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LSVR IETF Organizationally Specific TLVs for IEEE Std 802.1AB (LLDP)
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Abstract

IEEE Std 802.1AB, commonly known as the Link Layer Discovery Protocol (LLDP), provides a means for individual organizations to define their own Type-Length-Value (TLV) objects for exchange over the protocol. The IETF is a standards development organization with an IANA OUI (RFC 7042) that can be used in LLDP organizationally specific TLVs. This document specifies IETF Organizationally Specific TLVs that support LSVR protocols.

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1. Introduction

IEEE Std 802.1AB [802.1AB], commonly known as the Link Layer Discovery Protocol (LLDP), provides a means for individual organizations to define their own Type-Length-Value (TLV) objects for exchange over the protocol. TLVs that belong to an organization are identified by the inclusion of the organization's OUI and an organizationally defined subtype in the initial octets of the information field.

The IETF is a standards development organization with an IANA OUI. The usage and considerations for this OUI are discussed in [RFC7042]. The IANA OUI can be used in LLDP organizationally specific TLVs.

The LSVR working group is specifying protocols that need to discover IP Layer 3 attributes about links, encapsulations and neighbors. This document specifies IETF Organizationally Specific TLVs that

carry the necessary discovery attributes for LSVR working group protocols.

The IEEE 802 recently approved project P802.1ABdh [802.1ABdh] to amend LLDP with the ability to transmit and receive a set of TLVs that exceed the space available in a single frame. Among other objectives, this project is intended to allow LLDP to better suit the needs of LSVR and other IETF working groups.

2. Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

In this document, these words will appear with that interpretation only when in ALL CAPS. Lower case uses of these words are not to be interpreted as carrying significance described in RFC 2119.

3. Abbreviations

LLDP - The Link Layer Discovery

TLV - Type-Length-Value

4. LLDP Organizationally Specific TLVs

IEEE Std 802.1AB defines the format of the organizationally specific TLVs. The format is redrawn here for convenience.

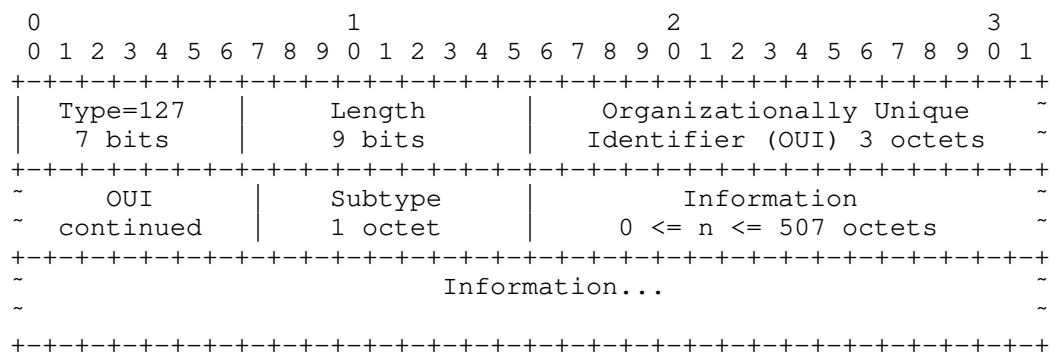


Figure 1 LLDP Organizationally Specific TLV Format

4.1. Type

The Type field is 7 bits in length and is set to the value of 127 indicating the TLV type is an Organizationally Specific TLV.

4.2. Length

The Length field contains the length of the TLV specific information, the OUI and subtype. The Length is from 4 to 511 octets.

4.3. Organizationally Unique Identifier

The Organizationally Unique Identifier indicates the organization specifying the TLV. For IETF use, this field is the IANA OUI as discussed in RFC 7042 and has the hex value of 00-00-5E.

4.4. Subtype

The Subtype field indicates the specific IETF Organizationally Specific TLV. The format of the information string is dependent upon the Subtype field. The following subtypes have been defined:

Subtype	Name
-----	-----
0	Logical Link Endpoint Identifier Attributes
1	IPv4 Announcement
2	IPv6 Announcement
3	MPLS IPv4 Announcement
4	MPLS IPv6 Announcement
5-255	Reserved

The specific TLV format for each subtype is defined in section 5.

4.5. Information

The Information field contains the octets that are specific to the Organizationally Specific TLV. The field length is between 0 and 507 octets.

5. IETF Organizationally Specific TLVs

This section defines the format for the IETF Organizationally Specific TLVs. The contents of the TLVs are modeled after the TLV PDUs of the L3DL protocol specified by the LSVR working group in [I-D.ietf-lsvr-l3dl].

Each TLV definition starts with the same first four fields that are described once here. The Type field SHALL be 127; the Length field SHALL be the length in octets of the LLDP TLV information string which starts immediately after the Length field; the OUI field SHALL be 00-00-0E and the Subtype field SHALL be one of the named values shown in the table of Section 4.4. The remaining fields of each TLV are specified in the section for the IETF Organizationally Specific TLV.

5.1. Logical Link Endpoint Identifier Attributes TLV

The Logical Link Endpoint Identifier (LLEI) Attributes TLV carries an LLEI and a list of operator-defined attributes. An LLEI is a variable length descriptor which is unique to a single logical link endpoint in the topology. An LLEI and its use in discovering a logical link are defined in [I-D.ietf-lsvr-l3dl].

A router or switch supporting LSVR protocols MAY include the Logical Link Endpoint Identifier Attributes TLV in LLDPDU transmissions. The format of the Logical Link Endpoint Identifier Attributes TLV is shown in Figure 2.

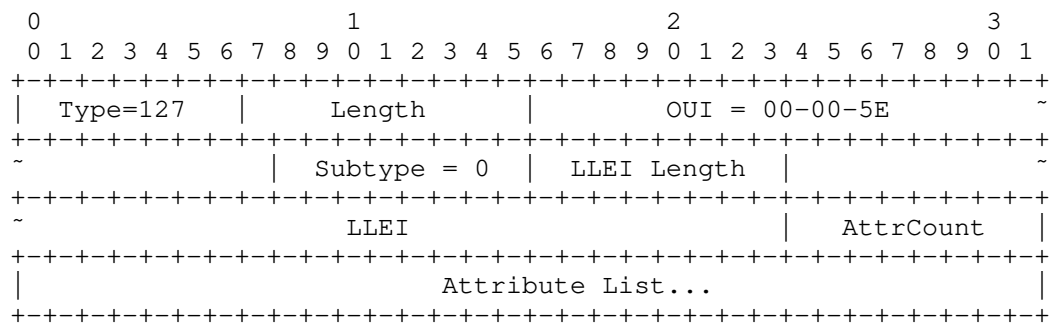


Figure 2 Logical Link Endpoint Identifier Attributes TLV

5.1.1. LLEI Length

The LLEI Length is 1 octet and specifies the length in octets of the LLEI field. The LLEI Length MUST NOT be 0.

5.1.2. LLEI

The LLEI is the variable length descriptor which is unique to a single logical link endpoint in the topology. Possible formats for the LLEI are discussed in [I-D.ietf-lsvr-l3dl].

5.1.3. AttrCount

The AttrCount field is 1 octet and specifies the number of attributes in the Attribute List. If there are no attributes in the Attribute List, then AttrCount SHALL be 0.

5.1.4. Attribute List

The Attribute List is a sequence of single octets, the syntax and semantics of which are local to an operator or datacenter.

5.1.5. Logical Link Endpoint Identifier TLV usage rules

An LLDPDU SHOULD contain at most one Logical Link Endpoint Identifier Attributes TLV for each unique LLEI operating on a physical port.

5.2. IPv4 Announcement TLV

The IPv4 Announcement TLV describes a device's ability to exchange IPv4 packets on one or more subnets. It does so by announcing the interface's addresses and the corresponding prefix lengths. Multiple tuples of IPv4 address information can be announced in a single TLV, each tuple with its own set of encapsulation flags, address and prefix length. The format of the IPv4 Announcement TLV is as follows:

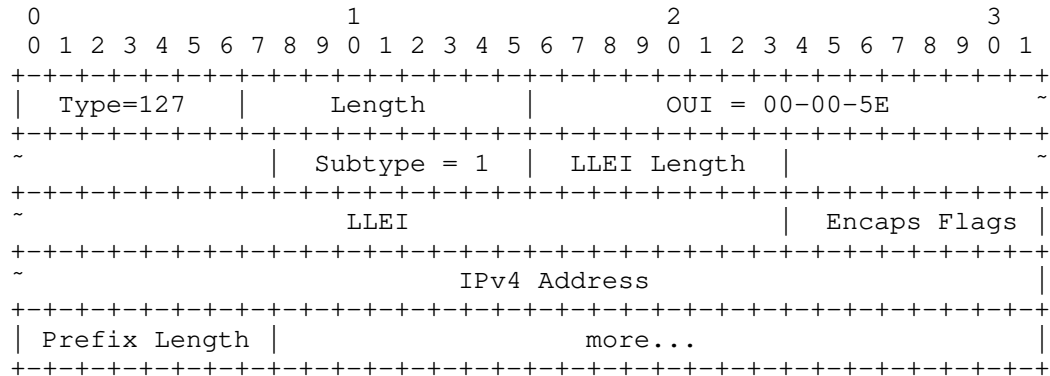


Figure 3 IPv4 Announcement TLV

5.2.1. LLEI Length

The LLEI Length is the same as specified in section 5.1.1.

5.2.2. LLEI

The LLEI is the same as specified in section 5.1.2.

5.2.3. Encaps Flags

The Encaps Flags specify attributes about the IPv4 address being announced and are compatible with the Encapsulation Flags defined [I-D.ietf-lsvr-l3dl]. The Encaps Flags have the following format:

0	1	2	3	4 ... 7
Announce	Primary	Under/Over	Loopback	Reserved

Figure 4 Encapsulation Flags

5.2.3.1. Announce

The Announce flag bit SHALL always be set to 1. [I-D.ietf-lsvr-l3dl] defines this bit as an Announce/Withdraw bit to allow encapsulations to be both announced and withdrawn by the L3DL protocol. Old encapsulations are withdrawn in LLDP by simply excluding them in the next transmission of an LLDPDU.

5.2.3.2. Primary

The Primary flag bit indicates that the encapsulation interface is a primary interface. The value of 1 indicates the interface is primary and the value of 0 indicates it is not. If the LLEI has multiple addresses for an encapsulation type, one and only one address SHOULD be marked as primary.

5.2.3.3. Under/Over

The Under/Over flag bit indicates if the interface address is for an underlay interface or an overlay interface. The value of 1 indicates the interface is an underlay and the value of 0 indicates it is an overlay.

5.2.3.4. Loopback

The Loopback flag bit indicates if the interface address is a loopback address. Loopback addresses are generally not seen directly on an external interface. One or more loopback addresses MAY be announced. The value of 1 indicates that the interface

address is a loopback address and the value of 0 indicates it is not.

5.2.4. IPv4 Address

The IPv4 Address field holds the IPv4 address to be announced.

5.2.5. Prefix Length

The Prefix Length field indicates the number of bits in the IPv4 Address that represent the IPv4 prefix for the subnet (network portion of the address).

5.2.6. IPv4 Announcement TLV usage rules

An LLDPDU MAY contain multiple IPv4 Announcement TLVs, however, the encapsulation flags, IPv4 address and prefix length tuple for a specific IPv4 address MUST only appear once in the LLDPDU.

5.3. IPv6 Announcement TLV

The IPv6 Announcement TLV describes a device's ability to exchange IPv6 packets on one or more subnets. It does so by announcing the interface's addresses and the corresponding prefix lengths. Multiple tuples of IPv6 address information can be announced in a single TLV, each tuple with its own set of encapsulation flags, address and prefix length. The format of the IPv6 Announcement TLV is as follows:

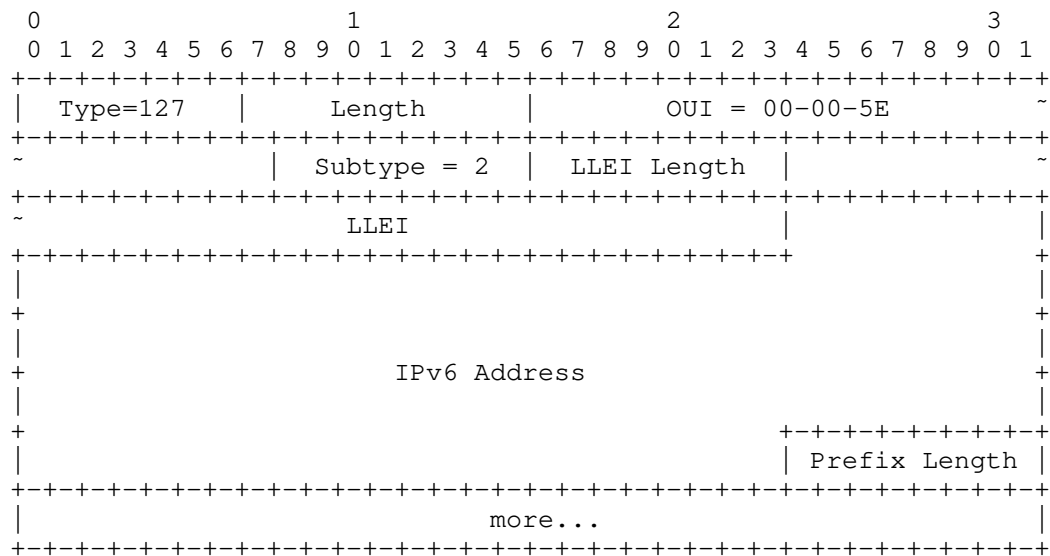


Figure 5 IPv6 Announcement TLV

5.3.1. LLEI Length

The LLEI Length is the same as specified in section 5.1.1.

5.3.2. LLEI

The LLEI is the same as specified in section 5.1.2.

5.3.3. Encaps Flags

The Encaps Flags are the same flags specified in section 5.2.3

5.3.4. IPv6 Address

The IPv6 Address field holds the IPv6 address to be announced.

5.3.5. Prefix Length

The Prefix Length field indicates the number of bits in the IPv6 Address that represent the IPv6 prefix for the subnet (network portion of the address).

5.3.6. IPv6 Announcement TLV usage rules

An LLDPDU MAY contain multiple IPv6 Announcement TLVs, however, the encapsulation flags, IPv6 address and prefix length tuple for a specific IPv6 address MUST only appear once in the LLDPDU.

5.4. MPLS IPv4 Announcement TLV

The MPLS IPv4 Encapsulation describes a logical link's ability to exchange labeled IPv4 packets on one or more subnets. It does so by stating the interface's addresses the corresponding prefix lengths, and the corresponding labels which will be accepted for each address. The format of the MPLS IPv4 Announcement TLV is as follows:

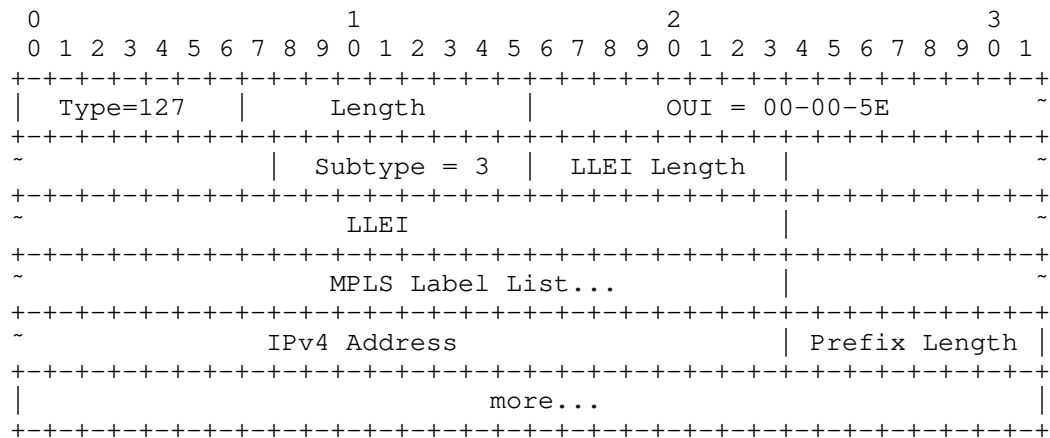


Figure 6 MPLS IPv4 Announcement TLV

5.4.1. LLEI Length

The LLEI Length is the same as specified in section 5.1.1.

5.4.2. LLEI

The LLEI is the same as specified in section 5.1.2.

5.4.3. Encaps Flags

The Encaps Flags are the same flags specified in section 5.2.3

5.4.4. MPLS Label List

The MPLS Label List is a variable length field that contains the label stack, see [RFC3032], that the sender will accept for the prefix to which the list is attached. The format of the MPLS Label List is as follows:

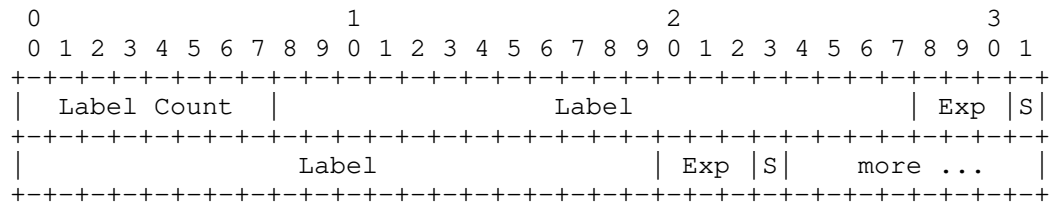


Figure 7 MPLS Label List

5.4.4.1. Label Count

The number of label stack entries that are included in the list. Each label stack entry has a label, experimental use bits and the bottom of stack indicator. The Label Count MUST NOT be 0.

<<Editor's note: We really don't need this count because the S bit indicates when the list ends>>

5.4.4.2. Label

The Label field is the 20-bit value of the label.

5.4.4.3. Exp

The Exp field is a 3-bit value reserved for experimental use.

5.4.4.4. S

The S field is a single bit that indicates the last entry in the label stack. The bit is set to 1 for the last entry and 0 for all other entries in the list.

5.4.5. IPv4 Address

The IPv4 Address field holds the IPv4 address to be announced.

5.4.6. Prefix Length

The Prefix Length field indicates the number of bits in the IPv4 Address that represent the IPv4 prefix for the subnet (network portion of the address).

5.4.7. IPv4 Announcement TLV usage rules

An LLDPDU MAY contain multiple MPLS IPv4 Announcement TLVs, however, the encapsulation flags, label list, IPv4 address and prefix length tuple for a specific IPv4 address MUST only appear once in the LLDPDU.

5.5. MPLS IPv6 Announcement TLV

The MPLS IPv6 Encapsulation describes a logical link's ability to exchange labeled IPv6 packets on one or more subnets. It does so by stating the interface's addresses the corresponding prefix lengths, and the corresponding labels which will be accepted for each address. The format of the MPLS IPv6 Announcement TLV is as follows:

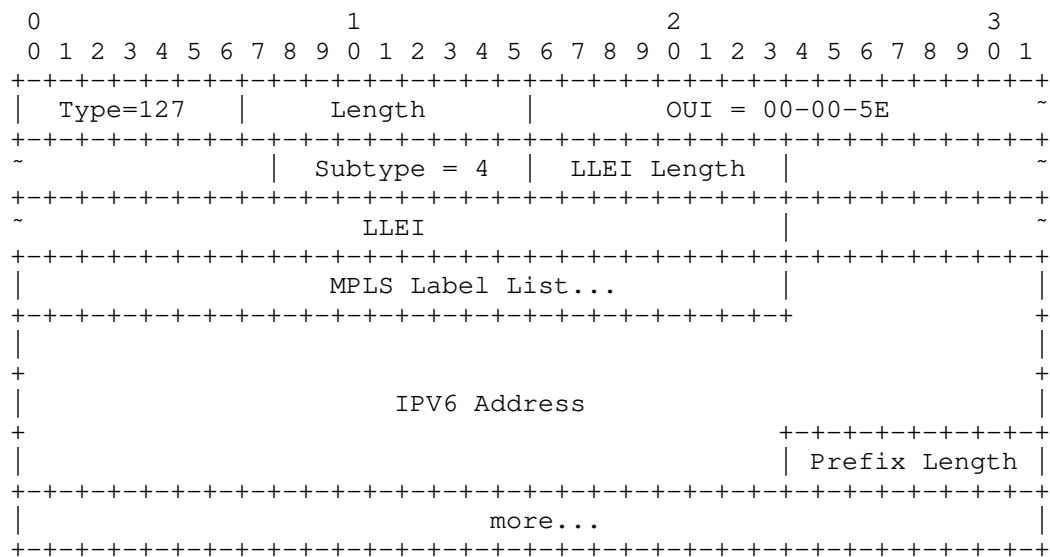


Figure 8 MPLS IPv6 Announcement TLV

5.5.1. LLEI Length

The LLEI Length is the same as specified in section 5.1.1.

5.5.2. LLEI

The LLEI is the same as specified in section 5.1.2.

5.5.3. Encaps Flags

The Encaps Flags are the same flags specified in section 5.2.3

5.5.4. MPLS Label List

The MPLS Label List is the same as specified in section 5.4.4

5.5.5. IPv6 Address

The IPv6 Address field holds the IPv6 address to be announced.

5.5.6. Prefix Length

The Prefix Length field indicates the number of bits in the IPv6 Address that represent the IPv6 prefix for the subnet (network portion of the address).

5.5.7. MPLS IPv6 Announcement TLV usage rules

An LLDPDU MAY contain multiple MPLS IPv6 Announcement TLVs, however, the encapsulation flags, label list, IPv6 address and prefix length tuple for a specific IPv6 address MUST only appear once in the LLDPDU.

6. Security Considerations

<Add any security considerations>

7. IANA Considerations

<Add any IANA considerations>

8. Conclusions

<Add any conclusions>

9. References

9.1. Normative References

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https://standards.ieee.org/project/802_1ABdh.html

10. Acknowledgments

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