

IETF DetNet and IEEE 802.1 Time-Sensitive Networking

Status update

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Outline

- The common vision
- TSN description and status
- DetNet description and status
- Cooperation status

TSN and DetNet: a common vision

- A DetNet/TSN data stream:
 - May be unicast or multicast.
 - Has an absolute maximum bandwidth, and uses most of it.
 - Requires an absolute upper bound on end-to-end latency.
 - Requires 0 congestion loss in the network.
 - May require extraordinary protection against random or equipment failures.
 - Can afford to make and wait for a resource reservation to obtain these goals.
- A small to enterprise-sized network can carry any mix of TSN and non-TSN traffic.
- DetNet/TSN applications typically require time synch to $< 1 \mu\text{s}$.

Time-Sensitive Networking Task Group

- TSN is one of 5 Task Groups of the IEEE 802.1 Higher-layer LAN Protocols Working Group of the IEEE 802 LAN/MAN Standards Committee.
- IEEE 802.1 chair: Glenn Parsons. TSN chair: János Farkas.
- TSN TG (née AVB TG) has been active since 2005.
- Typically, 2/3 of the 50-60 voting members of 802.1 participate in TSN.
- Six face-to-face meetings / year, approx. 24-32 hours / meeting
- 2 hours/week teleconferences.

TSN completed standards

- Amendments to IEEE Std 802.1Q Bridges and Bridged Networks:
 - 802.1Qat Stream advertisements and resource reservation
 - 802.1Qav Credit-based shaper
 - 802.1Qbu Transmission preemption (along with IEEE Std 802.3br)
 - 802.1Qbv Time scheduled output queues
 - 802.1Qca Extensions to ISIS for multi-pathing and reservations
 - 802.1Qch Cyclic Queuing and Forwarding
 - 802.1Qci Per-Stream Filtering and Policing
- Stand-alone IEEE standards:
 - 802.1AS Timing and Synchronization
 - 802.1BA Profile for plug-and play AVB networks
 - 802.1CB Frame Replication and Elimination for Reliability

TSN standards in progress

- Amendments to IEEE Std 802.1Q Bridges and Bridged Networks:
 - 802.1Qcc Enhancements for stream reservation protocol
 - 802.1Qcp YANG models for bridges
 - 802.1Qcr Asynchronous Traffic Shaping
 - 802.1Qcw YANG models for all TSN queuing and filtering techniques
- Stand-alone IEEE standards:
 - 802.1AS Timing and Synchronization revision and enhancements
 - 802.1CM Profile for CPRI front-haul networks over bridges
 - 802.1CS Link-local Registration Protocol

TSN Acceptance

- Increasing interest, actual deployments.
- Many vendors, including major bridge/switch vendors, claim compliance with AVB standards.
- Multiple vendors are claiming compliance with just-completed TSN standards, including credit-based shapers and cyclic queuing and forwarding.
- Active participation in TSN and in industry fora (ODVA, Avnu) by industrial, automotive, infotainment, and audio-video studio users.
- IEEE 802.3 has several TSN-specific MAC/PHYs started or starting.
- AVB deployment is growing. TSN deployments have commenced.

TSN issues

- Vendors and customers have both been waiting for each other.
- Many relatively small vendors of end stations must make a big leap from dedicated digital busses to a protocol stack.
- Standards are often ahead of products.
- No support for routers.

TSN summary

- A vendor can build a network claiming compliance to TSN standards that meet all of the goals in the “common vision”, above.
- There are gaps in management capabilities that hinder interoperability among different vendors, for which projects are now in place to close.
- Additional capabilities, as requested by certain verticals, are now in progress.

IETF Deterministic Networking WG

- DetNet is in the Routing Area, AD Deborah Brungard
- Charter approved October 5, 2015
- Chairs: Pat Thaler, Lou Berger
- 3 face-to-face meetings / year, 2-3 hours/meeting,
- 2 hours/week teleconferences
- Appreciable, but not heavy, activity on 3 mailing lists

DetNet status

- Two drafts adopted by WG:
 - Deterministic Networking Architecture
 - Deterministic Networking Use Cases
 - One or both may progress from this meeting
- Other DetNet drafts:
 - 4 Additional use cases
 - 1 Security
 - 1 Data plane
 - 2 Information model
 - 1 Architecture
 - 1 Control plane
 - A few are likely to be adopted from this meeting, especially the data plane draft.

DetNet issues

- Approximately one year behind original milestones.
- Standards are often ahead of products.
- The target users are still awakening to the value of networking, and to the differences between bridging and routing.

Cooperation status

- Significant common membership
 - More than half of active DetNet participants are also active in TSN.
 - Official liaisons have not been necessary.
- Apparent agreement on L2 vs. L3 data plane issues.
- Work on information models (YANG) is just blossoming in both TSN and DetNet.
 - There is a potential for conflict; perhaps a mailing list and teleconference series for information modeling is in order.
- Potential participants must ask in order to get access to TSN resources.
- **All in all, cooperation has been very successful.**