Flow Aggregation for Enhanced DetNet

draft-xiong-detnet-flow-aggregation-03

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Updates from last version

- Presented at IETF#119, #120 and #122 , and comments at meetings and on the mailing list are appreciated from :
  - Toerless, Janos and Lou

- Updates are following:
  - change to Informational as Chairs suggested.
  - revise to (1) clarify the motivation of the draft, (2) discuss the new requirements, and (3) propose the enhancements for flow aggregation
  - Realize the proposal via leveraging the 3GPP 5GS DetNet service
  - move some references to Infomative References
  - editorial revision

Motivation

- For enhanced DetNet data plane, [I-D.ietf-detnet-scaling-requirements] proposed the data plane requirements and it should support the explicit aggregated flow identification and provide aggregated flows over multi-domains with different levels of SLAs requirements.
- For multi-domain DetNet control plane, [I-D.bernardos-detnet-multi-domain-pce] discussed the consideration to achieve the end-to-end QoS guarantees for aggregated flows that span across multiple domains.

➢ This document describes the specific requirements and enhancements for flow aggregation in data plane and control plane in scaling networks that span across multiple domains.

  ❖ Gap: We found existing work addresses either the non-scaling case or intra-domain scenario.

Requirements for Flow Aggregation in Scaling Networks & Across Domains

1. **Aggregating DetNet flows across domains:**
   - Flow-aggregation in the multi-domain scenario to achieve the end-to-end QoS guarantees for aggregated flow(s) that span across multiple domains.
   - The flow aggregate should be identified, and the related information should be exchanged and coordinated among different network domains.
2. **Aggregated vs. Fine-grained (flow-level) QoS Provisioning:**
   - The draft [I-D.ietf-detnet-scaling-requirements] specifies that scalable number of flows co-exist and applications requires different levels of SLAs requirements.
   - The DetNet flows with the same level of service requirements can be aggregated to receive collective treatments and forwarding behaviors according to (some number of) pre-defined classes.
3. **Aggregated Flows with Bursts Flows across multiple hops:**
   - Flow aggregations in scaling network will experience individual flows frequently joining and leaving, which may potentially lead to accumulated bursts of flows across multiple hops.
   - The DetNet flows should be aggregated while coordinating packets (e.g., for scheduling, interleaving) within aggregated flows.

Enhancements for Flow Aggregation in Scaling Networks & Across Domains

- Flow Classification (for Req. #2)
  - the DetNet flows MAY be classified to pre-defined levels based on the service SLAs requirements of applications in scaling networks, such as tight/loose latency, jitter guarantee, low delay and jitter guarantee and so on.
  - the service should be provisioned on the aggregated-class level and the resources and routes should be controlled and scheduled on a per-class basis.
- Flow Identification (for Req. #1)
  - dynamically and concisely identify the aggregated flow to indicate the required treatment and forwarding behaviors on the aggregated-class level which can be identified by an aggregation class (A-Class) .
  - the encoding of the A-Class may reuse, e.g., the DSCP/TC or A-Label or other extensions.
- Flow Coordination (for Req. #1 & #3)
  - The control plane may advertise inter-domain resources and QoS coordination information for aggregated flows .
  - For data plane, the burstiness of aggregated flows could be mitigated by coordinating packets within aggregated flows, e.g., proportional scheduling and interleaving.

Realization Consideration of Flow Aggregation for 5GS DetNet Service

The 3GPP [TS.23.501, 23.503] defines a 5GS may behave as a logical DetNet (transit) node.

1. **Realization of 5GS DetNet Service across Domains:**
   - A 5GS (logical) DetNet node (like a sub-domain) integrated into the IP DetNet domain
   - CPF:DetNet Controller: dividing holistic DetNet service Reqs. into (sub)domain Reqs.
2. **5GS QoS Provisioning: Aggregated vs. Fine-grained**
   - 2-type Traffic parameters: per-(logical)-node (aggregated) vs. flow-level
   - Attributes & Specifications: coarse-grained (5GS-logical-node) **vs.** fine-grained (flow-level)
3. **Flow Classification, Identification & coordination at a 5GS Node**
   - Classification: IETF CPF:DetNet providing traffic parameters, specifications, class-mappings, etc.; relieve burden of 5GS nodes
   - Identification: Leverage 5GS advantages
   - Coordination: via the interactions between the IETF CPF:DetNet controller and the 5GS counterpart

NOTE: The realization of flow aggregation for a 5GS DetNet 'composite' node participating in an enhanced DetNet domains requires the seamless interactions between the IETF domain (DetNet) controller and the 5GS domain counterpart

**IETF I.D., draft-jlg-detnet-5gs-01, "DetNet YANG Model Extension for 5GS as a Logical DetNet Node"*

Next Step

- Comments and suggestions are very welcome!
- A useful work for WG adoption?
- Thank you!