IEEE P802.DP Features

Abdul Jabbar
GE Research
Objective

Further discussion on TSN Profile Features
Recap: Two Profile Approach

**Asynchronous Profile**

*targets current Ethernet based use cases*

- Asynchronous with slower cycle times (> 50 msec)
- Latency bounded with acceptable delay variation (jitter) up to latency bound
- Comfortable with rate constrained shaping
- Controlled network – no undefined traffic on the network
- Highly static – designed, analyzed, configured well ahead of operation
- Certification burden is significant – simplicity is valuable

**Asynchronous profile to provide an equivalent solution**

**Synchronous Profile**

*targets current non-Ethernet and future use cases*

- Segmented/partitioned subsystems
- Synchronous with cycle times in the order of 1 msec. Future use cases with sub-millisecond cycle times
- Sensitive to latency (or deadline) and delay variation (jitter)
- Convergence of mixed critical traffic
- Interoperability of legacy buses on top TSN backbone
- Platform wide clock time distribution
- Potential for dynamic (re)configuration

**Synchronous profile to provide an ethernet based converged system**
## Required Functions for Aerospace Profiles

<table>
<thead>
<tr>
<th>Functions</th>
<th>Asynchronous Profile</th>
<th>Synchronous Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Synchronization</td>
<td>None</td>
<td>802.1 AS – 2020</td>
</tr>
<tr>
<td>Egress Traffic Shaping</td>
<td>Credit Based Shaper (Qav)/Asynchronous Traffic Shaper (Qcr)?</td>
<td>Credit Based Shaper (Qav)/Asynchronous Traffic Shaper (Qcr)?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time Aware Shaper (Qbv)</td>
</tr>
<tr>
<td>Redundancy</td>
<td>Frame Replication and Elimination (CB)</td>
<td>Frame Replication and Elimination (CB)</td>
</tr>
<tr>
<td></td>
<td>• End stations shall support FRER functions</td>
<td>• End stations shall support FRER functions</td>
</tr>
<tr>
<td></td>
<td>• Bridges shall/may support FRER functions</td>
<td>• Bridges shall support FRER functions</td>
</tr>
<tr>
<td>Ingress Policing</td>
<td>Per-Stream Filtering and Policing (Qci)</td>
<td>Per-Stream Filtering and Policing (Qci)</td>
</tr>
<tr>
<td>Configuration</td>
<td>UNI (Qcc), Yang models (Qcw, CBcv)</td>
<td>UNI (Qcc), Yang models (Qcw, CBcv)</td>
</tr>
<tr>
<td>Management and Monitoring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forwarding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stream Separation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Traffic Shaping for Asynchronous Profile

- Example of VL1 with BAG of 64 milliseconds and VL2 with BAG of 128 milliseconds

Reference: ARINC 664p7 Traffic Shaping Features by Brent Nelson
Traffic Shaping for Asynchronous Profile

- Example of VL1 with BAG of 64 milliseconds and VL2 with BAG of 128 milliseconds
Traffic Shaping for Asynchronous Profile

- Example of VL1 with BAG of 64 milliseconds and VL2 with BAG of 128 milliseconds

Frames can go back-to-back under some conditions – this is OK
Traffic Shaping for Asynchronous Profile

SubVL frames are pulled in round robin fashion into the VL

Figure 34-1—Queuing model for a Talker station
Discussion

• Is Qav an appropriate replacement for current aerospace shaping solutions?
• Is Qav only needed on end stations?
• What about mixed traffic scenarios?

Notes from Meeting:
Large end systems have 64-256 transmit Virtual Links (VL) → maps to 256 TSN streams
Each VL may have up to 4 sub VLs.
One option is to assign each VL to per-stream queue

Requesting contributions from the group
Discussion Topics: Redundancy (ARINC 664)

Two independent networks A + B

- Full duplication of network
- separate power & different routing of cables
- End-Devices handle redundancy
- Packets duplicated on device only
- Network unaware of duplication / redundancy

Reference: Avionics Full Duplex Ethernet and the Time Sensitive Networking Standard by Bruno Pasquier and Stefan Schneele
Discussion Topics: Redundancy (ARINC 664)

ARINC 664 P7 - Section 3.2.6.1

Use of sequence numbers for deduplication

- One-Byte sequence number suffix **per stream**
  - 0 RESET
  - 1-255 sequences
- End-Devices either use
  - “first-valid wins” and forward one packet to
    application (check for seq no \{+0 \+1 \+2\} )
  - or forwards both packets to application

Reference: Avionics Full Duplex Ethernet and the Time Sensitive Networking Standard by Bruno Pasquier and Stefan Schneele

Does aerospace industry need this option?
Discussion Topics: Redundancy (FRER)

CB provides lots of redundancy variants

CB Capable, Dual Homed End Points using Link Aggregation

Bridged End Points. EP1 is no CB capable, EP2 is CB Capable

Ladder Redundancy: Resistant to multiple link failures

Flexible Positioning of CB functions. EP1 is not CB capable, EP2 is CB Capable
Discussion

• Is CB an appropriate network redundancy solution for aerospace applications?
• Is there a need to specify only a subset of CB redundancy patterns for DP?

**Notes from meeting:**
CB on bridges is desirable to enable different modes/topologies for redundancy. The added cost/complexity with requiring this feature may be “manageable”.

Need a detailed use case for forwarding both frames from a compound stream to higher layers.
It is unclear if CB is capable of sending both frames (from member streams) up to upper layer? 802.1DP may not support this feature. The user may choose to implement this behavior with two different streams (along two paths A and B).

**Requesting contributions from the group**