Application-aware IPv6 Networking (APN6) Encapsulation
draft-li-apn-ipv6-encap-00

Abstract

   Application-aware IPv6 Networking (APN6) makes use of IPv6
   encapsulation to convey the APN Attribute along with data packets and
   make the network aware about data flow requirements at different
   granularity levels. The APN attribute can be encapsulated in the APN
   header. This document defines the encapsulation of the APN header in
   the IPv6 data plane.

Requirements Language

   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 RFC 2119 [RFC2119].

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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   Task Force (IETF). Note that other groups may also distribute
   working documents as Internet-Drafts. The list of current Internet-
   Drafts is at https://datatracker.ietf.org/drafts/current/.

   Internet-Drafts are draft documents valid for a maximum of six months
   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 April 28, 2022.

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1. Introduction

   Application-aware Networking (APN) is introduced in
   [I-D.li-apn-framework] and [I-D.li-apn-problem-statement-usecases].
   APN conveys an attribute along with data packets into network and
   make the network aware about data flow requirements at different
   granularity levels. Such an attribute is acquired, constructed in a
   structured value, and then encapsulated in the packets. Such
   structured value is treated as an opaque object in the network, to
   which the network operator applies policies in various nodes/service
   functions along the path and provide corresponding services.

   [I-D.li-apn-header] defines the application-aware networking (APN)
   header which can be used in different data planes to carry the APN
   attribute. This document defines the encapsulation of the APN header
   in the IPv6 data plane.

2. Terminologies

   APN: Application-aware Networking

   APN6: Application-aware IPv6 Networking, i.e. the data plane of APN
   is IPv6

   APN Attribute: Application-aware information. It is added at the
   edge devices of an APN domain along with the tunnel encapsulation.

   APN ID: Application-aware Networking ID

   APN Para: Application-aware Networking Parameters

3. APN Option

   In order to support the Application-aware IPv6 networking, one
   option, the APN option, is defined.
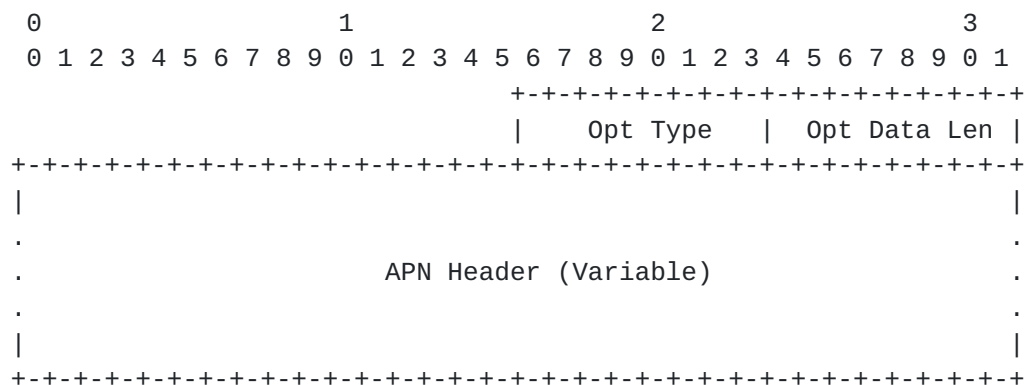
   The APN option has the following format:

```
 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
                    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                    |   Opt Type    | Opt Data Len  |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                                                               |
 .                                                               .
 .                       APN Header (Variable)                   .
 .                                                               .
 |                                                               |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

                        Figure 1. APN Option

   where:

   o Opt Type: Type value is TBD2. 8-bit unsigned integer. Identifier
   of the type of this APN Option.

   o Opt Data Len: 8-bit unsigned integer. Length of the Option Data
   field of this option, that is, length of the APN header.

   o Option Data: Option-Type-specific data. It carries the APN header.
   Variable-length field.

4. Locations for APN Option

   The APN option can be placed in several locations in the IPv6 packet
   header depend upon the scenarios and implementation requirements.

4.1. Hop-by-Hop Options Header (HBH)

The APN option can be carried in the Hop-by-Hop Options Header as the
new option. By using the HBH Options Header, the information carried
can be read by every node along the path.

4.2. Destination Options Header (DOH)

The APN option can be carried in the Destination Options Header as
the new option. By using the DOH Options Header, the information
carried can be read by the destination node along the path.

5. APN TLV of SRH

[RFC8754] defines the segment routing header (SRH) and the SRH TLV.
The SRH TLV provides meta-data for segment processing. The APN
header can also be placed in the SRH as one type of SRH TLV following
the Segment List. By using the SRH, the information carried can be
read by the specified segments along the SRv6 path.

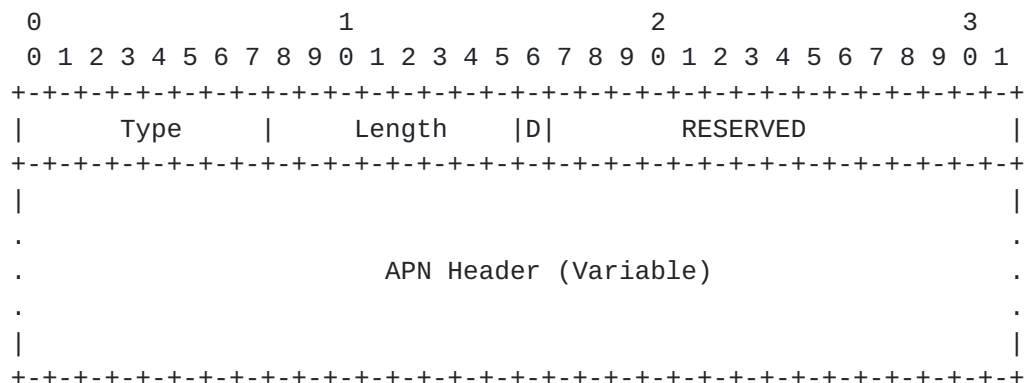The APN TLV is OPTIONAL and has the following format:

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Type      |    Length     |D|         RESERVED            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
.                                                               .
.                    APN Header (Variable)                      .
.                                                               .
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 2. APN TLV

where:

o Type: to be assigned by IANA (suggested value 5).

o Length: The length of the variable length data in bytes.

o D: 1 bit. When it is set, it indicates the Destination Address
verification is disabled due to use of reduced segment list.

o RESERVED: 15 bits. MUST be 0 on transmission.

o APN Header: It carries the APN header. Variable-length field.

6. IANA Considerations

   IANA maintains the registry for the Options and TLVs. The APN Option
   will require one new option type code and the APN TLV will require
   one new SRH TLV type code in this document:

```
   Type | Description         | Reference
   -----------------------------------------
   TBD1 | APN Option          | This ID
   TBD4 | APN TLV             | This ID
```

7. Security Considerations

   The Security Considerations described in
   [I-D.li-apn-problem-statement-usecases] can be referred to.

8. References

8.1. Normative References

   [I-D.li-apn-framework]
             Li, Z., Peng, S., Voyer, D., Li, C., Liu, P., Cao, C.,
             Mishra, G., Ebisawa, K., Previdi, S., and J. N. Guichard,
             "Application-aware Networking (APN) Framework", draft-li-
             apn-framework-03 (work in progress), May 2021.

   [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>.

   [RFC8754] Filsfils, C., Ed., Dukes, D., Ed., Previdi, S., Leddy, J.,
             Matsushima, S., and D. Voyer, "IPv6 Segment Routing Header
             (SRH)", RFC 8754, DOI 10.17487/RFC8754, March 2020,
             <https://www.rfc-editor.org/info/rfc8754>.

8.2. Informative References

   [I-D.li-apn-header]
             Li, Z. and S. Peng, "Application-aware Networking (APN)
             Header", draft-li-apn-header-00 (work in progress),
             October 2021.

   [I-D.li-apn-problem-statement-usecases]
              Li, Z., Peng, S., Voyer, D., Xie, C., Liu, P., Qin, Z.,
              Mishra, G., Ebisawa, K., Previdi, S., and J. N. Guichard,
              "Problem Statement and Use Cases of Application-aware
              Networking (APN)", draft-li-apn-problem-statement-
              usecases-04 (work in progress), June 2021.

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