DetNet SRv6 Data Plane Encapsulation
draft-geng-detnet-dp-sol-srv6-00

Abstract

   This document specifies Deterministic Networking data plane operation
   for SRv6 encapsulated user data.

Requirements Language

   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 RFC 2119 [RFC2119].

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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   time. It is inappropriate to use Internet-Drafts as reference
   material or to cite them other than as "work in progress."

   This Internet-Draft will expire on September 12, 2019.

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1. Introduction

Deterministic Networking(DetNet) provides a capability to carry
specified data flows with extremely low data loss rates and bounded
latency within a network domain. DetNet is enabled by a group of
technologies, such as resource allocation, service protection and
explicit routes.([I-D.ietf-detnet-architecture])

Segment Routing(SR) leverages the source routing paradigm. A ingress
node steers a packet through an ordered list of instructions, called
"segments". SR can be applied over IPv6 data plane using Routing
Extension Header(SRH). Besides routing, the segment of SRv6 can
indicate functions which are executed locally in the node where they

are defined. SRv6 network programming makes it convenient to add
sophisticated operations in the network. ([RFC8402])

This document describes how to implement DetNet with SRv6. It can
provide : 1. Source routing, which can steer the DetNet flows go
through the network according to an explicit route with allocated
resource; 2. Network programming, which can give packet instructions
in some special nodes(even all the nodes) along the path to guarantee
service protection and congestion protection. DetNet SRv6
encapsulation and new SRv6 functions for DetNet are defined in this
document.

Control plane and OAM are not in the scope of this document.

2. Terminology and Conventions

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].

2.1. Terminology

Terminologies for DetNet go along with the definition in
[I-D.ietf-detnet-architecture]. Other terminologies are defined as
follows:

o   NH: The IPv6 next-header field.

o   SID: A Segment Identifier which represents a specific segment in a
    segment routing domain([RFC8402]).

o   SRH: The Segment Routing Header
    ([I-D.ietf-6man-segment-routing-header]).

2.2. Conventions

Conventions in the document are defined as follows:

o   NH=SRH means that NH is 43 with routing type 4.

o   A SID list is represented as <S1, S2, S3> where S1 is the first
    SID to visit, S2 is the second SID to visit and S3 is the last SID
    to visit along the SR path.

o   SRH[SL] represents the SID pointed by the SL field in the first
    SRH. In our example, SRH[2] represents S1, SRH[1] represents S2
    and SRH[0] represents S3.

o (SA,DA) (S3, S2, S1; SL) represents an IPv6 packet with:

> IPv6 header with source and destination addresses SA and DA
> respectively, and next-header SRH, with SID list <S1, S2, S3>
> with SegmentsLeft = SL

> The payload of the packet is not represented

> (S3, S2, S1; SL) represents the same SID list as <S1, S2, S3>,
> but encoded in the SRH format where the rightmost SID in the
> SRH is the first SID and the leftmost SID in the SRH is the
> last SID

3. SRv6 DetNet Data Plane Overview

3.1. SRv6 DetNet Data Plane Layers

[I-D.ietf-detnet-architecture]decomposes the DetNet data plane into
two sub-layers: service sub-layer and transport sub-layer. Different
from DetNet MPLS data plane solution, which uses DetNet Control
Word(d-CW) and S-Label to support service sub-layer and uses T-Label
to support transport sub-layer, no explicit sub-layer division can be
found in SRv6 data plane. A classical SRv6 DetNet data plane
solution is showed in the picture below:

```
                                +-------------------+
                                | Outer Ipv6 Header |
                                +-------------------+
                                |        SRH        |
    +-------------------+       +-------------------+
    |    Ipv6 Header    | ----> |    Ipv6 Header    |
    +-------------------+       +-------------------+
```
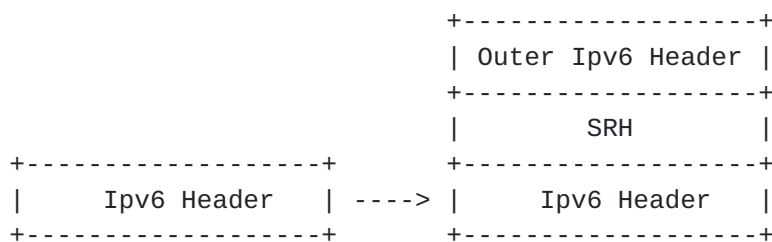
The outer IPv6 Header with SRH is used for carrying DetNet flows.
Traffic Engineering is programmed in the segment list of SRH, and
other functions and arguments for service protection (packet
replication, elimination and ordering) and congestion control (packet
queuing and forwarding) are also defined in SRH.

3.2. SRv6 DetNet Data Plane Scenarios

```
                    |                                     |
         ----IPv6--->|<---------------SRv6 DetNet------------->|<----IPv6---
                    |                                     |
                    |                 +------+T2+----+           |
    +---+    +---+          +-+-+           +-+-+         +---+    +---+
    | E1+----| In|--+T1+--+R1 |           |R2 |--+T4+--| Eg+----+ E2|
    +---+    +---+          +-+-+           +-+-+         +---+    +---+
                           +-----+T3+-----+
```
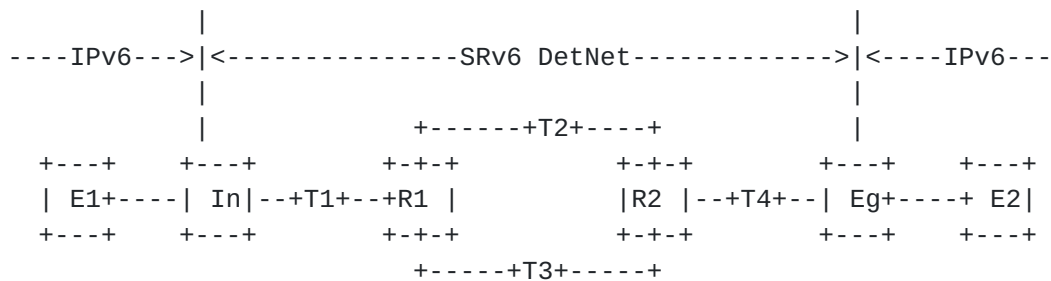
The figure above shows that an IPv6 flow is sent our from the end
station: E1. The packet of the flow is encapsulated as a DetNet SRv6
packet in the Ingress(In) and transported through an SRv6 DetNet
domain. In the Egress(Eg), the upper IPv6 header with SRH of the
packet is popped, and the packet is transmitted to the
destination(E2).

The DetNet packet processing is as follows:

Ingress:

   Insert SRv6 Policy, which can steer the packet from Ingress to
   Relay Node 1

   Flow Identification and Sequence Number are carried in SRH

Relay Node 1(Replication Node):

   Replicate the payload and IPv6 Header with SRH

   Binding two different SRv6 Policy respectively to the original
   packet and the replicated packet, which can steer the packet from
   Relay Node 1 to Relay Node 2 through two tunnels

Relay Node 2(Elimination Node):

   Eliminate the redundant packets

   Binding a new SRv6 Policy to the survival packet, which can steer
   the packet from Relay Node 2 to Egress.

Egress:

   Decapsulate the upper Ipv6 header

   Send the packet to the End Station 2

The DetNet packet encapsulation is as follows:

End Station1 out : (E1,E2)

Ingress out : (In, T1)(R1,T1,SL=2)(E1,E2)

Transit Node1 out : (In, R1)(R1,T1,SL=1)(E1,E2)

Relay Node1 out : (R2, R1)(R2,T2,SL=2)(E1,E2)/(R2,
R1)(R2,T3,SL=2)(E1,E2)

Transit Node2 out : (R2, R1)(R2,T2,SL=1)(E1,E2)

Transit Node3 out : (R2, R1)(R2,T3,SL=1)(E1,E2)

Relay Node2 out : (Eg, R2)(Eg,T4,SL=2)(E1,E2)

Transit Node4 out : (Eg, R2)(Eg,T4,SL=1)(E1,E2)

Egress out : (E1,E2)

[4]. SRv6 DetNet Data Plane Solution Considerations

To carry DetNet over SRv6, the following elements are required:

1. A method of identifying the SRv6 payload type;

2. A suitable explicit route to deliver the DetNet flow ;

3. A method of indicating packet processing, such as PREOF;

4. A method of identifying the DetNet flow;

5. A method of carrying DetNet sequence number;

6. A method of carrying queuing and forwarding indication to do
congestion protection;

In this design, DetNet flows are encapsulated with SRH in the Ingress
Node. The SR policy in the SRH steers the DetNet flow along a
selected path. The explicit route allocated to a DetNet flow, which
protect it from temporary interruptions caused by the convergence of
routing, is encoded within the SID list of a SR policy. The network
device inside the DetNet domain forwards the packet according to IPv6
Destination Address(DA), and the IPv6 DA is updated with the SID
list.

With SRv6 network programming, the SID list can also give instruments
representing a function to be called at the node in the DetNet
domain. Therefore DetNet specific functions defined in

[I-D.ietf-detnet-architecture], corresponding to local packet
processing in the network, can also be implemented by SRv6. New
functions associated with SIDs for DetNet are defined in this
document.

This document describes how DetNet flows are encapsulated/identified,
and how functions of Packet Replication/Elimination/Ordering are
implemented in an SRv6 domain. Congestion protection is also in the
scope of this document.

Editor: This version only covers the functions of service protection
and the congestion protection considerations will be added in the
following versions.

5. SRv6 DetNet Data Plane Solution for Service Sub-layer

This section defines options of SRv6 data plane solution to support
DetNet Service Sub-layer.

5.1. TLV Based SRv6 Data Plane Solution

5.1.1. Encapsulation

An SRv6 Segment is a 128-bit value. SID is used as a shorter
reference for "SRv6 Segment". SRv6 SID can also be represented as
LOC:FUNCT, where LOC, abbreviated for "LOCATION", directs the
explicit route, FUNCT, abbreviated for "FUNCTION", directs the packet
processing in the local node
([I-D.filsfils-spring-srv6-network-programming]).

The SRH for DetNet in the outer IPv6 header is showed 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Next Header  |  Hdr Ext Len  |  Routing Type |  Segment Left |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Last Entry   |    Flags      |              Tag              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
|                    Location & Function                        |
|         (Segment List[0] for relay node or edge node)         |
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                             ...                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
|                       Segment List[n]                         |
|                                                               |
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Optional TLVs                           |
|                             ...                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
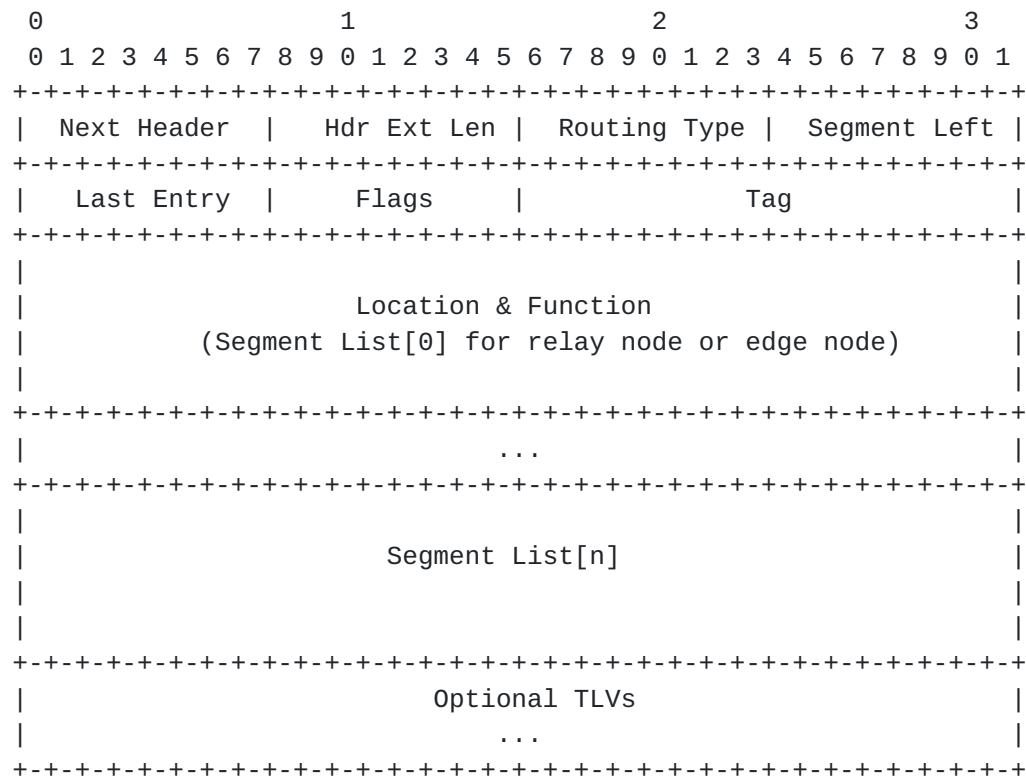
Two new TLVs are defined to support DetNet service protection.
DetNet Flow Identification TLV is used to uniquely identify a DetNet
flow in an SRv6 DetNet node. DetNet sequence number is used to dis
crime packets in the same DetNet flow. They are defined as follows:

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Type      |    Length     |              RESERVED         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      RESERVED         |            Flow Identification        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
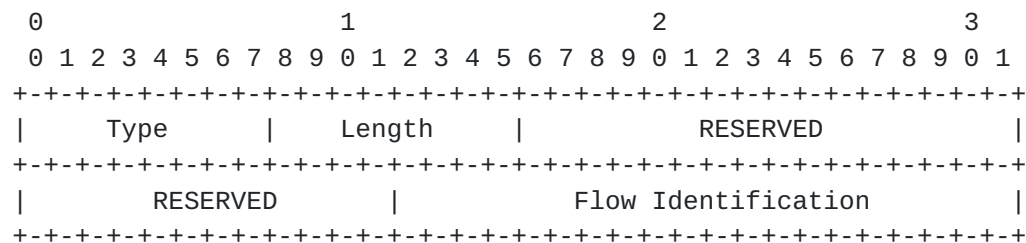
where:

o Type: 8bits, to be assigned by IANA.

o Length: 8.

o RESERVED: 28 bits, MUST be 0 on transmission and ignored on
   receipt.

o Flow Identification: 20 bits, which is used for identifying DetNet
   flow.

```
    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
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |     Type      |     Length    |            RESERVED           |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |RESERVE|                  Sequence Number                     |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

where:

o Type: 8 bits, to be assigned by IANA.

o Length: 8.

o RESERVED: 20 bits. MUST be 0 on transmission and ignored on
   receipt.

o Sequence Number: 28 bits, which is used for indicating sequence
   number of a DetNet flow.

5.1.2. Functions

New SID functions are defined as follows:

5.1.2.1. End. B.Replicatioreserve the value of argument field(Inherited argument)of segment[0] of SRH n: Packet Replication Function

1.   IF NH=SRH & SL>0 THEN

2.   do not decrement SL nor update the IPv6 DA with SRH[SL]

3.   reserve the value of DetNet TLVs of SRH

4.   add the DetNet TLVs into SRH'1 and SRH'2

5.   pop the SRH

6.   replicate the packet into two packets: packet'1, packet'2

7.   insert SRH'1 to packet'1

8.   insert SRH'2 to packet'2

9.   set the IPv6 DA of packet'1 to the first segment of the SRv6
     Policy of SRH'1

10. set the IPv6 DA of packet'2 to the first segment of the SRv6
     Policy of SRH'2

11. ELSE

12. drop the packet

5.1.2.2. **End. B.** Elimination: Packet Elimination Function

1. IF NH=SRH & SL>0 & "the packet is not a redundant packet" THEN

2. do not decrement SL nor update the IPv6 DA with SRH[SL]

3. reserve the value of DetNet TLVs of SRH

4. add the DetNet TLVs into SRH'

5. pop the SRH

6. insert SRH'

7. set the IPv6 DA to the first segment of the SRv6 Policy

8. ELSE

9. drop the packet

5.2. **SID Based SRv6 Data Plane Solution**

5.2.1. **Encapsulation**

SRv6 SID can be represented as LOC:FUNCT:ARG::, where LOC, abbreviated for "LOCATION", directs the explicit route, FUNCT, abbreviated for "FUNCTION", directs the packet processing in the local node, and ARG, abbreviated for "ARGUMENTS", provides the additional arguments for the functions. New SID functions for DetNet is defined in section 5.2.2.

The SRH for DetNet in the outer IPv6 header is showed 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
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  |  Next Header  |  Hdr Ext Len  |  Routing Type | Segment Left  |
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  |  Last Entry   |     Flags     |              Tag              |
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  |                      Location & Function                      |
  |           (Segment List[0] for relay node or edge node)       |
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  |       Location & Function     |        Flow Identification    |
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  |Flow ID|              Sequence Number                          |
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  |                             ...                               |
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  |                                                               |
  |                        Segment List[n]                        |
  |                                                               |
  |                                                               |
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  |                          Optional TLVS                        |
  |                             ...                               |
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
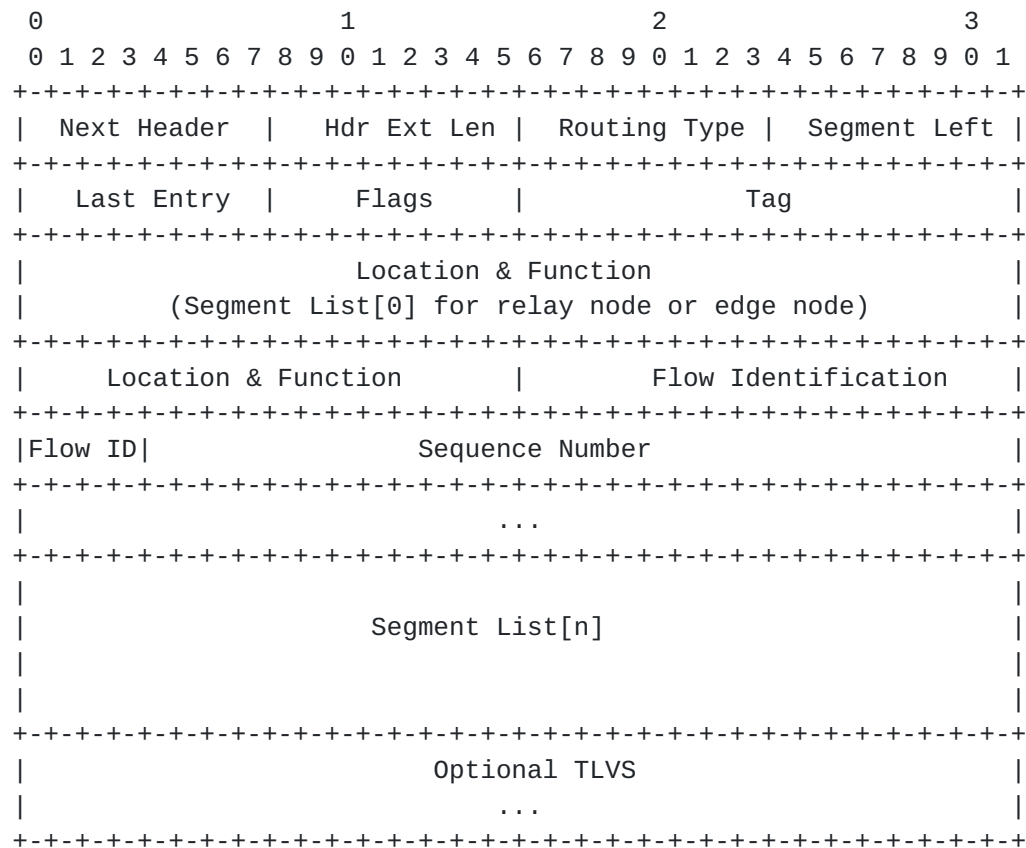
where:

o   LOCATION&FUNCTION: the 80 most significant bits that are used for
    routing;

o   FLOW IDENTIFICATION: 20 bits, which is used for DetNet flow
    identification in the DetNet relay node;

o   SEQUENCE NUMBER : 28 bits, which are used for dis crime packets in
    the same DetNet flow;

5.2.2. Functions

New SID functions are defined as follows:

5.2.2.1. End. B.Replication: Packet Replication Function

1.   IF NH=SRH & SL>0 THEN

2.   do not decrement SL nor update the IPv6 DA with SRH[SL]

3.   reserve the value of argument field(Inherited argument)of
     segment[0] of SRH

4. write the inherited arguments into the argument field of
    segment[0] of SRH'1 and SRH'2

5. pop the SRH

6. replicate the packet into two packets: packet'1, packet'2

7. insert SRH'1 to packet'1

8. insert SRH'2 to packet'2

9. set the IPv6 DA of packet'1 to the first segment of the SRv6
    Policy of SRH'1

10. set the IPv6 DA of packet'2 to the first segment of the SRv6
    Policy of SRH'2

11. ELSE

12. drop the packet

5.2.2.2. **End. B.** Elimination: Packet Elimination Function

1. IF NH=SRH & SL>0 & "the packet is not a redundant packet" THEN

2. do not decrement SL nor update the IPv6 DA with SRH[SL]

3. write the inherited arguments into the argument field of
    segment[0] of SRH'

4. pop the SRH

5. insert SRH'

6. set the IPv6 DA to the first segment of the SRv6 Policy

7. ELSE

8. drop the packet

5.3. **DetNet SID Based SRv6 Data Plane Solution**

5.3.1. **Encapulation**

A non-forwarding DetNet SID is defined to carry Flow Identification
and Sequence Number.

```
      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
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |  Next Header  |  Hdr Ext Len  |  Routing Type |  Segment Left |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |  Last Entry   |     Flags     |              Tag              |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                                                               |
     |                    Location & Function                        |
     |          (Segment List[0] for relay node or edge node)        |
     |                                                               |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                              ...                              |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                                                               |
     |                       Segment List[n]                         |
     |                                                               |
     |                                                               |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                                                               |
     |                        DetNet SID                             |
     |                                                               |
     |                                                               |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                        Optional TLVs                          |
     |                              ...                              |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
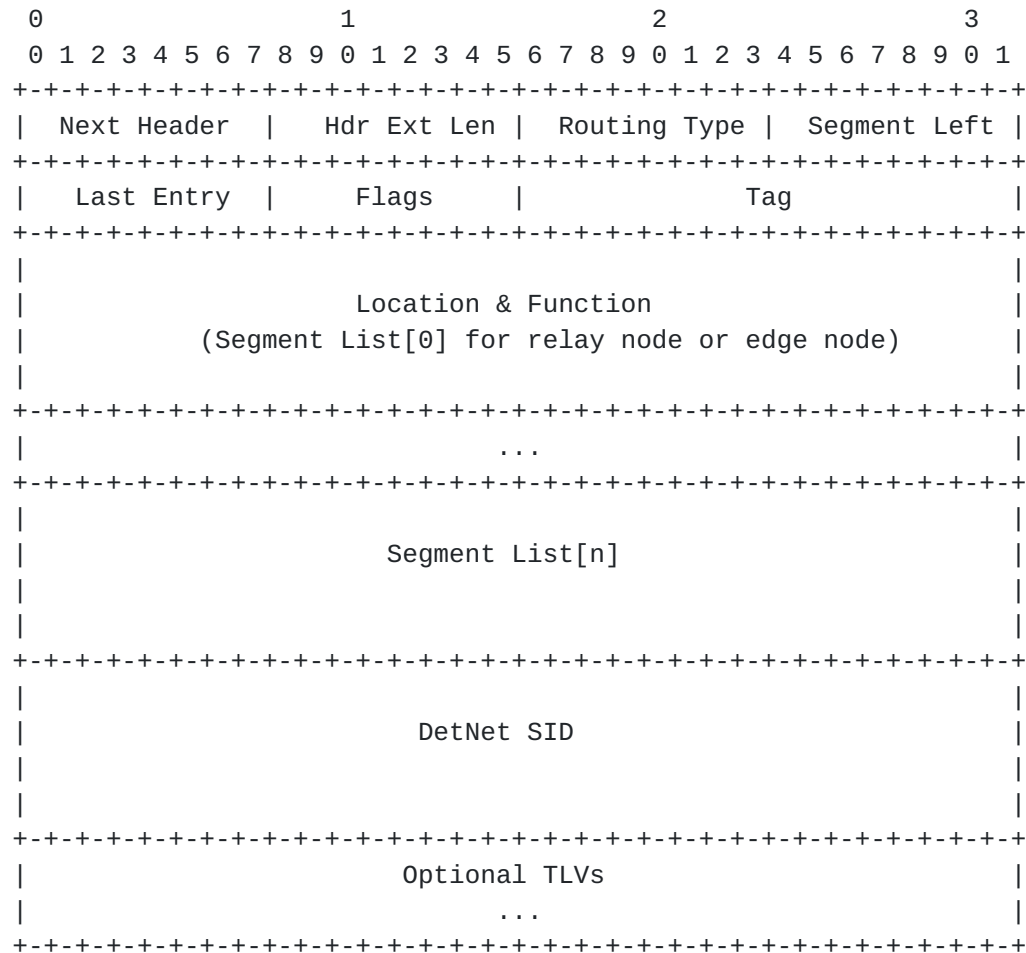
5.3.2. Functions

   TBD

5.4. DetNet SRH Based SRv6 Data Plane Solution

5.4.1. Encapsulation

   A New SRH is defined to carry Flow Identification and Sequence
   Number.

```
      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
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     | Next Header   | Hdr Ext Len | Routing Type | Segment Left  |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     | Last Entry    |    Flags    |              Tag              |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                                                               |
     |                    Location & Function                        |
     |          (Segment List[0] for relay node or edge node)        |
     |                                                               |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                            ...                                |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                                                               |
     |                     Segment List[n]                           |
     |                                                               |
     |                                                               |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                     Optional TLVs                             |
     |                            ...                                |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     | Next Header   | Hdr Ext Len | Routing Type | Segment Left  |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     | Last Entry    |    Flags    |              Tag              |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                                                               |
     |                       DetNet SID                              |
     |                                                               |
     |                                                               |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                     Optional TLVs                             |
     |                            ...                                |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
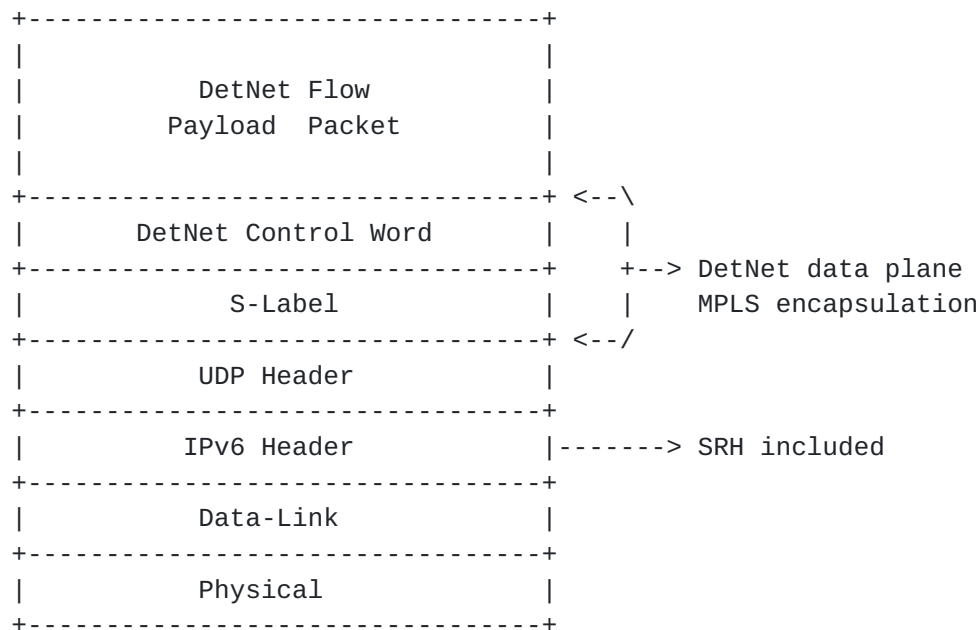
5.4.2. Functions

TBD

5.5. MPLS Based SRv6 Data Plane Solution

SRH can be part of IPv6 Header in the picture below, and no protocol
extensions are needed in SRH. The structure keeps the same as the
definition in [I-D.ietf-detnet-dp-sol-mpls] :

```
         +-------------------------------+
         |                               |
         |          DetNet Flow          |
         |         Payload  Packet       |
         |                               |
         +-------------------------------+ <--\
         |        DetNet Control Word     |    |
         +-------------------------------+    +--> DetNet data plane
         |            S-Label            |    |   MPLS encapsulation
         +-------------------------------+ <--/
         |           UDP Header          |
         +-------------------------------+
         |          IPv6 Header          |-------> SRH included
         +-------------------------------+
         |           Data-Link           |
         +-------------------------------+
         |            Physical           |
         +-------------------------------+
```

[6](). SRv6 DetNet Data Plane Solution for Transport Sub-layer

TBD

[7](). IANA Considerations

This document makes no request of IANA.

Note to RFC Editor: this section may be removed on publication as an RFC.

[8](). Security Considerations

TBD

[9](). Acknowledgements

Thank you for valuable comments from James Guichard and Andrew Mails.

[10](). Normative References

[I-D.filsfils-spring-srv6-network-programming]
         Filsfils, C., Camarillo, P., Leddy, J.,
         daniel.voyer@bell.ca, d., Matsushima, S., and Z. Li, "SRv6
         Network Programming", draft-filsfils-spring-srv6-network-
         programming-07 (work in progress), February 2019.

   [I-D.ietf-6man-segment-routing-header]
            Filsfils, C., Previdi, S., Leddy, J., Matsushima, S., and
            d. daniel.voyer@bell.ca, "IPv6 Segment Routing Header
            (SRH)", draft-ietf-6man-segment-routing-header-16 (work in
            progress), February 2019.

   [I-D.ietf-detnet-architecture]
            Finn, N., Thubert, P., Varga, B., and J. Farkas,
            "Deterministic Networking Architecture", draft-ietf-
            detnet-architecture-11 (work in progress), February 2019.

   [I-D.ietf-detnet-dp-sol-mpls]
            Korhonen, J. and B. Varga, "DetNet MPLS Data Plane
            Encapsulation", draft-ietf-detnet-dp-sol-mpls-01 (work in
            progress), October 2018.

   [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>.

   [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>.

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