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                   DetNet Flow Information Model
             draft-ietf-detnet-flow-information-model-04

Abstract

   This document describes flow and service information model for
   Deterministic Networking (DetNet). These models are defined for IP
   and MPLS DetNet data planes

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1. Introduction

   A Deterministic Networking (DetNet) service provides a capability to
   carry a unicast or a multicast data flow for an application with
   constrained requirements on network performance, e.g., low packet
   loss rate and/or latency. DetNet and TSN have common architecture as
   expressed in [IETFDetNet] and [I-D.ietf-detnet-architecture]. The
   DetNet service is provided for DetNet flows via the DetNet service
   and forwarding sub-layers.

   DetNet service is IP or MPLS and DetNet is currently defined for IP
   and MPLS networks as shown in Figure 1 based on Figure 2 and Figure 3
   of [I-D.ietf-detnet-data-plane-framework]. A DetNet flow includes
   one or more App-flow(s) as payload. App-flows can be Ethernet, MPLS,
   or IP flows, which impacts what header fields are use in order to
   identify a flow. DetNet flows are created by DetNet encapsulation of
   App-flow(s) (e.g., with added MPLS labels, etc.). In some scenarios
   App-flow and DetNet flow look similar on the wire (e.g., L3 App-flow
   over a DetNet IP network).

```
                                  +-----+
                                  | TSN |
                +-------+       +-+-----+-+
                | DN IP |       | DN MPLS |
             +--+--+----+----+  +-+---+-----+-+
             | TSN | DN MPLS |  | TSN | DN IP |
             +-----+---------+  +-----+-------+
```

              Figure 1: DetNet Service Examples as per Data Plane Framework

As shown in Figure 1 as per [I-D.ietf-detnet-data-plane-framework] a
DetNet flow can be treated as an application level flow (App-flow)
e.g., at DetNet flow aggregation or in a sub-network that
interconnects DetNet nodes.

The DetNet flow and service information model provided by this
document contains both DetNet flow and App-flow specific information
in an integrated fashion.

In a given network scenario three information models can
distinguished:

o Flow models describe characteristics of data flows. These models
   describe in detail all relevant aspects of a flow that are needed
   to support the flow properly by the network between the source and
   the destination(s).

o Service models describe characteristics of services being provided
   for data flows over a network. These models can be treated as a
   network operator independent information model.

o Configuration models describe in detail the settings required on
   network nodes to serve a data flow properly.

Service and flow information models are used between the user and the
network operator. Configuration information models are used between
the management/control plane entity of the network and the network
nodes. They are shown in Figure 2.

```
    User                    Network Operator
            flow/service
     /\       info model     +---+
    /  \ <---------------> | X |     management/control
    ----                    +-+-+         plane entity
                             ^
                             |   configuration
                             |      info model
                   +------------+
                    v        |     |
                   +-+       |     v  Network
                   +-+       v    +-+  nodes
                         +-+    +-+
                         +-+
```

         Figure 2: Usage of Information models (flow, service and
                             configuration)

DetNet flow and service information model is based on
[I-D.ietf-detnet-architecture] and on the concept of data model
specified by [IEEE8021Qcc]. Furthermore, the starting point of the
DetNet flow information model was the flow identification
possibilities described in [IEEE8021CB], which is used by
[IEEE8021Qcc] as well. In addition to TSN data model, [IEEE8021Qcc]
also specifies configuration of TSN features (e.g., traffic
scheduling specified by [IEEE8021Qbv]). Due to the common
architecture and flow model, configuration features can be leveraged
in certain deployment scenarios, e.g., when the network that provides
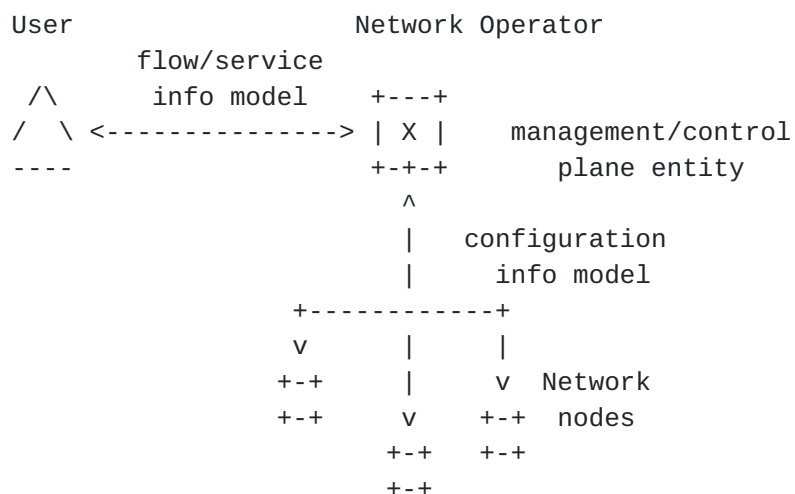the DetNet service includes both L3 and L2 network segments.

1.1. Goals

As it is expressed in the Charter [IETFDetNet], the DetNet WG
collaborates with IEEE 802.1 TSN in order to define a common
architecture for both Layer 2 and Layer 3, which is beneficial for
various reasons, e.g., in order to simplify implementations. The
flow and service information models should be also aligned along
those lines. Therefore, the DetNet flow and service information
models described in this document are based on [IEEE8021Qcc], which
is an amendment to [IEEE8021Q].

This document intends to specify flow and service information models
only.

1.2. Non Goals

This document (this revision) does not intend to specify either flow
data model or DetNet configuration. From these aspects, the goals of
this document differ from the goals of [IEEE8021Qcc], which also
specifies data model and configuration of certain TSN features.

2. Terminology

2.1. Terms Used in This Document

This document uses the terminology established in the DetNet
architecture [I-D.ietf-detnet-architecture] and the the DetNet Data
Plane Framework [I-D.ietf-detnet-data-plane-framework]. The reader
is assumed to be familiar with these documents and any terminology
defined therein. The DetNet <=> TSN dictionary of
[I-D.ietf-detnet-architecture] is used to perform translation from
[IEEE8021Qcc] to this document.

The following terminology is used according to
[I-D.ietf-detnet-architecture]:

App-flow   The payload (data) carried over a DetNet service.

DetNet flow   A DetNet flow is a sequence of packets which conform
              uniquely to a flow identifier, and to which the DetNet
              service is to be provided. It includes any DetNet
              headers added to support the DetNet service and
              forwarding sub-layers.

The following terminology is introduced in this document:

Source   Reference point for an App-flow, where the flow starts.

Destination   Reference point for an App-flow, where the flow
              terminates.

DN Ingress   Reference point for DetNet flow, where it starts.
              Networking technology specific encapsulation may be
              added here to the served App-flow(s).

DN Egress   Reference point for DetNet flow, where it terminates.
              Networking technology specific encapsulation may be
              removed here from the served App-flow(s).

2.2. Abbreviations

The following abbreviations are used in this document:

DetNet   Deterministic Networking.

DN   DetNet.

MPLS   Multiprotocol Label Switching.

PSN   Packet Switched Network.

TSN   Time-Sensitive Networking.

2.3. Naming Conventions

The following naming conventions were used for naming information
model components in this document. It is recommended that extensions
of the model use the same conventions.

o Names SHOULD be descriptive.

o Names MUST start with uppercase letters.

o Composed names MUST use capital letters for the first letter of
   each component. All other letters are lowercase, even for
   acronyms. Exceptions are made for acronyms containing a mixture
   of lowercase and capital letters, such as IPv6. Examples are
   SourceMacAddress and DestinationIPv6Address.

2.4. 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. DetNet Domain and its Modeling

3.1. DetNet Service Overview

The DetNet service can be defined as a service that provides a
capability to carry a unicast or a multicast data flow for an
application with constrained requirements on network performance,
e.g., low packet loss rate and/or latency.

Figure 5. and Figure 8. in [I-D.ietf-detnet-architecture] show the
DetNet service related reference points and main components.

3.2. Reference Points Used in Modeling

From service design perspective a fundamental question is the
location of the service/flow endpoints, i.e., where the service/flow
starts and ends.

App-flow specific reference points are the Source (where it starts)
and the Destination (where it terminates). Similarly a DetNet flow
have reference points named as DN Ingress (where it starts) and DN
Egress (where it ends). These reference points may coexist in the
same node (e.g., in a DetNet IP end system). DN Ingress and DN
Egress reference points are intermediate reference points for a
served App-flow.

All reference points are assumed in this document to be packet-based
reference points. A DN Ingress may add and a DN Egress may remove
networking technology specific encapsulation to/from the served App-
flow(s) (e.g., MPLS label(s), UDP and IP headers).

3.3. Information Elements

The DetNet flow information model and the service model relies on
three groups of information elements:

o App-flow related paramaters: they describe the App-flow
   characteristics (e.g., identification, encapsulation, traffic
   specification, endpoints, status, etc.) and the App-flow
   requirements (e.g., delay, loss, etc.).

o DetNet flow related parameters: they describe the DetNet flow
   characteristics (e.g., identification, format, traffic
   specification, endpoints, rank, etc.).

o DetNet service related parameters: they describe the expected
   service characteristics (e.g., delivery type, connectivity delay/
   loss, status, rank, etc.).

In the information model a DetNet flow contains one or more App-flows
(N:1 mapping). During DetNet aggregation the aggregated DetNet flows
are treated as App-flows and the aggregate is the DetNet flow, which
provides N:1 mapping. Similarly, there is a M:1 relationship of
DetNet flow(s) and a DetNet Service.

4. App-flow Related Parameters

Deterministic service is required by time/loss sensitive
application(s) running on an end system during communication with its
peer(s). Such a data exchange has various requirements on delay and/
or loss parameters.

4.1. App-flow Characteristics

App-flow characteristics are described with the following parameters:

o FlowID: it is a unique (management) identifier of the App-flow.
   It can be used to define the N:1 mapping of App-flows to a DetNet
   flow.

o FlowType: it is set according to the encapsulation format of the
   flow. It can be Ethernet (TSN), MPLS, or IP.

o DataFlowSpecification: it is a flow descriptor, defining which
   packets belongs to a flow using, e.g., FlowType specific packet
   header fields like src-addr, dst-addr, label, VLAN-ID, etc.

o TrafficSpecification: it is a flow descriptor, defining traffic
   parameters like packet size, interval, and max. packets per
   interval.

o FlowEndpoints: it defines the start and termination reference
   points of the App-flow by pointing to the source interface/node
   and destination interface(s)/node(s).

o FlowStatus: it provides the status of the App-flow with respect to
   the establishment of the flow by the network, e.g., ready, failed,
   etc.

o FlowRank: it provides the rank of this flow relative to other
   flows in the network.

4.2. App-flow Requirements

App-flow requirements are described with the following parameters:

o FlowRequirements: it defines the requirement of the App-flow
   regarding bandwidth, latency, latency variation, loss, and
   misorder tolerance.

o FlowBiDir: it defines the requirement of the App-flow whether it
   has to be routed together with other App-flow(s) through the
   network, e.g., to provide congruent paths in the two directions.

5. DetNet Flow Related Parameters

Data model specified by [IEEE8021Qcc] describes data flows using TSN
service as periodic flows with fix packet size (i.e., Constant Bit
Rate (CBR) flows) or with variable packet size. The same concept is
applyed for flows using DetNet service.

Latency and loss parameters are correlated because the effect of late
delivery can result data loss for an application. However, not all
applications require hard limits on both parameters (latency and
loss). For example, some real-time applications allow graceful
degradation if loss happens (e.g., sample-based processing, media
distribution). Some others may require high-bandwidth connections
that make the usage of techniques like packet replication
economically challenging or even impossible. Some applications may
not tolerate loss, but are not latency sensitive (e.g., bufferless
sensors). Time/loss sensitive applications may have somewhat special
requirements especially for loss (e.g., no loss in two consecutive
communication cycles; very low outage time, etc.).

DetNet flows have the following attributes:

   a. DnFlowID ([Section 5.1](#))

   b. DnPayloadType ([Section 5.2](#))

   c. DnFlowFormat ([Section 5.3](#))

   d. DnFlowSpecification ([Section 5.4](#))

   e. DnTrafficSpecification ([Section 5.5](#))

   f. DnFlowEndpoints ([Section 5.6](#))

   g. DnFlowRank ([Section 5.7](#))

   h. DnFlowStatus ([Section 5.8](#))

   DetNet flows have the following requirement attributes:

   o DnFlowRequirements ([Section 5.9](#))

   o DnFlowBiDir ([Section 5.10](#))

   Flow attributes are described in the following sections.

[5.1](#). Management ID of the DetNet Flow

   A unique (management) identifier is needed for each DetNet flow
   within the DetNet domain. It is specified in DnFlowID. It can be
   used to define the M:1 mapping of DetNet flows to a DetNet service.

[5.2](#). Payload type of the DetNet Flow

   DnPayloadType attribute is set according to encapsulated App-flow
   format. The attribute can be Ethernet, MPLS, or IP.

[5.3](#). Format of the DetNet Flow

   DnFlowFormat attribute is set according to DetNet PSN technology.
   The attribute can be MPLS or IP.

[5.4](#). Identification and Specification of DetNet Flows

   Identification options for DetNet flows at the Ingress/Egress and
   within the DetNet domain are specified as follows; see [Section 5.4.1](#)
   for DetNet MPLS flows and [Section 5.4.2](#) for DetNetw IP flows.

5.4.1. DetNet MPLS Flow Identification and Specification

Identification of DetNet MPLS flows within the DetNet domain are used in the service information model. The attributes are specific to the MPLS forwarding paradigm within the DetNet domain [I-D.ietf-detnet-mpls]. DetNetwork MPLS flows can be identified and specified by the following attributes:

a. SLabel

b. FLabelStack

5.4.2. DetNet IP Flow Identification and Specification

DetNet IP flows can be identified and specified by the following attributes (6-tuple) [I-D.ietf-detnet-ip]:

a. SourceIpAddress

b. DestinationIpAddress

c. IPv6FlowLabel

d. Dscp

e. Protocol

f. SourcePort

g. DestinationPort

5.5. Traffic Specification of the DetNet Flow

DnTrafficSpecification attributes specify how the DN Ingress transmits packets for the DetNet flow. This is effectively the promise/request of the DN Ingress to the network. The network uses this traffic specification to allocate resources and adjust queue parameters in network nodes.

TrafficSpecification has the following attributes:

a. Interval: the period of time in which the traffic specification cannot be exceeded.

b. MaxPacketsPerInterval: the maximum number of packets that the Ingress will transmit in one Interval.

   c. MaxPayloadSize: the maximum payload size that the Ingress will
       transmit.

   These attributes can be used to describe any type of traffic (e.g.,
   CBR, VBR, etc.) and can be used during resource allocation to
   represent worst case scenarios.

   [[Editor's note (to be removed from a future revision): Further
   optional attributes can be considered to achieve more efficient
   resource allocation. Such optional attributes might be worth for
   flows with soft requirements (i.e., the flow is only loss sensitive
   or only delay sensitive, but not both d elay-and-loss sensitive).
   Possible options how to extend DnTrafficSpecification attributes is
   for further discussion.]]

5.6. Endpoints of the DetNet Flow

   DnFlowEndpoints attribute defines the starting and termination
   reference points of the DetNet flow by pointing to the ingress
   interface/node and egress interface(s)/node(s). Depending on the
   network scenario it defines an interface or a node. Interface can be
   defined for example if the App-flow is a TSN Stream and it is
   received over a well defined UNI interface. For exampe for App-flows
   with MPLS encapsulation defining an ingress node is more common when
   per platform label space is used.

5.7. Rank of the DetNet Flow

   DnFlowRank provides the rank of this flow relative to other flows in
   the DetNet domain. Rank (range: 0-255) is used by the DetNet domain
   to decide which flows can and cannot exist when network resources
   reach their limit. Rank is used to help to determine which flows can
   be dropped (i.e., removed from node configuration) if for example a
   port of a node becomes oversubscribed (e.g., due to network re-
   configuration).

5.8. Status of the DetNet Flow

   DnFlowStatus provides the status of the DetNet flow with respect to
   the establishment of the flow by the DetNet domain.

   The DnFlowStatus SHALL include the following attributes:

   a. DnIngressStatus is an enumeration for the status of the flow's
       Ingress reference point:

       * None: no Ingress.

> * Ready: Ingress is ready.
>
> * Failed: Ingress failed.
>
> * OutOfService: Administratively blocked.

b. DnEgressStatus is an enumeration for the status of the flow's
    Egress reference points:

> * None: no Egress.
>
> * Ready: all Egresses are ready.
>
> * PartialFailed: One or more Egress ready, and one or more
>   Egress failed. The DetNet flow can be used if the Ingress is
>   Ready.
>
> * Failed: All Egresses failed.
>
> * OutOfService: Administratively blocked.

c. FailureCode: A non-zero code that specifies the problem if the
    DetNet flow encounters a failure (e.g., packet replication and
    elimination is requested but not possible, or DnIngressStatus is
    Failed, or DnEgressStatus is Failed, or DnEgressStatus is
    PartialFailed).

[[Editor's note (to be removed from a future revision): FailureCodes
to be defined for DetNet. Table 46-1 of [IEEE8021Qcc] describes TSN
failure codes.]]

5.9. Requirements of the DetNet Flow

DnFlowRequirements specifies requirements to ensure proper serving of
the DetNet flow.

The DnFlowRequirements includes the following attributes:

a. MinBandwidth

b. MaxLatency

c. MaxLatencyVariation

d. MaxLoss

e. MaxConsecutiveLossTolerance

   f. MaxMisordering

5.9.1. Minimum Bandwidth of the DetNet Flow

   MinBandwidth is the minimum bandwidth that has to be guaranteed for
   the DetNet flow.

5.9.2. Maximum Latency of the DetNet Flow

   MaxLatency is the maximum latency from Ingress to Egress(es) for a
   single packet of the DetNet flow. MaxLatency is specified as an
   integer number of nanoseconds.

5.9.3. Maximum Latency Variation of the DetNet Flow

   MaxLatencyVariation is the difference between the minimum and the
   maximum end-to-end one-way latency.

5.9.4. Maximum Loss of the DetNet Flow

   MaxLoss defines the maximum Packet Loss Ratio (PLR) requirement for
   the DetNet flow between the Ingress and Egress(es).

5.9.5. Maximum Consequtive Loss of the DetNet Flow

   Some applications have special loss requirement, like
   MaxConsecutiveLossTolerance. The maximum consecutive loss tolerance
   parameter describes the maximum number of consecutive packets whose
   loss can be tolerated. The maximum consecutive loss tolerance can be
   measured for example based on sequence number.

5.9.6. Maximum Misordering Tolerance of the DetNet Flow

   MaxMisordering describes the tolerable maximum number of packets that
   can be received out of order. The maximum allowed misordering can be
   measured for example based on sequence number. The value zero for
   the maximum allowed misordering indicates that in order delivery is
   required, misordering cannot be tolerated.

5.10. BiDir requirement of the DetNet Flow

   DnFlowBiDir attribute defines the requirement whether the served
   packets have to be routed together with packets of other flows
   through the DetNet domain, e.g., to provide congruent paths in the
   two directions.

6. DetNet Service Related Parameters

   DetNet service have the following attributes:

   a. DnServiceID (Section 6.1)

   b. DnServiceDeliveryType (Section 6.2)

   c. DnServiceDeliveryProfile (Section 6.3)

   d. DNServiceConnectivity (Section 6.4)

   e. DnServiceBiDir (Section 6.5)

   f. DnServiceRank (Section 6.6)

   g. DnServiceStatus (Section 6.7)

   Service attributes are described in the following sections.

6.1. Management ID of the DetNet service

   A unique (management) identifier is needed for each DetNet service
   within the DetNet domain. It is specified in DnServiceID. It can be
   used to define the M:1 mapping of DetNet flows to a DetNet service.

6.2. Delivery Type of the DetNet service

   DnServiceDeliveryType attribute is set according to the payload of
   the served DetNet flow (i.e., the encapsulated App-flow format). The
   attribute can be Ethernet, MPLS, or IP.

6.3. Delivery Profile of the DetNet Service

   DnServiceDeliveryProfile specifies delivery profile to ensure proper
   serving of the DetNet flow.

   The DnServiceDeliveryProfile includes the following attributes:

   a. MinBandwidth

   b. MaxLatency

   c. MaxLatencyVariation

   d. MaxLoss

   e. MaxConsecutiveLossTolerance

   f. MaxMisordering

6.3.1. Minimum Bandwidth of the DetNet Service

   MinBandwidth is the minimum bandwidth that has to be guaranteed for
   the DetNet service.

6.3.2. Maximum Latency of the DetNet Service

   MaxLatency is the maximum latency from Ingress to Egress(es) for a
   single packet of the DetNet flow. MaxLatency is specified as an
   integer number of nanoseconds.

6.3.3. Maximum Latency Variation of the DetNet Service

   MaxLatencyVariation is the difference between the minimum and the
   maximum end-to-end one-way latency.

6.3.4. Maximum Loss of the DetNet Service

   MaxLoss defines the maximum Packet Loss Ratio (PLR) parameter for the
   DetNet service between the Ingress and Egress(es) of the DetNet
   domain.

6.3.5. Maximum Consequtive Loss of the DetNet Service

   Some applications have special loss requirement, like
   MaxConsecutiveLossTolerance. The maximum consecutive loss tolerance
   parameter describes the maximum number of consecutive packets whose
   loss can be tolerated. The maximum consecutive loss tolerance can be
   measured for example based on sequence number.

6.3.6. Maximum Misordering Tolerance of the DetNet Service

   MaxMisordering describes the tolerable maximum number of packets that
   can be received out of order. The maximum allowed misordering can be
   measured for example based on sequence number. The value zero for
   the maximum allowed misordering indicates that in order delivery is
   required, misordering cannot be tolerated.

6.4. Connectivity Type of the DetNet Service

   Two connectivity types are distinguished: point-to-point (p2p) and
   point-to-multipoint (p2mp). Connectivity type p2mp is created by a
   transport layer function (e.g., p2mp LSP). (Note: mp2mp connectivity
   is a superposition of p2mp connections.)

6.5. BiDir requirement of the DetNet Service

DnServiceBiDir attribute defines the requirement whether the served packets have to be routed together with packets of other service instances through the DetNet domain, e.g., to provide congruent paths in the two directions.

6.6. Rank of the DetNet Service

DnServiceRank attribute provides the rank of a service instance relative to other services in the DetNet domain. DnServiceRank (range: 0-255) is used by the network in case of network resource limitation scenarios.

6.7. Status of the DetNet Service

DnServiceStatus information group includes elements that specify the status of the service specific state of the DetNet domain. This information group informs the user whether or not the service is ready for use.

The DnServiceStatus SHALL include the following attributes:

a. DnServiceIngressStatus is an enumeration for the status of the service's Ingress:

    * None: no Ingress.

    * Ready: Ingress is ready.

    * Failed: Ingress failed.

    * OutOfService: Administratively blocked.

b. DnServiceEgressStatus is an enumeration for the status of the service's Egress:

    * None: no Egress.

    * Ready: all Egresses are ready.

    * PartialFailed: One or more Egress ready, and one or more Egress failed. The DetNet flow can be used if the Ingress is Ready.

    * Failed: All Egresses failed.

    * OutOfService: Administratively blocked.

c. DnServiceFailureCode: A non-zero code that specifies the problem
    if the DetNet service encounters a failure (e.g., packet
    replication and elimination is requested but not possible, or
    DnServiceIngressStatus is Failed, or DnServiceEgressStatus is
    Failed, or DnServiceEgressStatus is PartialFailed).

[[Editor's note (to be removed from a future revision):
DnServiceFailureCodes to be defined for DetNet service. Table 46-1
of [IEEE8021Qcc] describes TSN failure codes.]]

7. Flow Specific Operations

The DetNet flow information model relies on three high level
information groups:

o DnIngress: The DnIngress information group includes elements that
   specify the source for a single DetNet flow. This information
   group is applied from the user of the DetNet service to the
   network.

o DnEgress: The DnEgress information group includes elements that
   specify the destination for a single DetNet flow. This
   information group is applied from the user of the DetNet service
   to the network.

o DnFlowStatus: The status information group includes elements that
   specify the status of the flow in the network. This information
   group is applied from the network to the user of the DetNet
   service. This information group informs the user whether or not
   the DetNet flow is ready for use.

There are three possible operations for each DetNet flow with respect
to its DetNet service at a DN Ingress or a DN Egress (similarly to
App-flows at a Source or a Destination):

o Join: DN Ingress/DN Egress intends to join the flow.

o Leave: DN Ingress/DN Egress intends to leave the flow.

o Modify: DN Ingress/DN Egress intends to change the flow.

7.1. Join Operation

For the join operation, the DnFlowSpecification, DnFlowRank,
DnFlowEndpoint, and DnTrafficSpecification SHALL be included within
the DnIngress or DnEgress information group. For the join operation,
the DnServiceRequirements groups MAY be included.

7.2. Leave Operation

For the leave operation, the DnFlowSpecification and DnFlowEndpoint
SHALL be included within the DnIngress or DnEgress information group.

7.3. Modify Operation

For the modify operation, the DnFlowSpecification, DnFlowRank,
DnFlowEndpoint, and DnTrafficSpecification SHALL be included within
the DnIngress or DnEgress information group. For the join operation,
the DnServiceRequirements groups MAY be included.

Modify operation can be considered to address cases when a flow is
slightly changed, e.g., only MaxPayloadSize (Section 5.5) has been
changed. The advantage of having a Modify is that it allows to
initiate a change of flow spec while leaving the current flow is
operating until the change is accepted. If there is no linkage
between the Join and the Leave, then in figuring out whether the new
flow spec can be supported, the controller entity has to assume that
the resources committed to the current flow are in use. Via Modify
the controller entity knows that the resources supporting the current
flow can be available for supporting the altered flow. Modify is
considered to be an optional operation due to possible controller
plane limitations.

8. Summary

This document describes DetNet flow information model and service
information model for DetNet IP networks and DetNet MPLS networks.

9. IANA Considerations

N/A.

10. Security Considerations

N/A.

11. References

11.1. Normative References

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