

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/kkoMYTWtSy51loLhOZgWerc2VA8/>—Bala'zs

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

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

Summary of comments and changes-Major

- **Name:** Change to 'Requirements for Scaling Deterministic Network'
- **Section 3:** Add explicit requirement regarding flow fluctuation(Section 3.5)
- **Introduction:** Add the specific section references to each bullet, while add a bullet 5 related to section 3.5.
- **Section 3.1.4:** Change the title to 'Provide Mechanisms not requiring Synchronization'.
- **Section 3.4&3.7:** Move the different level of DetNet service demand to Section 3.7, add some explanations for the different situations.
- **Section 3.4:** It is now about the aggregation which is in Section 3.5 in the old version,and also add some words refers to RFC2475.
- **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.
- Some scenarios/attributes are refer to heterogeneity and not necessarily the scale itself.

Summary of comments and changes-Minor

- **Abstract:** Change “large per-hop time variation” to “large variation in latency among hops” .
- **Introduction:** Some phrases that are "marketing" and thus not appropriate for RFC.
- **Section 3:** 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 DetNet service.
- **Section 3.1:** Add "multiple domains" at 3.1.1 while removing it in 3.1.2, and rewording 3.1.3 to indicate the “consequence of” relationship.
- **Section 3.2:** Clarify Using CQF is not limited to 2 queues and refer to article on “Multiple Cyclic Queuing and Forwarding” , while changing “The end to end path is a combination of short and long distance hops.” to “The end to end path is a combination of low and high latency hops.”
- **Section 3.2:** Change "gives a great description of the problem and the solution as well" to "describes this problem in more detail and also proposes a mechanism to address it".
- **Section 3.3:** Consider adding "at the time of publication" when stating current numbers as they are likely to be outdated at some point.
- **Section 3.4:** As the restructure of the section, "access in/ leave out the DetNet more irregular" is removed, this sentence has another explanation at the begin of Section 3.5 "More kinds of traffic flows described in Section 3.4 will cause more dynamic joining or leaving of the flows"
- **Section 3.5:** Change the title to “Prevent Flow Fluctuation from Disrupting Service”
- **Section 3.6:** Strengthen slightly the text at paragraph 2 in Section 3.6.
- **Section 6:** Correct the minor errors.

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 identify 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)

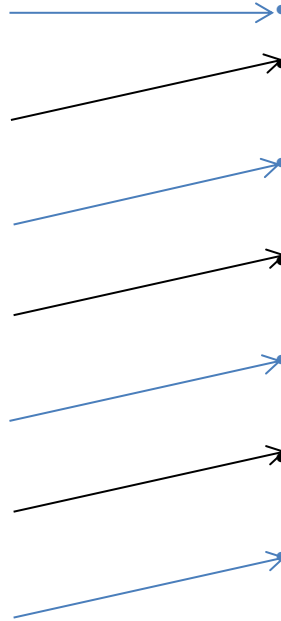
-closely aligned with each key attributes

- 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 Massive Traffic Flows (*Move the different level of detnet service demand to Req 7*)
- **Req 5. Prevent Flow Fluctuation from Disrupting Service** (*Move the 'teaggregation text to Req 4*)
- 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 mechanisms*)
 - 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 identify 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 Topology Changes
- 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 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.

Next step

- Hope to get more comments and refine it together.