Workgroup: Network Working Group
Internet-Draft:
draft-yang-apn-sd-wan-usecase-05
Published: 4 July 2022
Intended Status: Informational
Expires: 5 January 2023
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Usage scenarios of Application-aware Networking (APN) for SD-WAN

Abstract

This document describes the usage of Application-aware Networking (APN) in SD-WAN scenarios. In these scenarios, APN is able to identify a application group, steer its traffic flows along explicit path across the network, and provide SLA guaranteed network services such as low latency and high reliability.

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].

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1. Introduction

As more and more applications are moved to the cloud, the traditional WAN architecture starts facing challenges. Software-defined Wide Area Network (SD-WAN) provides a cloud-friendly way of interconnecting branch offices and applications in the cloud over any combination of transport services such as MPLS and 4G LTE, which is able to optimising application performance with low costs.

Application-aware Networking (APN) is introduced in [I-D.li-apn-framework] and [I-D.li-apn-problem-statement-usecases]. APN conveys application-aware information (i.e. APN attribute) along data packets traversing across the APN domain and facilitate fine-granularity network service provisioning and guarantee their SLA requirements. The ever-emerging network services such as network slicing and IOAM can be further enhanced with APN.

This document describes the usage scenarios of APN for SD-WAN.

2. Usage Scenarios of APN for SD-WAN

This section describes the scenarios that can use APN to meet the fine-granularity service operations in SD-WAN.

2.1. APN for Traffic Steering into Dedicated WAN

In CPE, different application groups are identified based on the existing information in the packet header, and APN attribute is added to the packets along with the tunnel encapsulation. Then the traffic flows can be steered into different WANs that can guarantee their corresponding SLA requirements.

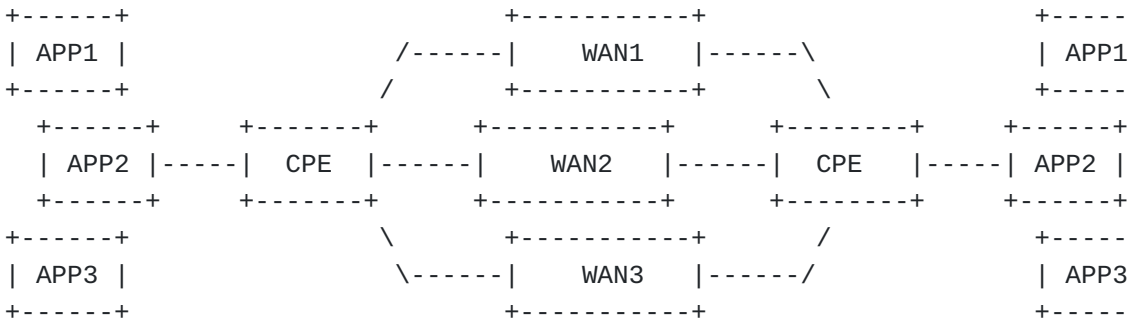

Figure 1: Traffic Steering into WAN

2.2. APN for Traffic Steering into Particular Cloud

In the multi-cloud scenario, a CPE can be deployed by an enterprise as its gateway to access different clouds. In the CPE (e.g. an universial CPE, called uCPE), different application groups can be identified based on the existing information in the packet header, and APN attribute is added to the packets along with the tunnel encapsulation. The traffic flows are steered into the corresponding cloud where the application servers are running through the corresponding WANs.

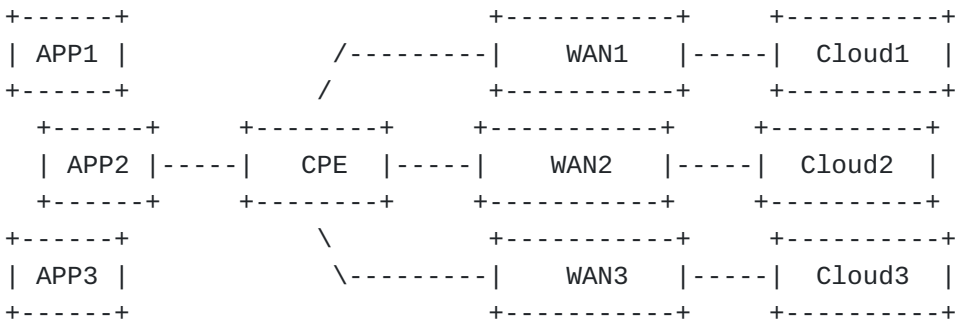

Figure 2: Traffic Steering into Cloud

2.3. APN for Value-added Service Provisioning in SD-WAN

APN can faciliate the value-added service provisioning in SD-WAN, either at the CPE or the POP.

At the CPE, network security and application acceleration services can be provided. With APN, certain malicious traffic can be identified and blocked, while the traffic that requires acceleration can be steered through the acceleration service.

At the POP, value-added service can be provisioned for certain application groups according to the APN attribute carried in their packets.

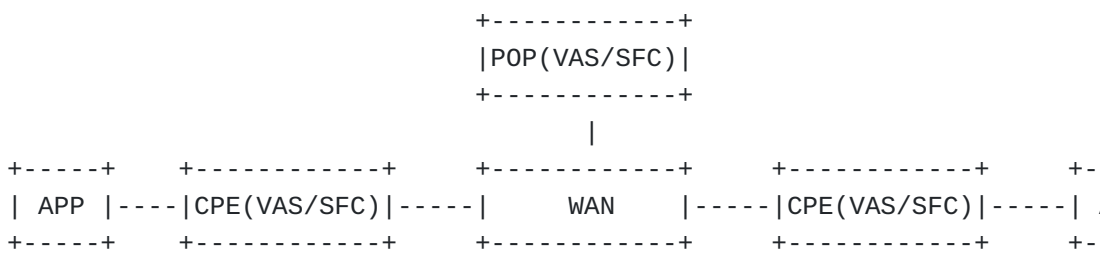

Figure 3: VAS Provisioning

2.4. APN for Data Processing in SD-WAN

In enterprise, usually important data is kept locally and it is preferred to be processed locally, while other data can be processed with the complex processing capabilities in the cloud.

With APN, the traffic can be steered according to the localization characteristics of the data, either being processed locally or in the cloud.

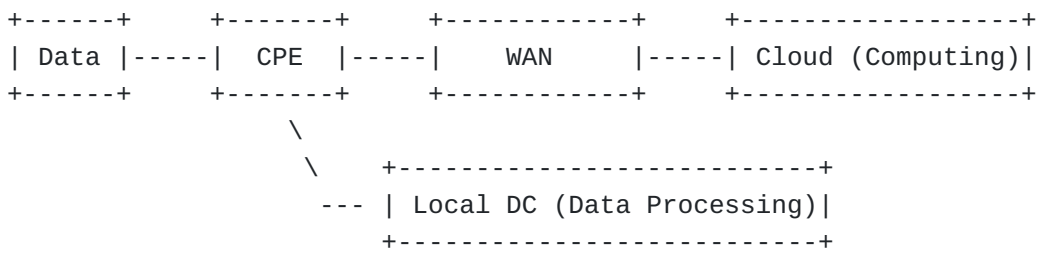

Figure 4: Data Processing

3. APN with SRv6

By carrying the APN attribute (including APN ID and APN parameters) through data packets, i.e., the delivery of application-aware information and ensuring the security and reliability of application-aware information, the network senses the application groups' requirements and provides high-quality differentiated services according to the demand of the applications. And when the network transmits the data packets, it matches the network correspondence policy according to the APN attribute in the data packets and selects the corresponding SRv6 path to transmit the data packets (e.g., low latency path) to meet the SLA requirements and service chain in order to improve the service quality.

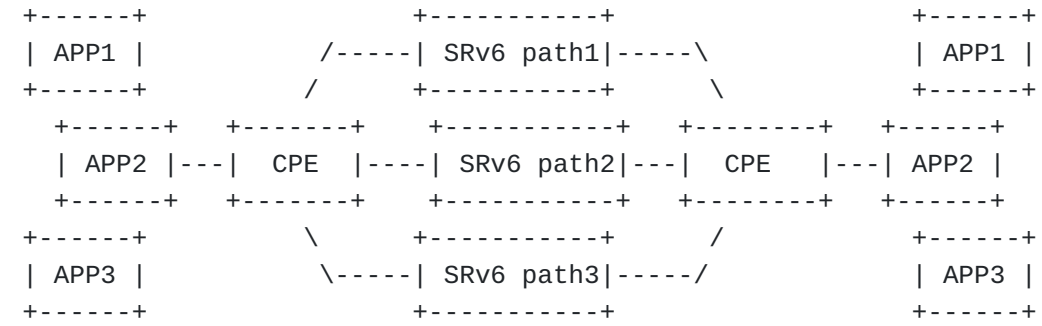

Figure 5: SRv6 enabled SD-WAN

4. APN with In-Flow OAM

SD-WAN needs to guarantee the experience of critical applications, and APNs can be used to carry application information to differentiate between different application traffic. At the same time, it is necessary to conduct end-to-end application-level

network quality awareness to achieve closed-loop control of network quality. SD-WAN uses Overlay to establish connectivity, which enable flow classification with APN, and work with In-Flow OAM detection to identify critical applications from thousands of streams, thus simplifying network quality assurance technology complexity for critical applications.

5. APN with Intention based Policy

By using APNs to identify services, SD-WAN can relate global policies to user service. This allows SD-WAN to automatically enforce performance goals and access security for users, regardless of their location. By identifying and sensing the service type, the global policy automatically selects a path for the service, such as Internet, to offload bandwidth-hungry services to the lower-cost Internet. Based on the global policy, rather than the network architecture, decisions can be made on how to isolate between endpoints, applications, and the cloud. Global policies also can be visualized and changed in real time to achieve sustainable trust as the network evolves.

6. APN for bandwidth utilization optimization

Bandwidth resource scheduling needs to perceive bandwidth consumption from a high level rather than a fine-grained application perspective. Using APN, a group of applications with the same characteristics can be aggregated into an application group, which is convenient to analyze the bandwidth resource occupation of the application group, so as to optimize network bandwidth utilization and application QoE.

7. Business Model of APN enhanced SD-WAN

With the digital transformation, the network infrastructure and cloud-based applications are emerging as an integrated service of network operators to provide a complete solution to customer. As an overlay technology, SD-WAN is able to simplify the network and make it more service-focused, which has become the de facto option for the Enterprise WAN Edge. SD-WAN enables the network service providers to reshape their network to provide more complex products to meet customers' various requirements.

When SD-WAN is integrated with APN, service providers are able to provide network services together with cloud services in a fine-granularity SaaS-like model. The latest functionalities can be delivered via cloud. Customers benefit from the pay-for-use model in per application granularity and have the agility to adjust the level of functionality, capability, and capacity. According to the APN attribute carried by the packets, corresponding paths/WANs can be

selected, the SLA can be guaranteed, and value-added services can be provisioned.

8. Security Considerations

The security consideration can refer to [I-D.li-apn-framework] .

9. IANA Considerations

There are no IANA considerations in this document.

10. Normative References

[I-D.li-6man-app-aware-ipv6-network]
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