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                BGP Flow Specification for DetNet Flow Mapping
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Abstract

   This document proposes extensions to BGP Flow Specification for the
   flow mapping of Deterministic Networking (DetNet) when interconnected
   with IEEE 802.1 Time-Sensitive Networking (TSN). The BGP flowspec is
   used for the filtering of the packets that match the DetNet newtworks
   and the mapping between TSN streams and DetNet flows in the control
   plane.

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1. Introduction

[RFC8655] specifies the architecture of Deterministic Networking
(DetNet), which provide a capability for the delivery of data flows
with extremely low packet loss rates and bounded end-to-end delivery
latency. DetNet-enabled end systems and DetNet nodes can be
interconnected by sub-networks, i.e., Layer 2 technologies such as
IEEE 802.1 Time-Sensitive Networking (TSN).

As defined in [RFC8655], the DetNet IP and MPLS flows can be carried
over TSN sub-networks. DetNet needs to be mapped to the sub-networks
technology used to interconnect DetNet nodes. For example, a TSN
node may be used to interconnect DetNet-aware nodes, and these DetNet
nodes can map DetNet flows to TSN streams. When the Detnet provide
the deterministic service for the TSN end system, a DetNet edge node
may be used to interconnect the TSN end system, and the DetNet nodes
can map the TSN streams to DetNet flows.

As described in [RFC8938], one of the primary requirements of the
DetNet Controller Plane is restricting flows to IEEE 802.1 TSN and
the requirement could use the centralized network management
provisioning mechanisms such as BGP protocol. As defined in
[RFC8955], the Flow Specifications for BGP is an n-tuple consisting
of several matching criteria which is comprised of traffic filtering
rules and is associated with actions that can be applied to the
traffic flows. The DetNet edge nodes can provide the capability to
process the traffic including classifing, shaping, rate limiting,

filtering, and redirecting packets based on the policies configured by the BGP Flow Specification.

This document proposes extensions to BGP Flow Specification for the interconnection of DetNet and TSN. The BGP flowspec is used for the filtering of the packets that match the DetNet newtworks and the mapping between TSN streams and DetNet flows in the control plane.

2. Conventions used in this document

2.1. Terminology

The terminology is defined as [RFC8655], [RFC8938], and [RFC8955].

2.2. 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.
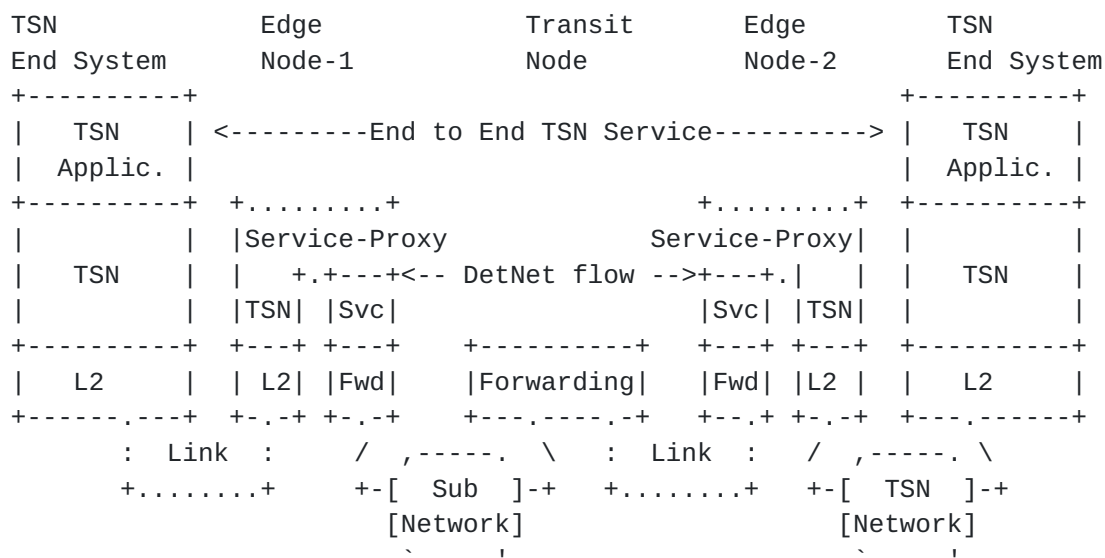
3. The Flow Mapping of DetNet

As described in [I-D.ietf-detnet-tsn-vpn-over-mpls], TSN networks can be interconnected over a DetNet MPLS Network. And as discussed in [I-D.ietf-detnet-ip-over-tsn] and [I-D.ietf-detnet-mpls-over-tsn], DetNet IP or MPLS networks can be operating over a TSN sub-network. The mapping between TSN Streams and DetNet flows is required for the service proxy function at DetNet Edge nodes. And the mapping table can be configured and maintained in the control plane. When a DetNet Edge Node receives a packet, it MUST identify and check whether such flow is present in its mapping table and decide to drop (when not match) or to forward the packet (when match) to the associated service. 1:1 and N:1 mapping (aggregating multiple TSN Streams in a single DetNet flow) MUST be supported.

As Figure 1 shows, it is required to configue the identification information when mapping received TSN Streams to the DetNet flows at Edge Node-1. Mechanisms and Parameters of TSN stream identification (e.g.,Mask-and-Match Stream identification) defined in [IEEE8021CB] and [IEEEP8021CBdb] can be used for service proxy function. After the identification of the TSN stream, it need to map the packet to the DetNet flow information such as S-Label, d-CW when in DetNet MPLS data plane and handle the packet as defined in [RFC8964].

When the DetNet Edge Node-2 receives a DetNet flow, it MUST identify the DetNet flow-ID information such as IP 6-tuple in DetNet IP data

plane or S-Label and d-CW information in DetNet MPLS data plane.
Then the Service proxy function need to map the DetNet flow-ID and
flow related parameters to the associated TSN Stream IDs and streams
related parameters.

As defined in [RFC8955], the nodes that applied a Flow Specification
can fillter the received pakects according to the matching criteria
and can forward the flows based on the associated actions. This
document proposes extensions to BGP Flow Specification for the
mapping of DetNet flows and TSN streams by using the traffic
filtering rules to identify the packet and using the associated
action to map the packet to the related service.

```
TSN              Edge             Transit        Edge            TSN
End System       Node-1             Node         Node-2       End System
+----------+                                              +----------+
|   TSN    | <---------End to End TSN Service----------> |   TSN    |
|  Applic. |                                              |  Applic. |
+----------+  +.........+                      +.........+  +----------+
|          |  |Service-Proxy           Service-Proxy|  |          |
|   TSN    |  |   +.+---+<-- DetNet flow -->+---+.|  |  |   TSN    |
|          |  |TSN| |Svc|                  |Svc| |TSN|  |          |
+----------+  +---+ +---+    +----------+   +---+ +---+  +----------+
|   L2     |  | L2| |Fwd|    |Forwarding|   |Fwd| |L2 |  |   L2     |
+------.---+  +-.-+ +-.-+    +---.----.-+   +--.+ +-.-+  +---.------+
     :  Link  :     / ,-----. \   :  Link  :   / ,-----. \
     +........+    +-[  Sub  ]-+  +........+   +-[  TSN  ]-+
                   [Network]                   [Network]
                    `-----'                     `-----'
Flow Mapping:
     |TSN N:1 DetNet|<--------- DetNet ---------->|DetNet 1:N TSN|
```

Figure 1: Flow Mapping in TSN over DetNet Network

4. BGP Extensions for Flow Specification Encoding

4.1. Filtering Rules for TSN Streams

As IEEE Std 802.1Q defined, a Stream ID is a 64-bit field that
uniquely identifies a stream and can be generated by the system
offering the stream, or possibly a device controlling that system.
But it is not carried in the header of the TSN Stream. As defined in
[IEEE8021CB] and [IEEEP8021CBdb], five specific Stream identification
functions are described: Null Stream identification, Source MAC and
VLAN Stream identification, Active Destination MAC and VLAN Stream

identification, and IP Stream identification, and Mask-and-match
Stream identification. It needs to examines the header of the
streams such as destination_address, vlan_identifier, IP source
address, IP destination address, DSCP, IP next protocol, source port,
destination port and mac_service_data_unit.

As defined in [I-D.ietf-idr-flowspec-l2vpn], the Ethernet Layer 2
(L2) related fields has been covered by the L2 traffic filtering
rules except the mac_service_data_unit in Mask-and-Match Stream
identification. A mac_service_data_unit mask is defined to identify
communication flows supported by various higher-layer protocols.
This document proposes a new type in L2 components flowspec Type for
TSN Streams.

Type TBD1 - Mac Service Data Unit

Encoding: <type (1 octet), length (1 octet), [op, value]+>

Defines a list of {operation, value} pairs used to match 6-octet Mac
Service Data Unit field. Values are encoded as 6-octet quantities.
op is encoded as specified in Section 4.2.1.1 of [RFC8955].

4.2. Traffic Action for TSN Streams

The action for an TSN traffic filtering flowspec is to accept the TSN
streams that matches that particular rule and map the streams to the
DetNet flows. The action for L3 traffic with extended communities
types per [RFC8955] and [RFC8956] such as traffic-rate, traffic-
marking, traffic-action, and redirect can be used for TSN to DetNet
IP flow mapping.

The DetNet flow is identified by a S-Label and the DetNet Header
consists of d-CW and F-Labels. The MPLS label related action for an
TSN stream mapping to a DetNet MPLS network can use the Label-action
defined in [I-D.ietf-idr-bgp-flowspec-label]. And the action for the
sequence in d-CW field, this document specifies the following BGP
extended communitiy for TSN Streams as following shown.

```
+--------+----------------------+------------+
| type   | extended community   | encoding   |
+--------+----------------------+------------+
| TBD2   | Sequence-action      | bitmask    |
+--------+----------------------+------------+
```

Table 1

The The Sequence-action extended community is shown as the Figure 2.

```
                  0                                            15
                  +--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
                  |Type |              Resv                    |
                  +--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
                  |   Resv   |        Sequence Number          |
                  +--+--+--+--+                                +
                  |                    ~                       |
                  +--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
```
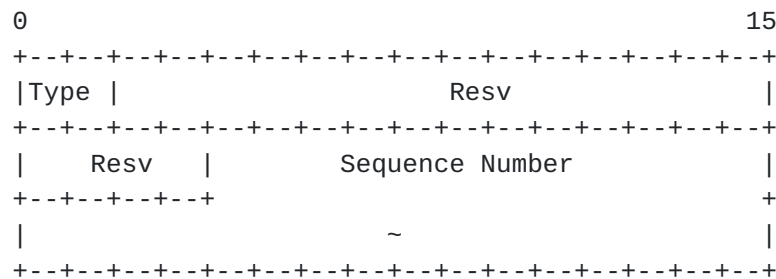
Figure 2: Sequence-action

Type: 2 bits, indicates the length of the sequence number:

0: 0 bits

1: 16 bits

2: 28 bits

Resv: 18 bits, reserved for future use. MUST be sent as zero and ignored on receipt.

Sequence Number: 28 bits, an unsigned value implementing the DetNet sequence number.

4.3. Filtering Rules for DetNet Flows

The L3 traffic filtering rules defined in [RFC8955] and [RFC8956] can be used for DetNet IP flow.

As defined in RFC8964, the MPLS-based DetNet data plane encapsulation consists of d-CW, S-Label and F-Labels. The MPLS label filtering rules have been defined in [I-D.ietf-idr-flowspec-mpls-match].

This document proposes a new community type in L3 components flowspec Type for DetNet MPLS flows.

Type TBD3 - d-CW

Encoding: <type (1 octet), length (1 octet), [op, value]+>

Defines a list of {operation, value} pairs used to match Sequence. Values are encoded as 4-octet quantities, where the four most significant bits are set to zero and ignored for matching and the 28 least significant bits contain the sequence value. op is encoded as specified in Section 4.2.1.1 of [RFC8955].

4.4. Traffic Action for DetNet Flows

The extended action for an DetNet traffic filtering flowspec is to
accept the DetNet flows that matches that particular rule and map the
flows to the TSN streams. This document specifies the following BGP
extended communitiy as the following shown.

```
+--------+----------------------+------------+
|  type  |   extended community |  encoding  |
+--------+----------------------+------------+
|  TBD4  | TSN-action           |  bitmask   |
+--------+----------------------+------------+
```

                          Table 2

The The TSN-action extended community is shown as the Figure 3.

```
0                                             15
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|          Type           |        Resv        |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|                  TSN-Profile                 |
|                      ~                       |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
```
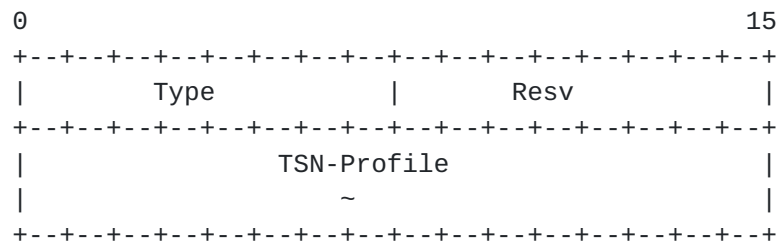
                     Figure 3: TSN-action

Type: 1-octet, indicates the type of TSN profiles. The value of the
types is TBD:

Resv: 1-octet, reserved for future use. MUST be sent as zero and
ignored on receipt.

TSN-profile: 4-octet, can be converted to the TSN Stream ID and
stream related parameters and requirements as the following shown.

stream_handle: identifying the Stream to which the packet belongs in
TSN networks.

sequence_number: identifying the order in which the packet was
transmitted relative to other packets in the same Compound Stream in
TSN networks.

traffic_scheduling: identifying the traffic scheduling mechanisms including traffic policy, queuing and forwarding methods in TSN networks.

5. Security Considerations

TBA

6. Acknowledgements

TBA

7. IANA Considerations

TBA

8. Normative References

[I-D.ietf-detnet-ip-over-tsn]
          Varga, B., Farkas, J., Malis, A. G., and S. Bryant,
          "DetNet Data Plane: IP over IEEE 802.1 Time Sensitive
          Networking (TSN)", draft-ietf-detnet-ip-over-tsn-07 (work
          in progress), February 2021.

[I-D.ietf-detnet-mpls-over-tsn]
          Varga, B., Farkas, J., Malis, A. G., and S. Bryant,
          "DetNet Data Plane: MPLS over IEEE 802.1 Time-Sensitive
          Networking (TSN)", draft-ietf-detnet-mpls-over-tsn-07
          (work in progress), February 2021.

[I-D.ietf-detnet-tsn-vpn-over-mpls]
          Varga, B., Farkas, J., Malis, A. G., Bryant, S., and D.
          Fedyk, "DetNet Data Plane: IEEE 802.1 Time Sensitive
          Networking over MPLS", draft-ietf-detnet-tsn-vpn-over-
          mpls-07 (work in progress), February 2021.

[I-D.ietf-idr-bgp-flowspec-label]
          Liang, Q., Hares, S., You, J., Raszuk, R., and D. Ma,
          "Carrying Label Information for BGP FlowSpec", draft-ietf-
          idr-bgp-flowspec-label-01 (work in progress), December
          2016.

[I-D.ietf-idr-flowspec-l2vpn]
          Hao, W., Eastlake, D. E., Litkowski, S., and S. Zhuang,
          "BGP Dissemination of L2 Flow Specification Rules", draft-
          ietf-idr-flowspec-l2vpn-16 (work in progress), November
          2020.

[I-D.ietf-idr-flowspec-mpls-match]
          Yong, L., Hares, S., Liang, Q., and J. You, "BGP Flow
          Specification Filter for MPLS Label", draft-ietf-idr-
          flowspec-mpls-match-01 (work in progress), December 2016.

[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>.

[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>.

[RFC8655] Finn, N., Thubert, P., Varga, B., and J. Farkas,
          "Deterministic Networking Architecture", RFC 8655,
          DOI 10.17487/RFC8655, October 2019,
          <https://www.rfc-editor.org/info/rfc8655>.

[RFC8938] Varga, B., Ed., Farkas, J., Berger, L., Malis, A., and S.
          Bryant, "Deterministic Networking (DetNet) Data Plane
          Framework", RFC 8938, DOI 10.17487/RFC8938, November 2020,
          <https://www.rfc-editor.org/info/rfc8938>.

[RFC8955] Loibl, C., Hares, S., Raszuk, R., McPherson, D., and M.
          Bacher, "Dissemination of Flow Specification Rules",
          RFC 8955, DOI 10.17487/RFC8955, December 2020,
          <https://www.rfc-editor.org/info/rfc8955>.

[RFC8956] Loibl, C., Ed., Raszuk, R., Ed., and S. Hares, Ed.,
          "Dissemination of Flow Specification Rules for IPv6",
          RFC 8956, DOI 10.17487/RFC8956, December 2020,
          <https://www.rfc-editor.org/info/rfc8956>.

[RFC8964] Varga, B., Ed., Farkas, J., Berger, L., Malis, A., Bryant,
          S., and J. Korhonen, "Deterministic Networking (DetNet)
          Data Plane: MPLS", RFC 8964, DOI 10.17487/RFC8964, January
          2021, <https://www.rfc-editor.org/info/rfc8964>.

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