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RFC 10094
Clarifying Segment Routing over IPv6 (SRv6) Segment Identifier (SID) List Processing

Abstract

Segment Routing over IPv6 (SRv6) is the instantiation of Segment Routing (SR) on the IPv6 data plane. Segments are indicated by Segment Identifiers (SIDs). SRv6 utilizes the Segment Routing Header (SRH), an IPv6 extension header that includes a SID list indicating the sequence of segments and any additional processing to be performed.

This document updates RFC 8754 by clarifying the processing of SID list entries. It does not change any elements of the SRv6 architecture.

Status of This Memo

This is an Internet Standards Track document.

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1. Introduction

The Segment Routing (SR) architecture is specified in [RFC8402]. SR forwards packets along a series of segments, and it may perform additional segment-specific processing on packets. Segments are indicated by Segment Identifiers (SIDs).

The mechanisms to achieve Segment Routing over IPv6 (SRv6) include the use of the Segment Routing Header (SRH) [RFC8754], an IPv6 extension header that includes a SID list indicating the sequence of segments and any additional processing to be performed.

This document updates [RFC8754] by clarifying the processing of SID list entries. It does not change any elements of the SRv6 architecture.

2. Clarification

The SRH is processed per Section 4 of [RFC8754]. One objective of that processing is to determine the value to place in the Destination Address field of the IPv6 packet. To this end, the next entry in the SID list in the SRH is processed and mapped to the value to place in the Destination Address field.

The value placed in the 128-bit Destination Address field of an IPv6 packet header needs to be a routable IPv6 address since that is required for forwarding the packet.

Note that entries in the SID list do not need to be fully formed IPv6 addresses that are copied directly to the Destination Address field of the IPv6 packet. The mapping from SID list entry to the destination address could be a direct copy (the SID list contains a list of IPv6 addresses) or could involve a more complex function.

An example of such a function is shown in [RFC9800], where a REPLACE-CSID compressed SID is expanded to be placed in the Destination Address field. Note that [RFC9800] formally updates [RFC8754] to allow this mapping function -- such an update would not have been needed if this document had already existed.

3. Updates to RFC 8754

3.1. Segments Left in Section 2 of RFC 8754

The definition of the Segments Left field of the SRH is presented as:

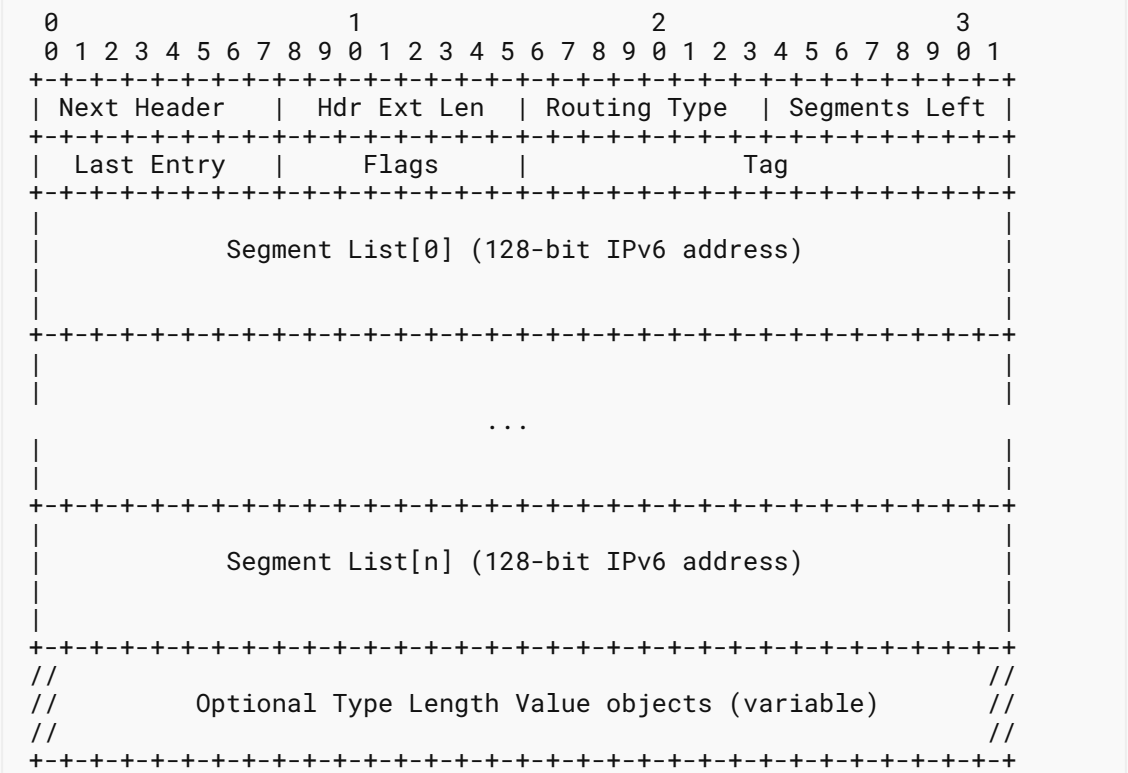
> Segments Left: Defined in [RFC8200], Section 4.4.

This is clarified by Erratum ID 7102 [Err7102]. This clarification is included in this update for completeness. The new text reads:

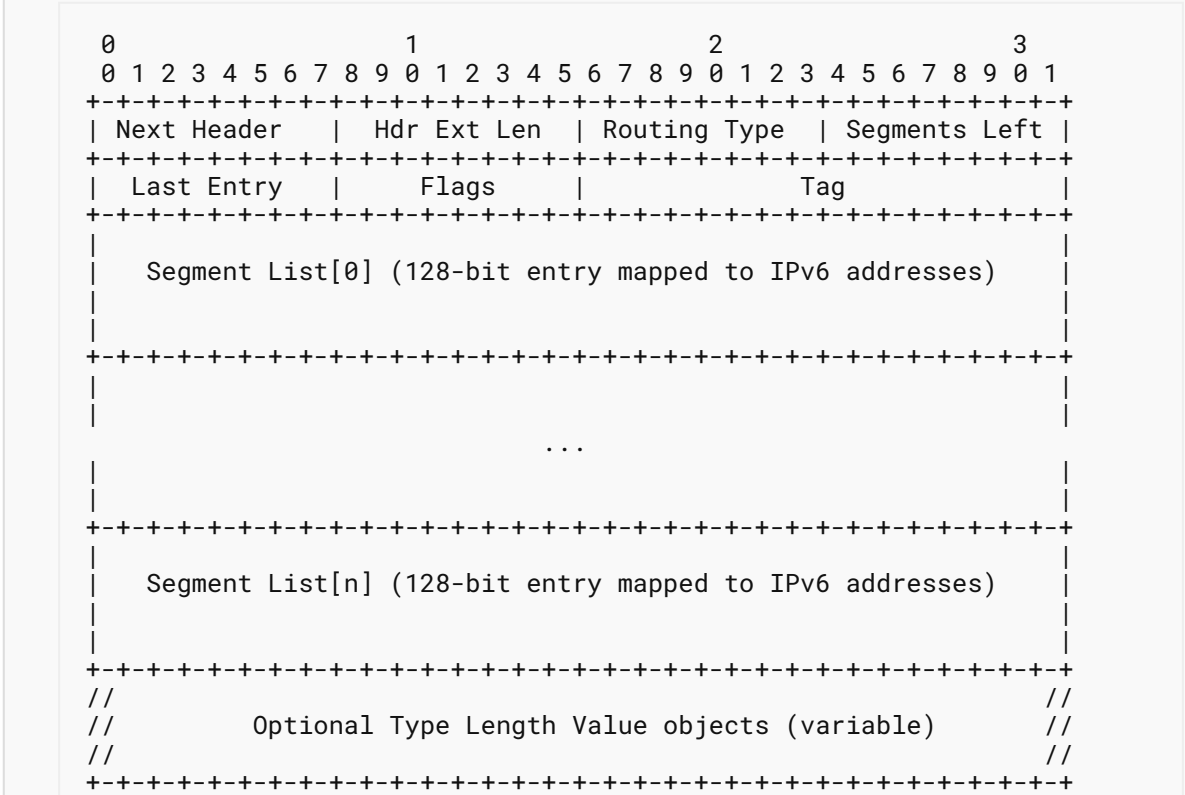
> Segments Left: Defined in [RFC8200], Section 4.4. Specifically, for the SRH, the number of unprocessed 128-bit entries in the Segment List.

3.2. Segment List in Section 2 of RFC 8754

The figure in Section 2 of [RFC8754] reads:



This is updated as follows to clarify that the entries in the Segment List are 128-bit entries, but not necessarily IPv6 addresses.



The text in [RFC8754] reads:

> Segment List[0..n]: 128-bit IPv6 addresses representing the nth segment in the Segment List. The Segment List is encoded starting from the last segment of the SR Policy. That is, the first element of the Segment List (Segment List[0]) contains the last segment of the SR Policy, the second element contains the penultimate segment of the SR Policy, and so on.

This is updated as follows to clarify that the entries in the Segment List are 128-bit entries, but not necessarily IPv6 addresses.

Segment List[0..n]: 128-bit entries representing the nth segment in the Segment List. The Segment List is encoded starting from the last segment of the SR Policy. That is, the first element of the Segment List (Segment List[0]) contains the last segment of the SR Policy, the second element contains the penultimate segment of the SR Policy, and so on.

3.3. HMAC Processing in Section 2.1.2.1 of RFC 8754

In describing the Hashed Message Authentication Code (HMAC) processing, the text in [RFC8754] says that HMAC verification checks that the destination address of the packet matches that indicated by the next entry in the Segment List.

- HMAC Segments Left is less than or equal to Last Entry, and the destination address is equal to Segment List[Segments Left].

This is updated to allow a nondirect mapping from the Segment List entry to the destination address as follows:

- HMAC Segments Left is less than or equal to the Last Entry, and the destination address is equal to the address created by mapping from Segment List[Segments Left].

Further, in describing the concatenation of information to generate the text field input to the HMAC computation, Section 2.1.2.1 of [RFC8754] says:

- SRH: All addresses in the Segment List (variable octets)

This is updated as follows to indicate that Segment List entries are not necessarily IPv6 addresses.

- SRH: All entries in the Segment List (variable octets)

3.4. ICMP Processing in Section 5.4 of RFC 8754

The method for deriving the destination address of the invoking packet in [RFC8754] reads as:

> - The SID at Segment List[0] may be used as the destination address of the invoking packet.

To allow for the zeroth entry in the Segment List to be mapped rather than copied to a destination address, this is updated to:

> - The SID at Segment List[0] may be mapped to derive the destination address of the invoking packet.

4. Operational Considerations

This document does not change any elements of the SRv6 architecture and, as such, it makes no change to the operational procedures or management tools of SR.

In clarifying the nature of SID list processing, this document also clarifies the nature of SID list entries. Operational and management tools that examine the SID list in a packet need to be aware of the nature of those entries in order to offer maximal clarity to the users of those tools.

5. Security Considerations

This document makes no changes to the security properties of SRv6. See [SRv6-SECURITY], [RFC8402], and [RFC8754] for more discussion of SRv6 security.

Note that describing the SID list entries as being mapped to the destination address of a packet enables potential additional security mechanisms, such as encrypting the SID list.

6. IANA Considerations

This document has no IANA actions.

7. References

7.1. Normative References

[RFC8200] Deering, S. and R. Hinden, "Internet Protocol, Version 6 (IPv6) Specification", STD 86, RFC 8200, DOI 10.17487/RFC8200, July 2017, <https://www.rfc-editor.org/info/rfc8200>.

[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>.

[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>.

7.2. Informative References

[Err7102] RFC Errata, Erratum ID 7102, RFC 8754, <https://www.rfc-editor.org/errata/eid7102>.

[RFC9800] Cheng, W., Ed., Filsfils, C., Li, Z., Decraene, B., and F. Clad, Ed., "Compressed SRv6 Segment List Encoding", RFC 9800, DOI 10.17487/RFC9800, June 2025, <https://www.rfc-editor.org/info/rfc9800>.

[SRv6-SECURITY] Buraglio, N., Mizrahi, T., Tong, T., Contreras, L. M., and F. Gont, "Segment Routing over IPv6 (SRv6) Security Considerations", Work in Progress, Internet-Draft, draft-ietf-spring-srv6-security-20, 17 November 2026, <https://datatracker.ietf.org/doc/html/draft-ietf-spring-srv6-security-20>.

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