Application-Aware Networking (APN): Framework and Application-Side Extension

draft-li-rtgwg-apn-framework-00

draft-li-rtgwg-apn-app-side-framework-00

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Application-aware Networking (APN) Framework

draft-li-rtgwg-apn-framework-00

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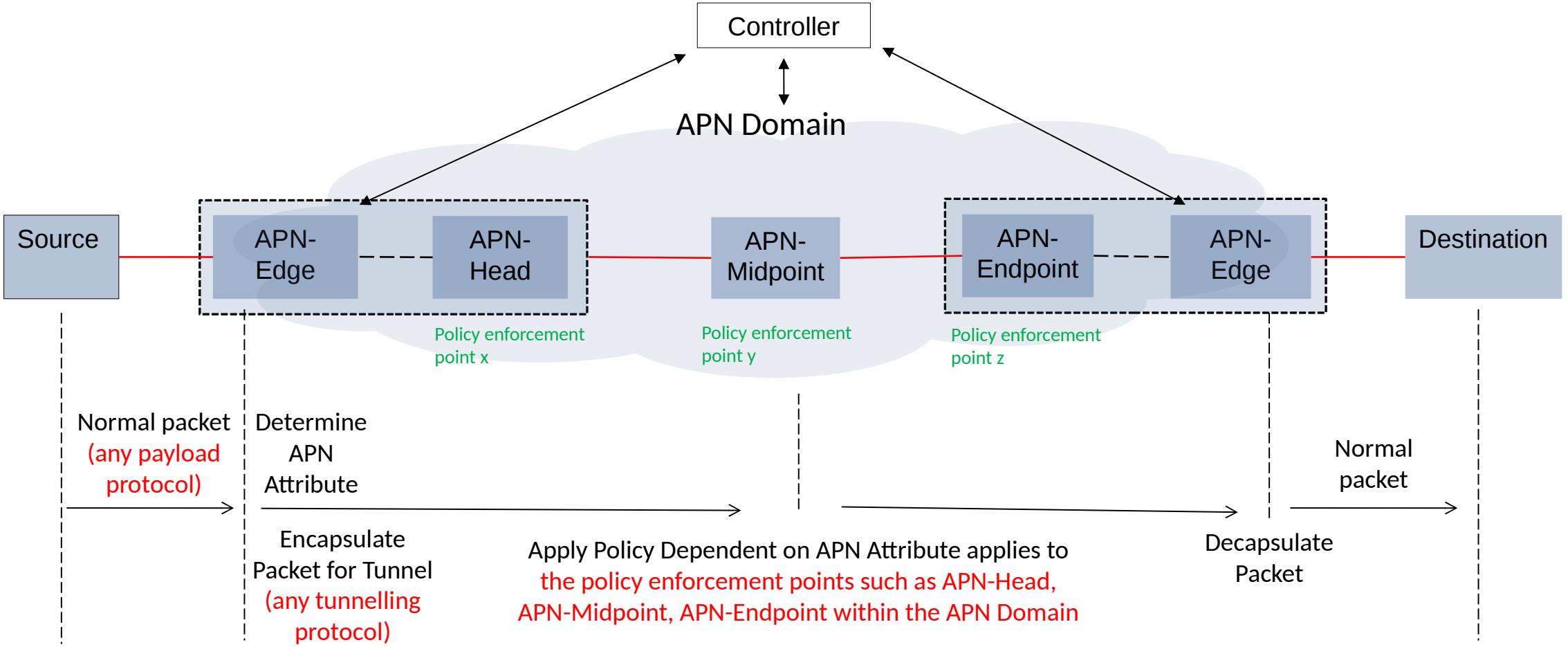
APN Framework (1)

- ***draft-li-rtgwg-apn-framework*** (replaces draft-li-apn-framework)
- The Application-aware Networking (APN) framework defines the encapsulation of application-aware information, known as the APN attribute, within packets traversing an APN domain. This information includes APN identification (ID) and/or APN parameters (e.g., network performance requirements) at network edge devices. The purpose is to facilitate service provisioning, enable fine-grained traffic steering, and support network resource adjustment.
- History
  - APN framework was presented in RTGWG WG, RTGWG Interim Meeting, APN Side Meetings, APN BOF meeting since 2020.
  - Rough consensus was achieved in RTGWG to propose setup of APN WG.
  - The process of setup of APN WG was abandoned because the charter could not be approved by IESG.
- The co-authors would like to continue the work in the RTGWG WG.

APN Framework (2)

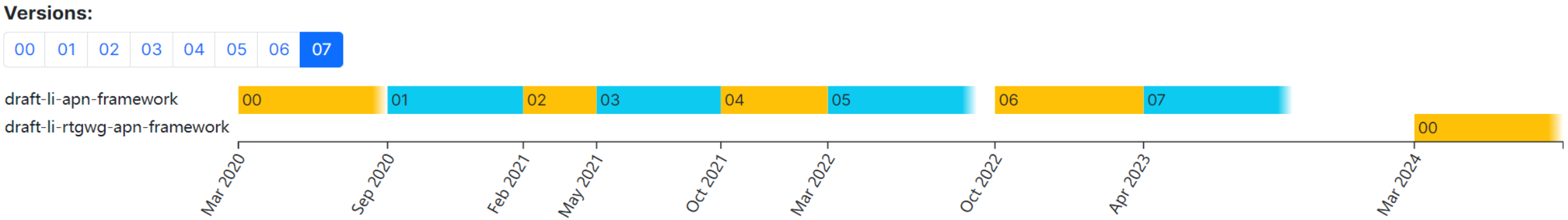


An APN Domain may span multiple network domains controlled by the same operator

https://datatracker.ietf.org/doc/draft-li-apn-framework/

Next-Step

- The initial -00 version draft was published in March 2020. The draft has undergone multiple rounds of refinement and has addressed the comments received.
- Request for WG adoption.



Extension of Application-aware Networking (APN) Framework for Application Side

draft-li-rtgwg-apn-app-side-framework-00

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Extensions of APN Framework for Application Side (1)

- ***draft-li-rtgwg-apn-app-side-framework***

- This document extends the APN framework to incorporate application-side considerations. In this extension, APN resources within an APN domain are allocated to applications, and applications compose and encapsulate the APN attribute within packets. When network devices within the APN domain receive packets containing the APN attribute, they can perform fine-grained traffic operations directly based on these attributes.

Extension of APN Framework for Application Side (2)

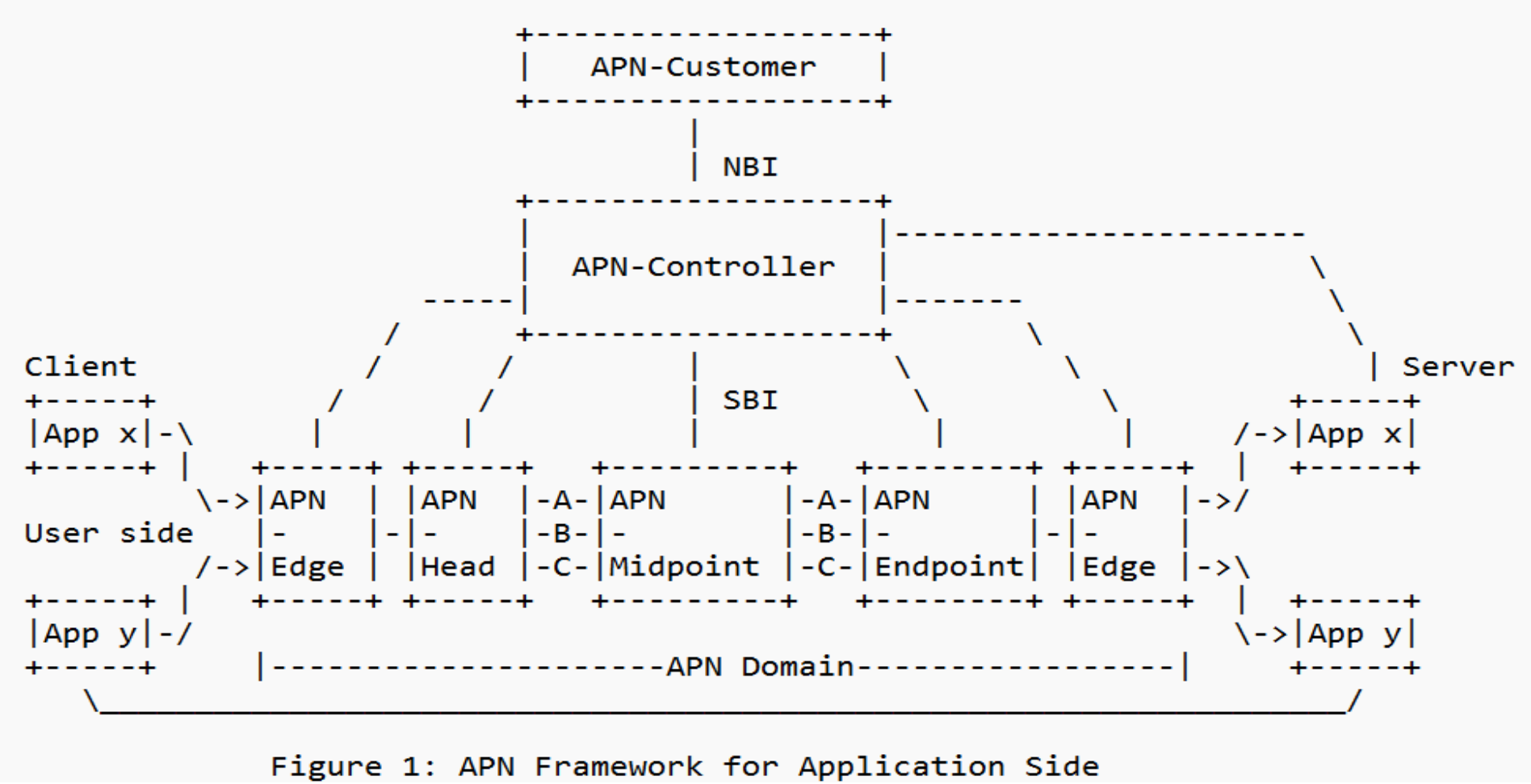

Figure 1: APN Framework for Application Side

Comparison between APN Framework and Extensions of APN Framework for Application Side

	APN Framework	Extension of APN Framework for Application Side
Encapsulation of APN information	Be encapsulated by network edge device	Be encapsulated by applications
Transmission Scope of APN information	Only in APN domain	End-to-end
Allocation of APN ID	Be allocated by controller to network edge device	Be allocated from controller to applications
Security and Privacy Concern	Less	More
Key Components	APN-Controller APN-Edge APN-Head/APN-Midpoint/APN-Endpoint APN-capable Application Server (AAS) APN-capable Application Client (AAC)	APN-Controller APN-Edge APN-Head/APN-Midpoint/APN-Endpoint

New Key Components

In this extension the new key components, APN-capable Application Server (AAS) and APN-capable Application Client (AAC), are introduced as follows:

- APN-capable Application Server (AAS): The AAS requests the APN-Controller to allocate the APN resources of a controlled APN domain. And the AAS allocates the APN resources received from the APN-Controller to the AAC to compose APN attribute according to the requirement from the AAC. When the AAS sends packets to the AAC, it adds APN attribute in these packets. The request sent by the AAS to the APN-Controller includes the application information, network service requirement, etc. The APN resources allocated by the APN-controller to the AAS includes sets of APN IDs and corresponding network service attributes.

- APN-capable Application Client (AAC): The AAC requests the AAS to allocate the APN resources. The AAC composes the APN attribute according to the allocated APN resources from the AAS. When the AAC sends packets to the AAS, it adds the APN attribute in these packets. The APN resources allocated by the AAS to the AAC includes the unique APN ID and the corresponding network service attributes.

Change of Functionalities of Key Components

In the extension of the APN framework for the application side, the functionalities of the following key components are extended or changed:

- **APN-Edge:** In the extension of APN framework for the application side, since the APN attribute is added by the application, the functionalities of the APN-Edge needs to be changed. The APN-Edge can directly transmit the packets without encapsulating tunnels for the purpose of carrying APN attribute. If the APN-Edge needs to encapsulate a tunnel for packets, it can directly obtain the APN attribute from these packets sent by the AAS/AAC and the APN attribute can be copied or be mapped into the outer tunnel header.
- **APN-Head:** The APN-Head can directly obtain the APN attribute from packets sent by the AAS/AAC to apply corresponding policies.
- **APN-Midpoint:** If policies need to be adjusted on the APN-Midpoint, the APN-Midpoint can also directly obtain the APN attribute from packets sent by the AAS/AAC.
- **APN-Endpoint:** The APN-Endpoint MUST keep the APN attribute in packets sent by the AAS/AAC without any change.
- **APN-Controller:** In the extension of APN framework for the application side, the APN-Controller is responsible for processing the request from the AAS and allocating the APN resources of the controlled APN domain to the AAS.

Security Consideration

The transmission of APN attributes among the AAS, AAC, and APN domain requires robust security measures. The design and implementation of a security mechanism MUST ensure secure transmission. Further details regarding the security mechanism will be proposed in future versions of the draft.

Requirements

According to the extension of APN framework for the application side, there are following basic protocol extension requirements:

- [REQ01] Protocol extensions MUST be defined for the AAS to request the APN-Controller to allocated the APN resources of the APN domain.
- [REQ02] Protocol extensions MUST be defined for the APN-Controller to notify the allocated APN resources to the AAS.
- [REQ03] Protocol extensions MUST be defined for the AAC to request the AAS to allocate the APN resources.
- [REQ04] Protocol extensions MUST be defined for the AAS to notify the allocated APN resources to the AAC.

- [REQ05] Security mechanism MUST be defined to guarantee for that the APN attribute being securely transmitted among the AAS, AAC and the APN domain.

Use cases and Requirements of APN Framework for Application Side

- Application-aware Networking (APN) for Performance Enhancement of Media Service
  https://datatracker.ietf.org/doc/draft-peng-rtgwg-apn-for-media-service/
- Application-aware Date Center Network (APDN) Use Cases and Requirements
  https://datatracker.ietf.org/doc/draft-wh-rtgwg-application-aware-dc-network/
- Application Aware Computing Network
  https://datatracker.ietf.org/doc/html/draft-li-cats-application-aware-computing-network

Next-Step

Solicit comments and refine solutions and drafts.

Cooperation are welcome.

Thank you!