



3. Notes

- The LLDP function is enabled by default and no configuration is required.
- The default LLDP work mode of an interface is TxRx and no configuration is required.
- The default LLDP packet transmission interval is 30 seconds, the default LLDP packet transmission delay is 2 seconds, and no configuration is required.

4. Verification

Check information about the neighbor connected to port GigabitEthernet 0/2 of Device A. It can be seen that GigabitEthernet 0/2 of Device A is connected to GigabitEthernet 0/1 of Device B, and the neighbor supports the bridging (B) and routing (R) functions.

```
DeviceA# show lldp neighbors interface gigabitethernet 0/2
Capability codes:
    (R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
    (W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other
System Name       Local Intf          Port ID           Capability        Aging-
time
DeviceB           Gi0/2               Gi0/1             B, R
1minutes 49seconds

Total entries displayed: 1
```

Check details about the neighbor connected to GigabitEthernet 0/2 of Device A.

```
DeviceA# show lldp neighbors interface gigabitethernet 0/2 detail
------------------------------------------------------------------------------
LLDP neighbor-information of port [GigabitEthernet 0/2]
------------------------------------------------------------------------------
  Neighbor index                  : 1
  Device type                     : LLDP Device
  Update time                     : 18minutes 14seconds
  Aging time                      : 1minutes 44seconds

  Chassis ID type                 : MAC address
  Chassis ID                      : 0074.9cee.f49e
  System name                     : DeviceB
  System description              : System description
  System capabilities supported   : Bridge, Router
  System capabilities enabled     : Bridge, Router

  Management address subtype      : ipv4
  Management address              : 172.26.147.182
  Interface numbering subtype     : ifIndex
  Interface number                : 8193
  Object identifier               :

  Management address subtype      : ipv6
  Management address              : 1010::1
  Interface numbering subtype     : ifIndex
  Interface number                : 4197
  Object identifier               :

  Port ID type                    : Interface name
  Port ID                         : Gi0/1
```

```
Port description                 :

802.1 organizationally information
Port VLAN ID                     : 101
Port and protocol VLAN ID(PPVID) : 0
    PPVID Supported              : NO
    PPVID Enabled                : NO
VLAN name of VLAN 101            : VLAN0101
Protocol Identity                :

802.3 organizationally information
Auto-negotiation supported       : YES
Auto-negotiation enabled         : YES
PMD auto-negotiation advertised  :
Operational MAU type             : Speed(1000)/Duplex(Full)
PoE support                      : NO
Link aggregation supported       : YES
Link aggregation enabled         : NO
Aggregation port ID              : 0
Maximum frame Size               : 1500
```

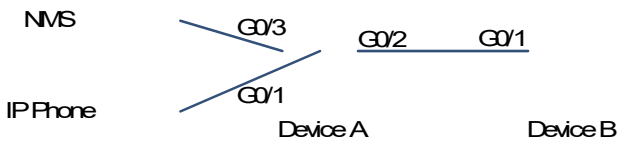
1.20.2 Configuring the LLDP Error Detection Function

1. Requirements

As shown in Figure 1-1, Device A and Device B are connected through Gigabit Ethernet (GE) interfaces. When an administrator configures the VLAN, port rate, duplex mode, aggregate port, and port MTU, an error will be prompted if the configurations do not match those on the connected neighbor.

2. Topology

Figure 1-1Typical Topology of LLDP



3. Notes

- The LLDP function is enabled by default and no configuration is required.
- The default LLDP work mode of an interface is TxRx and no configuration is required.
- The LLDP error detection function is enabled by default and no configuration is required.
- The default LLDP packet transmission interval is 30 seconds, the default LLDP packet transmission delay is 2 seconds, and no configuration is required.

4. Verification

Forcibly set the rate of GigabitEthernet 0/2 of Device A to 100 Mbps. When the system prompts a mismatch with the rate and duplex mode of the connected port on the neighbor, the LLDP error detection function takes effect.

```
DeviceA# configure terminal
DeviceA(config)# interface gigabitethernet 0/2
DeviceA(config-if-GigabitEthernet 0/2)# speed 100
%Warning: the speed/duplex of port GigabitEthernet 0/2 may not match with it's
neighbor.
```