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SRv6 Policy SID List Optimization
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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.

In some use cases, an SRv6 Policy’s SID list ends with the policy endpoint’s node SID, and the traffic steered (over policy) already ensures that it is taken to the policy endpoint. In such cases, the SID list can be optimized by excluding the endpoint Node SID when installing the policy. This draft specifies procedures to indicate whether the endpoint’s node SID needs to be included or excluded when installing the SRv6 Policy.

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.

This Internet-Draft will expire on 7 January 2026.

Copyright Notice

Table of Contents

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. [RFC8986] describes the representation and processing of this ordered list of segments for Segment Routing over IPv6 (SRv6). [RFC9603] specifies PCEP extensions to support SR for the IPv6 data plane.

The SRv6 Policy SID list may end with the policy endpoint’s Node SID or the penultimate hop adjacency SID. If the computed SID list ends with the policy endpoint’s node SID and the overlay SID in the steered traffic (over policy) already ensures that the traffic is taken to the policy endpoint with the same intent, the SRv6 policy endpoint device needs to process back-to-back local node SIDs. Examples of overlay SID containing the local node SID are a service SID, a binding SID for transit policies, an EPE SID, etc. From a compression efficiency viewpoint, carrying back-to-back end-point node SID is inefficient. The SID list in the packet can be optimized by excluding the end-point node SID when installing the policy. End-point node SID exclusion improves the compression efficiency and makes packet processing more efficient for the policy endpoint.

Excluding the policy endpoint’s node SID is possible in most use cases, but not all. For example, if the SRv6 Policy is used to carry MPLS traffic, as described in [I-D.ietf-spring-srv6-mpls-interworking], it is not possible to exclude the policy endpoint’s node SID. Specifically, the endpoint’s node SID inclusion or exclusion is a policy attribute.

This draft specifies procedures needed to include or exclude the node SID when installing the SRv6 Policy.

3. SID List Optimization During Policy Creation

3.1. Policy Creation when using PCEP

The following procedure is applicable to both PCC-initiated Mode and PCE-initiated Mode.

A PCE always computes the SRv6 TE Policy SID list from the headend to the endpoint (node SID).

PCC and PCE exchange capabilities during the PCEP initialization phase to indicate the support for the SID list optimization.

If the PCEP peers are capable of supporting the SID list optimization, the PCE indicates the inclusion or exclusion of the last SID in the ERO as follows:

* If the computed SID list ends with the policy endpoint’s Node SID and the traffic steered over policy already ensures that the traffic is taken to the policy endpoint, the PCE MUST signal the exclusion of the last SID to the PCC. In this case, the PCC MUST NOT include the last SID (the endpoint node SID) when installing the SRv6 Policy sid list(s) used to carry data traffic. In this case, the PCE does not consider the the policy endpoint’s Node SID in the MSD consideration procedure. Specifically, suppose the size of the SRv6 TE Policy SID list computed by PCE is L. In this case, the PCE uses the sid-list length L-1 in the headend MSD consideration procedure. This is because the endpoint node SID is suppressed.

* If the computed SID list ends with the penultimate hop adjacency SID, the PCE MUST signal the inclusion of the last SID to the PCC. In this case, the PCC MUST include the last SID when installing the SRv6 Policy sid list(s) used to carry data traffic.

Protocol extension details can be found in [I-D.all-pce-srv6-policy-sid-list-optimization].

3.2. Policy Creation when using BGP

As defined in [RFC9256], an SR Policy is associated with one or more candidate paths. An SR Policy Controller [RFC9256] defines the set of policies and advertises them to policy headend routers (typically ingress routers). These policy advertisements use the BGP SR Policy SAFI [I-D.ietf-idr-sr-policy-safi].

When the SR Policy Controller completes computation of the SID list path:

* Endpoint Node SID Case:
  If the computed SID list ends with the policy endpoint's Node SID and the traffic steered by the policy already ensures delivery to the endpoint, the SR Policy Controller MUST signal exclusion of the terminal SID to SRv6 Policy headend routers. The headend routers MUST NOT include the endpoint's Node SID when installing the SRv6 Policy SID list(s) for data traffic.

* Penultimate Hop Adjacency SID Case:
  If the computed SID list ends with a penultimate hop Adjacency SID, the SR Policy Controller MUST signal inclusion of the terminal SID to SRv6 Policy headend routers. The headend routers MUST include this SID when installing the SRv6 Policy SID list(s) for data traffic.

Protocol extension details can be found in [I-D.liu-idr-sr-segment-list-optimize] and [I-D.lin-idr-sr-policy-admin-flags].

4. SID List Optimization Advertisement

[I-D.ietf-idr-bgp-ls-sr-policy] describes a mechanism to distribute SR policy information to external components using BGP-LS. SR policy information can be used by external components for path computation, re-optimization, service placement, network visualization, etc.

BGP-LS needs to be extended to indicate whether the endpoint's node SID is included or excluded in installing SID list(s) of the Candidate Path (CP) of an SRv6 Policy.

Protocol extension details can be found in [I-D.ali-idr-srv6-policy-sl-opt-distribution].

5. OAM Considerations

The SID list optimization outlined in this draft applies to the case where service traffic, like L3VPN, L2VPN, etc. is steered over policy. It does not apply to the probe packets, e.g., ping, traceroute, BFD, STAMP, etc., used for OAM (Operational and Management) of the SRv6 policy in the transport network.

6. Security Considerations

[RFC8754] defines the notion of an SR domain and use of SRH within the SR domain. Procedures for securing an SR domain are defined the section 5.1 and section 7 of [RFC8754]. This document does not impose any additional security challenges to be considered beyond security threats described in [RFC8754], [RFC8679] and [RFC8986].

7. IANA Considerations

None

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9. References

9.1. 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>.

[RFC5440] Vasseur, JP., Ed. and JL. Le Roux, Ed., "Path Computation Element (PCE) Communication Protocol (PCEP)", RFC 5440, DOI 10.17487/RFC5440, March 2009, <https://www.rfc-editor.org/info/rfc5440>.

[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>.

[RFC8679] Shen, Y., Jeganathan, M., Decraene, B., Gredler, H., Michel, C., and H. Chen, "MPLS Egress Protection Framework", RFC 8679, DOI 10.17487/RFC8679, December 2019, <https://www.rfc-editor.org/info/rfc8679>.

[RFC8754] Filsfils, C., Ed., Dukes, D., Ed., Previdi, S., Leddy, J., Matsushima, S., and D. Voyer, "IPv6 Segment Routing Header (SRH)", RFC 8754, DOI 10.17487/RFC8754, March 2020, <https://www.rfc-editor.org/info/rfc8754>.

[RFC8986] Filsfils, C., Ed., Camarillo, P., Ed., Leddy, J., Voyer, D., Matsushima, S., and Z. Li, "Segment Routing over IPv6 (SRv6) Network Programming", RFC 8986, DOI 10.17487/RFC8986, February 2021, <https://www.rfc-editor.org/info/rfc8986>.

[RFC9256] Filsfils, C., Talaulikar, K., Ed., Voyer, D., Bogdanov, A., and P. Mattes, "Segment Routing Policy Architecture", RFC 9256, DOI 10.17487/RFC9256, July 2022, <https://www.rfc-editor.org/info/rfc9256>.

[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>.

9.2. Informative References

[I-D.ali-idr-srv6-policy-sl-opt-distribution] Ali, Z., Lin, C., Liu, Y., Chen, R., Li, C., Venkateswaran, R. M., and Y. Qiu, "SRv6 Policy SID List Optimization Advertisement", Work in Progress, Internet-Draft, draft-ali-idr-srv6-policy-sl-opt-distribution-00, 1 March 2025, <https://datatracker.ietf.org/doc/html/draft-ali-idr-srv6-policy-sl-opt-distribution-00>.

[I-D.all-pce-srv6-policy-sid-list-optimization] Ali, Z., Lin, C., Liu, Y., Chen, R., and C. Li, "Path Computation Element Communication Protocol (PCEP) extensions for SRv6 Policy SID List Optimization", Work in Progress, Internet-Draft, draft-all-pce-srv6-policy-sid-list-optimization-01, 16 March 2025, <https://datatracker.ietf.org/doc/html/draft-all-pce-srv6-policy-sid-list-optimization-01>.

[I-D.ietf-idr-bgp-ls-sr-policy] Previdi, S., Talaulikar, K., Dong, J., Gredler, H., and J. Tantsura, "Advertisement of Segment Routing Policies using BGP Link-State", Work in Progress, Internet-Draft, draft-ietf-idr-bgp-ls-sr-policy-17, 6 March 2025, <https://datatracker.ietf.org/doc/html/draft-ietf-idr-bgp-ls-sr-policy-17>.

[I-D.ietf-idr-sr-policy-safi]
Previdi, S., Filsfils, C., Talaulikar, K., Mattes, P., and D. Jain, "Advertising Segment Routing Policies in BGP", Work in Progress, Internet-Draft, draft-ietf-idr-sr-policy-safi-13, 6 February 2025, <https://datatracker.ietf.org/doc/html/draft-ietf-idr-sr-policy-safi-13>.

[I-D.ietf-spring-srv6-mpls-interworking]
Agrawal, S., Filsfils, C., Voyer, D., Dawra, G., Li, Z., and S. Hegde, "SRv6 and MPLS interworking", Work in Progress, Internet-Draft, draft-ietf-spring-srv6-mpls-interworking-00, 17 October 2024, <https://datatracker.ietf.org/doc/html/draft-ietf-spring-srv6-mpls-interworking-00>.

[I-D.lin-idr-sr-policy-admin-flags]
Lin, C., Li, J., and R. Chen, "BGP SR Policy Extensions for Administrative Flags", Work in Progress, Internet-Draft, draft-lin-idr-sr-policy-admin-flags-01, 20 February 2025, <https://datatracker.ietf.org/doc/html/draft-lin-idr-sr-policy-admin-flags-01>.

[I-D.liu-idr-sr-segment-list-optimize]
Liu, Y., Lin, C., and R. Chen, "BGP Extension for SRv6 Policy Segment List optimization", Work in Progress, Internet-Draft, draft-liu-idr-sr-segment-list-optimize-01, 20 February 2025, <https://datatracker.ietf.org/doc/html/draft-liu-idr-sr-segment-list-optimize-01>.

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