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         Application-aware IPv6 Networking (APN6) Encapsulation

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 of 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.

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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 the network and make the network aware of data flow requirements at different granularity levels. Such an attribute is acquired, constructed as a structured value, and then encapsulated in the packets. Such a 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, providing 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. 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 RFC 2119 [RFC2119] RFC 8174 [RFC8174] when, and only when, they appear in all capitals, as shown here.

3. 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 any tunnel encapsulation.

APN ID: Application-aware Networking ID

APN Para: Application-aware Networking Parameters

SRH: Segment Routing Header RFC 8754 [RFC8754]

4. The APN Option

To support Application-aware IPv6 networking, one IPv6 Header option
RFC 8200 [RFC8200], 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 = TBD1|  Opt Data Len |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                                                               |
 .                                                               .
 .                       APN Header (Variable)                   .
 .                                                               .
 |                                                               |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
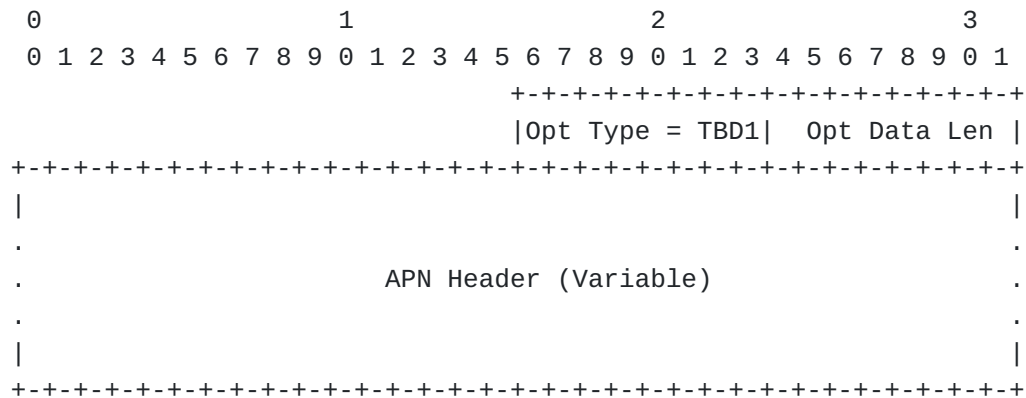
Figure 1. The APN Option

where:

o Opt Type: Type value is TBD1 (suggested value 0x13), an 8-bit
unsigned integer. Identifier of the type of this APN Option.

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

o APN Header: Option-Type-specific data. It carries the APN header.
Variable-length field as specified in [I-D.li-apn-header].

5. Locations for the APN Option

The APN IPv6 Header option can be placed in two locations in an IPv6
packet header RFC 8200 [RFC8200] depend upon the scenario and

implementation requirements. These are defined in the subsections
below.

5.1. IPv6 Hop-by-Hop Options Header (HBH)

The APN option can be carried in the IPv6 Hop-by-Hop Options Header.
By using the HBH Options Header, the information carried can be read
by every node along the path.

5.2. IPv6 Destination Options Header (DOH)

The APN option can be carried in the IPv6 Destination Options
Header. By using the DOH Options Header, the information carried can
be read by the destination node but would not normally be seen by
other nodes along the path.

6. APN TLV for the 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 be placed in the SRH as the value of one type of SRH TLV
following the Segment List. By using the SRH, the information
carried can be read by the specified segment destinations along the
SRv6 path.

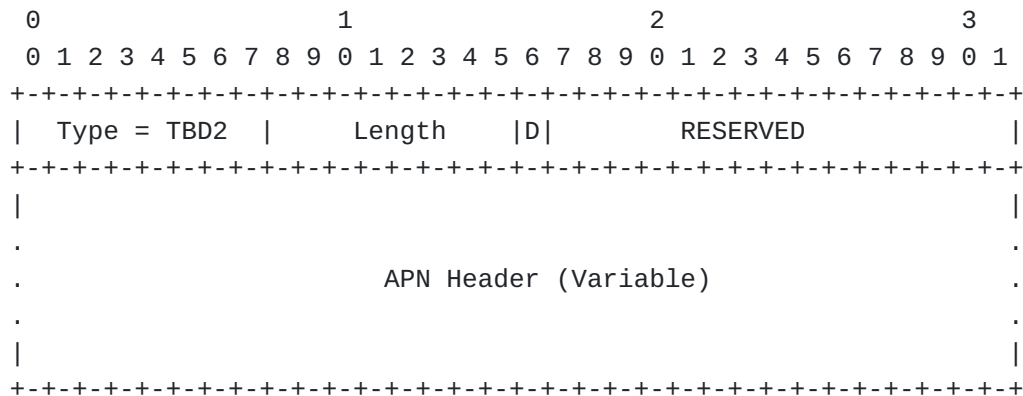The APN TLV is OPTIONAL and has the following format:

```
 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 = TBD2  |     Length    |D|           RESERVED          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
.                                                               .
.                    APN Header (Variable)                      .
.                                                               .
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 2. The APN SRH TLV

where:

o Type: TBD2 (suggested value 0x13).

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 a reduced segment list.

o RESERVED: 15 bits. MUST be 0 on transmission and ignored on
receipt.

o APN Header: It carries the APN header as specified in [I-D.li-apn-
header]. A variable-length field.

7. IANA Considerations

IANA is requested to assign two code points as below.

7.1. IPv6 Header Option

IANA is requested to assign an IPv6 Header Option as follows:

Hex Value	Binary Value act chg rest	Description	Reference
0x13	00 0 10011	Application-aware Networking	[this document]

7.2. SRH TLV Type

IANA is requested to assign an SRH TLV Type from the range of type
values for TLVs that do not change en route (2-127) as follows:

Value	Description	Reference
0x13	Application-aware Networking	[this document]

8. Security Considerations

The Security Considerations are described in [I-D.li-apn-problem-
statement-usecases].

9. References

9.1. Normative References

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