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DLEP Radio Channel Utilization Extension
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Abstract

This document defines an extension to the Dynamic Link Exchange Protocol (DLEP) to provide the utilization of a radio channel.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

The Dynamic Link Exchange Protocol (DLEP) is defined in [RFC8175]. It provides the exchange of link-related control information between DLEP peers. DLEP peers are comprised of a modem and a router. DLEP defines a base set of mechanisms as well as support for possible extensions. This document defines one such extension. Radio channel utilization provides a packet/frame independent measurement how a radio channel is used and how much resources are still available. While incoming and outgoing traffic can be easily measured on the router, the amount of airtime used by management traffic of the radio is invisible to the router, as is unicast traffic between two adjecant radios (unless the radio supports promiscous mode). This could present the a fully utilized radio channel to the router as totally empty. Getting a direct radio level information how much time on the radio channel has been used up by incoming or outgoing data or control frames allows a router to calculate a better routing metric or allows management agents to detect a channel being unusable for communication because of external jamming.

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

2. Extension Usage and Identification

The use of the Channel Utilization Extension SHOULD be configurable. To indicate that the Channel Utilization Extension is to be used, an implementation MUST include the Radio Channel Utilization Extension ID in the Extensions Supported Data Item. The Extensions Supported Data Item is sent and processed according to [RFC8175].

The Channel Utilization TLVs can be used by the router to improve the tracking of channel usage by different radios and give a more exact estimate how much free capacity the channel has currently. This information can be used for adjusting timing intervals between automatically generated data, e.g. HELLO messages of the local routing protocol.

All four Data Items are 64 bit unsigned integers time measurements in nanoseconds since an arbitrary starting point, e.g. the radio bootup. Each value monotonically increases for the entire duration of the DLEP session; they are never reset.

Each of the four data items tracks the time the radio is in a certain type of operation.

Type	Description
Active	Time the radio has been operational and able to interact with the channel
Busy	Time the radio channel was blocked for an arbitrary reason
RX	Time the radio was receiving data
TX	Time the radio was transmitting data

Table 1: Channel utilization data types

A radio that doesn’t track the time for receiving (RX) and transmitting (TX) data explicitly MUST add all time intervals the radio channel is not free into the Radio Channel Busy Data Item.

The time the radio channel has been free can be calculated by substracting the values of Busy, Rx and Tx from the value provided by the Radio Active Channel Data Item. By tracking these values over time the router can calculate the channel usage statistics for routing metrics or report the received value to a management layer.

A radio that is using independent channel resources for each neighbor (e.g. by beam forming) can also track and report channel usage time for each DLEP neighbor.

3. Data Items

All four Data Items of this extension can be used both as Session specific and Destination specific metrics. If the radio is only tracking channel usage on the interface level, the Data Items are used in SessionInitResponse and SessionUpdate messages. If the radio also is tracking channel usage for each Destination, they are also used in DestinationUp, DestinationUpdate and DestinationAnnounceResponse messages.

All four Data Items contain a single 64 bit unsigned integer time interval measured in nanoseconds as the TLV value.

3.1. Radio Channel Active Data Item

Radio Channel Active Item contains information how long the radio channel has been active. This provides the router with a reference to interpret the values provided by the other three Data Items. Because of this the value in this item must be larger than the values in the other three Data Items this extensions defines together.

This Data Item is mandatory for SessionInitResponse messages.

The format of the Radio Channel Active Data Item is:

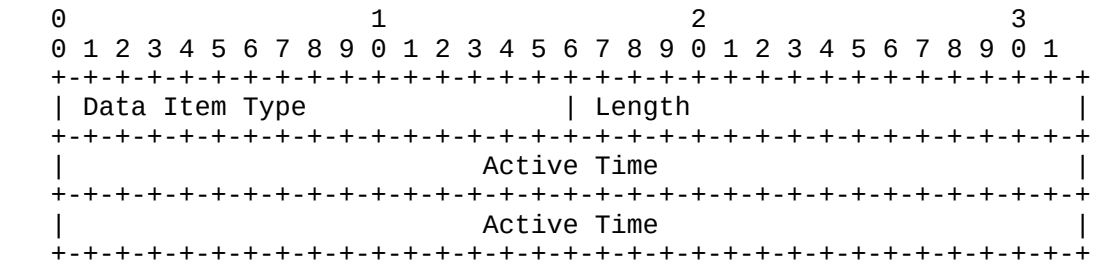

Figure 1

Data Item Type: TBD1

Length: 8

Active Time: Time in nanoseconds since the channel has been in use.

3.2. Radio Channel Busy Data Item

Radio Channel Busy Item contains information how much time the radio channel has been busy, not including the time provided in the Channel Rx and Chanel Tx Data Item.

The format of the Radio Channel Busy Data Item is:

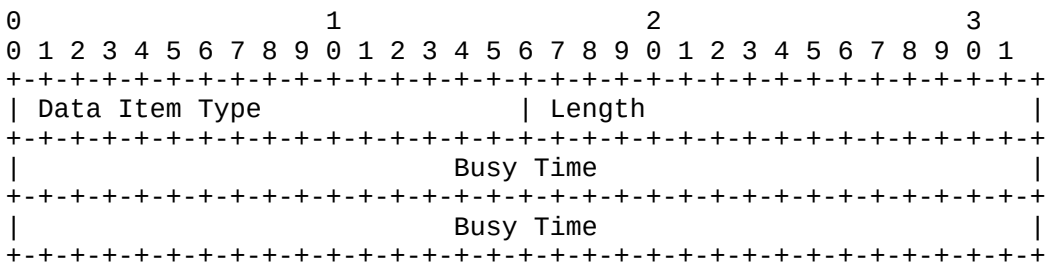

Figure 2

Data Item Type: TBD2

Length: 8

Busy Time: Time in nanoseconds the channel was busy during its active time.

3.3. Radio Channel Rx Data Item

Radio Channel Rx Item contains information how much time the local radio has been receiving data from other radios.

The format of the Radio Channel Rx Data Item is:

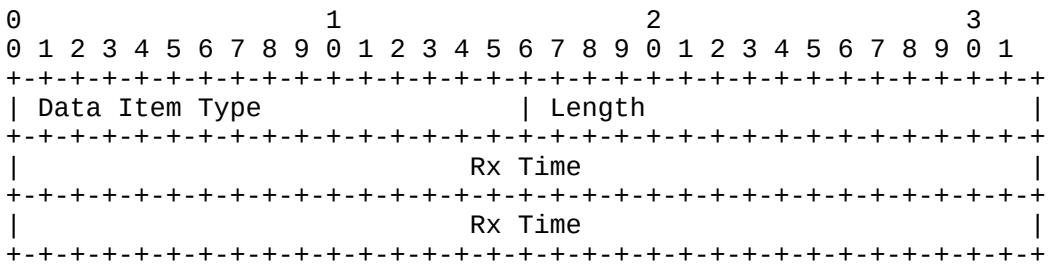

Figure 3

Data Item Type: TBD3

Length: 8

Rx Time: Time in nanoseconds the local radio has received data from other radios during its active time.

3.4. Radio Channel Tx Data Item

Radio Channel Tx Item contains information how much time the local radio has been transmitting data to other radios.

The format of the Radio Channel Tx Data Item is:

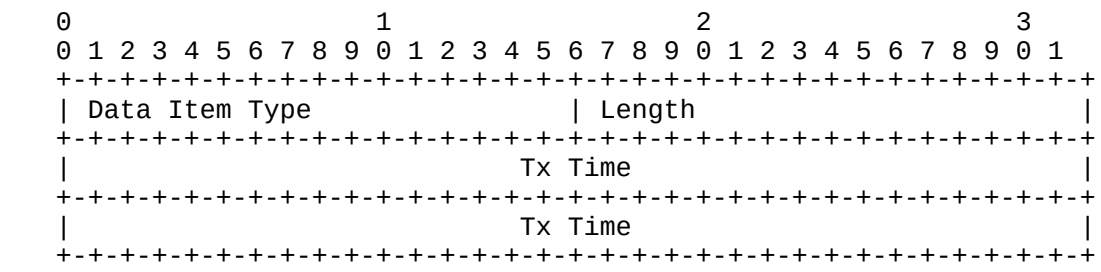

Figure 4

Data Item Type: TBD4

Length: 8

Tx Time: Time in nanoseconds the local radio has transmitted data to other radios during its active time.

4. Security Considerations

The extension introduces a new Data Item for DLEP. The extension does not inherently introduce any additional vulnerabilities above those documented in [RFC8175]. The approach taken to security in that document applies equally when running the extension defined in this document.

5. IANA Considerations

As described below, IANA has assigned two values per this document. Both assignments are to registries defined by [RFC8175].

5.1. Extension Type Value

IANA has assigned the following value in the "Extension Type Values" registry within the "Dynamic Link Exchange Protocol (DLEP) Parameters" registry. The new value is in the range with the "Specification Required" [RFC8126] policy:

Code	Description
TBD5	Radio Channel Utilization

Table 2: New Extension Type Value

5.2. Data Item Value

IANA has assigned the following value in the "Data Item Type Values" registry within the "Dynamic Link Exchange Protocol (DLEP) Parameters" registry. The new value is in the range with the "Specification Required" [RFC8126] policy:

Type Code	Description
TBD1	Radio Channel Active
TBD2	Radio Channel Busy
TBD3	Radio Channel Rx
TBD4	Radio Channel Tx

Table 3: New Data Item Value

6. 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>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <https://www.rfc-editor.org/info/rfc8174>.

[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>.

7. Informative References

[RFC8126] Cotton, M., Leiba, B., and T. Narten, "Guidelines for Writing an IANA Considerations Section in RFCs", BCP 26, RFC 8126, DOI 10.17487/RFC8126, June 2017, <https://www.rfc-editor.org/info/rfc8126>.

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