Traffic Engineering Extensions for Enhanced DetNet

draft-xiong-detnet-teas-te-extensions-01

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IETF 118 DetNet, November 2023

What is TE for DetNet?

- As per draft-ietf-teas-rfc3272bis, DetNet is described:
  - "DetNet can be seen as a specialized branch of TE"
  - "since it sets up explicit optimized paths with allocation of resources as requested. "
  - "A DetNet application can express its QoS attributes or traffic behavior using any combination of DetNet functions described in sub-layers."
  - "They are then distributed and provisioned using well-established control and provisioning mechanisms adopted for traffic engineering."

- As per draft-ietf-teas-rfc3272bis, the scalability concerns for DetNet:
  - "In DetNet, a considerable amount of state information is required to maintain per-flow queuing disciplines and resource reservation for a large number of individual flows. "
  - "This can be quite challenging for network operations during network events such as faults, change in traffic volume or re-provisioning."
  - "DetNet recommends support for aggregated flows, however, it still requires a large amount of control signaling to establish and maintain DetNet flows"

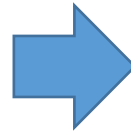# What is TE Requirements for enhanced DetNet?

DetNet QoS of Scaling Deterministic Networks

- DetNet QoS can be classified based on the applications with different SLAs requirements
- It demands differentiated QoS behaviors in scaling deterministic networks

Characteristics of Scaling Deterministic Networks

- Scaling Flows
  - Massive traffic flows
  - Different levels/types services
  - Flows with Different T-Spec/SLAs
- Scaling Networks
  - Large number of nodes and links
  - High speed, long-distance transmission
  - Multiple domains
  - Interconnected with Heterogeneous sub-network technologies

TE Requirements for enhanced DetNet

- Provide path steering to forward packet and provide determinstic behaviors for data plane to achieve differentiated DetNet QoS

- Resolve the scalability issues to reduce the amount of control signaling and network operations

- Resource management should be considered
  - guanrantee the time-based SLAs requirements
  - make reasonable use of resources

- End-to-end deterministic routes establishment and control in scaling networks
  - Distributed routes and inter-domain routes
  - Path computation with multiple network metrics and frequent topology changes
  - Path planning with resource reservation

Solution Consideration from TE Elements

- Policy
  - The routing policy including bounded latency constraint-based routing can be considered when selecting and distributing the candidate paths.

- Path Steering
  - Per-class traffic scheduling should be considered for differentiated DetNet QoS.
  - The deterministic latency information may be provided to forward packets for path steering in IPv6/SRv6/MPLS.

- Resource management
  - Time-based resource-aware control and forwarding should be considered based on the queuing mechanisms and different traffic classes.

Differentiated DetNet-aware Traffic Engineering (DD-TE)

- Differentiated DetNet-aware Traffic Engineering (DD-TE) Vs DetNet
  - DetNet
    - per-flow/ Flow-aggregates based DetNet QoS + per-flow/aggregates TE (explicit path+resources allocation)
  - DD-TE
    - traffic-aggregates based Differentiated DetNet QoS + per-class TE (QoS-aware Routing policy+Time-based Resources management)
- Benifits
  - achieve scalable network supporting different levels of deterministic applications
  - achieve fine-grained time-based resource scheduling and management to meet the bounded latency requirements, rational utilization of resources, improvement of network performance

Next Step

- Seek feedback in TEAS WG.

- Comments and discussions are very welcome!

Thank you!