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DLEP Radio Channel Utilization Extension

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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   This Internet-Draft will expire on 8 September 2022.

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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

In many IETF documents, several words, when they are in all capitals
as shown below, are used to signify the requirements in the
specification. These capitalized words can bring significant clarity
and consistency to documents because their meanings are well
defined. This document defines how those words are interpreted in
IETF documents when the words are in all capitals.

   *These words can be used as defined here, but using them is not
    required. Specifically, normative text does not require the use

of these key words. They are used for clarity and consistency
when that is what's wanted, but a lot of normative text does not
use them and is still normative.

*The words have the meanings specified herein only when they are
in all capitals.

*When these words are not capitalized, they have their normal
English meanings and are not affected by this document.

Authors who follow these guidelines should incorporate this phrase
near the beginning of their document: 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].

All four Data Items are time measurements in nanoseconds since an
arbitrary starting point, e.g. the radio bootup. They are never
reseted and will just increase monotonic.

The first Data Item (Radio Channel Active) announces the channels
livetime of the radio channel while the other three provide the
amount of time the channel has been used in different ways. Radio
Channel Rx provides the time the radio is receiving data, Radio
Channel Tx the time the radio is sending data and Radio Channel Busy
the time the radio channel is blocked for any unknown reason.

A radio that doesn't track the time for receiving and transmitting
data explicitly can just add all times 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 statistics on the channel usage for
routing metrics or report the received value to a management layer.

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 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.

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:

```
 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                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Active Time                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Active Time                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
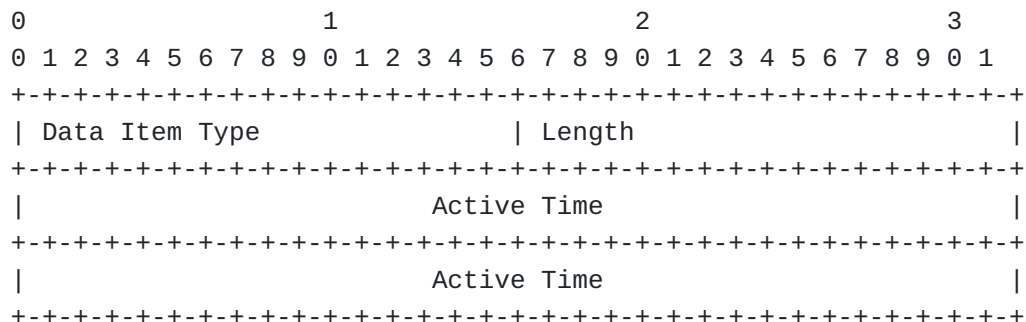
Figure 1

Data Item Type: TBD

Length: 8

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

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.

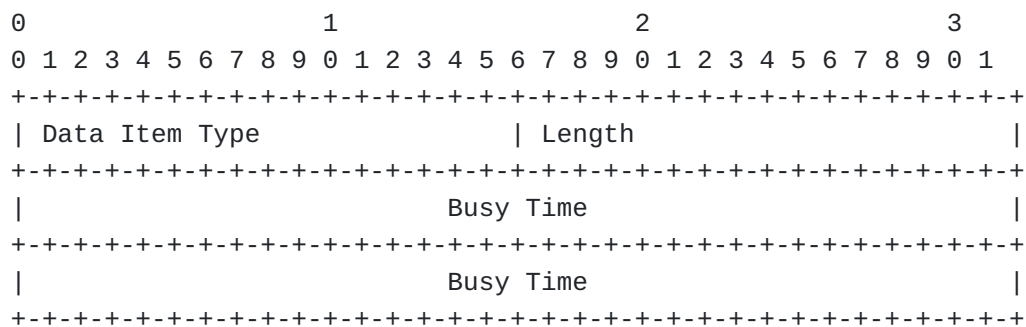The format of the Radio Channel Busy Data Item is:

```
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                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Busy Time                            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Busy Time                            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

                          Figure 2

   Data Item Type: TBD

   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.

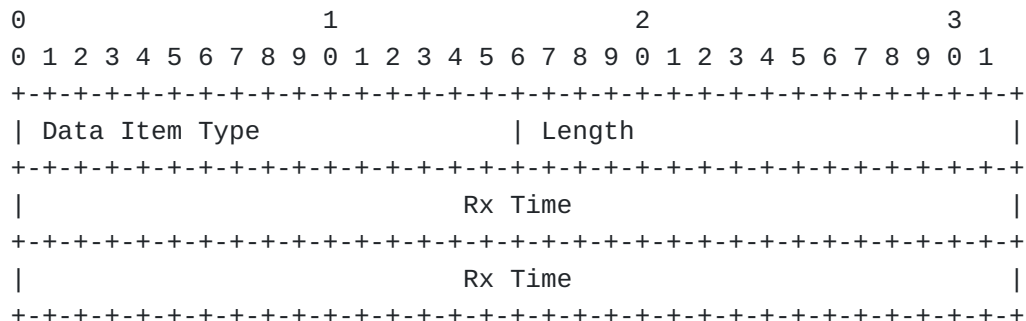   The format of the Radio Channel Rx Data Item is:

```
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                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                           Rx Time                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                           Rx Time                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

                          Figure 3

   Data Item Type: TBD

   Length: 8

   Rx Time: Time in nanoseconds the local radio was receiving 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.
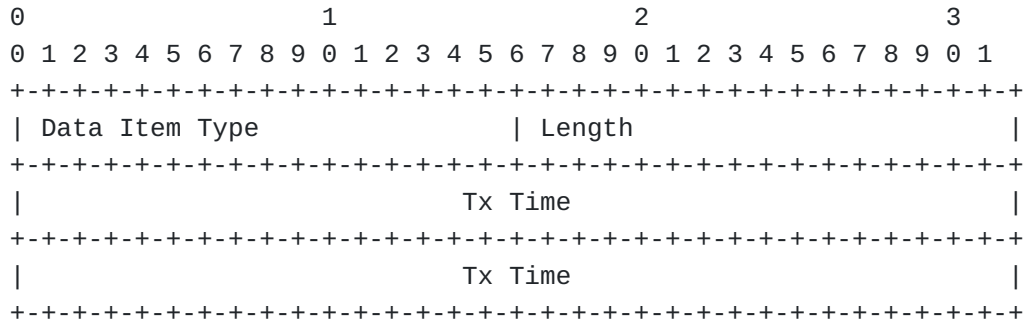
The format of the Radio Channel Tx Data Item is:

```
 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                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                             Tx Time                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                             Tx Time                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 4

Data Item Type: TBD

Length: 8

Tx Time: Time in nanoseconds the local radio was transmitting 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
TBD	Radio Channel Utilization

Table 1: 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
TBD	Radio Channel Active
TBD	Radio Channel Busy
TBD	Radio Channel Rx
TBD	Radio Channel Tx

Table 2: 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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