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DLEP Control Plane Based Pause Extension
draft-ietf-manet-dlep-pause-extension-06

Abstract

   This document defines an extension to the Dynamic Link Exchange
   Protocol (DLEP) that enables a modem to use DLEP messages to pause
   and resume data traffic coming from its peer router.

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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   and may be updated, replaced, or obsoleted by other documents at any
   time. It is inappropriate to use Internet-Drafts as reference
   material or to cite them other than as "work in progress."

   This Internet-Draft will expire on October 5, 2019.

Table of Contents

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.

   The base DLEP specification does not include any data plane flow
   control capability. Various flow control methods are possible, e.g.,
   see [I-D.ietf-manet-dlep-da-credit-extension]. The extension defined
   in this document supports flow control of data traffic based on
   explicit messages sent via DLEP by a modem to indicate when a router
   should hold off sending traffic, and when it should resume. The
   extension also optionally supports DSCP (differentiated services
   codepoint) aware flow control. For general background on
   Differentiated Services see [RFC2475]. The extension defined in this
   document is referred to as "Control Plane Based Pause". Note that
   this mechanism only applies to traffic that is to be transmitted on
   the modem's attached data channel and not to DLEP control messages
   themselves.

   This document defines a new DLEP Extension Type Value in Section 2
   which is used to indicate the use of the extension, and three new
   DLEP Data Items in Section 3.

1.1. Key Words

   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 Control Plane Based Pause Extension SHOULD be
   configurable. To indicate that the implementation supports use of
   the Control Plane Based Pause Extension, an implementation MUST
   include the Control Plane Based Pause Extension Type Value in the
   Extensions Supported Data Item. The Extensions Supported Data Item
   is sent and processed according to [RFC8175].

   The Control Plane Based Pause Extension Type Value is TBA1, see
   Section 5.

3. Extension Data Items

   Three data items are defined by this extension. The Queue Parameters
   Data Item is used by a modem to provide information about the DSCPs
   it uses in forwarding. The Pause Data Item is used by a modem to
   indicate when a router should cease sending packets and the Restart
   Data Item is used by a modem to indicate when a router can resume
   sending packets.

3.1. Queue Parameters

   The Queue Parameters Data Item is used by a modem to indicate DSCP
   values that may be independently paused. This data item MUST be
   included in a Session Initialization Response Message that also
   contains the Control Plane Based Pause Extension Type Value in the
   Extensions Supported Data Item. Updates to these parameters MAY be
   sent by a modem by including the data item in Session Update
   Messages.

   The Queue Parameters Data Item groups DSCPs into logical queues, each
   of which is identified by a "Queue Index". The number of logical
   queues, or queue indexes, is variable as is the number of DSCPs
   associated with each queue. A queue size (in bytes) is provided for
   informational purposes. Queue Indexes are numbered sequentially from
   zero, where queue index zero is a special case covering DSCPs which
   are not otherwise associated with Queue Index.

An implementation that does not support DSCPs would indicate 1 queue
with 0 DSCPs, and the number of bytes that may be in its associated
link transmit queue. Additional logical queues are represented in a
variable series of Queue Parameter sub data items.

The format of the Queue Parameters 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                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Num Queues  | Scale |             Reserved                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Queue Parameter Sub Data Item 1                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
:                             ...                               :
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Queue Parameter Sub Data Item n                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Data Item Type: TBA2

Length: Variable

   Per [RFC8175] Length is the number of octets in the data item,
   excluding the Type and Length fields.

Num Queues:

   An 8-bit unsigned integer indicating the number of queues
   represented in the data item. This field MUST contain a value of
   at least one (1), and is equal to one greater than the number of
   included Queue Parameter Sub Data Items.

Scale:

   An 4-bit unsigned integer indicating the scale used in the Queue
   Size fields. The valid values are:

```
   Value  Scale
   ------------
       0   B - Bytes     (Octets)
       1  KiB - Kilobytes (1024 B)
       2  MiB - Megabytes (1024 KiB)
       3  GiB - Gigabytes (1024 MiB)
```

Reserved:

MUST be set to zero by the sender (a modem) and ignored by the
receiver (a router).

3.1.1. Queue Parameter Sub Data Item

Queue Parameter Sub Data Items are an unordered list composed of sub
data items with a common format. The format of the Queue Parameter
Sub Data Item is patterned after the standard DLEP data item format,
see [RFC8175] Section 11.3. Any errors or inconsistencies
encountered in parsing Sub Data Items are handled in the same fashion
as any other Data Item parsing error encountered in DLEP.

The format of the Queue Parameter Sub 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Sub Data Item Type (1)        | Length                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                             Value...                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

and Value has the format:

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Queue Index  |           Queue Size Qn                       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Num DSCPs Qn  | DS Field Qn   |             ...               :
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
:                         ...                   | DS Field Qn   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Sub Data Item Type:

   A 16-bit unsigned integer that indicates the type and
   corresponding format of the Sub Data Item's Value field. Sub Data
   Item Types are scoped within the Data Item in which they are
   carried, i.e., the Sub Data Item Type field MUST be used together
   with the Queue Parameters Data Item Type to identify the format of
   the Sub Data Item. This field MUST be set to one (1) for the
   Queue Parameter Sub Data Item.

Length: Variable

   Length is the number of octets in the sub data item, excluding the
   Type and Length fields.

Queue Index:

   An 8-bit field indicating the queue index of the queue parameter
   represented in the sub data item. Only the first instance of a
   particular Queue Index value is meaningful. Subsequent sub data
   items containing the same Queue Index values, if present, MAY be
   logged via a management interface and MUST otherwise be ignored.
   Note that the value 255 is reserved and MUST NOT be used in this
   field.

Queue Size Qn:

   A 24-bit unsigned integer representing the size, in the octet
   scale indicated by the Scale field, of the queue supporting
   traffic with the DSCPs associated with the queue index.

Num DSCPs Qn:

   An 8-bit unsigned integer indicating the number of DSCPs
   associated with the queue index associated with the sub data item.
   This field MUST contain a value of at least one (1).

DS Field Qn:

   The data item contains a sequence of 8 bit DS Fields. The number
   of DS Fields present MUST equal the sum of all Num DSCPs field
   values.

   The DS Field structure is the same as [RFC2474].

```
      0   1   2   3   4   5   6   7
    +---+---+---+---+---+---+---+---+
    |         DSCP          | CU    |
    +---+---+---+---+---+---+---+---+

      DSCP: differentiated services codepoint
      CU:   currently unused, MUST be zero
```

3.2. Pause

   The Pause Data Item is used by a modem to indicate to its peer that
   traffic is to be suppressed. The motivating use case is for this
   data item is when a modem's internal queue length exceeds a
   particular threshold. Other use cases are possible, e.g., when there
   a non queue related congestion points within a modem, but such are
   not explicitly described in this document.

A modem can indicate that traffic is to be suppressed on a device-
wide or destination-specific basis. An example of when a modem might
use device wide indications is when output queues are shared across
all destinations, and destination specific might be used when per
destination queuing is used. To indicate that suppression applies to
all destinations, a modem MUST send the Pause Data Item in a Session
Update Message. To indicate that suppression applies to a particular
destination a modem MUST send the Pause Data Item in a Destination
Update Message.

Each Pause Data Item identifies the traffic to be suppressed by the
Queue Index defined by Section 3.1, which in turn indicates a set of
traffic identified by DSCPs. The special value of 255 is used to
indicate that all traffic is to be suppressed.

While there is no restriction on the number of Messages containing
Pause Data Item that may be sent by a modem, a modem SHOULD include
multiple queue indexes in the same message when possible.

A router which receives the Pause Data Item MUST cease sending the
identified traffic to the modem. This may of course translate into
the router's queues exceeding their own thresholds. If a received
Pause Data Item contains a Queue Index value other than 255, or a
queue index established by a Session Initialization or Session Update
Message, the router MUST terminate the session with a Status Data
Item indicating Invalid Data.

The format of the Pause 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                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Queue Index  |               ...                             :
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
:                               ...             |  Queue Index  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Data Item Type: TBA3

Length: Variable

   Per [RFC8175] Length is the number of octets in the data item,
   excluding the Type and Length fields. It will equal the number of
   Queue Index fields carried in the data item.

Queue Index:

One or more 8-bit fields used to indicate a queue index defined by
a Queue Parameters Data Item. The special value of 255 indicates
all traffic is to be suppressed to the modem, when the data item
is carried in a Session Update Message, or is to be suppressed to
a destination, when the data item is carried in Destination Update
Message.

3.3. Restart

The Restart Data Item is used by a modem to indicate to its peer that
transmission of previously suppressed traffic may be resumed. An
example of when a modem might send this data item is when an internal
queue length drops below a particular threshold.

The sending of this data item parallels the Pause Data Item, see the
previous section, and follows the same rules. As above, to indicate
that transmission can resume to all destinations, a modem MUST send
the Restart Data Item in a Session Update Message. It also includes
that to indicate that transmission can resume to a particular
destination a modem MUST send the Pause Restart Item in a Destination
Update Message. Finally, queue indexes are interpreted in the same
way as in the Pause Data Item..

A router which receives the Restart Data Item SHOULD resume
transmission of the identified traffic to the modem.

The format of the Restart Data Item matches the Pause Data Item and
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                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Queue Index  |               ...                             :
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
:                               ...             |  Queue Index  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Data Item Type: TBA4

Length: See Section 3.2.

Queue Index: See Section 3.2.

4. Security Considerations

   The extension introduces a new mechanism for flow control between a
   router and modem using 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.

   Note that this extension does allow a compromised or impersonating
   modem to suppress transmission by the router, but this is not a
   substantively different attack by such a compromised modem simply
   dropping all traffic destined to, or sent by a router. [RFC8175]
   defines the use of TLS to protect against the impersonating attacker.

5. IANA Considerations

   This document requests the assignment of 4 values by IANA. All
   assignments are to registries defined by [RFC8175].

5.1. Extension Type Value

   This document requests 1 new assignment to the DLEP Extensions
   Registry named "Extension Type Values" in the range with the
   "Specification Required" policy. The requested value is as follows:

```
              +------+---------------------------+
              | Code | Description               |
              +------+---------------------------+
              | TBA1 | Control Plane Based Pause |
              +------+---------------------------+
```

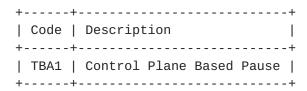   Table 1: Requested Extension Type Value

5.2. Data Item Values

   This document requests 3 new assignments to the DLEP Data Item
   Registry named "Data Item Type Values" in the range with the
   "Specification Required" policy. The requested values are as
   follows:

```
+-----------+-------------------+
| Type Code | Description       |
+-----------+-------------------+
| TBA2      | Queue Parameters  |
|           |                   |
| TBA3      | Pause             |
|           |                   |
| TBA4      | Restart           |
+-----------+-------------------+
```

Table 2: Requested Data Item Values

5.3. Queue Parameters Sub Data Item Values

   Upon approval of this document, IANA is requested to create a new
   DLEP registry, named "Queue Parameters Sub Data Item Type Values".

   The following table provides initial registry values and the
   [RFC8126] defined policies that should apply to the registry:

```
+-------------+-----------------------+
| Type Code   | Description/Policy     |
+-------------+-----------------------+
| 0           | Reserved              |
|             |                       |
| 1           | Queue Parameter       |
|             |                       |
| 2-65407     | Specification Required |
|             |                       |
| 65408-65534 | Private Use           |
|             |                       |
| 65535       | Reserved              |
+-------------+-----------------------+
```

Table 3

6. References

6.1. Normative References

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

6.2. Informative References

   [I-D.ietf-manet-dlep-da-credit-extension]
              Cheng, B., Wiggins, D., and L. Berger, "DLEP DiffServ
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   [RFC2474] Nichols, K., Blake, S., Baker, F., and D. Black,
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              Field) in the IPv4 and IPv6 Headers", RFC 2474,
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   [RFC2475] Blake, S., Black, D., Carlson, M., Davies, E., Wang, Z.,
              and W. Weiss, "An Architecture for Differentiated
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              <https://www.rfc-editor.org/info/rfc2475>.

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

Appendix A. Acknowledgments

   The sub data item format was inspired by Rick Taylor's "Data Item
   Containers" idea.

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