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C. Li
Huawei Technologies
W. Cheng
China Mobile
M. Chen
D. Dhody
Z. Li
J. Dong
Huawei Technologies
R. Gandhi
Cisco Systems, Inc.
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Path Segment for SRv6 (Segment Routing in IPv6)
draft-li-spring-srv6-path-segment-01

Abstract

Segment Routing (SR) allows for a flexible definition of end-to-end paths by encoding paths as sequences of topological sub-paths, called "segments". Segment routing architecture can be implemented over an MPLS data plane as well as an IPv6 data plane.

Further, Path Segment has been defined to identify an SR path in SR-MPLS networks, and used for various use-cases such as end-to-end SR Path Protection and Performance Measurement (PM) of an SR path. Similar to SR-MPLS, this document defines Path Segment in SRv6 networks to identify an SRv6 path.

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1. Introduction

Segment routing (SR) [RFC8402] is a source routing paradigm that explicitly indicates the forwarding path for packets at the ingress node by inserting an ordered list of instructions, called segments.

When segment routing is deployed on MPLS dataplane, called SR-MPLS [I-D.ietf-spring-segment-routing-mpls], a segment is an MPLS label. When segment routing is deployed on IPv6 dataplane, called SRv6 [I-D.ietf-6man-segment-routing-header], a segment is a 128 bit value, and it can be an IPv6 address of a local interface but it does not have to. For supporting SR, an extended header called Segment Routing Header (SRH), which contains a list of SIDs and several needed information such as Segments Left, has been defined in [I-D.ietf-6man-segment-routing-header].

In an SR-MPLS network, when a packet is transmitted along an SR path, the labels in the MPLS label stack will be swapped or popped, so no

label or only the last label may be left in the MPLS label stack when the packet reaches the egress node. Thus, the egress node can not determine from which ingress node or SR path the packet comes. For identifying an SR-MPLS path, Path Segment is defined in [I-D.ietf-spring-mpls-path-segment].

Likewise, a path needs to be identified in an SRv6 network for several use cases such as binding bidirectional path [I-D.li-pce-sr-bidir-path] and end-to-end performance measurement [I-D.gandhi-spring-udp-pm]. A SRv6 path can be identified by the full segment list that made up of several SRv6 segments. However, the segment list may not be a good key to identify an SRv6 path, since the the length of segment list is too long and flexible according to the number of SIDs.

This document defines a new SRv6 segment called "SRv6 Path Segment" to identify an SRv6 path. Using of Path Segment as an SRv6 SID (instead of path ID carried by an SRH TLV) will see benefit in performance and also ease of using the same concept in SR, irrespective of SR-MPLS and SRv6 data planes. The Path Segment is inserted as the last segment in the segment list and will not affect the order of the original SID list.

1.1. 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.

1.2. Terminology

DM: Delay Measurement.

LM: Loss Measurement.

MPLS: Multiprotocol Label Switching.

PM: Performance Measurement.

PSID: Path Segment ID.

SID: Segment ID.

SL: Segment List.

SR: Segment Routing.

SR-MPLS: Segment Routing with MPLS data plane.

SRH: Segment Routing Header.

PSID: Path Segment ID.

PSP: Penultimate Segment Popping.

Further, this document makes use of the terms defined in [RFC8402] and [I-D.ietf-spring-srv6-network-programming].

2. SRv6 Path Segment

As defined in [I-D.ietf-spring-srv6-network-programming], a SRv6 segment is a 128 bit value, which can be present as LOC:FUNCT.

For identifying an SRv6 path, this document defines a new segment called SRv6 Path Segment.

A Path Segment (consisted of LOC and FUNCT part) can identify an SRv6 path within an SRv6 domain. Also, the SRv6 Path Segment may be used to identify an SRv6 Policy, its Candidate-path or a SID-List [I-D.ietf-spring-segment-routing-policy] terminating on an egress node depending on the use-case.

Note that, based on the use-case, the different SID-Lists of SR Policy may use the same SRv6 Path Segment.

3. Operation

A Path Segment is a local segment of egress node, it is allocated by the egress node. A Path Segment can be allocated by several ways, such as CLI, BGP [I-D.li-idr-sr-policy-path-segment-distribution], PCEP [I-D.li-pce-sr-path-segment] or other ways. The procedure of Path Segment allocation is out of scope of this document.

When the Path Segment is allocated by the egress, it MUST be distributed to the ingress node at minimum. In this case, the transit nodes do not know how to process the Path Segment.

A Path Segment is used for path identification and it MUST NOT be copied to the IPv6 destination address.

The SRv6 Path Segment MUST be inserted as the last entry in the SID list without affecting the segment left field in the SRH. The last entry field in SRH should be set as the index of the Path Segment, which is the last entry in the SID list. In this case, Path Segment presenting to a transit node is an error condition.

Also, PSP of the SRH MUST be disabled.

The Path Segment SHOULD appear only once in a SID list, and the one that appears at the last entry in the SID list will be processed while the rests will be ignored.

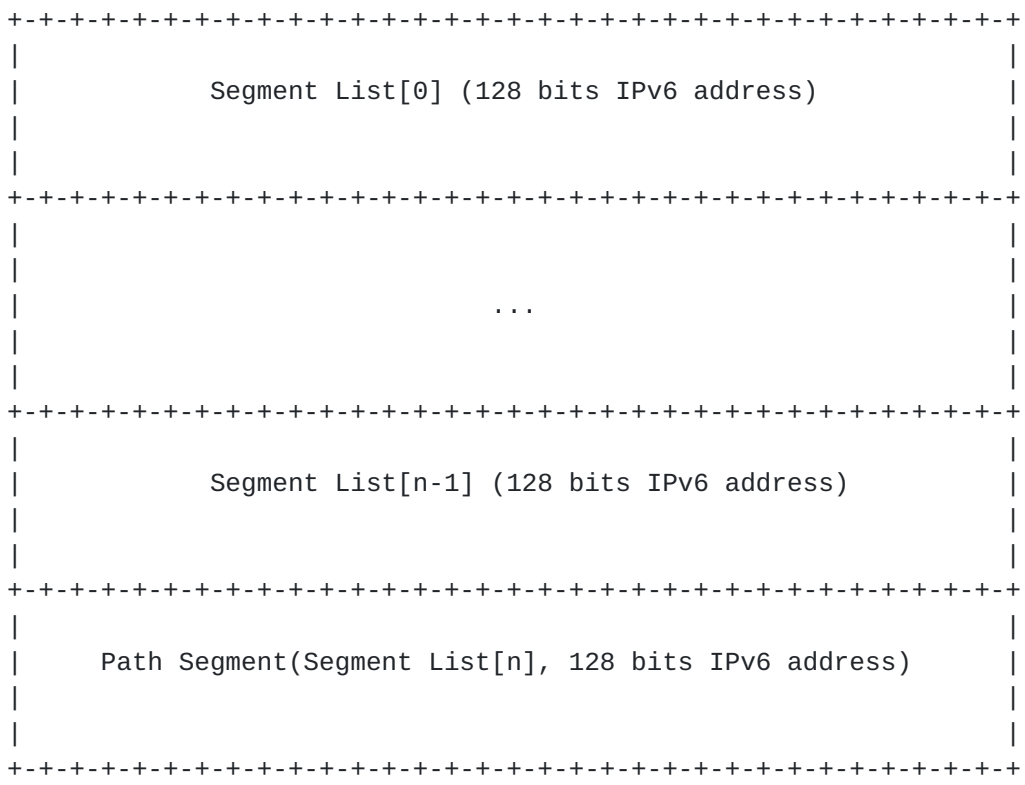

Figure 1. SRv6 Path Segment in SID List

If an egress node supports Path Segment processing and related OAM mechanisms are enabled, the node will inspect the last entry in the SID list to obtain the Path Segment. The behavior of Path Segment related function will be defined in the future version of this draft or related use-case drafts.

4. IANA Considerations

This document does not require any IANA actions.

5. Security Considerations

This document does not introduce additional security requirements and mechanisms other than the ones described in [RFC8402].

6. Acknowledgements

The authors would like to thank Zafar Ali for his valuable comments and suggestions.

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Authors' Addresses

Cheng Li
Huawei Technologies

Email: chengli13@huawei.com

Weiqiang Cheng
China Mobile

Email: chengweiqiang@chinamobile.com

Mach(Guoyi) Chen
Huawei Technologies

Email: mach.chen@huawei.com

Dhruv Dhody
Huawei Technologies
Divyashree Techno Park, Whitefield
Bangalore, Karnataka 560066
India

Email: dhruv.ietf@gmail.com

Zhenbin Li
Huawei Technologies
Huawei Campus, No. 156 Beiqing Rd.
Beijing 100095
China

Email: lizhenbin@huawei.com

Jie Dong
Huawei Technologies
Huawei Campus, No. 156 Beiqing Rd.
Beijing 100095
China

Email: jie.dong@huawei.com

Rakesh Gandhi
Cisco Systems, Inc.
Canada

Email: rgandhi@cisco.com