DetNet Enhancements for Large-Scale Deterministic Networks

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Update

- Presented at IETF#114 and thanks for the suggestions from Xuesong Geng and Lou Berger
  - New requirements should align with RFC8938
- Discuss the gap analysis when applying the DetNet data plane as per RFC8938 in large-scale networks
    - Describe primary goals for large-scale deterministic networks
    - Describe the characteristics of large-scale deterministic networks
    - Discuss the gap analysis of large-scale deterministic networks
  - Propose the enhancements of DetNet Data Plane including the enhanced functions, metadata, treatment and encapsulation
    - Enhancements of functions for Flow Identification
    - Enhancements of functions for Packet Treatment
    - Enhancements of DetNet-Specific Metadata
    - Enhancements of DetNet IP/MPLS/SRv6 Data Plane
  - Describe the further controller plane considerations

Gap analysis

Primary Goals

- Support the Different Levels of DetNet QoS for Multiple Services
- Support the Utilization of Network Resources

Characteristics of Large-Scale Deterministic Networks

- Large-scale Dynamic Flows
- Large-scale Network Topology
  - large number of nodes and links
  - High speed, long-distance transmission and asymmetric links
  - multiple domains
  - nodes may be interconnected with different sub-network technologies

Gap Lists for RFC8938

- Providing Aggregated Flows Identification in service sub-layer
  - it requires large amount of control signaling to establish and maintain DetNet Data Plane DetNet per-flows or aggregated flows
- Providing Deterministic Latency in forwarding sub-layer
  - Explicit Routes
    - be challenging to compute paths due to the multiple network metrics and frequent topology changes
    - loose routes, inter-domain routes and multiple disjoint paths should be considered in large-scale nworks
  - Resources Allocation
    - rational allocation of deterministic latency resources for different levels of services
  - Queuing Mechanisms
    - Enhancement of queuing mechanisms and the related DetNet-Specific Metadata
- DetNet-Specific Metadata for enhanced functions
- DetNet-Specific treatment at ingress nodes and transit nodes
- Encapsulations for IPv6/MPLS/SR-MPLS/SRv6

Enhancement

- The enchanced QoS-related functions and DetNet-specific metadata Should be supported for enhancemnt of flow identification and packet treatment align with RFC8938.

	RFC8938	Enhanced Functions and metadata for DetNet Data Plane
Functions	Service Sub-layer: • Packet sequencing/Flow replication • Duplicate elimination/Flow merging • Packet encoding/decoding Forwarding Sub-layer: • Resource allocation • Explicit routes	Service Sub-layer: • Flow identification for Service-level Aggregation Forwarding Sub-layer: • Deterministic Routes • Loose/Distributed routes • Inter-domain routes • Replication and elimination routes • Deterministic Resources • Deterministic Links • Queuing Treatment
Metadata	1. Flow-ID 2. Sequence number	1. Deterministic latency information Other information being comfirmed: • Path-ID information • Aggregation information • ....
Encapsulation	IP/MPLS	IPv6/MPLS/SR-MPLS/SRv6

Controller Plane Consideration

- Particular considerations and requirements for the Controller Plane should be taken into consideration according to the enhancement of DetNet Data Plane.
  - Management and Scheduling of Deterministic Latency Resources
  - Distributed Deterministic Path Establishment
  - Inter-domain Deterministic Path Establishment
  - Multiple Disjoint Paths Establishment with Configured Delay and Jitter Policy
  - Deterministic Path Calculation based on the deterministic metrics
  - Configuration of Flow Mapping
  - and so on...

Next Steps

- The enhanced functions and metedata are open to WG and need to be aligned with requirements.
  - Call for co-authors to provide a more feasible and achievable way to progress this work.
- Comments and Questions are appreciated.

Thank you!