Requirements for Scaling Deterministic Network

draft-ietf-detnet-scaling-requirements-01

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Motivations and Status

Motivations

Aiming at scaling deterministic network with large variation in latency among hops, 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 was updated to 01 version with the renaming, while trying to address the good comments from David, Bala'zs, Kiran and Dhruv:

(https://mailarchive.ietf.org/arch/msg/detnet/EbRhlhitJrI5csu9DF_Xzkq1_go/——David

https://mailarchive.ietf.org/arch/msg/detnet/kkoMYTWtSy51IoLhOZgWerc2VA8/——Bala'zs

https://mailarchive.ietf.org/arch/msg/detnet/hz6H5vfy-VNjEEai7X-nxnjw3Gs/——Kiran

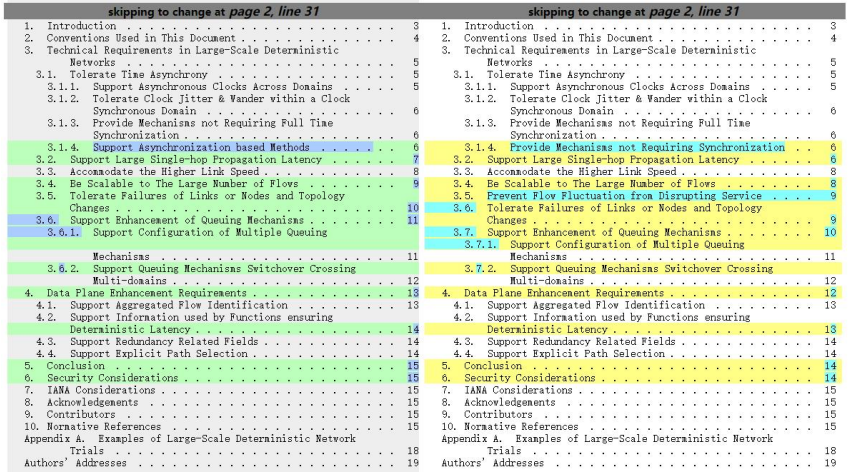
https://mailarchive.ietf.org/arch/msg/detnet/r-bnIib-G1NDqCyzEX4Rj7CdC5U/——Dhruv)

There was the good discussion in the last interim based on 01 version and the co-authors are going to refine the draft accordingly.

Summary of Major comments and changes

------have been addressed

- **Name:** Change to ‘Requirements for Scaling Deterministic Network’
- **Introduction:** add a bullet 5 related to flow fluctuation.
- **Section 3.1.4:** Change the title to 'Provide Mechanisms not requiring Synchronization'.
- **Section 3.4:** Move the different level of DetNet service demand to Section 3.7, it is now about the aggregation
- **Section 3.5:** A new sub section to add explicit requirement regarding flow fluctuation
- **Section 3.7:** add some explanations for the different situations.



------have not been addressed

- **Section 4.3&4.4:** There is no 1-to-1 reference between bullets in intro and subsections in section 3, the relationship might be n-to-n here. The text can are expected to be improved to show the relationships, or be removed.

Changes of key attributes of scaling DetNet(Introduction)

- There is relaxed clock synchronization or no clock synchronization in different domains. (Section 3.1)
- The end to end path is a combination of low and high latency hops. (Section 3.2)
- There are various transmission rate supported at the different ports and on different network node.(Section 3.3)
- There are a large number of flows which may be difficult to identifiy per-flow state. (Section 3.4)
- The flow fluctuation caused by large number of flows may happen frequently. (Section 3.5)
- The topology change and failures of link might be more common. (Section 3.6)
- The mechanisms used to ensure bounded latency (e.g. queuing mechanism) may be multiple or have different configuration/parameter in multi-domains with different level demands of DetNet service. (Section 3.7)

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

Changes of technical requirements(Section 3)

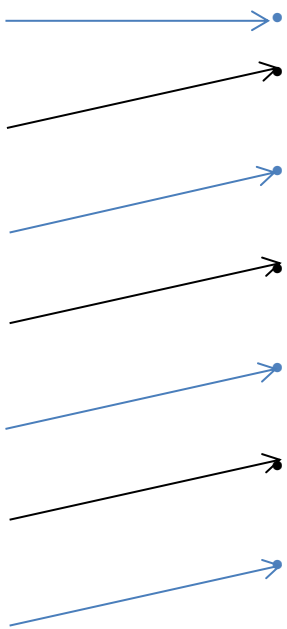
-closely aligned with each key attributes

- 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
  - Provide Mechanisms not Requiring Synchronization
- Req 2. Support Large Single-hop Propagation Latency
- Req 3. Accommodate the Higher Link Speed
- Req 4. Be Scalable to The Large Number of Flows *(Move the different level of detnet service demand to Req 7)*
- Req 5. Prevent Flow Fluctuation from Disrupting Service
- Req 6. Tolerate Failures of Links or Nodes and TopologyChanges
- Req 7. Support Enhancement of Queuing Mechanisms*(add some explanations for the different situations related to the multiple queuing mechanisims)*
  - Support Configuration of Multiple Queuing Mechanisms
  - Support Queuing Mechanisms Switchover Crossing Multi-domain

Mapping of key attributes and technical requirements

key attributes

- There is relaxed clock synchronization or no clock synchronization in different domains.
- The end to end path is a combination of low and high latency 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 be difficult to identifiy per-flow state.
- The flow fluctuation caused by large number of flows may happen frequently.
- 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 with different level demands of DetNet service.



technical requirements

Req 1. Tolerate Time Asynchrony

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. Prevent Flow Fluctuation from Disrupting Service

Req 6. Tolerate Failures of Links or Nodes and TopologyChanges

Req 7. Support Enhancement of Queuing Mechanisms

Data Plane Enhancement Requirements(Section 4)

-not closely aligned with each technical requirements(maybe N to N)

- Req 1. Support Aggregated Flow Identification (aligned with Req 4)
  - 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 (aligned with Req 7)
  - Supporting synchronized or asynchronized 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.

Next step

- Remove section 4.3 and section 4.4 unless to enhance section 3 correspondingly.
- Classify and/or sort the technical requirements to find out the priority.
  - Queuing is one of the focus of detnet next step work
  - Suggest solutions draft to describe which reqs were met/or new reqs need to be added

For scaling Network

- Req 1. Tolerate Time Asynchrony
- Req 2. Support Large Single-hop Propagation Latency
- Req 3. Accommodate the Higher Link Speed
- Req 6. Tolerate Failures of Links or Nodes and TopologyChanges

For scaling Flows：

- Req 4. Be Scalable to Massive Traffic Flows
- Req 5. Prevent Flow Fluctuation from Disrupting Service

Renaming might be needed:

- Req 7. Support Enhancement of Queuing Mechanisms
  - Support Configuration of Multiple Queuing Mechanisms
  - Support Queuing Mechanisms Switchover Crossing Multi-domain

Comments from interim:

1. Considering the impact under different load, heavy and light may expose differently
2. Bandwidth utilization is a factor to be considered
3. Hard latency bound requirement discussion. Hard vs soft, upper bound only vs upper & lower bound (i.e. jitter bound)