Network Working Group
Internet-Draft
Intended status: Standards Track
Expires: April 28, 2022

Z. Li
S. Peng
Huawei Technologies
October 25, 2021

Application-aware Networking (APN) Header
draft-li-apn-header-00

Abstract

This document defines the application-aware networking (APN) header which can be used in the different data planes.

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.

Internet-Drafts are working documents of the Internet Engineering 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.

Copyright Notice

Table of Contents

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 of fine-grain user group-level and application group-level requirements.

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.

This structured attribute can be encapsulated in various data plane adopted within a Network Operator controlled limited domain, e.g. MPLS, VXLAN, SR/SRv6 and other tunnel technologies, which waits to be further specified.

This document defines the application-aware networking (APN) header which can be used in different data planes. The typical data plane include MPLS data plane and IPv6 data plane..

2. Terminologies

APN: Application-aware Networking

APN Attribute: Application-aware Networking Attribute, including APN ID and APN Parameters. It can be added at the edge devices of an APN domain along with the tunnel encapsulation.

APN ID: Application-aware Networking ID, including Application Group ID and User Group ID.

APN Para: Application-aware Networking Parameters, including, e.g., network performance parameters.

3. Application-aware Networking Header

A common header is defined and can be used in different data planes. The common header carries the APN attribute that is composed of APN ID and APN parameters.

This document defines two types of APN ID:

- Short APN ID: it is 32 bits.

- Long APN ID: it is 128 bits.

According to the types of APN ID, two types of APN headers are defined.

Type 1 APN Header:

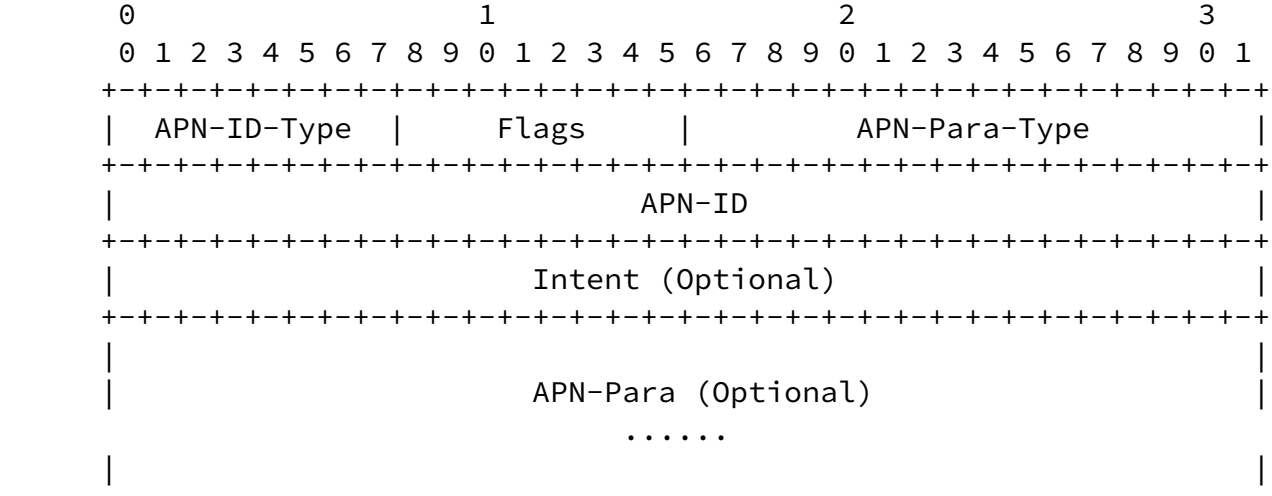


Figure 1. APN Header with Short APN ID

In this type of APN Header, the length of the APN ID (Short APN ID) is 32 bits.

APN-ID-Type: An 8-bit identifier, indicates the type of APN ID.

Flags: An 8-bit field. The possible flags will be defined in the future version.

APN-Para-Type: A 16-bit identifier, specifies which APN parameters are specified for the APN ID. The APN-Para-Type value is a bitmap. The packing order of the APN parameters follows the bit order as specified in the APN-Para-Type bitmap field. The following bits are defined in this document, with details on each bit described in Section 5.

Bit 0 (Most significant bit) When set, indicates the presence of the bandwidth requirement.

Bit 1 When set, indicates the presence of the delay requirement.

Bit 2 When set, indicates the presence of the jitter requirement.

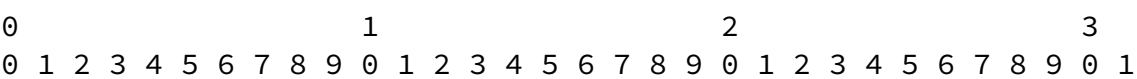
Bit 3 When set, indicates the presence of the packet loss ratio requirement.

APN-ID: A 32-bit identifier.

Intent: A 32-bit identifier, represents a set of service requirements to the network.

APN-Para: A variable field including APN parameters. The presence of the APN parameters is indicated by the APN-Para-Type.

Type 2 APN Header



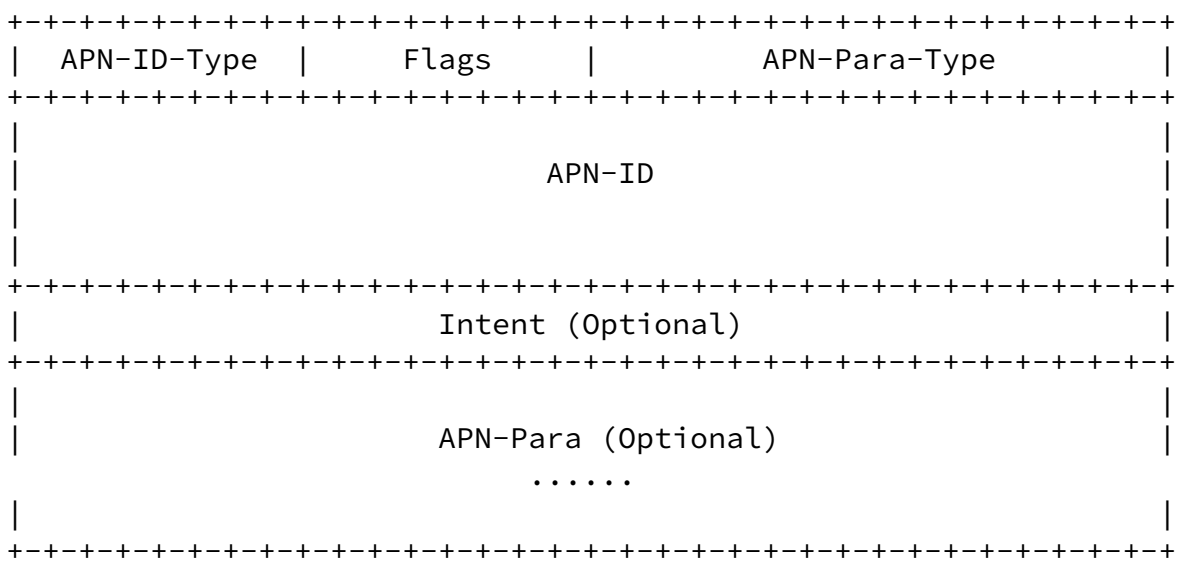


Figure 2. APN Header with Long APN ID

In this type of APN Header, the length of the APN ID (Long APN ID) is 128 bits.

APN-ID-Type: An 8-bit identifier, indicates the type of APN ID.

Flags: An 8-bit field. The possible flags will be defined in the future version.

APN-Para-Type: A 16-bit identifier which specifies which APN parameters are specified for the APN ID. The APN-Para-Type value is a bit field. The following bits are defined in this document, with details on each bit described in the Section 4. The order of packing the data fields in each node data element follows the bit order of the APN-Para-Type field, as follows:

Bit 0 (Most significant bit) When set, indicates the presence of the bandwidth requirement.

Bit 1 When set, indicates the presence of the delay requirement.

Bit 2 When set, indicates the presence of the jitter requirement.

Bit 3 When set, indicates the presence of the packet loss ratio requirement.

APN-ID: A 128-bit identifier.

Intent: A 32-bit identifier, represents a set of service requirements to the network.

APN-Para: A variable field including APN parameters. The presence of the APN parameters is indicated by the APN-Para-Type.

4. APN ID

The APN ID can be divided into three parts:

APP-Group-ID: Application Group ID

USER-Group-ID: User Group ID

Reserved: The reserved fields.

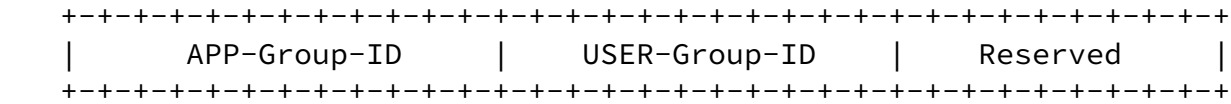


Figure 3. Structure of APN-ID

The lengths of the APP-Group-ID and the USER-Group-ID are variable. Their lengths must be configured and consistent within a specific APN domain.

5. APN Parameters

In the APN Header, the APN-Para-Type is a bit field to indicate the presence of corresponding APN parameters. When the bit is set, the corresponding APN parameter MUST exist in the APN Header. The length of each APN parameter is 32 bits.

The typical APN parameters are the parameters related with the network performance requirements.

1. Bandwidth Requirement

This Bandwidth Requirement parameter indicates the bandwidth requirement of the APN traffic. The format of this parameter is shown in the following diagram:

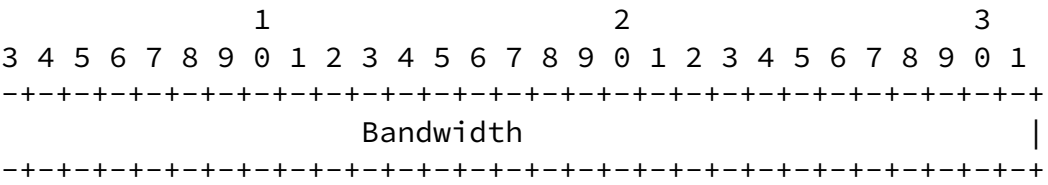


Figure 4. Bandwidth Requirement Parameter

where:

Bandwidth: This 32-bit field carries the bandwidth requirement in Mbps along the path.

2. Delay Requirement

This Delay Requirement parameter indicates the delay requirement. The format of this parameter is shown in the following diagram:

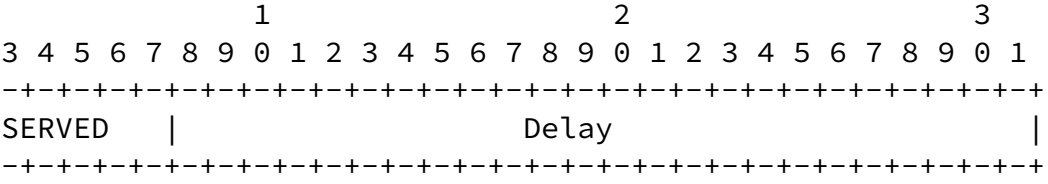


Figure 5. Delay Requirement Parameter

where:

RESERVED: This field is reserved for future use. It MUST be set to 0 when sent and MUST be ignored when received.

Delay: This 24-bit field carries the delay requirements in microseconds, encoded as an integer value. When set to the maximum value 16,777,215 (16.777215 sec), then the delay is at least that value and may be larger. This value is the highest delay that can be tolerated.

3. Delay Variation Requirement

This Delay Variation Requirement parameter indicates the delay requirement. The format of this parameter is shown in the following diagram:

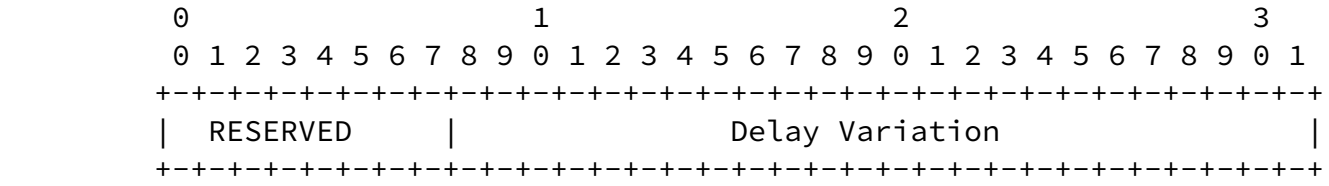


Figure 6. Delay Variation Parameter

where:

RESERVED: This field is reserved for future use. It MUST be set to 0 when sent and MUST be ignored when received.

Delay Variation: This 24-bit field carries the delay variation requirements in microseconds, encoded as an integer value.

4. Packet Loss Ratio Requirement

This Packet Loss Ration Requirement parameter indicates the delay requirement. The format of this parameter is shown in the following diagram:

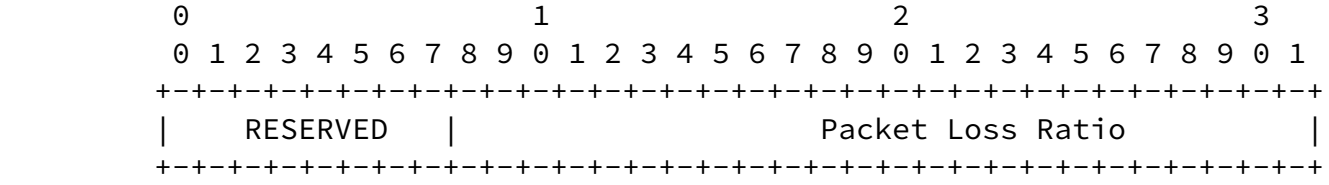


Figure 7. Packet Loss Ratio Sub-TLV

where:

RESERVED: This field is reserved for future use. It MUST be set to 0

when sent and MUST be ignored when received.

Packet Loss Ratio: This 24-bit field carries packet loss ratio requirement in packets per second. This value is the highest packet-loss ratio that can be tolerated.

6. IANA Considerations

The types of APN ID used in the APN header need to be allocated by IANA.

Type | Description

TBD1 | Type of the Short APN ID

TBD2 | Type of the Long APN ID

7. Security Considerations

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

8. References

8.1. 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>.

[RFC8200] Deering, S. and R. Hinden, "Internet Protocol, Version 6 (IPv6) Specification", STD 86, RFC 8200, DOI 10.17487/RFC8200, July 2017, <https://www.rfc-editor.org/info/rfc8200>.

8.2. Informative References

[I-D.ietf-spring-srv6-network-programming] Filsfils, C., Garvia, P. C., Leddy, J., Voyer, D., Matsushima, S., and Z. Li, "Segment Routing over IPv6 (SRv6) Network Programming", draft-ietf-spring-srv6-network-programming-28 (work in progress), December 2020.

[I-D.li-6man-hbh-fwd-hdr]
Li, Z., Peng, S., and G. Mishra, "Hop-by-Hop Forwarding Options Header", draft-li-6man-hbh-fwd-hdr-01 (work in progress), February 2021.

[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.

[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.

[I-D.liu-apn-edge-usecase]
Liu, P., Du, Z., Peng, S., and Z. Li, "Use cases of Application-aware Networking (APN) in Edge Computing", draft-liu-apn-edge-usecase-03 (work in progress), June 2021.

[I-D.peng-apn-security-privacy-consideration]
Peng, S., Li, Z., Voyer, D., Li, C., Liu, P., and C. Cao, "APN Security and Privacy Considerations", draft-peng-apn-security-privacy-consideration-02 (work in progress), June 2021.

[I-D.zhang-apn-acceleration-usecase]
Zhang, S., Cao, C., Peng, S., and Z. Li, "Use cases of Application-aware Networking (APN) in Game Acceleration", draft-zhang-apn-acceleration-usecase-02 (work in progress), June 2021.

[RFC3272] Awduche, D., Chiu, A., Elwalid, A., Widjaja, I., and X. Xiao, "Overview and Principles of Internet Traffic Engineering", RFC 3272, DOI 10.17487/RFC3272, May 2002, <https://www.rfc-editor.org/info/rfc3272>.

Authors' Addresses

Zhenbin Li
Huawei Technologies
Beijing 100095
China

Email: lizhenbin@huawei.com

Shuping Peng
Huawei Technologies
Beijing 100095
China

Email: pengshuping@huawei.com