# 802.1Qcc:
# Cut-through Specs
# (and a few other items)

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# Assumptions

- Cut-through is an important feature for TSN

  - Without it, TSN is not comparable
    to legacy automotive / industrial media

- Qcc's Central Network Config (CNC) must be able to

  - Determine min/max delay through bridge's relay

    - Datasheet is not sufficient; Network management is required

    - For design of the schedule and/or analysis of latency

    - Worst-case, not measured

  - Determine if cut-through is supported

    - Major impact on bridge delay

- For a single bridge, delay can vary by stream and ports

  - Specify a way to scope metrics to a stream and its ports

# Qcc D0.3: Reporting Relay Delay

Using Figure 8-11 from 802.1Q subclause 8.6…
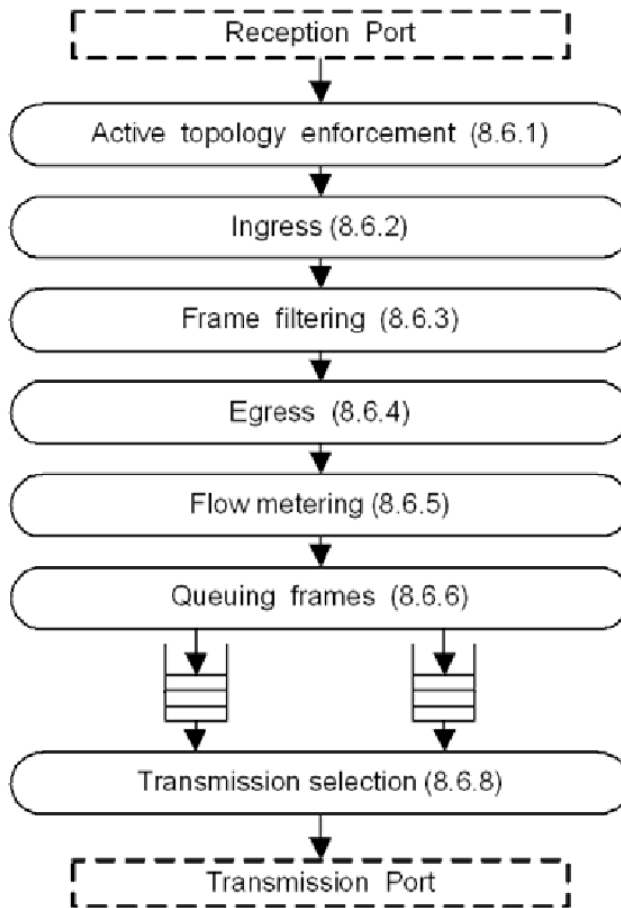


Min/MaxIngressDelay:
 Nanosec from 1588 timestamp point (end of SFD) on ingress PHY to queuing complete (8.6.6);
 Includes bridge relay

Tx selection is shaping and scheduling;
CNC is responsible for this computation;
Not reported by bridge

Min/MaxEgressDelay:
 From tx selection complete (8.6.8) to timestamp point on egress PHY

# Qcc D0.3: Scoping Delay

- Qcc D0.3 uses CircuitIdentifier, but this doesn't work
  - 802.1CB CircuitIdentifier is not stream-specific within bridge
    - One circuit ID can be used by several streams
  - Circuit ID alone doesn't scope to an egress port
    - E.g. If stream egresses a 100M and 1000M port, delays differ

- Stream ID doesn't work
  - Bridge doesn't know Stream ID in centralized Qcc models

- Proposal for Qcc D0.4
  - Stream: Use 802.1CB encapsulation type & parameters
  - Egress port number: Use whatever we decide for topology

# Qcc D0.3: Reporting Cut-through

- Qcc D0.3 has CutThroughStorage
  - Number of MTU-size frame octets stored prior to egress
    - MTU means store&forward
    - < MTU means cut-through (e.g. 64)
  - Applies only when frame's tx selection encounters zero delay
    - I.e. Egress port is idle
    - CNC responsible for knowing this
  - Applies for subsequent frames of same traffic class, as long as class' transmit is selected
    - Enables CNC to design for cut-through of a burst of frames
  - Scoped to stream/ports same as ingress/egress delays
    - E.g. If port speeds differ, bridge can return MTU

# Question: Enable Cut-through?

- Qcc D0.3 assumes that a bridge that supports cut-through will always use it for TSN streams
  - Cut-through is implicitly enabled for TSN queues
    - Disabled by default for non-TSN queues
- Cut-through does have some risks/trade-offs
  - E.g. Corrupted frame header forwards wrong way
- For Qcc D0.4, do we want to enable it explicitly?
  - Per-stream at user level (i.e. talker asks for it)?
  - Per-queue using management (i.e. like 802.1Qbu)?

# Other Qcc Items

# TE-MSTID of MSTP: Background

- TSN requirement: Explicit trees
  - Assumption of Qbv, CB, etc (e.g. CB D1.0 Annex C.2)
  - VIDs for TSN are explicit, but other VIDs remain dynamic
    - E.g. VIDs 1 and 2 use MSTP, best-effort traffic, managed by IT; VIDs 4 and 5 for TSN traffic, explicitly configured by Qcc's CNC
- Qca (IS-IS PCR): Strict explicit trees from PCE
- MSTP: TE-MSTID feature of PBB-TE
  - TE-MSTID identifies VIDs of that MSTI as explicit
  - MSTP BPDUs have no effect on topology of these VIDs
  - Static Filtering Entries (VLAN/MAC) configure topology
  - VIDs can be C-VLAN (simple 12-bit)

# TE-MSTID of MSTP: Conformance

- Relevant clauses in 802.1Q-2014

  - 8.6.1: If bridge supports PBB-TE, and VID is ESP-VID, forwarding=TRUE, learning=FALSE… Static Filtering Entries control active topology… ESP-VIDs use TE-MSTID (0xFFE)

  - 8.9, 12.2 : MST configuration (how to map ESP-VIDs to TE-MSTID)

  - 25.10: ESP-VID specs buried in PBB concepts (B-VLAN, TESI, IB-BEB, …)
    e.g. 25.10.2.a: If no static entry exists for ESP-VID frame, discarded

- Annex A (bridge PICS)

  - TE-MSTID is not listed as a feature of MSTP (A.18)

    - Not mandatory for a conformant MSTP implementation

  - TE-MSTID (ESP-VID) is part of 'O.1' PBB-TE  feature (A.5)

    - PBB-TE includes all of 25.10

    - 'O.1' mandates one or more of: RSTP, MSTP, SPB, PBB-TE

# TE-MSTID of MSTP: Proposal

- Does PBB-TE mandate more than TE-MSTID?
  - This is not clear in 802.1Q-2014
  - Most TSN applications use C-VLAN only (nothing provider)

- Proposal (assuming 'No'): Clarify TE-MSTID in Qcc D0.4
  - Add TE-MSTID subclause to Qcc
    - Brief CB-like background: Many TSN applications need explicit trees
    - Summarize how TE-MSTID is used to configure explicit trees
    - Clarify that the PBB-TE feature includes TE-MSTID,
      but its VIDs can be limited to C-VLAN only
      - B-VLAN, TESI, IB-BEB, "provider", and "backbone" can be ignored
    - TSN-capable bridge can support both (e.g. MSTP and PBB-TE)
  - In PICS row for PBB-TE (A.5), add reference to Qcc subclause

# MVRP Conformance

- 802.1Q-2014 Annex A (bridge PICS): MVRP is 'M'

| MVRP | Is automatic configuration and management of VLAN topology using MVRP supported? | ¬TPMR:M TPMR:X | 5.4, A.21 | Yes [ ] |
|------|------|------|------|------|

  - MMRP is optional; MRP is conditioned on M?RP

- MVRP is not applicable for explicit VIDs of TSN

  - Needed for distributed Qcc models (AVB), but not centralized

- TSN is targeting constrained devices

  - E.g. Industrial sensor with 802.1Q bridged end-station

- Ideally, 802.1Q wouldn't mandate unused protocols

- Proposal: Change MVRP to 'O' for TSN

  - Open to suggestions on how to approach this

# TSN and LAG
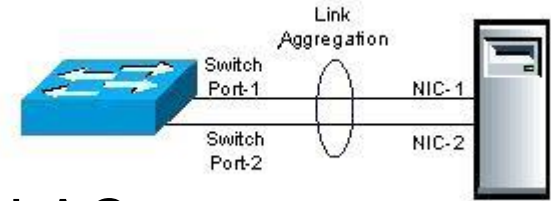
- 802.1AS-2011 didn't specify use over LAG,
  but in AS Rev we are associating to a physical link

  - 3rd option of http://www.ieee802.org/1/files/public/docs2015/liaison-response-itu-t-ls206-0115-v01.pdf

- What about TSN data?

  - Aggregation can be non-deterministic… TSN needs physical links

  - Best-effort traffic (e.g. untagged) must remain aggregated

  - TSN's explicit trees enable this via the 1st option of ITU-T liaison
    - 802.1AX-2014 per-service frame distribution, ESP-VID per physical link

- Proposal for Qcc D0.4: Point this out

  - Add new informative annex for Qcc, with subclause on LAG

# Thank You