MPLS
Internet-Draft
Intended status: Informational
Expires: January 14, 2021

Q. Xiong
G. Mirsky
ZTE Corporation
W. Cheng
China Mobile

July 13, 2020

The Use of Path Segment in SR-MPLS and MPLS Interworking draft-xiong-mpls-path-segment-sr-mpls-interworking-02

Abstract

This document illustrates the SR-MPLS and MPLS interworking scenarios to support end-to-end bidirectional tunnel across multiple domains with the use of Path Segments.

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 January 14, 2021.

Table of Contents

1. Introduction

Segment Routing (SR) leverages the source routing paradigm. A node steers a packet through an SR Policy instantiated as an ordered list of instructions called "segments". SR supports a per-flow explicit routing while maintaining per-flow state only at the ingress nodes of the SR domain. Segment Routing can be instantiated on MPLS data plane which is referred to as SR-MPLS [RFC8660]. SR-MPLS leverages the MPLS label stack to construct the SR path.

IP/MPLS technology can be deployed in domains, which may serve as an access, aggregation, or core network. Further, using SR architecture, the IP/MPLS network may be upgraded to support the SR-MPLS technology. As such transformation is performed incrementally, by one domain at the time, operators are faced with a requirement to support the interworking between MPLS and SR-MPLS networks at the boundaries to provide the end-to-end bidirectional service. As defined in [RFC8402], the headend of an SR Policy binds a Binding Segment ID(B-SID) to its policy. The B-SID could be bound to a SID List or selected path and used to stitch the SR list and the SR Label Switched Paths (LSP) across multiple domains. The use of the B-SID is recommended to reduce the size of the label stack and stitch the SR LSPs.

In some scenarios, for example, a mobile backhaul transport network, it is required to provide end-to-end bidirectional path across SR and MPLS networks. The Path Segment as defined in [I-D.ietf-spring-mpls-path-segment] can be used to support bidirectional tunnel scenarios such as SR path Performance Measurement (PM), end-to-end 1+1 SR path protection and bidirectional SR paths correlation.

This document illustrates the SR-MPLS and MPLS interworking scenarios to support end-to-end bidirectional tunnel across multiple domains with the use of Path Segments.

2. Conventions used in this document

2.1. Terminology

ABR: Area Border Routers. Routers used to connect two IGP areas (areas in OSPF or levels in IS-IS).

AS: Autonomous System. An Autonomous System is composed by one or more IGP areas.

ASBR: Autonomous System Border Router. A router used to connect together ASes of the same or different service providers via one or more inter-AS links.

Border Node: An ABR that interconnects two or more IGP areas.

Border Link: Two ASes are interconnected with ASBRs.

B-SID: Binding Segment ID.

Domains: Autonomous System (AS) or IGP Area. An Autonomous System is composed of one or more IGP areas.

e-PSID: end-to-end Path Segment.

IGP: Interior Gateway Protocol.

N-PSID: Nesting of Path Segments.

PM: Performance Measurement.

SID: Segment ID.

SR: Segment Routing.

SR-MPLS: Segment Routing with MPLS data plane.

S-PSID: Stitching of Path Segments.

VPN: Virtual Private Network.

2.2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

3. SR-MPLS Interworking with MPLS

It is required to establish the end-to-end Virtual Private Network (VPN) service across the access network, aggregation network, and core network. For example, SR-MPLS may be deployed in access and core network, and MPLS may be deployed in the aggregation network. The network interworking should be taken into account in deployment are the following:

- Border Node or Border Link
- Stitching of Path Segments or Nesting of Path Segments
- End-to-end Path Monitoring

The domains of the networks may be IGP Areas or ASes. The SR-MPLS and MPLS networks can be interconnected with a border node between IGP areas or border links between ASes. MPLS domain can be deployed between two SR-MPLS domains, as Figure 1 shows. The packets being transmitted along the SR path in SR-MPLS domains by using the SID list at the ingress node. And the path in MPLS domains can be pre-configuration either via NMS or via the MPLS control plane signaling. This document takes border node scenarios across IGP Areas domains for example. The border link scenarios are in future discussion.

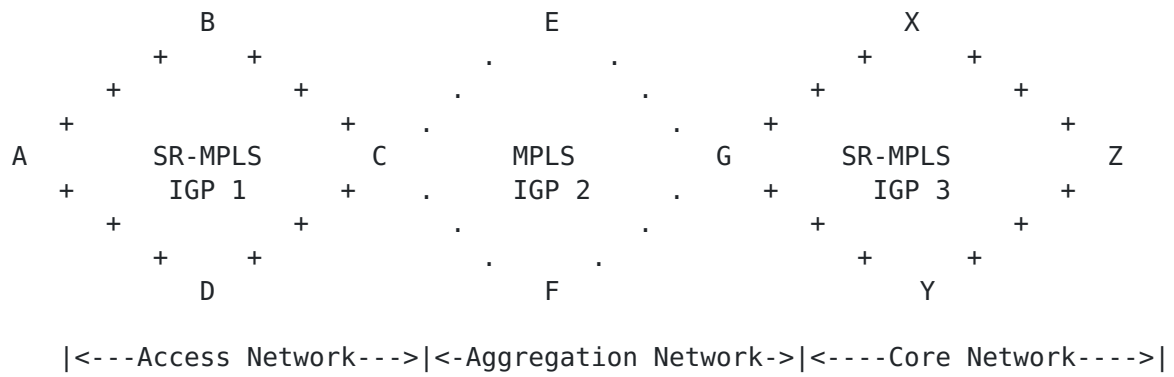

Figure 1: SR-MPLS and MPLS interworking Scenario

The VPN service across the SR-MPLS and MPLS domains is an end-to-end bidirectional path. In the SR-MPLS network, a Path Segment uniquely identifies an SR path and can be used for the end-to-end bidirectional path. This document illustrates the end-to-end Path Segment used in the interworking scenario including the stitching and nesting models. As described in [I-D.ietf-spring-mpls-path-segment], an end-to-end path segment or PSID (e-PSID), is also referred to as Nesting of Path SID (N-PSID) in nesting model or Stitching of Path SID (S-PSID) in stitching model.

3.1. Stitching of Path Segments

It is a common requirement that SR-MPLS needs to interwork with MPLS when SR is incrementally deployed in the MPLS domain. Figure 2 shows the stitching of Path Segments in SR-MPLS interworking with MPLS. The SR-LSPs and IP/MPLS LSPs are established independently in each domain which consist of SID list or MPLS label. The end-to-end bidirectional path acrossing the SR-MPLS and MPLS networks is split into multiple segments which can be identified by the S-PSID. The end-to-end path is terminated at the egress node in egress domain. The S-PSID will be popped out at the border node in each domain and correlated to the S-PSID of next domain.

The correlation of S-PSIDs can bind the segments of end-to-end path. The S-PSIDs are valid in the corresponding domain and the border nodes maintain the forwarding entries of that S-PSID segment that maps to the next S-PSID and the related path segments. In the headend node, the S-PSID can correlate the inter-domain path of reverse direction and bind the two unidirectional paths. The stitching of Path Segments can support the end-to-end path stitching and monitoring.

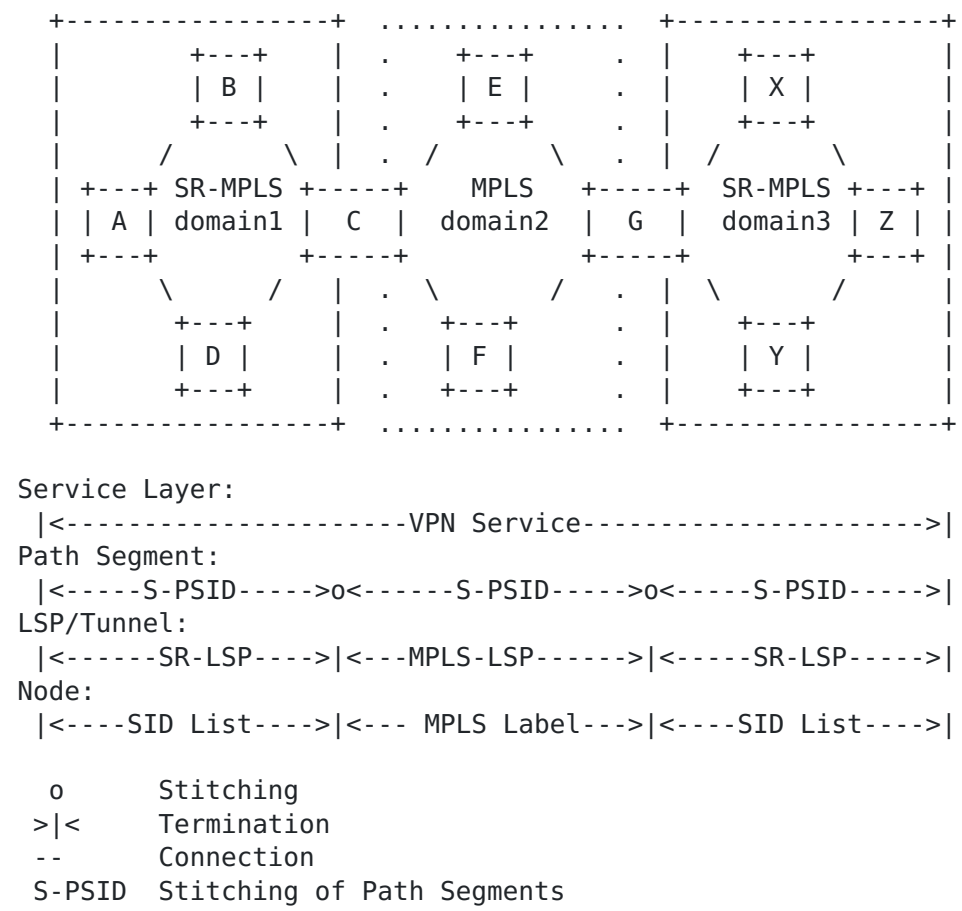

Figure 2: Stitching of Path Segments in SR-MPLS and MPLS interworking

3.2. Nesting of Path Segments

Figure 3 displays the nesting of Path Segments in SR-MPLS and MPLS interworking. The SR-LSPs and IP/MPLS LSPs are established in respective domain which consist of SID list or MPLS label. The SR-LSPs and IP/MPLS LSPs may be stitched across domains with B-SID. Comparing with S-PSID in the stitching model, the N-PSID presents end-to-end encapsulation in the packet from an SR-MPLS domain to an MPLS domain which is encapsulated at the ingress nodes and decapsulated at the egress nodes. The transit nodes, even the border nodes of domains, are not aware of the N-PSID.

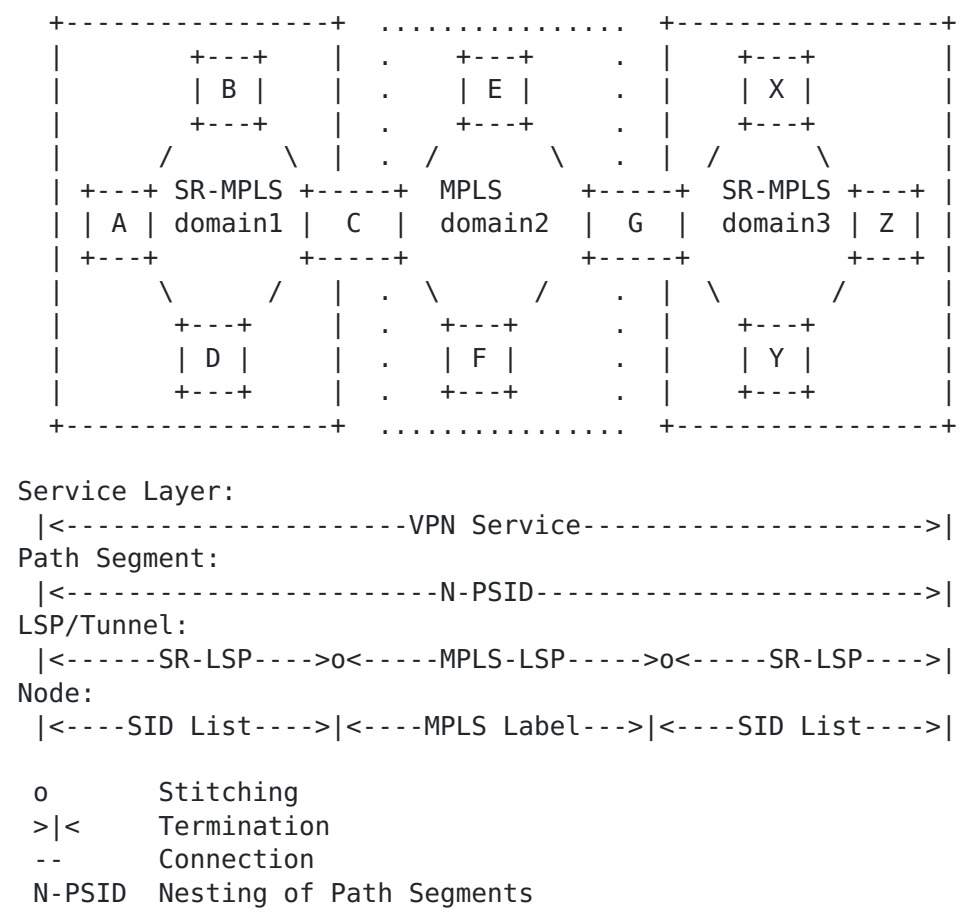

Figure 3: Nesting of Path Segments in SR-MPLS and MPLS interworking

4. Security Considerations

TBA

5. Acknowledgements

TBA

6. IANA Considerations

TBA

7. Normative References

[I-D.ietf-spring-mpls-path-segment]
Cheng, W., Li, H., Chen, M., Gandhi, R., and R. Zigler, "Path Segment in MPLS Based Segment Routing Network", draft-ietf-spring-mpls-path-segment-02 (work in progress), February 2020.

[I-D.xiong-spring-path-segment-sr-inter-domain]
Xiong, Q., Mirsky, G., and W. Cheng, "The Use of Path Segment in SR Inter-domain Scenarios", draft-xiong-spring-path-segment-sr-inter-domain-01 (work in progress), October 2019.

[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>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <https://www.rfc-editor.org/info/rfc8174>.

[RFC8402] Filsfils, C., Ed., Previdi, S., Ed., Ginsberg, L., Decraene, B., Litkowski, S., and R. Shakir, "Segment Routing Architecture", RFC 8402, DOI 10.17487/RFC8402, July 2018, <https://www.rfc-editor.org/info/rfc8402>.

[RFC8660] Bashandy, A., Ed., Filsfils, C., Ed., Previdi, S., Decraene, B., Litkowski, S., and R. Shakir, "Segment Routing with the MPLS Data Plane", RFC 8660, DOI 10.17487/RFC8660, December 2019, <https://www.rfc-editor.org/info/rfc8660>.

Authors' Addresses

Quan Xiong
ZTE Corporation
No.6 Huashi Park Rd
Wuhan, Hubei 430223
China

Phone: +86 27 83531060
Email: xiong.quan@zte.com.cn

Greg Mirsky
ZTE Corporation
USA

Email: gregimirsky@gmail.com

Weiqiang Cheng
China Mobile
Beijing
China

Email: chengweiqiang@chinamobile.com