

**Link Identifier Extension to DLEP**  
**draft-dlep-lid-02**

**Abstract**

There exists a class of modems that wish to support 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 individual DLEP destinations do exist, but are not directly reachable by MAC address.

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.

To enable devices to take advantage of the DLEP protocol this extension adds a single enhancement: A new Link Identifier Data Item ([Section 3](#)).

### **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](#) [[RFC2119](#)].

## **2. Operation**

To refer to a Layer 3 DLEP Destination, the DLEP session participant adds a Link Identifier Data Item ([Section 3](#)) 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 describes the MAC address of the node in the network beyond which the Layer 3 DLEP Destination resides. The MAC address MAY belong to the DLEP peer modem, if the over-the-air network is not a single Layer 2 domain, or MAY be the MAC address of a remote node in the Layer 2 domain that has indicated that it has DLEP Destinations reachable beyond it. 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.

### **2.1. Identifier Restrictions**

A Link identifier is 4 octets in length. The method for generating identifiers is a modem implementation matter and out of scope of this document. Routers MUST NOT make any assumptions about the meaning of identifiers, or how 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 Id}.

Identifiers MUST NOT be reused, i.e. a {MAC Address, Link Id} pair that has been used to refer to one 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. 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                     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|  Flags                                     | Link Identifier...                |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

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

Length: 5

Flags: Flags field, defined below.

Link Identifier: The 4 octet unique identifier of the Layer 3 destination. This identifier has no implicit meaning and is only used to discriminate between multiple links.

The Flags field is defined as:

```

      0 1 2 3 4 5 6 7
+---+---+---+---+---+---+
|   Reserved   |
+---+---+---+---+---+---+

```

Reserved: MUST be zero. Left for future assignment.

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

### 5.1. DLEP Link Identifier Flag

Upon approval of this document, IANA is requested to create a new DLEP registry, named "Link Identifier Flags".

The following table provides initial registry values and the [RFC5226] defined policies that should apply to the registry:

+-----+	+-----+	+-----+
Bit	Description/Policy	
+-----+	+-----+	+-----+
0-7	Unassigned/Specification Required	
+-----+	+-----+	+-----+

## 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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