Encoding Network Slice Identification for SRv6

draft-cheng-spring-srv6-encoding-network-sliceid-09

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IETF-121 Meeting, November 2024

Overview

- To provide network slicing service, network nodes need to identify a packet belonging to a network slice before it can apply the proper forwarding treatment.
- The Slice identifier (SLID) carried in the packet can be used to identify the network resources used in the forwarding process. (May also be referred to as NRP-ID [I-D.ietf-teas-ietf-network-slices])
- This Draft describes a method to encode SLID in the outer IPv6 header of an SR domain. It is more friendly to devices with limited performance and does not require hardware to process extra header or option on the data plane.

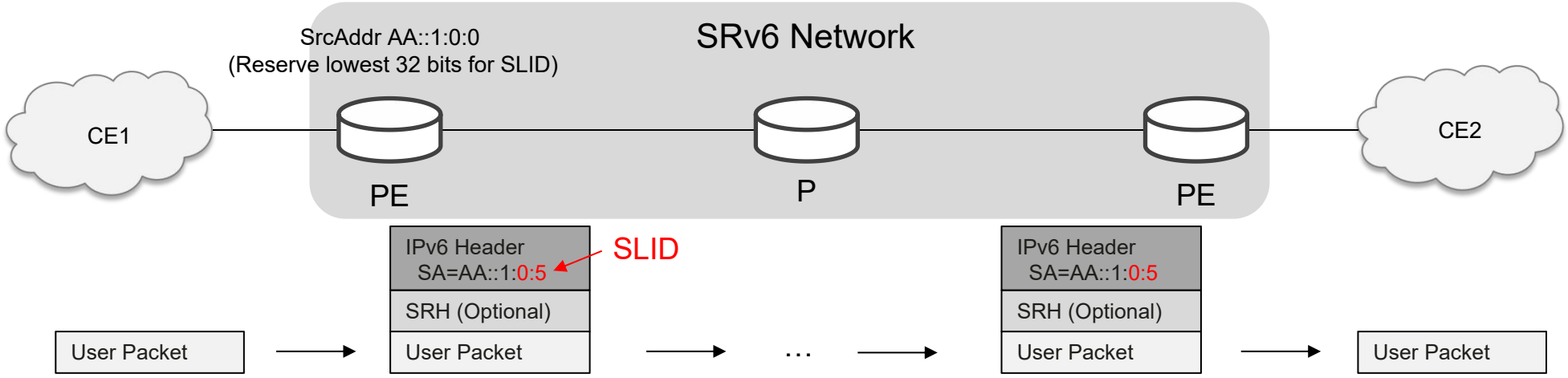
Encoding SLID in IPv6 Source Address

- When a packet enters the SR domain from an ingress PE, the ingress PE encapsulates the packet in an outer IPv6 header and optional SRH as defined in [RFC8754].
- The Slice identifier (SLID) is encoded in the Source Address of the outer IPv6 header.

Ingress PE:
- Encapsulate outer IPv6 header
- Encode SLID in Source Address
- Set SPI (SLID Presence Indicator)

P:
- Check SPI
- Parse SLID from Source Address
- Apply proper forwarding treatment

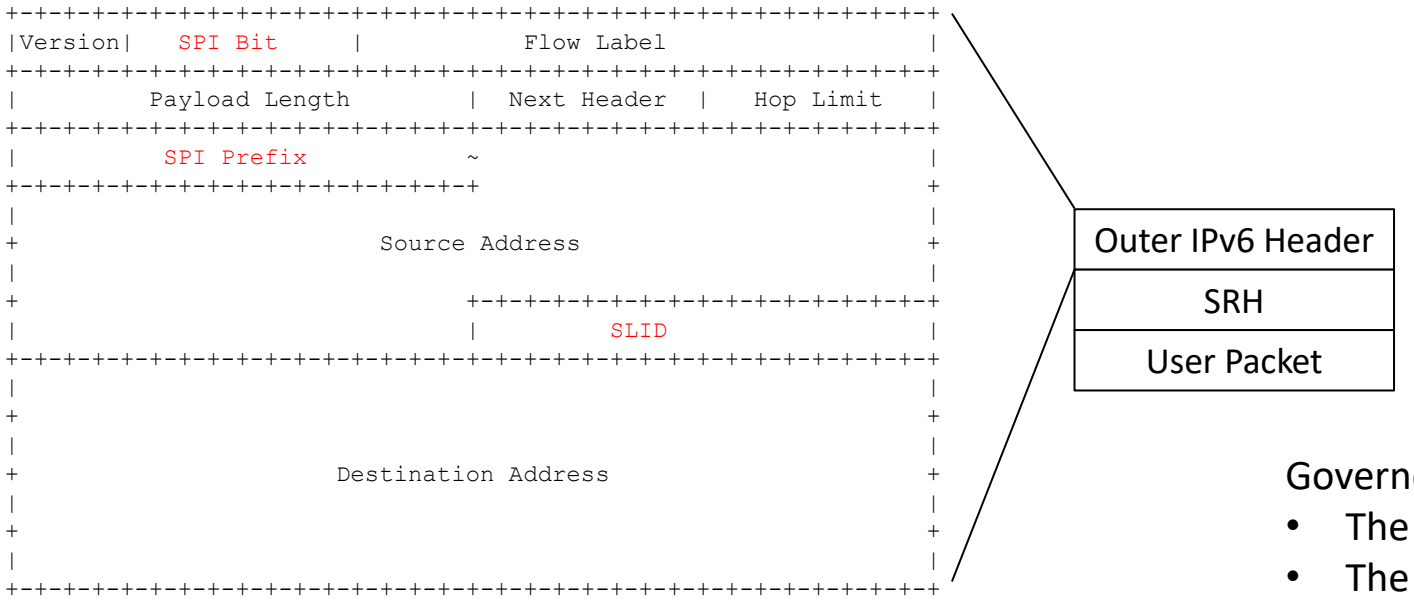
Egress PE:
- Decapsulate outer IPv6 header



SLID & SPI

- SPI (SLID Presence Indicator) is used to inform transit routers that a SLID is encoded.
- Two possible places in the outer IPv6 header for SPI:
  - SPI-bit in Traffic Class
  - SPI-Prefix in Source Address

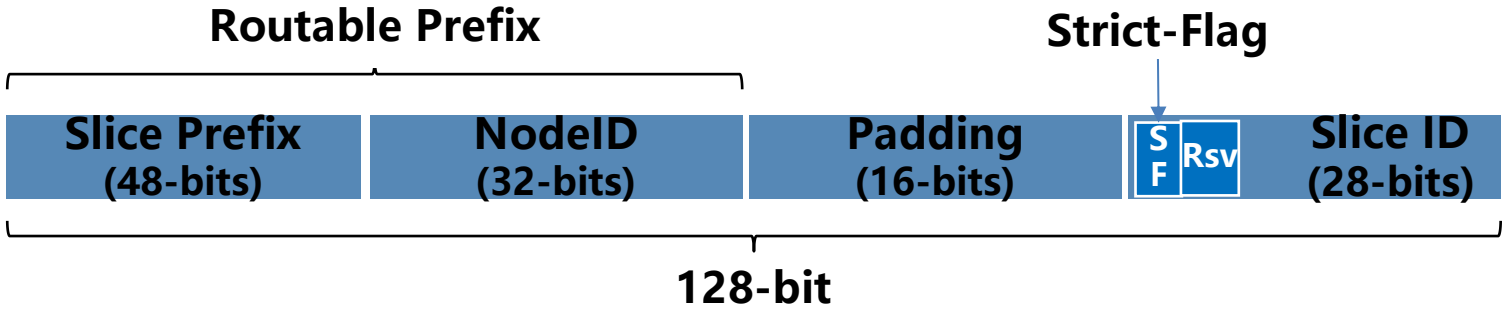
SPI Prefix	Node ID	Padding	SLID



Governed by local policy and uniform within the SR domain:

- The length of SLID
- The position of SPI bit, or the assignment of SPI prefix

Example IPv6 Slice Address Structure



		Len	
Slice Prefix		48 bits	The slice prefix is used to identify whether the source address includes a SLID, and this prefix is delivered to the chip. It should support the configuration of multiple slice prefixes.
NodeID		32 bits	Distinguish between different devices
Padding		16 bits	
SLID	Strict-Flag	1 bit	indicate whether the packet MUST be forwarded strictly using the network resource associated with the Slice ID
	Reserved	3 bits	
	Slice ID	28 bits	The slice identifier is contained within the lower 28 bits.

Implementation :

1. Slice Identification:

When forwarding packets, the IPv6 source address is matched against a slice-specific source prefix to identify packets belonging to a particular slice. NodeID is used to distinguish the source addresses of different devices.

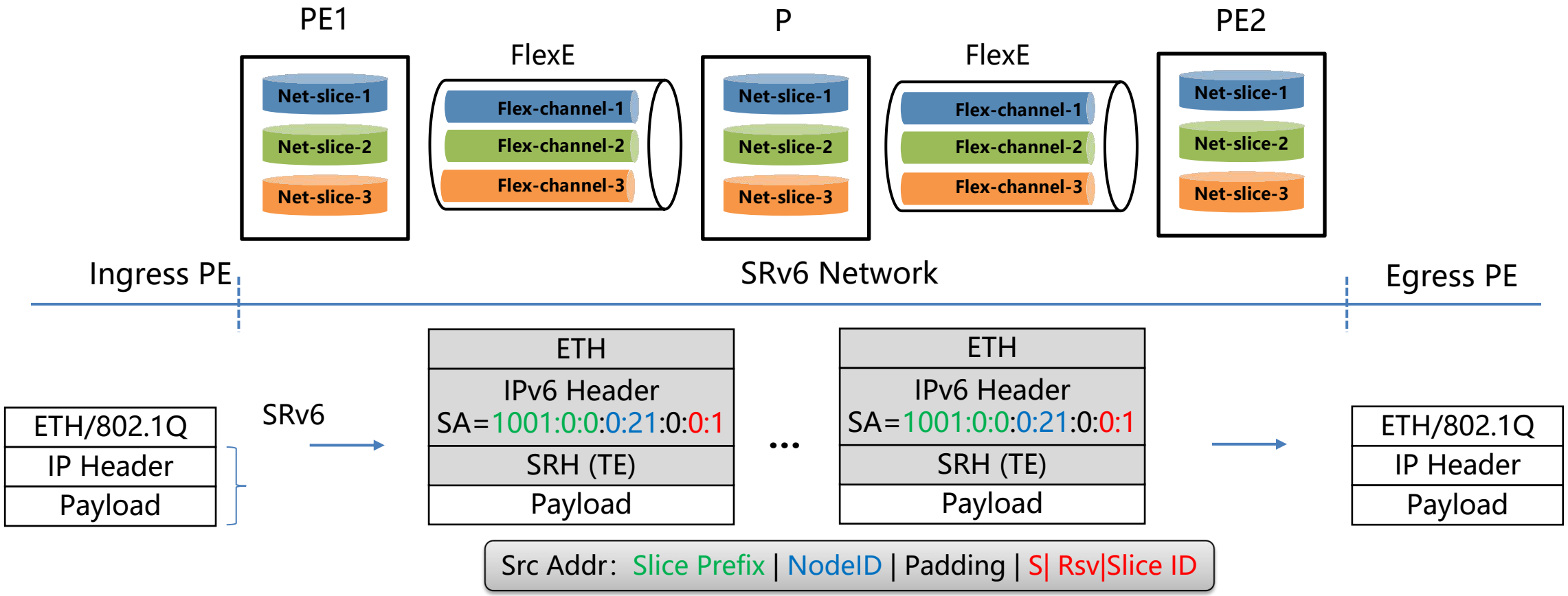
2. Slice ID Encapsulation:

The last 28 bits of the IPv6 source address are used to encapsulate the Slice ID.

3. Routable Prefix:

The combined slice prefix and NodeID constitute a routable prefix, which is advertised through Interior Gateway Protocol (IGP).

Use case



- Ingress PE : Encapsulate an outer IPv6 header, fill in the slice-specific source address, and carry the S Flag and slice ID in the last 32 bits.
- P: Match the IPv6 source address with the slice-specific source prefix, extract the S Flag and slice ID from the last 32 bits.
- Egress PE : Decapsulate the outer IPv6 header.

Running Code

Lab Interop-test Status

Hardware devices and software solutions that have successfully passed the SRv6 Source Address-based Network Slice Interoperability tests, conducted by China Mobile in 2024, include:

- H3C CR16010H-FA and CR19000-8
- Huawei NE40E and NE5000E
- ZTE M6000-8S Plus and M6000-3S
- Ruijie RG-N8010-R

EANTC 2024 TEST

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# 3.21 Link Slicing over Srv6  Feature: uSID
https://corteza.eantc.de/compose/ns/mpls2024/pages/353351227130384387/record/362466083095056386
### Purpose
Verify interoperability of link slicing via data and /or control plane
### Topology
![ImageLost](./img/20240105151219.png)
![ImageLost](./img/20240105151221.png)
### Description
Link slicing is a methodology employed to allocate the physical bandwidth on links amongst various tenants, ensuring the provision of minimum bandwidth for each tenant when
congestion arises and the capability to impose maximum transmission rates per tenant. Each slice can maintain its queue configurations, allowing for distinct classes of
service within that particular slice.
This could be realized using  data plane identifiers or control plane identifiers.

The draft is an individual draft, not WG adopted, so it is at all not certain that the suggestions specified in the draft (slice ID is encoded in last few bits of source
IPv6 address) will be adopted. The vendors participating in the test will agree what bits in the source IPv6 address will be used as slice ID.
### Test Procedure
Configure one/two IGP domains (topology 1 or 2), Configure eBGP/iBGP.
Configure SRv6/Srmpls
Define the slices and Assign traffic to the appropriate slice after the agreement between vendors in the network, which fields in the packet will be used for slice
identification. Or in case of control signaled slicing other attributes like BGP community.
Configure slice-specific QoS profile
Inject traffic that matches the criteria of each slice and verify that it is receiving the expected treatment based on the QoS policies applied.
### References
https://datatracker.ietf.org/doc/draft-cheng-spring-srv6-encoding-network-sliceid/07/
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Next Step

- Any questions or comments are welcome