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Export of Segment Routing over IPv6 (SRv6) Information in  
IP Flow Information Export (IPFIX)  
draft-tgraf-opsawg-ipfix-srv6-srh-05

Abstract

This document introduces new IP Flow Information Export (IPFIX) information elements to identify a set of Segment Routing over IPv6 (the SRv6) related information such as data contained in Segment Routing Header (SRH) dimensions, the SRv6 Control-control Plane plane Protocol protocol, and the SRv6 Endpointendpoint Behavior-behavior that traffic is being forwarded with.

Commenté [BMI1]: I don't parse what is meant here.

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## 1. Introduction

A ~~new typed~~dedicated ~~of~~-Routing Extension Header, called Segment Routing Header (SRH), is defined ~~by in~~ [RFC8754] ~~which is used for applying for use of~~ Segment Routing (SR) ~~on over the~~ IPv6 data plane.

~~Also, Three three~~ routing protocol extensions ~~(, OSPFv3-Extensions [I-D.li-lsr-ospfv3-srv6-extensions], IS-IS Extensions [I-D.ietf-lsr-isis-srv6-extensions], and BGP Prefix Segment Identifiers (Prefix-SIDs) [I-D.ietf-bess-srv6-services])~~ and one Path Computation Element Communication Protocol (PCEP) Extension [I-D.ietf-pce-segment-routing-ipv6] ~~have been~~are defined to propagate Segment Identifiers (SIDs) for ~~the IPv6 data plane~~SRv6.

SRv6 segment endpoint behaviors ~~have been~~are defined in [RFC8986] and describe how packets should be processed.

This document defines eleven new IPFIX Information Elements (IEs) and three new subregistries within the "IPFIX Information Elements" registry [RFC7012], ~~respectively~~ for the ~~new SRH dimensions, SRv6 endpoint behaviors and routing protocol and PCEP extensions~~SRv6 purposes (see Section 4 for more details).

Some examples are provided in Appendix A.

This document makes use of terms defined in [RFC8402].

## 2. IPFIX Information Elements

This section ~~defines and describes~~specifies the new SRv6 IPFIX IEs.

srhFlagsIPv6

8-bit flags defined in the SRH (Section 2 of [RFC8754]).

srhTagIPv6

16-bit tag field defined in the SRH (Section 2 of [RFC8754]). A tag is used to ~~that~~ marks a packet as part of a class or group of packets sharing the same set of properties.

srhSegmentIPv6

128-bit IPv6 address that represents an SRv6 segment.

srhActiveSegmentIPv6

128-bit IPv6 address that represents the active SRv6 segment.

srhSegmentIPv6BasicList

Ordered basicList (Section 4.1.1 of [RFC6313]) of zero or more 128-bit IPv6 addresses in the SRH that represents the SRv6 segment list. As specified in Section 2 of [RFC8754], The 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.

srhSegmentIPv6ListSection

Exposes the SRH Segment List as defined in ~~section~~ Section 2 of [RFC8754] as series of n octets.

srhSegmentIPv6sLeft

8-bit unsigned integer defining the number of ~~route~~ segments remaining to reach the end of the segment list.

srhSectionIPv6

Exposes the SRH and its ~~TLV's~~ TLVs as defined in ~~section~~ Section 2 of [RFC8754] as series of n octets.

srhActiveSegmentIPv6Type

Name of the routing protocol or PCEP extension from where the active SRv6 segment has been learned from.

srhSegmentLocatorLength

The number of significant bits. Together with srhSegmentIPv6 it enables the calculation of the SRv6 Locator.

srhSegmentEndpointBehavior

16-bit unsigned integer that represents a SRv6 Endpoint behavior as per Section 4 of [RFC8986].

Note that the srhSegmentIPv6, srhSegmentLocatorLength, and srhSegmentEndpointBehavior IPFIX IEs are generic fields, to be used

**Commenté [BMI2]:** You may explain why you need these two IEs.

**Commenté [BMI3]:** Do you mean « 128-bit IPv6 addresses representing the nth segment in the Segment List » ?

**Commenté [BMI4]:** Wouldn't the content be redundant with some of the above IEs? How this IE is typically used?

in the context of IPFIX Options Templates or IPFIX Structured Data [RFC6313].

### 3. Sample Use Cases

~~By using The IPFIX IEs~~ srhSegmentIPv6BasicList(TBD5) or ~~the~~ srhSegmentIPv6ListSection (TBD6), srhActiveSegmentIPv6 (TBD4), srhSegmentIPv6sLeft (TBD7), srhActiveSegmentIPv6Type(TBD9), ~~the~~ forwardingStatus(89), and some existing counters information allows to provide, it is possible ~~to answer the following questions (amongst others) answers to the following:~~

\* ~~how~~ How many packets are forwarded or dropped using SRv6 in a network?

\* if dropped, for which reasons,

\* ~~identify the~~ What is the current -active segment and its associated control plane protocol ?

\* What is the SRv6 segment list ?

\* What is the next SRv6 node and its type ?

\* ~~and h~~ How many SRv6 segments are left ?

### 4. IANA Considerations

This document requests IANA to create ~~new IEs (see table 1) and~~ three new subregistries called "IPFIX IPv6 SRH Flags" (table 2), "IPFIX IPv6 SRH Segment ~~type~~ Type" (table 3), and "IPFIX ~~SRV6-SRv6~~ Endpoint Behavior"

(table 4) under the "IPFIX Information Elements" registry [RFC7012] available at [IANA-IPFIX]. ~~and assign the following initial code points.~~

Also, document requests IANA to register the new IEs (see the following subsections) in the "IPFIX Information Elements" registry [RFC7012] available at [IANA-IPFIX].

Commenté [BMI5]: Which IE allows this?

Element ID	Name
TBD1	srhFlagsIPv6
TBD2	srhTagIPv6
TBD3	srhSegmentIPv6
TBD4	srhActiveSegmentIPv6

TBD5	srhSegmentIPv6BasicList
TBD6	srhSegmentIPv6ListSection
TBD7	srhSegmentIPv6sLeft
TBD8	srhSectionIPv6
TBD9	srhActiveSegmentIPv6Type
TBD10	srhSegmentLocatorLength
TBD11	srhSegmentEndpointBehavior

Table 1: ~~Creates-New~~ IEs in the "IPFIX Information Elements" registry

Note to the RFC-Editor:

- \* Please replace TBD1 - TBD16 with the values allocated by IANA
- \* Please replace the [RFC-to-be] with the RFC number assigned to this document

4.1. **srhFlagsIPv6**

Name: srhFlagsIPv6 ElementID: TBD1 Description: This Information Element identifies the 8-bit flags defined in the SRH. Values for this Information Element are listed in the "IPFIX IPv6 SRH Flags" registry, see Abstract Data Type: unsigned8 Data Type Semantics: flags Reference: [RFC-to-be], RFC8754[IANA-IPFIX]. srhFlagsIPv6 values must not be directly added to this "IPFIX IPv6 SRH Flags" registry. They must instead be added to the "Segment Routing Header Flags" registry. Both the "IPFIX IPv6 SRH Flags" and the "Segment Routing Header Flags" registries must be kept in synch. Initial values in the registry are defined by the table below.

Value	Description	Reference
0-1	Unassigned	
2	O-flag	[RFC-ietf-6man-spring-srv6-oam-13]
3-7	Unassigned	

Table 2: "IPFIX IPv6 SRH Flags" registry

4.2. **srhTagIPv6**

**Commenté [BMI6]:** I would remove this table as this is redundant with the content of the following subsections.

**Commenté [BMI7]:** Please fix the formatting. This applies for all the following subsections.

**Commenté [BMI8]:** Consider adding a note to that registry to echo new values into this IPFIX one.

Name: srhTagIPv6 ElementID: TBD2 Description: This Information Element identifies the 16-bit tag field defined in the SRH that marks a packet as part of a class or group of packets sharing the same set of properties. Abstract Data Type: unsigned16 Data Type Semantics: identifier Reference: [RFC-to-be], RFC8754

#### 4.3. srhSegmentIPv6

Name: srhSegmentIPv6 ElementID: TBD3 Description: This Information Element identifies the 128-bit IPv6 address that represents an SRv6 segment. Abstract Data Type: ipv6address Data Type Semantics: default Reference: [RFC-to-be], RFC8754

#### 4.4. srhActiveSegmentIPv6

Name: srhActiveSegmentIPv6 ElementID: TBD4 Description: This Information Element identifies the 128-bit IPv6 address that represents the active SRv6 segment. Abstract Data Type: ipv6address Data Type Semantics: default Reference: [RFC-to-be], RFC8754

#### 4.5. srhSegmentIPv6BasicList

Name: srhSegmentIPv6BasicList ElementID: TBD5 Description: This Information Element identifies the Ordered basicList [RFC6313] of zero or more 128-bit IPv6 addresses in the SRH that represents the SRv6 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. Abstract Data Type: basicList Data Type Semantics: list Reference: [RFC-to-be], RFC8754

#### 4.6. srhSegmentIPv6ListSection

Name: srhSegmentIPv6ListSection ElementID: TBD6 Description: Exposes the SRH Segment List as defined in section 2 of Abstract Data Type: octetArray Data Type Semantics: default Reference: [RFC-to-be], RFC8754[RFC8754] as series of n octets.

#### 4.7. srhSegmentIPv6sLeft

Name: srhSegmentIPv6sLeft ElementID: TBD7 Description: This Information Element identifies the 8-bit unsigned integer defining the number of route segments remaining to reach the end of the segment list. Abstract Data Type: unsigned8 Data Type Semantics: quantity Reference: [RFC-to-be], RFC8754

#### 4.8. srhSectionIPv6

Name: srhSectionIPv6 ElementID: TBD8 Description: This Information Element exposes the SRH and its TLV's as defined in section 2 of Abstract Data Type: octetArray Data Type Semantics: default Reference: [RFC-to-be], RFC8754[RFC8754] as series of n octets.

#### 4.9. srhActiveSegmentIPv6Type

Name: srhActiveSegmentIPv6Type ElementID: TBD9 Description: This

Information Element identifies the name of the routing protocol or PCEP extension from where the active SRv6 segment has been learned from. Values for this Information Element are listed in the "IPFIX IPv6 SRH Segment type" subregistry, see Abstract Data Type: unsigned8 Data Type Semantics: identifier Reference: [RFC-to-be][IANA-IPFIX]. Initial values in the registry are defined by the table below. New assignments of values will be administered by IANA and are subject to Expert Review [RFC8126]. Experts need to check definitions of new values for completeness, accuracy, and redundancy.

Value	Description	Reference
TBD12	Unknown	[RFC-to-be]
TBD13	Path Computation Element	[RFC-to-be], draft-ietf-pce-segment-routing-ipv6
TBD14	OSPFv3 Segment Routing	[RFC-to-be], draft-li-ospf-ospfv3-srv6-extensions
TBD15	IS-IS Segment Routing	[RFC-to-be] draft-ietf-lsr-isis-srv6-extensions
TBD16	BGP Segment Routing Prefix-SID	[RFC-to-be], draft-ietf-bess-srv6-services

Table 3: "IPFIX IPv6 SRH Segment type" subregistry

4.10. srhSegmentLocatorLength

Name: srhSegmentLocatorLength ElementID: TBD10 Description: This Information Element identifies the number of significant bits and together with srhSegmentIPv6 enables the calculation of the SRv6 Locator. Abstract Data Type: unsigned8 Data Type Semantics: default Reference: [RFC-to-be], RFC8986 Section 3.1

4.11. srhSegmentEndpointBehavior

Name: srhSegmentEndpointBehavior ElementID: TBD11 Description: This Information Element identifies the 16-bit SRv6 Endpoint behavior. Values for this Information Element are listed in the "IPFIX SRV6 Endpoint Behavior" registry, see Abstract Data Type: unsigned16 Data Type Semantics: identifier Reference: [RFC-to-be], RFC8986 Section 4[IANA-IPFIX]. srhSegmentEndpointBehavior values must not be directly added to this "IPFIX SRV6 Endpoint Behavior" registry. They must instead be added to the "Segment Routing SRv6 Endpoint Behaviors" registry. Both the "IPFIX SRV6 Endpoint Behavior" and the "Segment Routing SRv6 Endpoint Behaviors" registries must be kept in synch.

Value	Hex	Endpoint Behavior	Reference	Change Controller

Commenté [BMI9]: Add NEW text to ask IANA to add a note to that registry so that new values are echoed in the new "IPFIX SRV6 Endpoint Behavior " registry

Commenté [BMI10]: Do you really need to define a new registry here?





## 8. References

### 8.1. Normative References

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- [RFC8126] Cotton, M., Leiba, B., and T. Narten, "Guidelines for Writing an IANA Considerations Section in RFCs", RFC 8126, DOI 10.17487/RFC8126, BCP 26, June 2017, <<https://www.rfc-editor.org/info/rfc8126>>. [RFC8754]
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a mis en forme : Français (France)

a mis en forme : Anglais (États-Unis)

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[IANA-IPFIX]  
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<<https://www.iana.org/assignments/ipfix/ipfix.xhtml>>.

~~[RFC8754] Filsfils, C., Ed., Dukes, D., Ed., Previdi, S., Leddy, J.,  
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(SRH)", DOI 10.17487/RFC8754, RFC 8754, 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>>.

#### Appendix A. IPFIX Encoding Examples

This appendix represents three different encodings for the newly  
introduced IEs, for the example values in ~~the table Table~~ 5. The  
three  
different encodings ~~uses-use~~ the following IEs, respectively:  
srhSegmentIPv6BasicList, srhSegmentIPv6ListSection, and  
srhSectionIPv6.

SRH Nr	SRH Flags	SRH Tag	Active Segment Type	Segment List
1	0	123	IS-IS <del>[TBD15]</del>	2001:db8::1, 2001:db8::2, 2001:db8::3
2	0	456	IS-IS <del>[TBD15]</del>	2001:db8::4, 2001:db8::5
3	0	789	IS-IS <del>[TBD15]</del>	2001:db8::6

Table 5: three observed SRH headers and their routing protocol

##### A.1. Template Record and Data Set with Segment Basic List

With this encoding, the examples in Table 5 are represented with the  
following IEs: "=>" is used to indicate which IE is mapped to a given  
information.

- \* SR Flags => srhFlagsIPv6 ~~(TBDxx)~~
- \* SR Tag => srhTagIPv6 ()
- \* Active Segment Type => srhActiveSegmentIPv6Type ()

**Commenté [BMI12]:** No need to mix with IE related  
information in the table

**Commenté [BMI13]:** Please indicate the TBDx, each time  
an IE is called in the text. I suggest this to be consistently  
applies for all IEs through the document. Thanks.

```

* Segment List => srhSegmentIPv6BasicList
  0      1      2      3
  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          SET ID = 2          |          Length = 24          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          Template ID = 256   |          Field Count = 4      |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|0|          srhFlagsIPv6 = TBD1 |          Field Length = 1   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|0|          srhTagIPv6 = TBD2  |          Field Length = 2   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|0|srhActiveSegmentIPv... = TBD9|          Field Length = 1   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|0|srhSegmentIPv6BasicList= TBD5|          Field Length = 0xFFFF |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

Table 6 Figure X: Template Record with Basic List Encoding

**Commenté [BMI14]:** For convenience, add a text to reminder readers about where to find the definition for other fields in the template.

Format

In this example, the Template ID is 256, which will be used in the Data Record. The field length for srhSegmentIPv6BasicList is 0xFFFF, which means the length of this IE is variable, and the actual length of this IE is indicated by the List Length field in the basicList format as per [RFC6313].

The data set is represented as follows:

```

  0      1      2      3
  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          SET ID = 256        |          Length = 136        |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| srhFlagsIPv6 |          srhTagIPv6 = 123 | srhActiveSegme |
| = 0          |                          | ntIPv...=TBD15 |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          255          | List Length = 53 | semantic=      |
|          |          | ordered        |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          srhSegmentIPv6 = TBD3 |          Field Length = 16 |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          Segment List[0] = 2001:db8::1 |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          Segment List[1] = 2001:db8::2 |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

```

|          Segment List[2] = 2001:db8::3          |
+-----+-----+-----+-----+-----+-----+
|          ...          |
+-----+-----+-----+-----+-----+-----+
|          ...          |
+-----+-----+-----+-----+-----+-----+
|          ...          |
+-----+-----+-----+-----+-----+-----+
| srhFlagsIPv6 |          srhTagIPv6 = 456          | srhActiveSegme|
| = 0          |          | ntIPv...=TBD15|
+-----+-----+-----+-----+-----+-----+
|          255          |          List Length = 37          | semantic=      |
|          |          | ordered          |
+-----+-----+-----+-----+-----+-----+
|          srhSegmentIPv6 = TBD3          |          Field Length = 16          |
+-----+-----+-----+-----+-----+-----+
|          Segment List[0] = 2001:db8::4          |
+-----+-----+-----+-----+-----+-----+
|          ...          |
+-----+-----+-----+-----+-----+-----+
|          ...          |
+-----+-----+-----+-----+-----+-----+
|          ...          |
+-----+-----+-----+-----+-----+-----+
|          Segment List[1] = 2001:db8::5 (16 bytes)          |
+-----+-----+-----+-----+-----+-----+
|          ...          |
+-----+-----+-----+-----+-----+-----+
|          ...          |
+-----+-----+-----+-----+-----+-----+
|          ...          |
+-----+-----+-----+-----+-----+-----+
| srhFlagsIPv6 |          srhTagIPv6 = 789          | srhActiveSegme|
| = 0          |          | ntIPv...=TBD15|
+-----+-----+-----+-----+-----+-----+
|          255          |          List Length = 21          | semantic=      |
|          |          | ordered          |
+-----+-----+-----+-----+-----+-----+
|          srhSegmentIPv6 = TBD3          |          Field Length = 16          |
+-----+-----+-----+-----+-----+-----+
|          Segment List[0] = 2001:db8::6 ...          |
+-----+-----+-----+-----+-----+-----+
|          ...          |
+-----+-----+-----+-----+-----+-----+
|          ...          |
+-----+-----+-----+-----+-----+-----+
|          ...          |
+-----+-----+-----+-----+-----+-----+

```

**Table 7Figure:** Data Set Encoding Format for Basic List

## A.2. Template Record and Data Set with Segment List Section

With **this** encoding, the examples in Table 5 are represented with the following IEs:

\* SR Flags => srhFlagsIPv6

**Commenté [BMI15]:** Call it out explicitly (again)

```

* SR Tag => srhTagIPv6
* Active Segment Type => srhActiveSegmentIPv6Type
* Segment List => srhSegmentIPv6List

```

```

      0          1          2          3
0 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          SET ID = 2          |          Length = 24          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          Template ID = 257   |          Field Count = 4      |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|0|          srhFlagsIPv6 = TBD1 |          Field Length = 1    |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|0|          srhTagIPv6 = TBD2  |          Field Length = 2     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|0|srhActiveSegmentIPv... = TBD9|          Field Length = 1    |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|0|          srhSegmentIPv6List |          Field Length = 0xFFFF |
| |          Section=TBD6       |                               |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

Table-8Figure x: Template Record with Segment List Section Encoding Format

In this example, the Template ID is 257, which will be used in the Data Record. The field length for srhSegmentIPv6ListSection is 0xFFFF, which means the length of this IE is variable.

The data set ~~is~~ can be represented as follows:

```

      0          1          2          3
0 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          SET ID = 257        |          Length = 116        |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| srhFlagsIPv6 |          srhTagIPv6 = 123          | srhActiveSegme|
| = 0          |                               | ntIPv...=TBD15|
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          0xFFFF          |          2001:db8::1          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...              |                               |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...              |                               |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...              |                               |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |          2001:db8::2          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...              |                               |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...              |                               |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |          2001:db8::3          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

```

|                                     ...                                     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     ...                                     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     ...                                     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| ... | srhFlagsIPv6 | srhTagIPv6 = 456 |
| | = 0 | |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| srhActiveSegme| 0xFFFF | 2001:db8::4 |
| ntIPv...=TBD15| | |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     ...                                     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     ...                                     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     ...                                     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| ... | 2001:db8::5 |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     ...                                     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     ...                                     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     ...                                     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| ... | srhFlagsIPv6=0 | srhTagIPv6... |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| = 789 | srhActiveSegment | 0xFFFF |
| | IPv6Type=TBD15 | |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| 2001:db8::6 ... |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     ...                                     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     ...                                     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     ...                                     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

**Table 9Figure x:** Data Set Encoding Format for Segment List

Section

### A.3. Template Record and Data Set with SRH Section

With **this encoding**, the examples in Table 5 are represented with the following IEs:

\* SR Flags + SR Tag + Segment List => srhSectionIPv6

\* Active Segment Type => srhActiveSegmentIPv6Type

```

0                                     1                                     2                                     3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| SET ID = 2 | Length = 16 |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Template ID = 258 | Field Count = 2 |

```

**Commenté [BMI16]:** Idem as above

```

+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|0| srhActiveSegmentIP... = TBD9|          Field Length = 1          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|0|   srhSectionIPv6 = TBD8   |          Field Length = 0xFFFF      |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

~~Table 10~~Figure X: Template Record with SRH Section Encoding

#### Format

In this example, the Template ID is 258, which will be used in the Data Record. The field length for srhSectionIPv6 is 0xFFFF, which means the length of this IE is variable.

The data set ~~is~~ can be represented as follows:

```

0          1          2          3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          SET ID = 258          |          Length = (*)          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   srhActiveSegmentIPv6Type = TBD15   |   0xFFFF   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Next Header | Hdr Ext Len | Routing Type | Segments Left |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Last Entry | Flags | Tag |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          Segment List[0] 2001:db8::1          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          Segment List[1] 2001:db8::2          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          Segment List[2] 2001:db8::3          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          ...          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
~          Optional Type Length Value objects (variable)          ~
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   srhActiveSegmentIPv6Type = TBD15   |   0xFFFF   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Next Header | Hdr Ext Len | Routing Type | Segments Left |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Last Entry | Flags | Tag |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          Segment List[0] 2001:db8::4          |

```

```

+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|                                     ...                                     |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|                                     ...                                     |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|                                     ...                                     |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|                               Segment List[1] 2001:db8::5                               |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|                                     ...                                     |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|                                     ...                                     |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|                                     ...                                     |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
~                               Optional Type Length Value objects (variable)                               ~
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|   srhActiveSegmentIPv6Type = TBD15   |   0xFFFF   |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| Next Header | Hdr Ext Len | Routing Type | Segments Left |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| Last Entry  | Flags       | Tag         |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|                               Segment List[0] 2001:db8::6                               |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|                                     ...                                     |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|                                     ...                                     |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|                                     ...                                     |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
~                               Optional Type Length Value objects (variable)                               ~
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+

```

~~Table 11~~Figure x: Data Set Encoding Format for SRH Section

(\*) The Length must be calculated to include the optional Type Length Value objects.

#### A.4. Options Template Record and Data Set for SRv6 end point behavior and Locator Length

This appendix provides an SRv6 EndPoint Behavior Options Template example, for the values presented in Table 12. In the Options Template case, the srhEndPointIPv6 Information Element is a Scope field

Entry Nr	SRH End Point IPv6	SRH End Point Behavior	SRH Segment Locator Length
1	2001:db8::1	End [1]	48
2	2001:db8::4	End with NEXT-CSID [43]	48
3	2001:db8::6	End.DX6 [16]	48



Table 12: three observed SRv6 End Point Behaviors

0	1	2	3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1			
Set ID = 3		Length = 24	
Template ID 259		Field Count = 3	
Scope Field Count = 1	0	srhSegmentIPv6 = TBD3	
Scope 1 Field Length = 4	0	srhSegmentEndpointBeh..=TBD11	
Field Length = 1	0	srhSegmentLocatorLength=TBD10	
Field Length = 4		Padding	

~~Table 13~~Figure X: Template Record with SRH Section Encoding

Format

In this example, the Template ID is 259, which will be used in the Data Record.

The data set is represented as follows:

0	1	2	3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1			
SET ID = 259		Length = 28	
2001:db8::1			
End [1]		48	
2001:db8::4			
End with NEXT-CSID [43]		48	
2001:db8::6			
End.DX6 [16]		48	

~~Table 14~~Figure: Data Set Encoding Format for SRH Section

(\*) The Length must be calculated to include the optional Type Length Value objects.

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