                   Traffic Selectors for Flow Bindings

Abstract

   This document defines binary formats for IPv4 and IPv6 traffic
   selectors to be used in conjunction with flow bindings for Mobile
   IPv6.

Status of This Memo

   This is an Internet Standards Track document.

   This document is a product of the Internet Engineering Task Force
   (IETF). It represents the consensus of the IETF community. It has
   received public review and has been approved for publication by the
   Internet Engineering Steering Group (IESG). Further information on
   Internet Standards is available in Section 2 of RFC 5741.

   Information about the current status of this document, any errata,
   and how to provide feedback on it may be obtained at
   http://www.rfc-editor.org/info/rfc6088.

Copyright Notice

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1. Introduction

   This document defines binary formats for IPv4 and IPv6 traffic
   selector sub-options, as defined in [RFC6089].

   The binary traffic selector format defined here, allows for efficient
   identification of flow(s) based on well-known fields in IPv4
   [RFC0791], IPv6 [RFC2460], and transport layer headers like TCP
   [RFC0793] and UDP [RFC0768].

2. Requirements Notation

   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
   document are to be interpreted as described in [RFC2119].

3. Traffic Selector Sub-Options

   [RFC6089] defines the format for the traffic selector sub-option.

   The following values of the TS Format field are defined in this
   specification for binary traffic selectors.

   TS Format:

      1 IPv4 binary traffic selector

      2 IPv6 binary traffic selector

3.1. IPv4 Binary Traffic Selector

   If the TS Format field of the traffic selector sub-option indicates
   "IPv4 binary traffic selector", then the traffic selector is
   formatted as shown below.

The alignment requirement for this sub-option is:

    4n if A, B, C, D, E, or F is set

    2n if G, H, I, or J is set

    n if K, L, M, or N is set

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 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Sub-opt Type   |   Sub-Opt Len  |   TS Format   |   Reserved    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|A|B|C|D|E|F|G|H|I|J|K|L|M|N|          Reserved                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     (A)Start Source Address                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     (B)End Source Address                     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   (C)Start Destination Address                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   (D)End Destination Address                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      (E)Start IPsec SPI                       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       (F)End IPsec SPI                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    (G)Start Source port        |    (H)End Source port        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    (I)Start Destination port   |    (J)End Destination port   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  (K)Start DS  |  (L)End DS     |(M)Start Prot. | (N) End Prot. |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
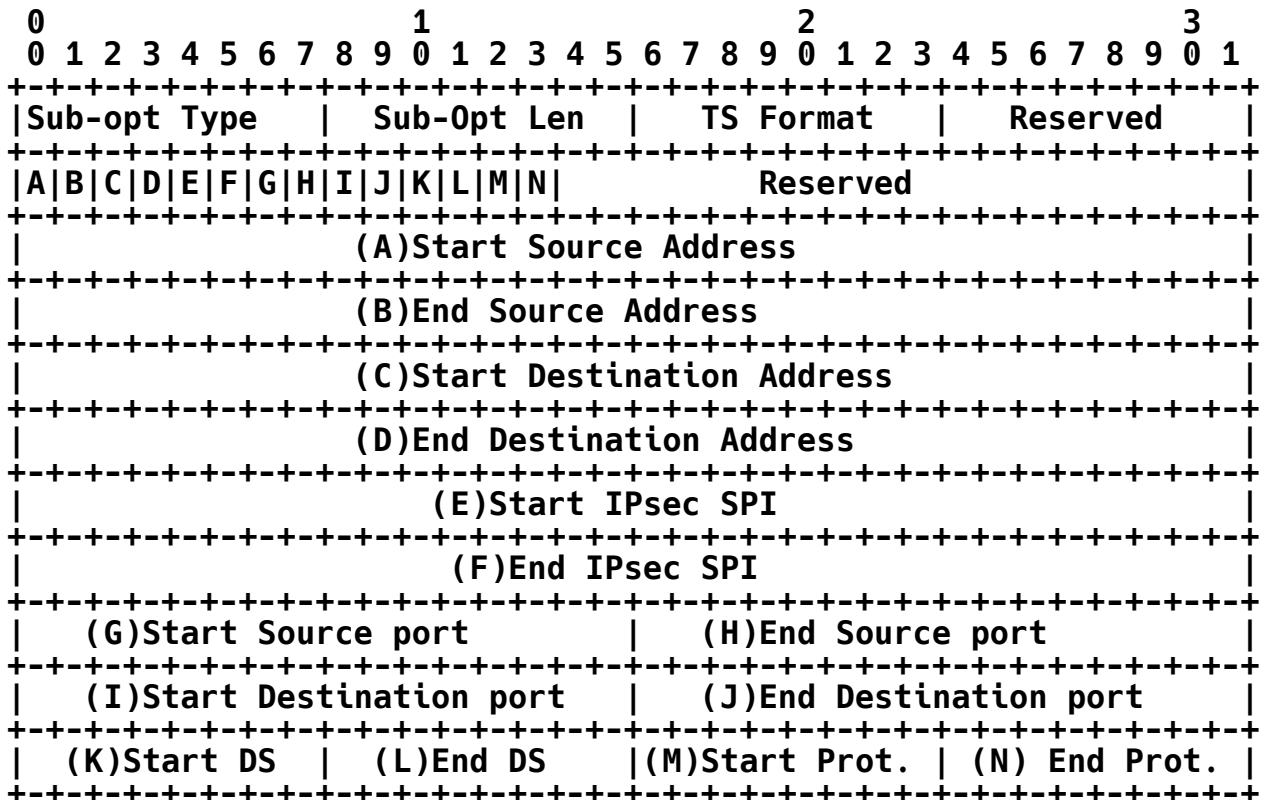
Figure 1: IPv4 binary traffic selector

Flags (A-N)

    Each flag indicates whether the corresponding field is present in
    the message.

(A)Start Source Address

    This field identifies the first source address, from the range of
    32-bit IPv4 addresses to be matched, on data packets sent from a
    corresponding node to the mobile node as seen by the home agent.
    In other words, this is one of the addresses of the correspondent
    node.

(B)End Source Address

   If more than one contiguous source address needs to be matched,
   then this field can be used to indicate the end value of a range
   starting from the value of the Start Source Address field. This
   field MUST NOT be included unless the Start Source Address field
   is included. When this field is included, the receiver will match
   all of the addresses between fields (A) and (B), inclusive of (A)
   and (B).

(C)Start Destination Address

   This field identifies the first destination address, from the
   range of 32-bit IPv4 addresses to be matched, on data packets sent
   from a corresponding node to the mobile node as seen by the home
   agent. In other words, this is one of the registered home
   addresses of the mobile node.

(D)End Destination Address

   If more than one contiguous destination address needs to be
   matched, then this field can be used to indicate the end value of
   a range starting from the value of the Start Destination Address
   field. This field MUST NOT be included unless the Start
   Destination Address field is included. When this field is
   included, the receiver will match all of the addresses between
   fields (C) and (D), inclusive of (C) and (D).

(E)Start IPsec SPI - Security Parameter Index

   This field identifies the first 32-bit IPsec SPI value, from the
   range of SPI values to be matched, on data packets sent from a
   corresponding node to the mobile node as seen by the home agent.
   This field is defined in [RFC4303].

(F)End IPsec SPI - Security Parameter Index

   If more than one contiguous SPI value needs to be matched, then
   this field can be used to indicate the end value of a range
   starting from the value of the Start IPsec SPI field. This field
   MUST NOT be included unless the Start IPsec SPI field is included.
   When this field is included, the receiver will match all of the
   SPI values between fields (E) and (F), inclusive of (E) and (F).

(G)Start Source Port

   This field identifies the first 16-bit source port number, from
   the range of port numbers to be matched, on data packets sent from
   a corresponding node to the mobile node as seen by the home agent.
   This is from the range of port numbers defined by IANA
   (http://www.iana.org).

(H)End Source Port

   If more than one contiguous source port number needs to be
   matched, then this field can be used to indicate the end value of
   a range starting from the value of the Start Source Port field.
   This field MUST NOT be included unless the Start Source Port field
   is included. When this field is included, the receiver will match
   all of the port numbers between fields (G) and (H), inclusive of
   (G) and (H).

(I)Start Destination Port

   This field identifies the first 16-bit destination port number,
   from the range of port numbers to be matched, on data packets sent
   from a corresponding node to the mobile node as seen by the home
   agent.

(J)End Destination Port

   If more than one contiguous destination port number needs to be
   matched, then this field can be used to indicate the end value of
   a range starting from the value of the Start Destination Port
   field. This field MUST NOT be included unless the Start
   Destination Port field is included. When this field is included,
   the receiver will match all of the port numbers between fields (I)
   and (J), inclusive of (I) and (J).

(K)Start DS - Differential Services

   This field identifies the first differential services value, from
   the range of differential services values to be matched, on data
   packets sent from a corresponding node to the mobile node as seen
   by the home agent. Note that this field is called a "Type of
   Service field" in [RFC0791]. [RFC3260] then clarified that the
   field has been redefined as a 6-bit DS field with 2 bits reserved,
   later claimed by Explicit Congestion Notification (ECN) [RFC3168].
   For the purpose of this specification, the (K)Start DS field is 8
   bits long, where the 6 most significant bits indicate the DS field
   to be matched and the 2 least significant bits' values MUST be
   ignored in any comparison.

(L)End DS - Differential Services

   If more than one contiguous DS value needs to be matched, then
   this field can be used to indicate the end value of a range
   starting from the value of the Start DS field. This field MUST
   NOT be included unless the Start DS field is included. When this
   field is included, it MUST be coded the same way as defined for
   (K). When this field is included, the receiver will match all of
   the values between fields (K) and (L), inclusive of (K) and (L).

(M)Start Protocol

   This field identifies the first 8-bit protocol value, from the
   range of protocol values to be matched, on data packets sent from
   a corresponding node to the mobile node as seen by the home agent.

(N)End Protocol

   If more than one contiguous protocol value needs to be matched,
   then this field can be used to indicate the end value of a range
   starting from the value of the Start Protocol field. This field
   MUST NOT be included unless the Start Protocol field is included.
   When this field is included, the receiver will match all of the
   values between fields (M) and (N), inclusive of (M) and (N).

Reserved

   Reserved for future use. These bits MUST be set to zero by the
   sender and ignored by the receiver.

3.2. IPv6 Binary Traffic Selector

If the TS Format field of the traffic selector sub-option indicates
"IPv6 binary traffic selector", then the traffic selector is
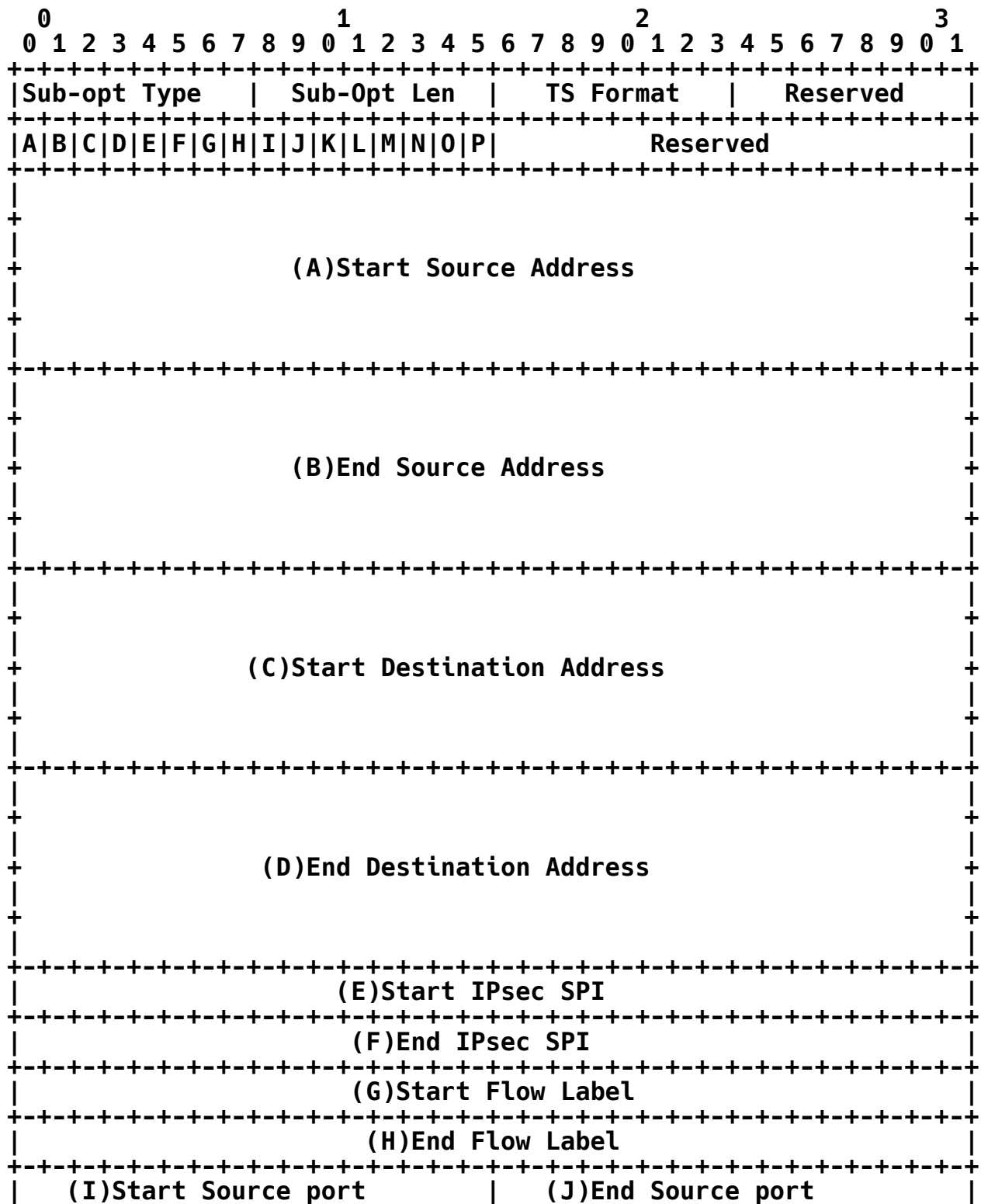formatted as follows:

The alignment requirement for this sub-option is:

   8n if A, B, C, or D is set

   4n if E, F, G, or H is set

   2n if I, J, K, or L is set

   n if M, N, O, or P is set

```
     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
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |Sub-opt Type   |  Sub-Opt Len  |   TS Format   |   Reserved    |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |A|B|C|D|E|F|G|H|I|J|K|L|M|N|O|P|           Reserved            |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                                                               |
    +                                                               +
    |                                                               |
    +                 (A)Start Source Address                       +
    |                                                               |
    +                                                               +
    |                                                               |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                                                               |
    +                                                               +
    |                                                               |
    +                  (B)End Source Address                        +
    |                                                               |
    +                                                               +
    |                                                               |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                                                               |
    +                                                               +
    |                                                               |
    +               (C)Start Destination Address                    +
    |                                                               |
    +                                                               +
    |                                                               |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                                                               |
    +                                                               +
    |                                                               |
    +                (D)End Destination Address                     +
    |                                                               |
    +                                                               +
    |                                                               |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                      (E)Start IPsec SPI                        |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                       (F)End IPsec SPI                         |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                     (G)Start Flow Label                        |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                      (H)End Flow Label                         |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |    (I)Start Source port        |     (J)End Source port        |
```

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    (K)Start Destination port   |   (L)End Destination port    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  (M)Start TC  |   (N)End TC    | (O)Start NH   | (P) End NH    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 2: IPv6 binary traffic selector

Flags (A-P)

   Each flag indicates whether the corresponding field is present in
   the message

(A)Start Source Address

   This field identifies the first source address, from the range of
   128-bit IPv6 addresses to be matched, on data packets sent from a
   corresponding node to the mobile node as seen by the home agent.
   In other words, this is one of the addresses of the correspondent
   node.

(B)End Source Address

   If more than one contiguous source address needs to be matched,
   then this field can be used to indicate the end value of a range
   starting from the value of the Start Source Address field. This
   field MUST NOT be included unless the Start Source Address field
   is included. When this field is included, the receiver will match
   all of the addresses between fields (A) and (B), inclusive of (A)
   and (B).

(C)Start Destination Address

   This field identifies the first destination address, from the
   range of 128-bit IPv6 addresses to be matched, on data packets
   sent from a corresponding node to the mobile node as seen by the
   home agent. In other words, this is one of the registered home
   addresses of the mobile node.

(D)End Destination Address

   If more than one contiguous destination address needs to be
   matched, then this field can be used to indicate the end value of
   a range starting from the value of the Start Destination Address
   field. This field MUST NOT be included unless the Start
   Destination Address field is included. When this field is
   included, the receiver will match all of the addresses between
   fields (C) and (D), inclusive of (C) and (D).

(E)Start IPsec SPI - Security Parameter Index

   This field identifies the first 32-bit IPsec SPI value, from the
   range of SPI values to be matched, on data packets sent from a
   corresponding node to the mobile node as seen by the home agent.
   This field is defined in [RFC4303].

(F)End IPsec SPI - Security Parameter Index

   If more than one contiguous SPI value needs to be matched, then
   this field can be used to indicate the end value of a range
   starting from the value of the Start IPsec SPI field. This field
   MUST NOT be included unless the Start IPsec SPI field is included.
   When this field is included, the receiver will match all of the
   SPI values between fields (E) and (F), inclusive of (E) and (F).

(G)Start Flow Label

   This field identifies the first flow label value, from the range
   of flow label values to be matched, on data packets sent from a
   corresponding node to the mobile node as seen by the home agent.
   According to [RFC2460], the flow label is 24 bits long. For the
   purpose of this specification, the sender of this option MUST
   prefix the flow label value with 8 bits of "0" before inserting it
   in the (G)Start Flow Label field. The receiver SHOULD ignore the
   first 8 bits of this field before using it in comparisons with
   flow labels in packets.

(H)End Flow Label

   If more than one contiguous flow label value needs to be matched,
   then this field can be used to indicate the end value of a range
   starting from the value of the Start Flow Label field. This field
   MUST NOT be included unless the Start Flow Label field is
   included. When this field is included, the receiver will match
   all of the flow label values between fields (G) and (H), inclusive
   of (G) and (H). When this field is included, it MUST be coded the
   same way as defined for (G).

(I)Start Source Port

   This field identifies the first 16-bit source port number, from
   the range of port numbers to be matched, on data packets sent from
   a corresponding node to the mobile node as seen by the home agent.

(J)End Source Port

   If more than one contiguous source port number needs to be
   matched, then this field can be used to indicate the end value of
   a range starting from the value of the Start Source Port field.
   This field MUST NOT be included unless the Start Source Port field
   is included. When this field is included, the receiver will match
   all of the port numbers between fields (I) and (J), inclusive of
   (I) and (J).

(K)Start Destination Port

   This field identifies the first 16-bit destination port number,
   from the range of port numbers to be matched, on data packets sent
   from a corresponding node to the mobile node as seen by the home
   agent.

(L)End Destination Port

   If more than one contiguous destination port number needs to be
   matched, then this field can be used to indicate the end value of
   a range starting from the value of the Start Destination Port
   field. This field MUST NOT be included unless the Start
   Destination Port field is included. When this field is included,
   the receiver will match all of the port numbers between fields (K)
   and (L), inclusive of (K) and (L).

(M)Start TC - Traffic Class

   This field identifies the first traffic class value, from the
   range of traffic class values to be matched, on data packets sent
   from a corresponding node to the mobile node as seen by the home
   agent. This field is equivalent to the Start DS field in the IPv4
   traffic selector in Figure 1. As per [RFC3260], the field is
   defined as a 6-bit DS field with 2 bits reserved, later claimed by
   Explicit Congestion Notification (ECN) [RFC3168]. For the purpose
   of this specification, the (M)Start TC field is 8 bits long, where
   the 6 most significant bits indicate the DS field to be matched
   and the 2 least significant bits' values MUST be ignored in any
   comparison.

(N)End TC - Traffic Class

   If more than one contiguous TC value needs to be matched, then
   this field can be used to indicate the end value of a range
   starting from the value of the Start TC field. This field MUST
   NOT be included unless the Start TC field is included. When this

field is included, it MUST be coded the same way as defined for
(M). When this field is included, the receiver will match all of
the values between fields (M) and (N), inclusive of (M) and (N).

(O)Start NH - Next Header

This field identifies the first 8-bit next header value, from the
range of next header values to be matched, on data packets sent
from a corresponding node to the mobile node as seen by the home
agent.

(P)End NH - Next Header

If more than one contiguous next header value needs to be matched,
then this field can be used to indicate the end value of a range
starting from the value of the Start NH field. This field MUST
NOT be included unless the Start next header field is included.
When this field is included, the receiver will match all of the
values between fields (O) and (P), inclusive of (O) and (P).

Reserved

Reserved for future use. These bits MUST be set to zero by the
sender and ignored by the receiver.

4. Security Considerations

This document defines the format of the traffic selector field of a
sub-option defined for flow bindings [RFC6089]. The authors have not
identified any security concerns pertaining to this document beyond
what is already identified in [RFC6089].

5. IANA Considerations

The following new TS format values have been assigned from the
"Traffic Selector Format" namespace for the traffic selector sub-
option defined in [RFC6089].

1 IPv4 Binary Traffic Selector

2 IPv6 Binary Traffic Selector

6. Acknowledgements

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7. References

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             January 2011.

7.2. Informative References

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