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LSP Ping/Traceroute for SR-MPLS NRP SIDs

Abstract

[RFC8287] defines the extensions to MPLS LSP ping and traceroute for Segment Routing IGP-Prefix and IGP-Adjacency SIDs with an MPLS data plane. To correctly identify and validate an SR NRP SID, the validating device also requires NRP-ID to be supplied in the FEC Stack sub-TLV. This document introduces new Target FEC Stack sub-TLVs to perform MPLS LSP ping and traceroute for NRP SIDs.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on 13 September 2023.

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1. Introduction

The definition of the IETF Network Slice and the general principles of network slicing in the IETF context are specified in [I-D.ietf-teas-ietf-network-slices].

[I-D.ietf-teas-ns-ip-mpls] introduces the notion of a Slice-Flow Aggregate which comprises of one or more IETF network slice traffic streams. It also describes the Network Resource Partition (NRP) and the NRP Policy that can be used to instantiate control and data plane behaviors on select topological elements associated with the NRP that supports a Slice-Flow Aggregate. The NRP Identifier (NRP-ID) is globally unique within an NRP domain and that can be used in the control or management plane to identify the resources associated with the NRP.

[I-D.bestbar-spring-scalable-ns] describes an approach to extend SR to advertise new SID types called NRP SIDs. Such NRP SIDs are used by a router to define the forwarding action for a packet (next-hop selection), as well as to enforce the specific treatment (scheduling and drop policy) associated with the NRP.

[I-D.bestbar-lsr-spring-nrp] defines the IGP extensions for the prefix segment and adjacency segment that are required to support the signaling of SR NRP SIDs operating over SR-MPLS and SRv6 data planes. An additional distinguisher (NRP-ID) is carried to allow multiple SIDs to be assigned (and advertised) for the same topological element.

[RFC8287] defines the extensions to MPLS LSP Ping and Traceroute for Segment Routing IGP-Prefix and IGP-Adjacency SIDs with an MPLS data

plane. To correctly identify and validate an SR NRP SID, the validating device also requires NRP-ID to be supplied in the FEC Stack sub-TLV. This document introduces new Target FEC Stack sub-TLVs to perform MPLS Ping and Traceroute for NRP SIDs.

1.1. Requirements Language

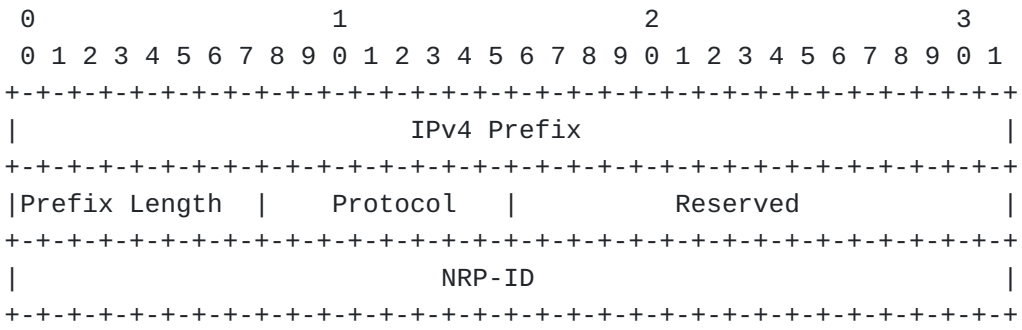
The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

2. NRP Segment ID Sub-TLVs

This section defines 3 new Segment ID Sub-TLVs. These sub-TLVs carry NRP-ID for OSPF and IS-IS as specified in [I-D.bestbar-lsr-spring-nrp] respectively.

2.1. IPv4 IGP-Prefix NRP Segment ID

The Sub-TLV format for IPv4 IGP-Prefix NRP Segment ID is as specified below:

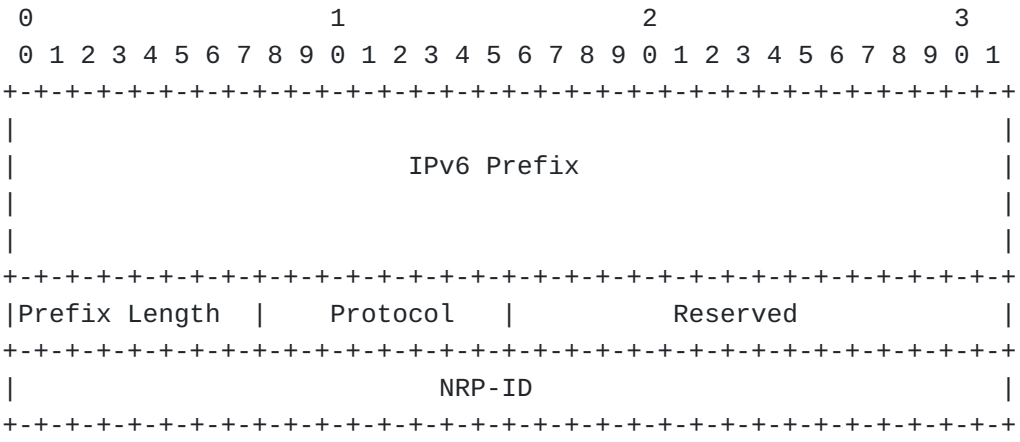


The meaning, format and processing rules of the IPv4 Prefix, Prefix Length and Protocol fields are the same as IPv4 IGP-Prefix Segment ID Sub-TLV defined in [RFC8287].

NRP-ID is a 4-octet identifier of Network Resource Partition.

2.2. IPv6 IGP-Prefix NRP Segment ID

The Sub-TLV format for IPv6 IGP-Prefix NRP Segment ID is as specified below:

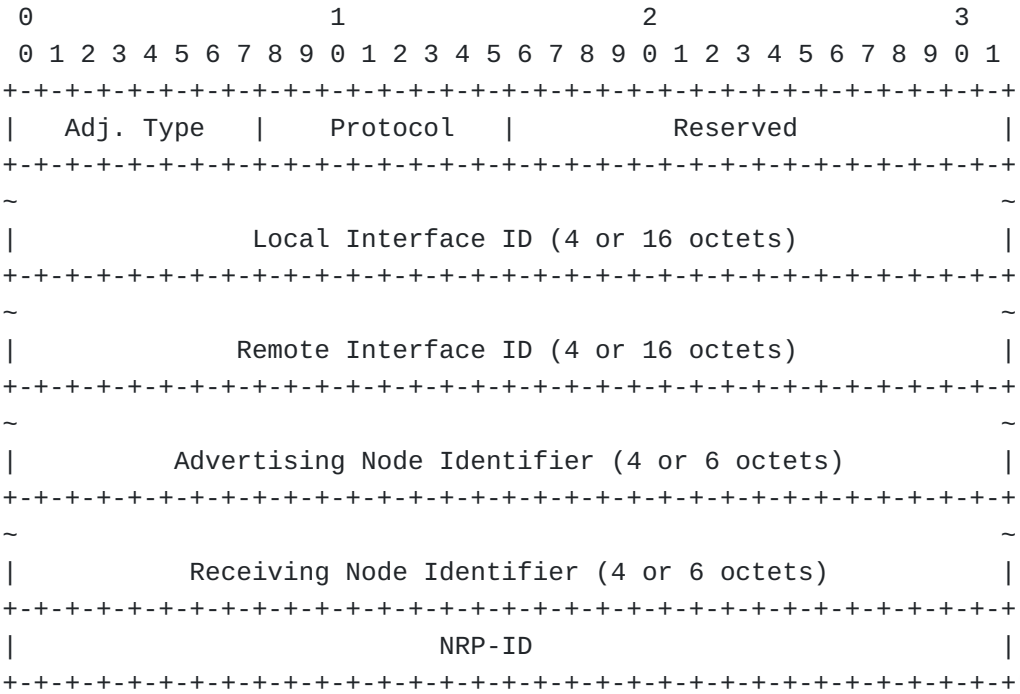


The meaning, format and processing rules of the IPv6 Prefix, Prefix Length and Protocol fields are the same as IPv6 IGP-Prefix Segment ID Sub-TLV defined in [RFC8287].

NRP-ID is a 4-octet identifier of Network Resource Partition.

2.3. IGP-Adjacency NRP Segment ID

The Sub-TLV format for IGP-Adjacency NRP Segment ID is as specified below:



The meaning, format and processing rules of the Adj. Type (Adjacency Type), Protocol, Local Interface ID, Remote Interface ID, Advertising Node Identifier, Receiving Node Identifier fields are the same as IGP-Adjacency Segment ID Sub-TLV defined in [RFC8287].

NRP-ID is a 4-octet identifier of Network Resource Partition.

3. Procedures

This section describes LSP Ping and Traceroute procedures for LSP with NRP SIDs.

3.1. Initiator Node Procedures

A node initiating LSP echo request packet for the NRP SID MUST identify and include the NRP-ID associated with the IGP Prefix/Adjacency SID in the Target FEC Stack sub-TLV. If the initiating node is not aware of the NRP-ID, the NRP-ID SHOULD be set to 0.

3.2. Responder Node Procedures

If responding node is validating the FEC Stack, it MUST validate the IGP Prefix/Adjacency SID advertisement for NRP-ID described in the incoming FEC sub-TLV.

If the responding node is including IGP Prefix/Adjacency NRP SID FEC in the FEC stack due to a FEC Stack Change operation, it MUST also include the NRP-ID associated with the SID, and set the Protocol to 1 or 2, based on the corresponding IGP.

4. IANA Considerations

IANA is requested to assign 3 new Sub-TLVs from "Sub-TLVs for TLV Types 1, 16 and 21" sub-registry from the "Multi-Protocol Label Switching (MPLS) Label Switched Paths (LSPs) Ping Parameters" (IANA-MPLS-LSP-PING) registry.

Sub-Type	Sub-TLV Name	Reference
TBD1	IPv4 IGP-Prefix NRP Segment ID	This document
TBD2	IPv6 IGP-Prefix NRP Segment ID	This document
TBD3	IGP-Adjacency NRP Segment ID	This document

5. Security Considerations

This document introduces no new security considerations.

6. References

6.1. 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>.

[RFC8287]
Kumar, N., Ed., Pignataro, C., Ed., Swallow, G., Akiya, N., Kini, S., and M. Chen, "Label Switched Path (LSP) Ping/Traceroute for Segment Routing (SR) IGP-Prefix and IGP-Adjacency Segment Identifiers (SIDs) with MPLS Data Planes", RFC 8287, DOI 10.17487/RFC8287, December 2017, <https://www.rfc-editor.org/info/rfc8287>.

6.2. Informative References

[I-D.bestbar-lsr-spring-nrp] Saad, T., Beeram, V. P., Chen, R., Peng, S., Wen, B., and D. Ceccarelli, "IGP Extensions for SR Network Resource Partition SIDs", Work in Progress, Internet-Draft, draft-bestbar-lsr-spring-nrp-01, 11 July 2022, <https://datatracker.ietf.org/doc/html/draft-bestbar-lsr-spring-nrp-01>.

[I-D.bestbar-spring-scalable-ns] Saad, T., Beeram, V. P., Chen, R., Peng, S., Wen, B., and D. Ceccarelli, "Scalable Network Slicing over SR Networks", Work in Progress, Internet-Draft, draft-bestbar-spring-scalable-ns-02, 16 September 2021, <https://datatracker.ietf.org/doc/html/draft-bestbar-spring-scalable-ns-02>.

[I-D.ietf-teas-ietf-network-slices]
Farrel, A., Drake, J., Rokui, R., Homma, S., Makhijani, K., Contreras, L. M., and J. Tantsura, "A Framework for IETF Network Slices", Work in Progress, Internet-Draft, draft-ietf-teas-ietf-network-slices-19, 21 January 2023, <https://datatracker.ietf.org/doc/html/draft-ietf-teas-ietf-network-slices-19>.

[I-D.ietf-teas-ns-ip-mpls]
Saad, T., Beeram, V. P., Dong, J., Wen, B., Ceccarelli, D., Halpern, J. M., Peng, S., Chen, R., Liu, X., Contreras, L. M., Rokui, R., and L. Jalil, "Realizing Network Slices in IP/MPLS Networks", Work in Progress, Internet-Draft, draft-ietf-teas-ns-ip-mpls-01, 24 October 2022, <https://datatracker.ietf.org/doc/html/draft-ietf-teas-ns-ip-mpls-01>.

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