DetNet
DetNet Flow Information Model Based on TSN

draft-farkas-detnet-flow-information-model-00

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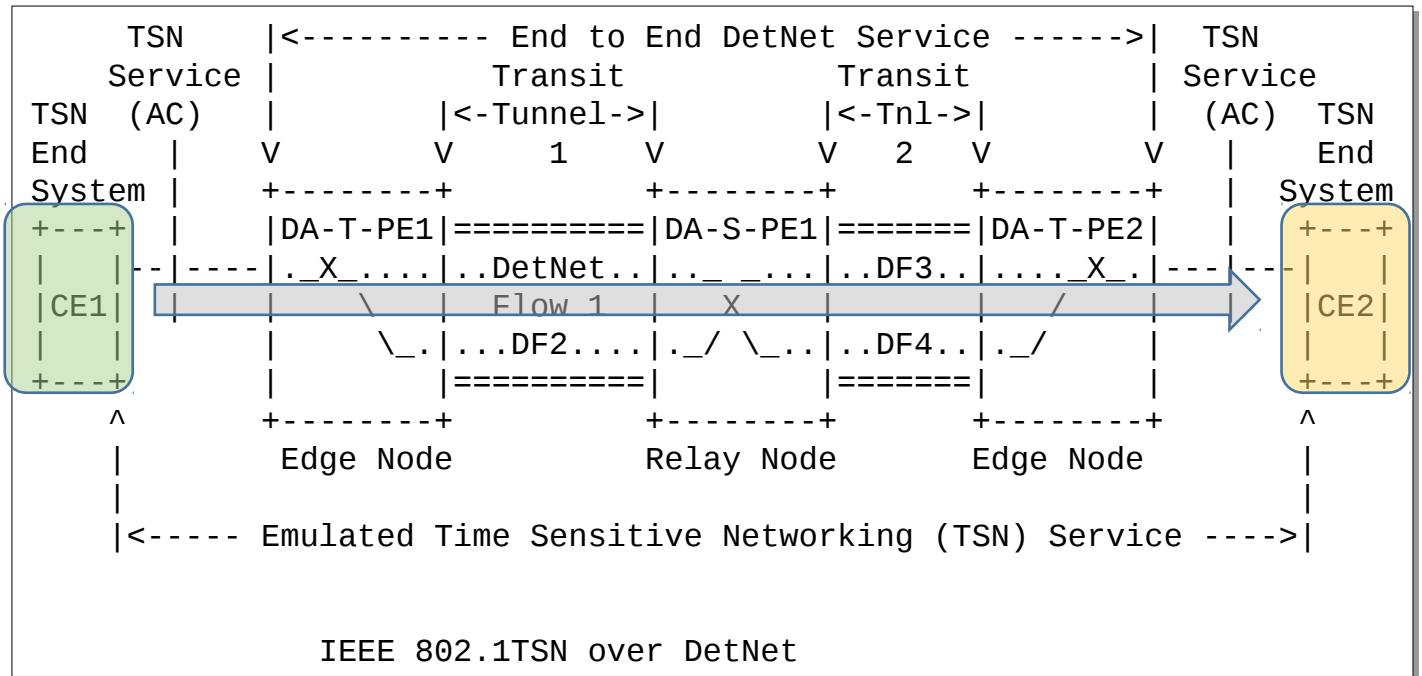
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DetNet WG

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Overview

- Goal
- Draft content
- Next steps

```
      TSN      |<---------- End to End DetNet Service ------>| TSN
     Service   |              Transit           Transit      | Service
TSN  (AC)      |          |<-Tunnel->|          |<-Tnl->|     | (AC)    TSN
End  |         V         V    1    V         V    2    V     |         End
System |       +--------+         +--------+         +--------+ |       System
+---+  |       |DA-T-PE1|=========|DA-S-PE1|=======|DA-T-PE2| |       +---+
|   |--|-----|._X_.....|..DetNet..|.._ _....|..DF3..|...._X_.|---|---|   |
|CE1|  |     |    |     \    |   Flow 1  |   X   |       |   /   |   |   |CE2|
|   |  |     |         \_.|...DF2....|._/ \_..|..DF4..|._/       |   |   |
+---+  |     |         |=========|         |=======|         |       +---+
       ^     +--------+         +--------+         +--------+       ^
       |      Edge Node          Relay Node         Edge Node       |
       |                                                            |
       |<----- Emulated Time Sensitive Networking (TSN) Service ---->|


                      IEEE 802.1TSN over DetNet
```

Based on Figure-2 of
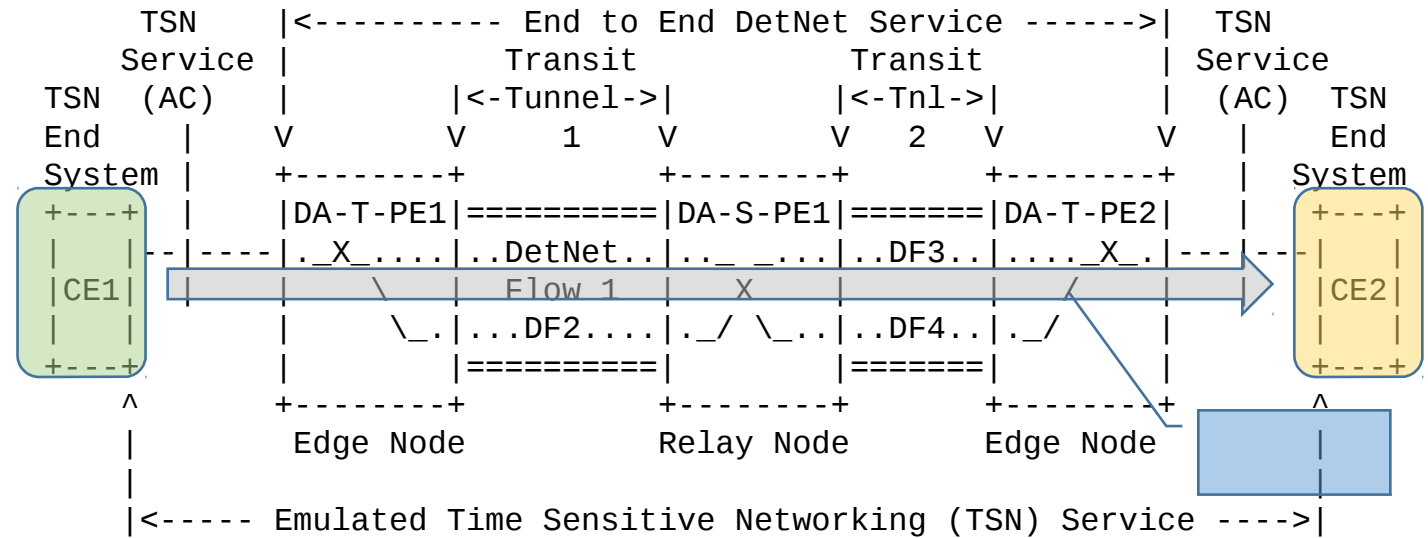https://datatracker.ietf.org/doc/html/draft-dt-detnet-dp-sol-00

Goal of the draft

- Describes
  - flow information model for Deterministic Networking (DetNet) based on the mature TSN flow information/data model specified by [IEEE8021Qcc]
- Defines
  - DetNet flow information model both for Layer 3 and Layer 2 flows in an integrated fashion
  - Centralized Network / Distributed User Model of [IEEE8021Qcc] is used in this revision as a start of the work. Further models can be also useful for DetNet, e.g., the Fully Centralized Model for the Industrial M2M use case.
- 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.

Content of the draft

- Technical content and structure

    Section 4.   Naming Conventions

    Section 5.   End System

    Section 6.   Flow (Identification and Specification, Flow Ranking)

    Section 7.   Source

    Section 8.   Destination

    Section 9.   Common Attributes of Source and Destination (End System Interfaces, Interface
                         Capabilities and User to Network Requirements)

    Section 10. Status (Status Info, Interface Configuration, Failed Interfaces)

5. End System

```
          TSN      |<---------- End to End DetNet Service ------>|  TSN
        Service    |             Transit            Transit      | Service
   TSN  (AC)       |           |<-Tunnel->|       |<-Tnl->|      |  (AC)   TSN
   End   |    V            V     1    V           V   2   V      |    V    End
   System|         +--------+        +-------+       +-------+   |  System
   +---+ |         |DA-T-PE1|========|DA-S-PE1|======|DA-T-PE2|   |  +---+
   |   |-|-----|._X_....|..DetNet..|.._ _...|..DF3..|....X_.|---|---|   |
   |CE1| |         |     \    |  Flow 1  |    X    |       |   \   |   |CE2|
   |   | |         |      \_.|...DF2....|._/ \_..|..DF4..|._/    |   |   |
   +---+ |         |         |==========|        |=======|      |   +---+
     ^   |         +--------+          +--------+        +-------+         ^
     |            Edge Node          Relay Node        Edge Node
     |
     |<----- Emulated Time Sensitive Networking (TSN) Service ---->|
```

- Source:
  - an end system capable of sourcing a DetNet flow. The Source information group includes elements that specify the Source for a single flow. This information group is applied from the user to the network.

- Destination:
  - an end system that is a destination of a DetNet flow. The Destination information group includes elements that specify the Destination for a single flow. This information group is applied from the user to the network.

- Status:
  - the status of a DetNet flow. 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. This information group informs the user whether or not the flow is ready for use.

5. End System

- Two operations for each flow
  - Join:
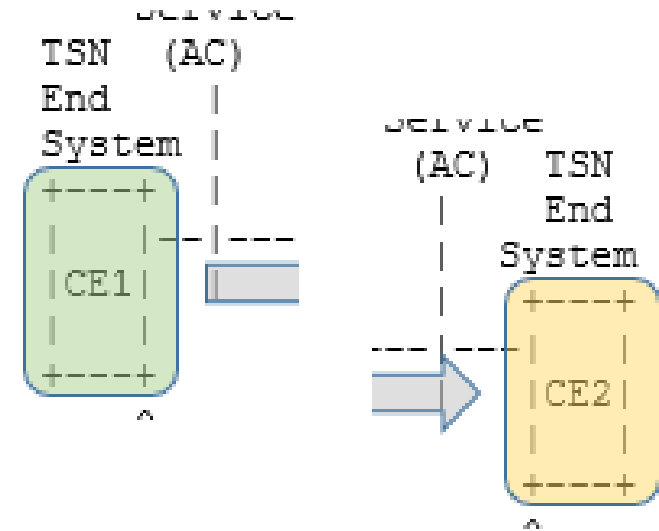   - Source/Destination request to join the flow.
  - Leave:
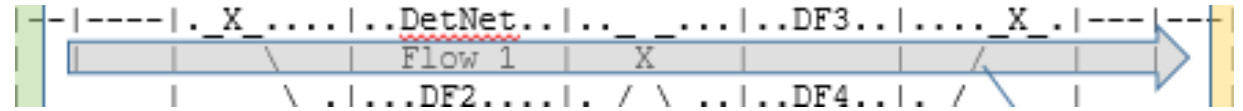   - Source/Destination request to leave the flow.

  - Note: Modify operation can be considered to address cases when a flow is slightly changed, e.g., only MaxPacketsPerInterval (Section 6.2)
    - Discussion1: Is "Modify" to be included?
    - Discussion2: If yes, what parameter changes can be considered under "Modify"?

TSN   (AC)
End |
System |
+---+ |
| |--|---
|CE1| |___
| |
+---+

                Service
            (AC)   TSN
               | End
               | System
               | +---+
    --|--- | |
             |CE2|
                   | |
                   +---+
                     ^

6. Flow attributes

```
+-|----|._X_....|..DetNet..|.._ _...|..DF3..|...._X_.|---|--
|      |    \    |  Flow 1  |    X   |       |        |  /    |
|      |     \ .|...DF2....|. / \ ..|..DF4..|. /  \   |
```

- DataFlowSpecification (Section 6.1)
  - DetNet L3 Flow
    - a. SourceIpAddress
    - b. DestinationIpAddress
    - c. Dscp
    - d. Protocol
    - e. SourcePort
    - f. DestinationPort
    - g. MplsLabel
  - DetNet L2 Flow
    - a. DestinationMacAddress
    - b. SourceMacAddress
    - c. Pcp
    - d. VlanId

- TrafficSpecification (Section 6.2)
  - a. Interval: the period of time in which the traffic specification cannot be exceeded.
  - b. MaxPacketsPerInterval: the maximum number of packets that the Source will transmit in one Interval.
  - c, MaxPayloadSize: the maximum payload size that the Source will transmit.
- FlowRank (Section 6.3)
  - FlowRank provides the rank of this flow relative to others flows in the network.
  - FlowRank (boolean) is used by the network to decide which flows can and cannot exist when network resources

7. Source attributes

- The Source object specifies:
    - The behavior of the Source for the flow (how/when the Source transmits).
    - The requirements of the Source from the network.
   - The capabilities of the interface(s) of the Source.

```
TSN   (AC)
End     |
System  |
+---+   |
|   | --|---
|CE1|     |
|   |     |
+---+
    ^
```
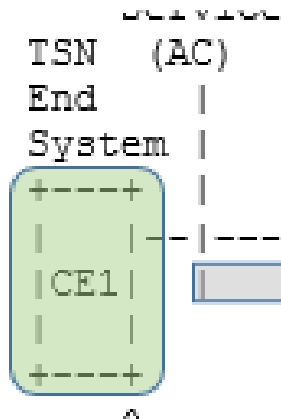
- Attributes:
    - a. DataFlowSpecification (Section 6.1)
    - b. TrafficSpecification (Section 6.2)
    - c. FlowRank (Section 6.3)
    - d. EndSystemInterfaces (Section 9.1)
    - e. InterfaceCapabilities (Section 9.2)
    - f. UserToNetworkRequirements (Section 9.3)

- Attributes per operation:
    - Join – SHALL: a, b, c, d,
    - Join – MAY: e, f,
    - Leave – SHALL: a, d,

8. Destination attributes

- The Destination object specifies:
  - The behavior of the Destination for the flow.

```
   SELVICE
    (AC)   TSN
     |     End
     |   System
     |    +---+
---|---  |   |
  =>     |CE2|
         |   |
         +---+
           ^
```
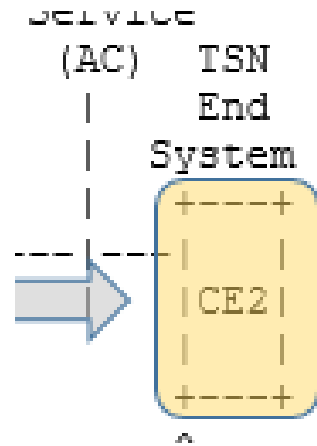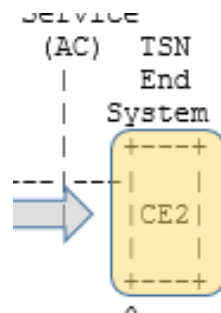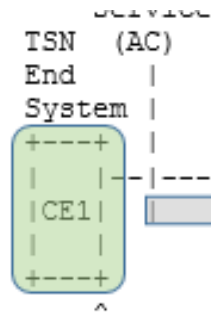
- Attributes:
  - a. DataFlowSpecification (Section 6.1)
  - b. EndSystemInterfaces (Section 9.1)
  - c. InterfaceCapabilities (Section 9.2)
  - d. UserToNetworkRequirements (Section 9.3)

- Attributes per operation:
  - Join – SHALL: a, b,
  - Join – MAY: c, d,
  - Leave – SHALL: a, b,

9. Common Attributes of Source and Destination

- End System Interfaces
  - EndSystemInterfaces is a list of identifiers, one for each physical interface (port) in the end system acting as a Source or Destination. An interface is identified by an IP or a MAC address.
  - NOTE: Sub-Interfaces to be added, e.g., based on IfIndex.

- Interface Capabilities:
  - to be defined ...

- User to Network Requirements
  - UserToNetworkRequirements specifies user requirements for the flow, such as latency and reliability.
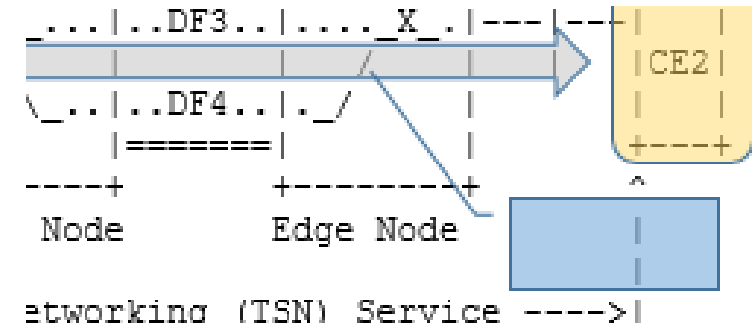 - Attributes:
    - a. NumReplicationTrees
    - b. MaxLatency

```
        service
TSN   (AC)
End      |
System |
+---+    |
|   |    |
|   |-|---
|CE1|    |___|
|   |    |
+---+    |
   ^
```

```
       service
(AC)   TSN
|     End
|     System
|     +---+
|     |   |
---|---|   |
|     |CE2|
|     |   |
|     +---+
        ^
```

10. Status

```
_...|..DF3..|.....X_.|---|---|        |
                      |   |   |CE2|
\_..|..DF4..|._/      |   |        |
    |=======|         |   |   +---+
----+       +-------+            ^
  Node        Edge Node        |
                        ---->|
etworking (TSN) Service ---->|
```

- Status object
  - The Status object is provided by the network for each Source and Destination of the flow. The Status object provides the status of the flow with respect to the establishment of the flow by the network.
  - The Status is distinct for each Source or Destination because the AccumulatedLatency and InterfaceConfiguration objects are distinct

- Attributes
  - SHALL
    - a. DataFlowSpecification (Section 6.1)
    - b. StatusInfo (Section 10.1)
    - c. AccumulatedLatency (section 10)
  - MAY
    - d. InterfaceConfiguration (Section 10.2)
    - e. FailedInterfaces (Section 10.3)

Next steps

- Discuss way forward in the work group;
  - E.g., what is missing
- Discuss attribute lists in the work group
  - Format of attributes (e.g., TrafficSpecification, etc.)
  - Need for further attributes (some examples highlighted as note)

- Update the draft based on the feedbacks