

# DetNet Enhancements for Large-Scale Deterministic Networks

draft-xiong-detnet-large-scale-enhancements-01

Quan Xiong(ZTE)  
Zongpeng Du(China Mobile)  
Zhao Junfeng(CAICT)  
Dong Yang(Beijing Jiaotong University)

IETF 115 DetNet, 2022

# 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

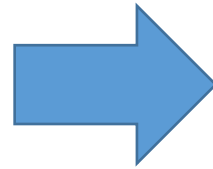
## Primary Goals

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

	RFC8938	Enhanced Functions and metadata for DetNet Data Plane
Functions	Service Sub-layer: <ul style="list-style-type: none"> <li>Packet sequencing/Flow replication</li> <li>Duplicate elimination/Flow merging</li> <li>Packet encoding/decoding</li> </ul> Forwarding Sub-layer: <ul style="list-style-type: none"> <li>Resource allocation</li> <li>Explicit routes</li> </ul>	Service Sub-layer: <ul style="list-style-type: none"> <li>Flow identification for Service-level Aggregation</li> </ul> Forwarding Sub-layer: <ul style="list-style-type: none"> <li>Deterministic Routes               <ul style="list-style-type: none"> <li>Loose/Distributed routes</li> <li>Inter-domain routes</li> <li>Replication and elimination routes</li> </ul> </li> <li>Deterministic Resources               <ul style="list-style-type: none"> <li>Deterministic Links</li> </ul> </li> <li>Queuing Treatment</li> </ul>
Metadata	1. Flow-ID 2. Sequence number	1. Deterministic latency information  Other information being confirmed: <ul style="list-style-type: none"> <li>Path-ID information</li> <li>Aggregation information</li> <li>....</li> </ul>
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 metadata 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!