

Requirements of large-scale deterministic network

draft-ietf-detnet-scaling-requirements-00

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Motivations

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Aiming at the large-scale deterministic network with long hops, large per-hop time variation, great number of flows and/or multiple domains without the same time source, this document describes the technical requirements including the data plane enhancement requirements when the different deterministic levels of applications co-exist and are transported.

Status

This document had absorbed some requirements of draft-xiong-detnet-large-scale-enhancements-00, and the co authors has discussed well with the authors of enhanced dataplane drafts.

This document had sufficient support and was just adopted as 00 version, while some outstanding comments are under addressed. Thanks to Bala'zs, Kiran and Dhruv for their good comments.

Key attributes of large-scale detnet

We define a large-scale DetNet network as a network that requires DetNet solutions for typically one or more of the following key attributes:

- There is relaxed clock synchronization or no clock synchronization in different domains.
- The end to end path is a combination of short and long distance hops.
- There are various transmission rate supported at the different ports and on different network node.
- There are a large number of flows which may has different level demands of DetNet service accrossing multi-domains.
- The topology change and failures of link might be more common.
- The mechanisms used to ensure bounded latency (e.g. queuing mechanism) may be multiple or have different configuration/parameter in multi-domains.

Such domains are normally within a single administrative control network or multiple cooperating administrative networks within a closed group of administrative control [RFC8655].

Overall technical requirements

-closely aligned with the key attributes

- Req 1. Tolerate Time Asynchrony
 - Support Asynchronous Clocks Across Domains
 - Tolerate Clock Jitter & Wander within a Clock Synchronous Domain
 - Provide Mechanisms not Requiring Full Time Synchronization
 - Support Asynchronization based Methods
- Req 2. Support Large Single-hop Propagation Latency
- Req 3. Accommodate the Higher Link Speed
- Req 4. Be Scalable to Massive Traffic Flows
- Req 5. Tolerate Failures of Links or Nodes and Topology Changes
- Req 6. Support Enhancement of Queuing Mechanisms
 - Support Configuration of Multiple Queuing Mechanisms
 - Support Queuing Mechanisms Switchover Crossing Multi-domain

Data Plane Enhancement Requirements

- **Req 1. Support Aggregated Flow Identification**
 - The number of individual flows is huge, and they may randomly join and leave the aggregated flow at each hop.
 - Explicit flow identification makes it easier to quickly distinguish the different kinds of DetNet flows instead of relying on the prefixes or wildcards as indicated in [RFC8938].
- **Req 2. Support Meta Information used by Functions ensuring Deterministic Latency**
 - Supporting synchronized or asynchronous queuing mechanisms requires different information to be defined as the DetNet-specific metadata
 - Data plane processing efficiency also needs to be considered
- **Req 3. Support Redundancy Related Fields**
 - Sequence number is the only metadata currently defined for redundancy feature of Detnet.
 - MPLS data plane uses Detnet-over-MPLS label stack to carry it, and native IPv6 data plane should be able to carry this information too.
- **Req 4. Support Explicit Path Selection**
 - MPLS label stack can be used for this purpose. IP data plane enhancement is required to support the explicit path selection based on IP source routing or SRv6.

Outstanding comments

- Adding explicit requirement regarding flow fluctuation
- Some scenarios/attributes are refer to heterogeneity and not necessarily the scale itself.
- Better to discussing how 'current' Detnet solution does not support 'large-scale' scenario, and whether this is still in single administrative domain or multiple or kind of federated domains collaborating for a detent service.
- Clarify Using CQF is not limited to 2 queues and refer to article on "Multiple Cyclic Queuing and Forwarding" in Section 3.2.
- Some phrases that are "marketing" and thus not appropriate for RFC.
- Consider adding "at the time of publication" when stating current numbers as they are likely to be outdated at some point.
- Correct the minor errors in Section 6.

Proposed update-Adding explicit requirement regarding flow fluctuation

- Req 1. Tolerate Time Asynchrony
 - Support Asynchronous Clocks Across Domains
 - Tolerate Clock Jitter & Wander within a Clock Synchronous Domain
 - Provide Mechanisms not Requiring Full Time Synchronization
 - Support Asynchronization based Methods
- Req 2. Support Large Single-hop Propagation Latency
- Req 3. Accommodate the Higher Link Speed
- Req 4. Be Scalable to Massive Traffic Flows
- **Req 5. Accommodate the Flow Fluctuation in Aggregation**
- Req 6. Tolerate Failures of Links or Nodes and TopologyChanges
- Req 7. Support Enhancement of Queuing Mechanisms
 - Support Configuration of Multiple Queuing Mechanisms
 - Support Queuing Mechanisms Switchover Crossing Multi-domain

Next step

- The proposed updated version will be sent to the mailing list, hope to get more comments and refine it together.