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Link Identifier Extension to DLEP
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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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Table of Contents

1.	Introduction	2
1.1.	Requirements	3
2.	Operation	3
2.1.	Identifier Restrictions	4
2.2.	Negotiation	4
3.	New Data Items	5
3.1.	Link Identifier Length Data Item	5
3.2.	Link Identifier Data Item	6
4.	Security Considerations	6
5.	IANA Considerations	7
5.1.	DLEP Link Identifier Flag	7
6.	References	7
6.1.	Normative References	7
6.2.	Informative References	7
	Authors' Addresses	8

[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.

2.1. Identifier Restrictions

A link identifier is by default 4 octets in length. If a modem wishes to use an 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 alter between destinations.

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

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 |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Flags | Link Identifier... |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

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

Length: The length of the Data Item, by default 5, but may be different if a Link Identifier Length Data Item ([Section 3.1](#)) has been announced during session initialization.

Flags: Flags field, defined below.

Link Identifier: The 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 Length".
- o Assign a new value (TBD3) 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 [RFC 5226](#) 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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