Outline of an Amendment to IEEE Std 802.1Q for Pulsed Queuing

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Specific clauses in
IEEE Std 802.1Q-2022/3

Preface

- This presentation assumes that a Pulsed Queuing PAR would amend IEEE Std 802.1Q-2022/3.

- The terminology used in this presentation is, obviously, subject to radical change.

- Because of the similarities among the ATS, MCQF, and paternoster algorithms, there is more than one way to describe the aggregate, and more than one way to specify managed objects to make choices. This presentation offers one approach, in order to show that it is possible to write a reasonable amendment. It is not necessary to finalize that choice in order to write the PAR.

Pulsed Queuing is a variant of Asynchronous Traffic Shaping (ATS)

- Pulsed Queuing could use the same model for transmission selection as ATS, based on eligibility time. A Pulsed Queuing "bin" is just some number of frames with the same eligibility time.

- Pulsed Queuing could use a bin-based model, using integers to select bins, instead of eligibility times.

- There are arguments for both approaches; there is not time to explore them at this moment. For this presentation, we will assume a time-based approach, in order to maximize commonality with the current document, and to minimize the number of concepts explained.

Synchronization

- For MCQF, syntonization with neighbors of bin rotation is essential.
- For paternoster, syntonization of bin rotation is a useful option:
  - It reduces the end-to-end latency variation.
  - It can be use in for policing, to remove the transitive trust issue with simple MCQF.
- For both MCQF and paternoster, if multiple queues are used with different bin periods, they must be syntonized with each other (if not with the network) and have integral period ratios.

Clause 8.6.8 Transmission selection

- Paternoster, MCQF, and ATS all use the same basic queue structure, organized around eligibility time.
- Syntonizing that queue with the network is pointless but harmless for ATS, a useful option for paternoster, and essential for MCQF. Inter-queue syntonization is required for MCQF and paternoster.
- **Thus, in 8.6.8 Table 8-6,** we re-label option 3, ATS, as "non-coordinated time-based transmission (ATS, paternoster)", and add an option 4 "coordinated time-based transmission (ATS, paternoster MCQF)". "Coordinated" refers to inter-queue syntonization, not network syntonization.
- **8.6.8.5** ATS transmission selection algorithm becomes the non-coordinated algorithm, and we **add 8.6.8.last**, for the coordinated algorithm.

Clause 8.6.5
Flow classification and metering

- We use two new methods for assigning each frame an eligibility time, both different from the one defined currently for ATS:
  - A "paternoster" scheme that counts transmission-time bits for each stream and ensures that no more than the maximum for that stream is stored with into one bin.
  - A "Multi Cyclic Queuing and Forwarding" (MCQF) scheme that computes the eligibility time based on the arrival time of the frame.
- **So, we add new subclauses:**

  8.6.5.7 Paternoster eligibility time assignment

  8.6.5.8 MCQF eligibility time assignment
- The introduction to FC&M in **8.6.5** must be modified, of course.
- How much of **8.6.5.2.3** needs to be modified or replicated is TBD.

Clause 5 Conformance

- Add options for VLAN Bridge components:
  - **5.4.1.last** Coordinated time-based queues
  - **5.4.1.last+1** Paternoster
    - Eligibility time assignment by paternoster algorithm
  - **5.4.1.last+2** MCQF
    - Eligibility time assignment by MCQF algorithm (requires coordinated time-based queues)
- Similar options for:
  - MAC Bridge component **5.13.1.last** (**three clauses**)
  - End station **5.last** (**two clauses**, coordinated time-based queues and paternoster, no MCQF).

Managed objects, MIBs, and YANG

Add managed objects, MIBs, and YANG for:

- Controlling MCQF
- Controlling paternoster
- In both cases, this is done in a straightforward manner, without requiring both MCQF and paternoster, or requiring a full ATS implementation, and in a manner that enables the use of both MCQF and paternoster on the same queue.

Annex

- Add a new annex for MCQF/paternoster covering:
  - Pulsed queues for MCQF/paternoster can be implemented as a simplified ATS queue.
  - Calculating per-hop and end-to-end latencies and buffer requirements. This includes explanations of the tradeoff between per-hop latency and per-cycle dead time.
  - Consideration of the effect on latency and buffer space of aggregating and dis-aggregating flows.

Thank you