QUANTUM® NETWORKS

NETWORK SWITCHING FEATURES

LLDP

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Contents

Glossary

The following terms are frequently used in this document.

Term	Definition
LLDP	Link Layer Discovery Protocol
VLAN	Virtual Local Area Network
MAC	Media Access Control
OSI	Open Systems Interconnection
TCP	Transmission Control Protocol
IP	Internet Protocol
PoE	Power over Ethernet
CLI	Command Line Interface
VoIP	Voice over Internet Protocol
TLV	Type Length Value
SNMP	Simple Network Management Protocol

Functional Description

Link Layer Discovery Protocol (LLDP) is an industry standard Protocol (IEEE 802.1 AB) used by network devices. It allows devices on the same local area network (LAN) to advertise and learn about each other's identities and capabilities, for smoothing better network management and configuration which is useful in troubleshooting the network.

Devices running LLDP, on one of their interfaces, uses TLVs (Type-Length-Value) to receive and send information to their neighbors. These devices store the information of neighboring devices in a local table that can be accessed using SNMP (Simple Network Management Protocol). Information stored by the devices includes: VLAN, IP Management address, MAC address, System name and description, Capabilities of neighboring devices, etc.)

These are the key features of LLDP:

- **Device Identification:** LLDP allows network devices, such as switches, routers, and servers, to advertise their identity (like their name and capabilities) to neighboring devices.
- **Network Mapping:** By exchanging information, LLDP helps network administrators map out the physical layout of the network and see how devices are connected.
- **Vendor-Neutral:** LLDP is standardized by the IEEE (802.1AB), meaning it can work across devices from different manufacturers, unlike proprietary protocols.

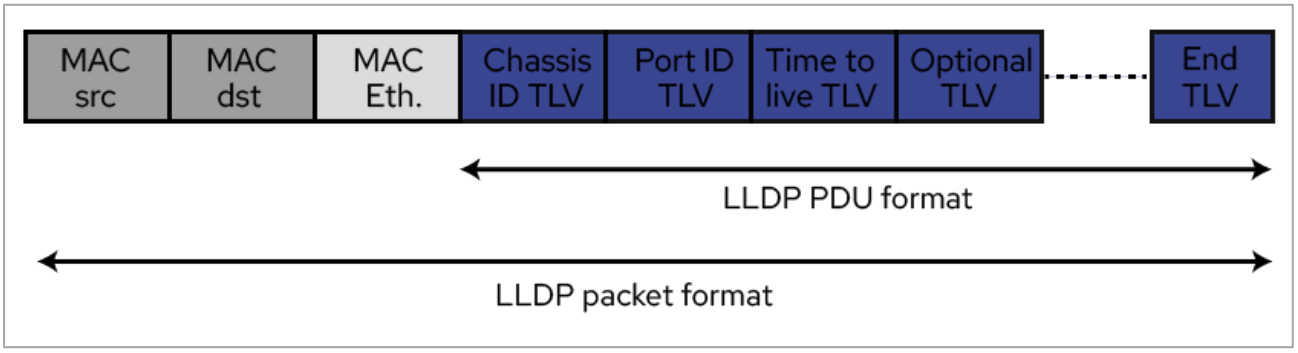

Figure 1

Here, Figure 1 shows LLDP packet format. As shown in image The **LLDP packet** starts with the Ethernet frame's basic fields such as MAC source, MAC destination and Ethernet type. After that **LLDP PDU** consists of mandatory TLVs such as Chassis ID, Port ID, and Time to Live, followed by optional TLVs for additional information. Above format allows devices on the same network segment to share information about their identity, capabilities, and port details, which is critical for network management and discovery.

LLDP in QN switches

Commands Outline

By default, LLDP is enabled in the device. Use the no lldp run Global Configuration mode command globally to disable LLDP.

switch(config)#no lldp run

Use the lldp chassis-id Global Configuration mode command to set the chassis id for the system. Use the no form of this command to disable it.

switch(config)#lldp chassis-id <mac-address / host-name>
switch(config)#no lldp chassis-id <mac-address / host-name>

Use the lldp lldpdu Global Configuration mode command to set the filtering for information. Use the no form of this command to disable it.

switch(config)#lldp lldpdu <filtering /flooding>
switch(config)#no lldp lldpdu <filtering /flooding>

Use the lldp med Global Configuration mode command to set the lldp for VoIP devices. Use the no form of this command to disable it.

switch(config)#lldp med <fast-start /network-policy>
switch(config)#no lldp med <fast-start /network-policy>

Use the lldp notifications interval Global Configuration mode command to set the notifications interval. Use the no form of this command to disable it.

switch(config)#lldp notifications interval <5-3600>
switch(config)#no lldp notifications interval

Use the lldp reinit Global Configuration mode command to set the reinit delay time. Use the no form of this command to disable it.

switch(config)#lldp reinit <1-10>
switch(config)#no lldp reinit

Use the lldp timer Global Configuration mode command to set the lldp discovery time. Use the no form of this command to disable it.

switch(config)#lldp timer <5-32768>
switch(config)#no lldp timer

Use the lldp tx-delay Global Configuration mode command to set the delay between successive LLDP frames. Use the no form of this command to disable it.

switch(config)#lldp tx-delay <1-8192>

Use the lldp med network-policy Global Configuration mode command to create network policy for voice devices. Use the no form of this command to disable it.

switch(config)#lldp med network-policy voice auto
switch(config)#no lldp med network-policy <1-32> <specify parameters>

Use the lldp management-address Interface Configuration mode command to set the management address for the LLDP process. Use the no form of this command to disable it.
switch(config-if)#lldp management-address <automatic/none/A.B.C.D> <IFNAME>
switch(config-if)#no lldp management-address

Use the lldp med enable/disable Interface Configuration mode command to set/unset the lldp for VoIP devices. Use the no form of this command to disable it.

switch(config-if)#lldp med <enable/disable>
switch(config-if)#no lldp med <enable/disable>

Use the lldp med notifications Interface Configuration mode command to enable/disable the topology change notifications of LLDP. Use the no form of this command to disable it.

switch(config-if)#lldp med notifications topology-change <enable / disable>
switch(config-if)#no lldp med notifications topology-change <enable / disable>

Use the lldp optional-tlv Interface Configuration mode command to set the other parameters. Use the no form of this command to disable it.

```
switch(config-if)#lldp optional-tlv <specify the parameters / none>
switch(config-if)#no lldp optional-tlv <specify the parameters / none>
```

Use the lldp receive Interface Configuration mode command to only receive neighbor information on a particular interface. Use the no form of this command to disable it.

```
switch(config-if)#lldp receive
switch(config-if)#no lldp receive
```

Use the lldp transmit Interface Configuration mode command to only transmit local information on a particular interface. Use the no form of this command to disable it.

```
switch(config-if)#lldp transmit
switch(config-if)#no lldp transmit
```

Use the no lldp receive & transmit Interface Configuration mode command to disable LLDP on a particular interface.

```
switch(config-if)#no lldp receive
switch(config-if)#no lldp transmit
```

Configuration Steps

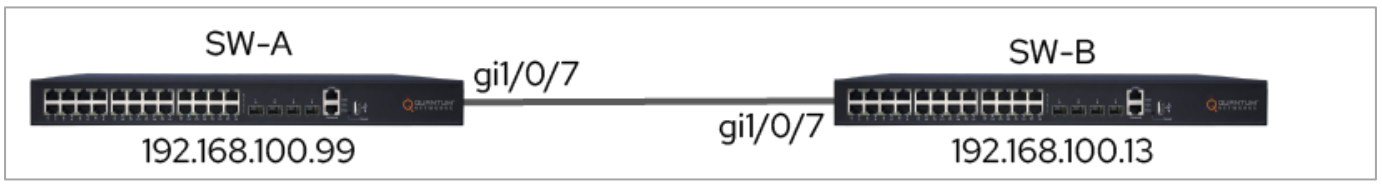

Figure 2

As per Fig.2 to get information of neighbor devices configure the LLDP in both the switches. By default, LLDP is enabled, to configure other parameters follow the below command lines.

SW-A:

To configure the source of the chassis ID of the port in Switch A, use the lldp chassis-id Global Configuration mode command. Host name specifies the chassis ID to use the device configured host name. The host name should be configured to be a unique value.

SW-A(config)#lldp chassis-id host-name

Navigate to the interface to configure the interface gi1/0/7.

SW-A(config)#int gi1/0/7

To enable sending LLDP notifications on an interface, use the lldp notifications Interface (Ethernet) Configuration mode command.

SW-A(config-if) #lldp notifications enable

SW-B:

Again To configure the source of the chassis ID of the port, use the lldp chassis-id Global Configuration mode command. Here, configuration will be done on Switch B.

SW-B(config)#lldp chassis-id host-name

Now, Navigate to the interface to configure the interface gi1/0/7.

SW-B(config)#int gi1/0/7

To enable sending LLDP notifications on an interface, use the lldp notifications Interface (Ethernet) Configuration mode command on Switch B.

SW-B(config-if)#lldp notifications enable

LLDP Optional-tlv

Optional TLVs in LLDP are not mandatory for the basic operation of LLDP, but they provide additional valuable information. Optional-tlv can provide information like, Port Description, System Name, System Description, System Capabilities, PoE, VLAN ID, MAC/PHY Configuration/Status etc.

To configure optional-tlv parameters use the below command.

Enter the configuration mode for a specific network interface on the switch, here, specified interface is gi1/0/7.

SW-A(config)#int gi1/0/7

To specify whether to transmit the 802.1 TLV, use the lldp optional-tlv 802.1 Interface (Ethernet) Configuration mode command. This configures the switch to include RSTP information in the optional protocol TLV within LLDP advertisements.

SW-A(config-if)#lldp optional-tlv 802.1 protocol add rstp

To configure the switch to include specific optional TLVs (Type-Length-Value) in LLDP advertisements sent out by the specified interface.

SW-A(config-if)#lldp optional-tlv port-desc sys-name sys-desc sys-cap 802.3-mac-phy 802.3-power-via-mdi 802.3-lag 802.3-max-frame-size

LLDP-MED

LLDP-MED is an extension of the LLDP protocol to support network devices that handle media-related functions, such as VoIP phones, networked audio-visual equipment. LLDP-MED includes several parameters like, Endpoint Discovery, Network Policy, Power Management, Location Information, Inventory Management etc.

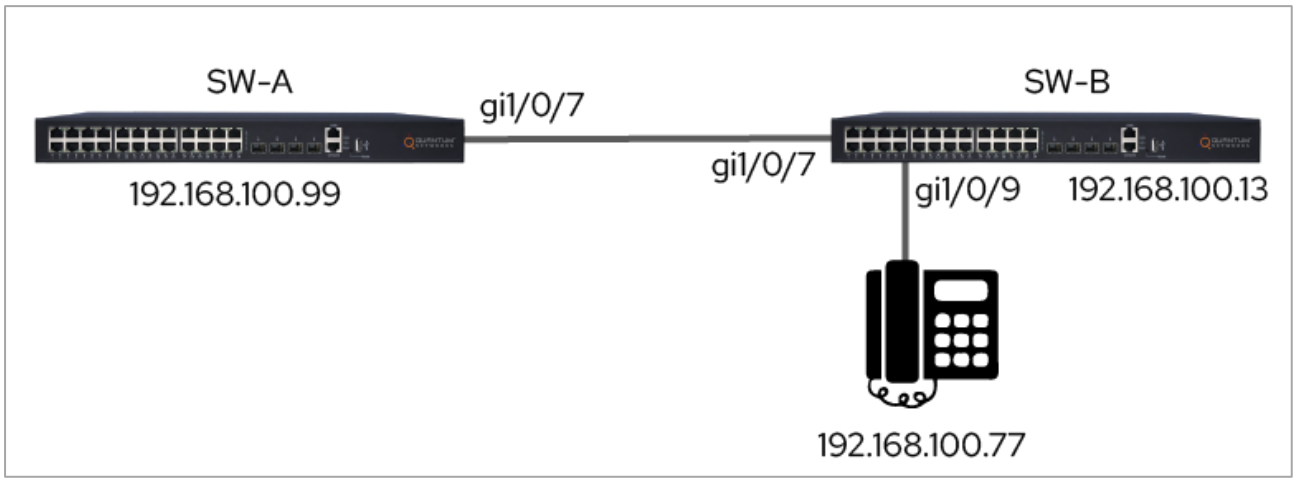

Figure 3

The diagram demonstrates a network setup involving two switches, Switch A and Switch B, connected by a link, and an IP phone connected to Switch B.

To configure LLDP-MED for above topology use the below command lines.

To configure lldp med network policy for voice signaling on a network switch (Switch B) in global configuration mode, use the command.

SW-B(config)#lldp med network-policy 1 voice-signaling vlan-type tagged up 1 dscp 41

Navigate to the interface to configure the interface gi1/0/9.

SW-B(config)#int gi1/0/9

To configure the interface to support and advertise several lldp med features, including network policies, location information, PoE capabilities, and inventory details for connected devices, use the command.

SW-B(config-if)#lldp med enable network-policy location poe-pse inventory

To configure the location information for the LLDP MED (Media Endpoint Discovery) for a port, use the lldp med location Interface (Ethernet) Configuration mode command. Civic-address specifies the location data as a civic address in hexadecimal format.

SW-B(config-if)#lldp med location civic-address 798215457155

To enable sending LLDP MED topology change notifications on a port, use the lldp med notifications topology-change Interface (Ethernet) Configuration mode command.
SW-B(config-if)#lldp med notifications topology-change enable

To define a LLDP MED network policy, use the lldp med network-policy Global Configuration mode command.

SW-B(config-if)#lldp med network-policy add 1

Verifying the Configuration:

To check the neighbor details using the below commands.

SW-B#show lldp neighbors
System capability legend: B - Bridge; R - Router; W - Wlan Access Point; T - telephone; D - DOCSIS Cable Device; H - Host; r - Repeater;
TP - Two Ports MAC Relay; S - S-VLAN; C - C-VLAN; O - Other

Port	Device ID	Port ID	System Name	Capabilities	TTL
gi1/0/7	58:61:63: 01:29:01	gi1/0/7	SW-A	B, R	57

SW-A#show lldp neighbors

System capability legend: B - Bridge; R - Router; W - Wlan Access Point; T - telephone; D - DOCSIS Cable Device; H - Host; r - Repeater

TP - Two Ports MAC Relay; S - S-VLAN; C - C-VLAN; O - Other

Port	*Device ID*	*Port ID*	*System Name*	*Capabilities*	*TTL*
gi1/0/7	*58:61:63:00:c5:e1*	*gi1/0/7*	*SW-B*	*B, R*	*89*

To verify optional-tlv configuration results use the below command.

SW-B#show lldp neighbors gi1/0/7
Device ID: 58:61:63:01:29:01

Port ID: gi1/0/7

Capabilities: Bridge, Router System
Name: SW-A
System description: QNOS 24G4XG Enterprise Switch
Port description: GigabitEthernet1/0/7

Management Address: 192.168.100.99

Management Address: fe80::5a61:63ff:fe01:2901

Time To Live: 110
802.3 MAC/PHY Configuration/Status Auto-negotiation support: Supported
Auto-negotiation status: Enabled
Auto-negotiation Advertised Capabilities: 1000BASE-T full duplex, 100BASE-TX full duplex mode, 100BASE-TX half duplex mode, 10BASE-T full duplex mode, 10BASE-T half duplex mode
Operational MAU type: 1000BaseTFD
802.3 Link Aggregation

Aggregation capability: Capable of being aggregated

Aggregation status: Currently not in aggregation

802.3 Maximum Frame Size: 1522
802.3 EEE:
Remote Tx: 17 uSec

Remote Rx: 17 uSec

Remote Tx Echo: 17 uSec

Remote Rx Echo: 17 uSec

802.1 PVID: 1

802.1 PPVID:

802.1 VLAN:

802.1 Protocol: RSTP

To verify MED configuration results use the below command.

SW-B#show lldp neighbors gi1/0/9
Device ID: 192.168.100.77

Port ID: c0:74:ad:b3:6c:58

Capabilities: Bridge, Telephone

System Name: GRP2601_c0:74:ad:b3:6c:58

System description: GRP2601P 1.0.3.59

Port description: eth0

Time To Live: 81
802.3 MAC/PHY Configuration/Status Auto-negotiation support: Supported
Auto-negotiation status: Enabled

Auto-negotiation Advertised Capabilities: 100BASE-T2 full duplex mode, 100BASE-TX full duplex mode, 100BASE-TX half duplex mode, 10BASE-T full duplex mode, 10BASE-T half duplex mode

Operational MAU type: 100BaseTXFD
802.1 PVID: None

802.1 PPVID:

802.1 VLAN:

802.1 Protocol:
LLDP-MED capabilities: Capabilities, Network Policy, Location, POE-PD, Inventory

LLDP-MED Device Type: Endpoint Class3
LLDP-MED Network policy

Application type: Voice
Flags: tagged VLAN
VLAN ID: 0
Layer 2 priority: 0 DSCP: 41

LLDP-MED Power over Ethernet Device
Type: Powered Device Power source:
From PSE

Power priority: Unknown

Power value: 3.8 Watts
Hardware revision: V1.7A Firmware
revision: 1.0.3.59
Software revision: 1.0.3.59
Serial number: c0:74:ad:b3:6c:58
Manufacturer name: Grandstream Networks, Inc.
Model name: GRP2601
Asset ID: Unknown

Notes & Limitations

- LLDP is by default enable on the device. You can disable it globally and on particular interfaces as per command lines.
- LLDP packets are not encrypted, which means that sensitive information, such as device capabilities and network configurations, could be intercepted by unauthorized users.
- LLDP's scalability can be concerned in very large networks. The more devices there are, the more LLDP packets are generated, which can contribute to network congestion.