

**DLEP Link Identifier Extension**  
**draft-ietf-manet-dlep-lid-extension-04**

Abstract

There exists a class of modems that would benefit from supporting the Dynamic Link Exchange Protocol (DLEP) [[RFC8175](#)] but do not present a single Layer 2 network domain as required by DLEP. Such devices may be:

- o Modems that maintain a varying link to some upstream backbone network infrastructure, where the ability to announce link state and DLEP metrics is desired, but the concept of a DLEP destination router for the backbone does not apply. Examples of such devices can include LTE modems, IEEE 802.11 stations not in ad-hoc mode, and some satellite terminals.
- o Modems that provide Layer 3 wide area network connectivity between devices, where remote DLEP destinations do exist, but are not directly reachable by MAC address, such as modems that contain embedded routing functionality.

This document introduces an optional extension to the core DLEP specification, allowing DLEP to be used between routers and modems that operate in this way.

Note:

- o This document is intended as an extension to the core DLEP specification, and readers are expected to be fully conversant with the operation of core DLEP.

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## [1.](#) Introduction

The Dynamic Link Exchange Protocol (DLEP) [[RFC8175](#)] describes a protocol for modems to advertise the status of wireless links between reachable destinations to attached routers. The core specification of the protocol assumes that every modem in the radio network has an attached DLEP router, and requires that the MAC address of the DLEP interface on the attached router is used to identify the destination



in the network for purposes of reporting the state and quality of the link to that destination.

This document describes a DLEP Extension allowing modems that do not meet the strict requirement that DLEP must be implemented on a single Layer 2 domain to use DLEP to describe link availability and quality to one or more destinations reachable beyond a local or remote device on the Layer 2 domain. A router can use this knowledge to influence any routing or flow-control decisions regarding traffic to this destination, understanding that such traffic flows via Layer 3.

A Layer 3 destination may be an attached DLEP router, in the case of a modem that provides Layer 3 wide area network connectivity between devices, or a logical destination that describes a set of attached subnets, when referring to some upstream backbone network infrastructure.

### **1.1. Requirements**

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 [BCP 14](#), [RFC 2119](#).

## **2. Operation**

To refer to a Layer 3 DLEP Destination, the DLEP session participant adds a Link Identifier Data Item ([Section 3.2](#)) to the relevant Destination Message, and (as usual) includes a MAC Address Data Item. When paired with a Link Identifier Data Item, the MAC Address Data Item MUST contain the MAC address of the last reachable node in the Layer 2 domain beyond which the Layer 3 DLEP Destination resides. For example, if the over-the-air network is not a single Layer 2 domain, the MAC Address Data Item might be the address of the LAN-side interface of the local modem. Alternatively, when used with some kind of backbone infrastructure, the MAC Address Data Item would be the address of the last device reachable on the local Layer 2 domain. However, how such remote destinations are discovered is beyond the scope of this specification.

As only modems are initially aware of Layer 3 DLEP Destinations, Link Identifier Data Items referring to a new link MUST first appear in a DLEP Destination Up Message from the modem to the router. Once a link has been identified in this way, Link Identifier Data Items MAY be used by either DLEP participant during the lifetime of a DLEP session. Because of this, a router MUST NOT send a DLEP Destination Announce Message containing a Link Identifier Data Item referring to a link that has not been mentioned in a prior DLEP Destination Up Message.



Because the MAC Address associated with any DLEP Destination Message containing a Link Identifier Data Item is not the Layer 2 address of the destination, all DLEP Destination Up Messages MUST contain Layer 3 information. In the case of modems that provide Layer 3 wide area network connectivity between devices, this means one or more IPv4 or IPv6 Address Data Items providing the Layer 3 address of the destination. When referring to some upstream backbone network infrastructure, this means one or more IPv4 or IPv6 Attached Subnet Data Items, for example: '0.0.0.0/0' or ':::/0'. This allows the DLEP peer router to understand the properties of the link to those routes.

When the DLEP peer router wishes to forward packets to the Layer 3 destination or subnet, the MAC address associated with the link MUST be used as the Layer 2 destination of the packet if it wishes to use the modem network to forward the packet.

As most mainstream routers expect to populate their routing information base with the IP address of the next router towards a destination, implementations supporting this extension SHOULD announce one or more valid IPv4 or IPv6 addresses of the last reachable Layer 2 device, i.e. the device with the corresponding MAC Address.

If the last reachable Layer 2 device is not the DLEP peer modem, then the modem SHOULD announce a DLEP Destination with the required MAC Address without including a Link Identifier Data Item.

## **2.1. Identifier Restrictions**

A Link Identifier is by default 4 octets in length. If a modem wishes to use a Link Identifier of a different length, it MUST be announced using the Link Identifier Length Data Item ([Section 3.1](#)) contained in the DLEP Session Initialization Response message sent by the modem to the router.

During the lifetime of a DLEP session, the length of Link Identifiers MUST remain constant, i.e. the Length field of the Link Identifier Data Item MUST NOT differ between destinations.

The method for generating Link Identifiers is a modem implementation matter and out of scope of this document. Routers MUST NOT make any assumptions about the meaning of Link Identifiers, or how Link Identifiers are generated.

Within a single DLEP session, all Link Identifiers MUST be unique per MAC Address. This means that a Layer 3 DLEP Destination is uniquely identified by the pair: {MAC Address, Link Identifier}.



Link Identifiers MUST NOT be reused, i.e. a {MAC Address, Link Identifier} pair that has been used to refer to one DLEP Destination MUST NOT be recycled to refer to a different destination within the lifetime of a single DLEP session.

## **2.2. Negotiation**

To use this extension, as with all DLEP extensions, the extension MUST be announced during DLEP session initialization. A router advertises support by including the value 'Link Identifiers' (TBD1), [Section 5](#), in the Extension Data Item within the Session Initialization Message. A modem advertises support by including the value 'Link Identifiers' (TBD1) in the Extension Data Item within the Session Initialization Response Message. If both DLEP peers advertise support for this extension then the Link Identifier Data Item MAY be used.

If a modem requires support for this extension in order to describe destinations, and the router does not advertise support, then the modem MUST NOT include a Link Identifier Data Item in any DLEP Message. However, the modem SHOULD NOT immediately terminate the DLEP session, rather it SHOULD use session-wide DLEP Data Items to announce general information about all reachable destinations via the modem. By doing this, a modem allows a router not supporting this extension to at least make a best guess at the state of any reachable network. A modem MUST NOT attempt to re-use the MAC Address Data Item to perform some kind of sleight-of-hand, assuming that the router will notice the DLEP Peer Type of the modem is special in some way.

## **3. New Data Items**

This extension introduces two new DLEP Data Items: the Link Identifier Data Item ([Section 3.2](#)) used to identify a Layer 3 link at or beyond a destination, and the Link Identifier Length Data Item ([Section 3.1](#)) used to announce the length of Link Identifiers at session initialization.

### **3.1. Link Identifier Length Data Item**

The Link Identifier Length Data Item is used by a DLEP modem implementation to specify the length of Link Identifier Data Items. It MUST be used if the specified length is not the default value of 4 octets.

The Link Identifier Length Data Item MAY be used during Session Initialization, contained in a Session Initialization Response Message.





```

      0                   1                   2                   3
      0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Data Item Type                               | Length                |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Link Identifier Length                       |
+---+---+---+---+---+---+---+---+---+---+---+---+

```

Data Item Type: TBD2, [Section 5](#)

Length: 2

Link Identifier Length: The length, in octets, of Link Identifiers used by the DLEP modem for this session.

### 3.2. Link Identifier Data Item

The Link Identifier Data Item MAY be used wherever a MAC Address Data Item is defined as usable in core DLEP.

```

      0                   1                   2                   3
      0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Data Item Type                               | Length                |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Link Identifier...                               :
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

Data Item Type: TBD3, [Section 5](#)

Length: The length of the Data Item, by default 4, but may be different if a Link Identifier Length Data Item ([Section 3.1](#)) has been announced during session initialization.

Link Identifier: The unique identifier of the Layer 3 destination. This Link Identifier has no implicit meaning and is only used to discriminate between multiple links.

## 4. Security Considerations

As an extension to the core DLEP protocol, the security considerations of that protocol apply to this extension. This extension adds no additional security mechanisms or features.

None of the features introduced by this extension require extra consideration by an implementation.



## 5. IANA Considerations

Upon approval of this document, IANA is requested to:

- o Assign a new DLEP Extensions Registry value (TBD1) from the Specification Required section, named "Link Identifiers".
- o Assign a new DLEP Data Item Type Values Registry value (TBD2) from the Specification Required section, named "Link Identifier Length".
- o Assign a new DLEP Data Item Type Values Registry value (TBD3) from the Specification Required section, named "Link Identifier".

## 6. References

### 6.1. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), DOI 10.17487/RFC2119, March 1997, <<https://www.rfc-editor.org/info/rfc2119>>.
- [RFC8175] Ratliff, S., Jury, S., Satterwhite, D., Taylor, R., and B. Berry, "Dynamic Link Exchange Protocol (DLEP)", [RFC 8175](#), DOI 10.17487/RFC8175, June 2017, <<https://www.rfc-editor.org/info/rfc8175>>.

### 6.2. Informative References

- [RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", [RFC 5226](#), DOI 10.17487/RFC5226, May 2008, <<https://www.rfc-editor.org/info/rfc5226>>.

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