Proposals for TSN Stream Reservation Class

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Introduction

The previous presentation ¹) in July, 2016 described

- issues of the current SR Class specification for use in TSN
- requirements for configurable SR Class

This presentation provides a summary of the needed features to support configurable SR Class, including

- the managed objects already specified in the current standard, but not explicitly stated for configuration of SR Class
- a list of To-Do items proposed for Qcc D1.1

Recap: SR Class in AVB

<table>
<thead>
<tr>
<th>AVB SR Class</th>
<th>srClassID</th>
<th>Mess. Interval</th>
<th>Priority</th>
<th>Traffic Class</th>
<th>Shaper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>== 6</td>
<td>== 125 µs</td>
<td>== 3</td>
<td>➔ 7 *</td>
<td>CBS</td>
</tr>
<tr>
<td>Class B</td>
<td>== 5</td>
<td>== 250 µs</td>
<td>== 2</td>
<td>➔ 6 *</td>
<td>CBS</td>
</tr>
</tbody>
</table>

**IEEE 802.1-2014:**
- Table 35-7
- Clause 34.4
- Table 6-5
- Table 34-1.2
- Table 12-5

**Definition type:**
- fixed
- fixed
- “default” (fixed)
- “recommended”
- R/W

* for the case of 8 traffic classes

**Issues in the current SR Class specification for use with TSN:**

- only two SR Class A/B with CBS specified for AV traffic
- lack of managed objects for configuration, e.g. in M2 and M3
- SR Class A/B tied to CBS in texts, but changeable in M5
Proposals for TSN SR Class

- Configurable SR-Class for TSN
  - allow up to 7 SR Classes (with defined srClassIDs)
  - allow configurable class measurement interval
  - allow configurable mapping of SR Class to Priority
  - allow configurable mapping of Priority to Traffic Class
  - allow use of new TSN shaper for SR class
Support of more SR Classes

Stream reservation (SR) class is defined in 3.231 of the IEEE 802.1-2014

“A traffic class whose bandwidth can be reserved for audio/video (AV) traffic. A priority value is associated with each SR class. SR classes are denoted by consecutive letters of the alphabet, starting with A and continuing for up to seven classes.”

In 5.4.1.5 FQTSS requirements

“f) Support two or more SR classes (a maximum of seven), … The number of SR classes supported shall be stated in the PICS.”

- The support of up to seven SR classes is already allowed by 802.1-2014
- **To-do:** revise the definition to match the scope of TSN
  - e.g. replace “audio/video (AV) traffic” with “time sensitive streams”
Assignment of srClassID for SR Class

srClassIDs for Class A and B are defined in Table 35-7

<table>
<thead>
<tr>
<th>SR Class</th>
<th>srClassID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>6</td>
</tr>
<tr>
<td>Class B</td>
<td>5</td>
</tr>
<tr>
<td>Class C</td>
<td>4</td>
</tr>
<tr>
<td>Class D</td>
<td>3</td>
</tr>
<tr>
<td>Class E</td>
<td>2</td>
</tr>
<tr>
<td>Class F</td>
<td>1</td>
</tr>
<tr>
<td>Class G</td>
<td>0</td>
</tr>
</tbody>
</table>

To-do: assign srClassIDs for SR Classes C to G
Configurable Class Measurement Interval

The class measurement intervals for SR Class A and B are described as fixed values in 34.4 Note 1

“NOTE 1 - … SR class A corresponds to a class measurement interval of 125 $\mu$s; SR class B corresponds to a class measurement interval of 250 $\mu$s. …”

✓ a managed object for class measurement intervals has been added to Table 12-4 in Qcc D1.0

Table 12-4—Bandwidth Availability Parameter Table row elements

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Operations supported&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Conformance&lt;sup&gt;b&lt;/sup&gt;</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic class</td>
<td>unsigned integer [0..7]</td>
<td>R</td>
<td>BE</td>
<td>34.3</td>
</tr>
<tr>
<td>deltaBandwidth</td>
<td>percentage</td>
<td>RW</td>
<td>BE</td>
<td>34.3</td>
</tr>
<tr>
<td>adminIdleSlope</td>
<td>unsigned integer</td>
<td>RW</td>
<td>BE</td>
<td>34.3</td>
</tr>
<tr>
<td>operIdleSlope</td>
<td>unsigned integer</td>
<td>R</td>
<td>BE</td>
<td>34.3</td>
</tr>
<tr>
<td>classMeasurementInterval</td>
<td>unsigned integer</td>
<td>RW</td>
<td>be</td>
<td>34.3, 34.4</td>
</tr>
</tbody>
</table>
The default priority values for Class A/B are defined in Table 6-5. But the default values cannot be changed by management due to lack of managed objects.

<table>
<thead>
<tr>
<th>SR class</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>🟢</td>
</tr>
<tr>
<td>B</td>
<td>🟡</td>
</tr>
<tr>
<td>C</td>
<td>🟢</td>
</tr>
<tr>
<td>D</td>
<td>🟢</td>
</tr>
<tr>
<td>E</td>
<td>🟢</td>
</tr>
<tr>
<td>F</td>
<td>🟢</td>
</tr>
<tr>
<td>G</td>
<td>🟢</td>
</tr>
</tbody>
</table>

(*) default values for AVB Class A and B

To-do: define new managed objects for SR Class to priority mapping (per Bridge component)

e.g. [SR Class (R), Priority (RW)]
Configurable Priority to Traffic Class Mapping

The recommended priority to traffic class mappings for Class A/B are defined in 34.5, Table 34-1 and 34-2.

<table>
<thead>
<tr>
<th>Priority</th>
<th>Traffic Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Recommended for AVB

“Note 2 - …The mappings shown deal only with one or two supported SR classes; a similar mapping strategy can be adopted if more than two SR classes are supported.”

✓ The managed objects for configuration of priority to traffic class mapping are already defined in “12.6.3.2 Set Port Traffic Class Table” as per-port *

*) per-port is due to the fact the number of supported traffic classes may be different on each port.
Traffic Class to Shaper Mapping

The Transmission Selection Algorithm Table (per-port) in 12.20.2 defines the managed objects for assigning shaper for each supported traffic class.

This implies that a SR Class can be mapped to different shaper
- on different port of the same bridge
- on different bridge

To-do:
- change texts in the current std., so that Class A/B are not tied to CBS, but as default for AV traffic.
- extend FTQSS* to include also other TSN shapers (Qch, Qcr …)

*) currently in 802.1-2014, FTQSS contains only CBS.
Proposals for FQTSS

In Clause 34.1, (Overview for FQTSS):

“This clause describes a set of tools that can be used to support the forwarding and queuing requirements of time-sensitive streams.”

Currently FQTSS describes only CBS. The question is whether to include the new TSN shapers also in FQTSS? If yes, the following are needed:

- **To-do:**
  - Add subclauses for each of the new TSN shapers into clause 34 (FQTSS)
  - Reconstruct subclause12.20 (Management entities for FQTSS) to contain:
    - shaper-specific configuration tables
    - for CBS: Table 12-4 - Bandwidth Availability Parameter Table row elements
    - add new tables for other shapers
    - common FQTSS tables
    - Table 12-5: Transmission Selection Algorithm Table row elements
    - Table 12-6: Priority Regeneration Override Table row elements
    - add a new table for SR Class to Priority mapping [SR Class (R), Priority (RW)] (see page 8)
Conclusion

Only minimum changes are required to support configuration of SR class for TSN

Already supported is:
- allow up to 7 SR Classes (with defined srClassIDs)
- allow configurable class measurement interval (defined in Qcc)
- allow configurable mapping of Priority to Traffic Class

Required changes:
- rewording of SR class to include scope of TSN
- assign srClassIDs for SR Classes C to G
- define new managed objects for SR Class to priority mapping
- allow use of new TSN shaper for SR class (extend FQTTS)
Thank you for your attention!

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