Data Fields for

DetNet Enhanced Data Plane

draft-xiong-detnet-data-fields-edp-03

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IETF123, DetNet , 2025-07

Motivation and Updates

- Recap of Motivation:
  - define the metadata for DetNet data plane solutions to support aggregated flow identification and the Information ensuring deterministic latency **as defined in draft-ietf-detnet-scaling-requirements**
  - define common DetNet Header for DetNet enhanced data plane to carry option-types and data
    - Aggregation Option
    - Deterministic Latency Option

- The new version -03 updates is like following:
  - align with the suitable categories **as defined in draft-ietf-detnet-dataplane-taxonomy**
    - the 7 Deterministic Latency Types align with the 7 categories
    - the deterministic latency metadata align with 7 categories in enhanced data plane to carry the required information

Deterministic Latency Option

- Deterministic Latency Option is defined to carry the <u>deterministic latency metadata aligning with the 7 categories</u> in enhanced data plane for forwarding nodes along the path which can apply the corresponding queuing mechanism and related information in the packet to achieve the end-to-end bounded latency.
    - the 7 Deterministic Latency Types align with the 7 categories defined in draft-ietf-detnet-dataplane-taxonomy
    - the deterministic latency metadata align with 7 categories in enhanced data plane to carry the required information

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Deterministic Latency Type    |   Flag         |   Data Len    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 5 Deterministic Latency Option header

Value	Deterministic Latency Type
0x0000	Unassigned
0x0001	Right-bounded category
0x0002	Flow level periodic bounded category
0x0003	Class level periodic bounded category
0x0004	Flow level non-periodic bounded category
0x0005	Class level non-periodic bounded category
0x0006	Flow level rate based unbounded category
0x0007	Flow level rate based left-bounded category

Figure 6 Deterministic Latency Type

Deterministic Latency Option-cont1

- Data Field in Right-bounded Category
  - As per [I-D.ietf-detnet-dataplane-taxonomy], for solutions in the right-bounded category, a packet has only a maximum time bound.
- Date Field in Flow Level Periodic Bounded Category
  - As per [I-D.ietf-detnet-dataplane-taxonomy], the flow Level periodic bounded solutions define a set of time slots, which will be scheduled for flows or flow aggregates.
- Date Field in Class Level Periodic Bounded Category
  - As per [I-D.ietf-detnet-dataplane-taxonomy], the periodic bounded

solutions can be further categorized by the traffic granularity with class level subcategory. The class Level periodic bounded solutions define a set of cycles and each cycle will be scheduled for flows of flow aggregates within a class level.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      Maximum time bound                       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 7 Data Field in Right-bounded Category

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Timeslot ID                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 8 Data Field in Flow Level Periodic Bounded Category

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        Cycle ID                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 9 Data Field in Class Level Periodic Bounded Category

Deterministic Latency Option-cont2

- Date Field in Flow Level Non-periodic Bounded Category
  - As per [I-D.ietf-detnet-dataplane-taxonomy], flow level non-periodic bounded solutions guarantee the minimum and maximum bounds of a packet in a flow or flow aggregate.
- Date Field in Class Level Non-periodic Bounded Category
  - As per [I-D.ietf-detnet-dataplane-taxonomy], class level non-periodic bounded solutions guarantee the minimum and maximum bounds of a packet within a class level. The format is the same with above.
- Date Field in Flow Level Rate-based Unbounded Category
  - In flow level rate based unbounded category, the latency bound is primarily influenced by the ratio of a flow's maximum packet size, its allocated service rate and completion time
- Date Field in Flow Level Rate-based Left-bounded Category
  - In flow level rate based left-bounded category, the latency bound is primarily influenced by the ratio of a flow's maximum packet size, its allocated service rate, start time and completion time.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Maximum time bound                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Minimum time bound                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 10 Data Field in Flow Level Non-periodic Bounded Category

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        Maximum packet size                    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Service rate                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Finish time                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 12 Data Field in Flow Level Rate-based Unbounded Category

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Maximum packet size                     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Service rate                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Finish time                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                         Eligible time                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 13 Data Field in Flow Level Rate-based Left-bounded Category

Aggregation Option

- This document proposes the aggregation-based metadata in enhanced data plane for the DetNet nodes along the path to <u>identify the aggregated flow</u> and achieve the end-to-end QoS in scaling networks.
  - Aggregation type: indicates the aggregation type of packet treatment ensuring the deterministic latency
  - Flag: When E is set to 1, it indicates the explicit aggregated flow identification
  - Aggregation ID: provides explicit and unique identifier

  for aggregated flow identification.
  - End-to-end Delay Budget: provides the value of end-to-end delay budget for the aggregated flow.
  - End-to-end Delay Variation Budget: 32bits. It provides the value of end-to-end delay variation budget for the aggregated 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      Aggregation  Type        |       Flag  |E|   Data Len    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 2 Aggregation Option Header

Value	Aggregation Type
0x0000	Reserved
0x0100	Bandwidth guarantee
0x0200	Jitter guarantee
0x0300	Delay guarantee
0x0400	Low delay and jitter guarantee
0x0500	Ultra-low delay and jitter guarantee

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Aggregation ID                                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              End-to-end Delay Budget                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              End-to-end Delay Variation Budget                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 4 Aggregation Option Data

Next Steps

- Follow up the progress of the enhancement requirements in scaling DetNet and align with the categories of solutions .
- Comments and Questions are very appreciated!