802.3da SPMD TF: LLDP overview and use cases

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Background

- Approved Objective 3
  - “Specify an optional PLCA node ID allocation method.”
- Other topics
  - Segment membership list
  - Capabilities exchange
  - Power assignment
- Simplicity goals
  - Limit technical complexity
  - Reuse existing protocols/techniques

Overview

- Use Link Layer Discovery Protocol (LLDP - 802.1AB-2016.pdf) to share attributes between mixing segment members
  - LLDP supports “shared media LANs”
  - LLDP triggers on change or timeout
  - If support is optional, how do we address devices that don’t support LLDP?
  - If support is mandatory, how do we address clause 147 devices?
- Not every device supporting LLDP will support all attributes
- Define state machines and procedures like those in 33.6
- Example information elements
  - MAC address
  - Capabilities (e.g., PLCA, PSE, PD, …)
  - PLCA Node ID
  - Power request (beyond startup power), power allocation
  - <next>

Prior material

- PLCA Node ID Allocation Strawman

  http://www.ieee802.org/3/SPMD/public/apr0820/spmd_nodeid_040820.pdf

Outline

- Discover mixing segment membership (MAC address list) using LLDP (802.1AB)
- nodeId=0 does nodeId allocation
- nodeId allocation method outside scope
- nodeID assignment distribution using LLDP

LLDP Background

LLDP overview - 802.1AB-2016.pdf

https://en.wikipedia.org/wiki/Link_Layer_Discovery_Protocol

Link Layer Discovery Protocol

From Wikipedia, the free encyclopedia

"LLDP" redirects here. For the lying position, see Decubitus.

The **Link Layer Discovery Protocol** (**LLDP**) is a vendor-neutral link layer protocol used by network devices for advertising their identity, capabilities, and neighbors on a local area network based on IEEE 802 technology, principally wired Ethernet.[1] The protocol is formally referred to by the IEEE as *Station and Media Access Control Connectivity Discovery* specified in **IEEE 802.1AB** and **IEEE 802.3 section 6 clause 79**.[2]

LLDP performs functions similar to several proprietary protocols, such as Cisco Discovery Protocol, Foundry Discovery Protocol, Nortel Discovery Protocol and Link Layer Topology Discovery.

LLDP overview - 802.1AB-2016.pdf

https://en.wikipedia.org/wiki/Link_Layer_Discovery_Protocol

Frame structure [edit]

LLDP information is sent by devices from each of their interfaces at a fixed interval, in the form of an Ethernet frame. Each frame contains one LLDP Data Unit (LLDPDU). Each LLDPDU is a sequence of type-length-value (TLV) structures.

The Ethernet frame used in LLDP typically has its destination MAC address set to a special multicast address that 802.1D-compliant bridges do not forward. Other multicast and unicast destination addresses are permitted. The EtherType field is set to 0x88cc.

Each LLDP frame starts with the following mandatory TLVs: *Chassis ID*, *Port ID*, and *Time-to-Live*. The mandatory TLVs are followed by any number of optional TLVs. The frame ends with a special TLV, named *end of LLDPDU* in which both the *type* and *length* fields are 0.

Accordingly, an Ethernet frame containing an LLDPDU has the following structure:

LLDP Ethernet frame structure

Preamble	Destination MAC	Source MAC	Ethertype	Chassis ID TLV	Port ID TLV	Time to live TLV	Optional TLVs	End of LLDPDU TLV	Frame check sequence
	01:80:c2:00:00:0e, or 01:80:c2:00:00:03, or 01:80:c2:00:00:00	Station's address	0x88CC	Type=1	Type=2	Type=3	Zero or more complete TLVs	Type=0, Length=0	

LLDP overview - 802.1AB-2016.pdf

https://en.wikipedia.org/wiki/Link_Layer_Discovery_Protocol

Media endpoint discovery extension [edit]

Media Endpoint Discovery is an enhancement of LLDP, known as **LLDP-MED**, that provides the following facilities:

- Auto-discovery of LAN policies (such as VLAN, Layer 2 Priority and Differentiated services (Diffserv) settings) enabling plug and play networking.
- Device location discovery to allow creation of location databases and, in the case of Voice over Internet Protocol (VoIP), Enhanced 911 services.
- Extended and automated power management of Power over Ethernet (PoE) end points.
- Inventory management, allowing network administrators to track their network devices, and determine their characteristics (manufacturer, software and hardware versions, serial or asset number).

The LLDP-MED protocol extension was formally approved and published as the standard ANSI/TIA-1057 by the Telecommunications Industry Association (TIA) in April 2006.[5]

LLDP & 802.3 – Clause 79

79.3 IEEE 802.3 Organizationally Specific TLVs

The currently defined IEEE 802.3 Organizationally Specific TLVs are listed in Table 79–1. Any additions or changes to these TLVs will be included in this clause.

Table 79–1—IEEE 802.3 Organizationally Specific TLVs

IEEE 802.3 subtype	TLV name	Subclause reference
1	MAC/PHY Configuration/Status	79.3.1
2	Power Via Medium Dependent Interface (MDI)	79.3.2
3	Link Aggregation (deprecated)	79.3.3
4	Maximum Frame Size	79.3.4
5	Energy-Efficient Ethernet	79.3.5
6	EEE fast wake	79.3.6
7	Additional Ethernet Capabilities	79.3.7
8 to 255	Reserved	—

LLDP & 802.3 PoE –Clause 33

33.6 Data Link Layer classification

Additional control and classification functions are supported using Data Link Layer classification using frames based on the IEEE 802.3 Organizationally Specific TLVs defined in Clause 79. Type 2 PDs that require more than 13.0 W support Data Link Layer classification (see 33.3.5). Data Link Layer classification is optional for all other devices.

All reserved fields in transmitted Power via MDI TLVs shall contain zero, and all reserved fields in received Power via MDI TLVs shall be ignored.

33.6.1 TLV frame definition

Implementations that support Data Link Layer classification shall comply with all mandatory parts of IEEE Std 802.1AB-2009; shall support the Power via MDI Type, Length, Value (TLV) defined in 79.3.2; and shall support the control state diagrams defined in 33.6.3.

LLDP elements for 802.3da

Segment Membership

- MAC address TLV
  - Local node MAC address
  - CRC of MAC address table content (consistency check)
- Each node advertises it’s MAC address, and a CRC of the ordered segment MAC address table (convergence check)

Capability Exchange

- Capabilities TLV
  - Bit list – PLCA, PSE, PD, <next>
- Each node advertises its capabilities, and a CRC of the ordered segment capabilities table (convergence check)
- Use 79.3.7.2 Additional Ethernet Capabilities TLV?

PLCA Node ID Exchange

- PLCA Current Node ID TLV
  - Current Node ID
  - Static/dynamic flag (is nodeID configured)
- PLCA Assigned Node ID TLV
  - Sent by NodeID = 0
  - MAC address
  - Node ID
  - Static/dynamic flag

Power Exchange

- Need to review 33.6 in detail, reuse concepts/approaches as much as possible
- PSE capabilities
  - Maximum power supported
  - Current power allocated
- PD requests
  - Power required
  - Power desired
- PSE Allocations (per PD)
  - Power allocated

Summary

- LLDP is an existing 802.1 protocol and is widely implemented
- 802.3 already includes multiple uses of LLDP
- LLDP infrastructure can be reused for exchanging multiple different types of information
- We should reuse LLDP instead of designing something new

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