Requirements of large scale deterministic network

draft-du-detnet-layer3-low-latency-03
draft-geng-detnet-requirements-bounded-latency-03

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Different levels of application requirements

- **Critical SLAs** - For “Industrial” networks
  - Manufacture: Control/remote control-Cloud PLC
  - Electricity: differential protection
- **Relatively lower levels of SLA** - For “Consumer” networks
  - Cloud gaming/Cloud VR
  - Online meeting

![Graph showing latency requirements]

- Critical latency requirement: Industrial, tight jitter, hard latency limit
- Industrial, hard latency limit
- Relatively lower levels latency requirement
- Best effort

Latency
Deployment and application status

• TSN has been used in several industries
• DetNet has done a lot of work and the standards are mature

• Some trials of deterministic IP network has been done:
  – Deterministic IP on CENI (3000 km and 13 hop devices, jitter<100 μs)
  – Remote control with Deterministic IP (Cooperate with Baosteel, 600km, latency<=4ms, jitter <20us)
  – Multi flows’ synchronization in an exhibition (Cooperate with Emergen, Inter provincial)

• More work for network service providers to successfully sell DetNet type services to customers:
  • Service Level objective definitions (absolute/relative latency/jitter/loss bounds, #flows, phycsical scale, ...)
  • More option of queuing mechanisms for different service level
  • Deployment considerations (such as integration into existing networks/service/controller-plane)
Requirements of technique in large scale deterministic network

- **Req1:** tolerate a certain degree of time variance
  - Synchronization
  - Asynchronization
- **Req2:** Consider the transmission latency
  - 300km/ms
- **Req3:** Scalability
  - a large number of network devices
  - a massive number of traffic flows
- **Req4:** Coexist with other traffic
- **Req5:** Balance of cost and service requirements
Req1: Tolerate a certain degree of time variance

- **Time Synchronization**
  - tolerate clock jitter & wander within a clock synchronous domain
  - should support asynchronous clocks across domains (if in the scope)

- **Frequency Synchronization**
  - Network overhead of time Synchronization
  - Accuracy

- **Asynchronizaton**
  - Not all the network or device support synchronization
  - To be proved bounded latency to some extent (IEEE 802.1Qcr)
Req2: Consider the transmission latency

- The distance of transmission is long enough to generate a larger latency than a LAN
- In particular, it will have an impact on queuing

Req3: Scalability

- a large number of network devices
  - For example, to connect so many 5G base stations
- a massive number of traffic flows
  - Flow aggregation needed
Req4: Coexist with best-effort traffic

• In the view of customers, dedicated network is the best network service (in fact maybe not)
• Coexist with best-effort traffic can be an advantage of deterministic network

Req5: Balance of cost and service requirements

• Whether to update all the network devices is the issue concerned by operators and related to the price concerned by customers
• Some application that requires relatively lower levels of SLA may need simpler solution
### Proposed queuing mechanisms beside TSN and IntServ/GS
(Mechanisms not included in draft-ietf-detnet-bounded-latency)

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<th>Mechanisms</th>
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<th>Scalability</th>
<th>Flow aggregation</th>
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If more queuing mechanisms could be proposed and be included in the scope of DetNet?
Thanks for listening

Welcome for comments