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DetNet Enhancement Data Plane Encapsulation Gap Analysis and Solution

Abstract

This document introduces the Gap Analysis and Solution for DetNet Enhancement Data Plane Encapsulation in order to deploy scalable DetNet Data Plane solution in layer 3 network.

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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This Internet-Draft will expire on 14 September 2023.

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1. Introduction

[I-D.ietf-detnet-scaling-requirements] has introduced the evaluation items for different mechanism and provide guidance for judging whether a cerntain mechasnim could satisfy DetNet Enhancement requirement in order to deploy in layer 3 network. This document introduces the Gap Analysis and Solution for DetNet Enhancement Data Plane Encapsulation.

2. DetNet Data Plane Enhanement Gap Analysis

DetNet data plane enhancement includes 2 parts: Queuing, Shaping, Scheduling, Preemption and encapsulation.

*Queuing, Shaping, Scheduling, and Preemption

As defined in [RFC8655] , queuing and transmission-selection algorithms allow DetNet mechanisms to compute the latency contribution of each DetNet node to the end-to-end latency, to compute the amount of buffer space required in each DetNet node for each incremental DetNet flow. So it provides the base of bounded latency.

IEEE also provide mechansim that could be reused in DetNet Data Plane Enhancment:

A credit-based shaper [IEEE802.1Qav] (incorporated to [IEEE802.1Q]).

Time-gated queues governed by a rotating time schedule based on synchronized time [IEEE802.1Qbv] (incorporated to [IEEE802.1Q]).

Synchronized double (or triple) buffers driven by synchronized time ticks. [IEEE802.1Qch] (incorporated to [IEEE802.1Q]).

Preemption of an Ethernet packet in transmission by a packet with a more stringent latency requirement, followed by the resumption of the preempted packet [IEEE802.1Qbu] (incorporated to [IEEE802.1Q]) [IEEE802.3br] (incorporated to [IEEE802.3]).

New mechanisms based on the hardware capability of existing network device are also considered.

*Encapsulation

Different queuing, shaping, scheduling mechanisms request different encapsulation in layer 3.

Priority:

Some of the queuing mechanism, e.g., QoS, L4S, preemption, DetNet traffic is handled differently based on the priority for bounded latency. The existing encapsulation, such as DSCP or ECN in IP header, could be used to differenciate the prioriy.

Flow/Flow Aggregation Identification

Some of the queuing mechanism, e.g., Qbv, VPN+, DetNet traffic is handled differently based on the flow identification or flow aggregation identification(network slice)for bounded latency. The existing encapsulation, such as DetNet Stream Label in MPLS or 5 tupes in IP , could be used to differenciate the flow or flow aggregation.

Time Information

Some of the queuing mechanism, e.g., Qbv, VPN+, DetNet traffic is handled differently based on the flow identification or flow aggregation identification(network slice)for bounded latency. The existing encapsulation, such as DetNet Stream Label in MPLS or 5 tupes in IP , could be used to differenciate the flow or flow aggregation.

3. DetNet Data Plane Enhanement Encapsultion

This section defined DetNet Data Plane Enhanement Encapsultion based on the analysis result of section 2.

3.1. IPv4/IPv6 Header

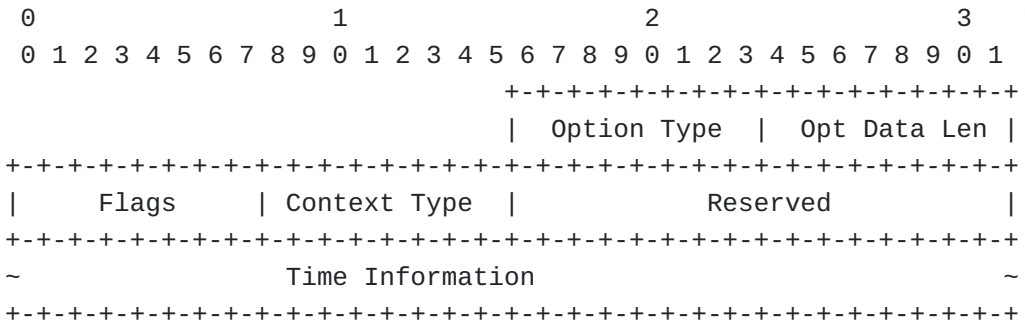
New DSCP value or new DSCP meaning could be defined for presenting time information, such as

3.2. MPLS

New EXP value of MPLS Lable could be introduced to convey time information.

3.3. IPv6 Extension Header

The following option could be defined in IPv6 extension header to convey time information:



Option Type: 8-bit identifier of the type of option. The type of VTN option is to be assigned by IANA.

Opt Data Len: 8-bit unsigned integer indicates the length of the option Data field of this option, in octets.

Flags: 8-bit flags field.

Time Information: time slot ID, cycel ID, timestamp, ect.

3.4. SR MPLS/ SRv6

Time Aware SID could be introduced to convey time information, such as[I-D.chen-detnet-sr-based-bounded-latency] and [I-D.geng-srv6-based-bounded-latency].

4. IANA Considerations

This document makes no request of IANA.

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

5. Security Considerations

This document does not introduce any new security considerations.

6. Acknowledgements

7. References

7.1. Normative References

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7.2. References

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