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MSD Consideration in Path Computation Element Communication Protocol (PCEP)
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Abstract

Segment Routing (SR) allows a node to steer a packet flow along any path. SR Policy is an ordered list of segments (i.e., instructions) that represent a source-routed policy. The packets steered into an SR Policy carry an ordered list of segments associated with that SR Policy. An SR Policy can be instantiated SR-MPLS and SRv6 data planes.

Maximum SID Depth (MSD) specifies the maximum number of SIDs that a Path Computation Client (PCC) is capable of imposing on a packet. The number of SIDs in an SR-TE path computed by the PCE on behalf of a PCC is dictated by the MSD value at the PCC. This draft specifies some MSD considerations PCE needs to take into account when computing the number of SIDs in an SR-TE path.

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.

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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1. Terminology

This document uses the following terms defined in [RFC5440]: PCC, PCE, PCEP.

SR: Segment Routing.

SID: Segment Identifier.

SRv6: Segment Routing over IPv6 data plane.

2. Introduction

Segment Routing (SR) [RFC8402] allows a node to steer a packet flow along any path. A Segment Routing Policy (SR Policy) [RFC8402] is an ordered list of segments that represent a source-routed policy. The headend node is said to steer a flow into an SR Policy. The packets steered into an SR Policy have an ordered list of segments associated with that SR Policy written into them. Segment Routing Policy Architecture [RFC9256] updates [RFC8402] as it details the concepts of SR Policy and steering into an SR Policy. An SR Policy can be instantiated SR-MPLS and SRv6 data planes.

Maximum SID Depth (MSD) specifies the maximum number of SIDs that a Path Computation Client (PCC) is capable of imposing on a packet. The number of SIDs in an SR-TE path computed by the PCE on behalf of a PCC is dictated by the MSD value at the PCC.

[RFC8664] defines the SR-PCE-CAPABILITY sub-TLV. PCEP speakers use this sub-TLV to exchange information about their SR capability, including MSD, which indicates that a PCC is capable of imposing on a packet. [RFC8664] also specifies MSD considerations PCE needs to take into account when computing the number of SIDs in an SR-TE path. Specifically, it mandates that once an SR-capable PCEP session is established with a non-zero MSD value, the corresponding PCE MUST NOT send SR-TE paths with a number of SIDs exceeding that MSD value. However, when an adjacency SID is the first SID in an SR Policy SID list, the top adjacency SID is not imposed on the packet.

This draft specifies a procedure for optimizing the number of SIDs in an SR-TE path that PCE can compute when the first SID in the SR Policy SID list is an adjacency SID. The procedure applies to the SR-MPLS data plane and SRv6 data plane. The procedure is backward compatible with [RFC8664].

3. Overview of PCEP Extensions

3.1. New flag in SR-PCE-CAPABILITY sub-TLV

A-flag (Adjacency SID exclusion for MSD consideration flag) is proposed in the SR-PCE-CAPABILITY sub-TLV defined in [RFC8664]. The bit position for the flag in the SR PCE Capability Flag Field registry is to be defined by IANA.

A (Adjacency SID exclusion for MSD consideration flag) - 1 bit (Bit Position TBD1):

* If set to 1, it indicates support for the A-flag by the PCEP peer.

3.2. New flag in SRv6-PCE-CAPABILITY sub-TLV

A-flag (Adjacency SID exclusion for MSD consideration flag) is proposed in the SRv6-PCE-CAPABILITY sub-TLV defined in [RFC9603]. The bit position for the flag in the SRv6 Capability Flag Field registry is to be defined by IANA.

A (Adjacency SID exclusion for MSD consideration flag) - 1 bit (Bit Position TBD1):

* If set to 1, it indicates support for the A-flag by the PCEP peer.

4. Operation

[RFC8664] mandates that once an SR-capable PCEP session is established with a non-zero MSD value, the corresponding PCE MUST NOT send SR-TE paths with a number of SIDs exceeding that MSD value.

This procedure MUST only be applied if both the PCE and PCC have advertised support for the capability by setting the A-flag in their respective SR-PCE-CAPABILITY sub-TLV [[RFC8664]] or SRv6-PCE-CAPABILITY sub-TLVs [[RFC9603]]. Under these conditions, if the first SID in an SR-TE path is an adjacency SID, the PCE MUST NOT send SR-TE paths with a number of SIDs exceeding that (MSD+1) value.

5. Backward compatibility

The proposed procedure is backward compatible with [RFC8664] as it requires both PCE and PCC to support the optimization capabilities during the PCEP initialization phase by setting the A-flag in the SR-PCE-CAPABILITY and SRv6-PCE-CAPABILITY sub-TLV in the Open message. Specifically, if at least one PCEP peer is not capable of supporting the A-flag, the PCE MUST NOT send SR-TE paths with a number of SIDs exceeding that MSD value.

6. Security Considerations

TBA

7. IANA Considerations

TBA

8. References

8.1. Normative References

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[RFC8664] Sivabalan, S., Filsfils, C., Tantsura, J., Henderickx, W., and J. Hardwick, "Path Computation Element Communication Protocol (PCEP) Extensions for Segment Routing", RFC 8664, DOI 10.17487/RFC8664, December 2019, <https://www.rfc-editor.org/info/rfc8664>.

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[RFC9603] Li, C., Ed., Kaladharan, P., Sivabalan, S., Koldychev, M., and Y. Zhu, "Path Computation Element Communication Protocol (PCEP) Extensions for IPv6 Segment Routing", RFC 9603, DOI 10.17487/RFC9603, July 2024, <https://www.rfc-editor.org/info/rfc9603>.

8.2. Informative References

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