

## DELAYS AND DELAY VARIATION IN AN ETHERNET FRONTHAUL NETWORK

János Farkas and Balázs Varga janos.farkas@ericsson.com balazs.a.varga@ericsson.com

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This presentation updates http://www.ieee802.org/1/files/public/docs2015/cm-farkas-delay-pdv-1215-v01.pdf



#### Assumptions

- Only frame preemption is used out of the TSN tools (no 802.1Qbv)
  - > Express: CPRI traffic
  - > Preemptable: all the rest of the traffic
- CPRI flows are allowed to race each other at every hop
- Playout buffer is used for outbound traffic at the edge bridge in order to cope with Frame Delay Variation (FDV)
  - Note: It is FLR (Frame Delay Variation) for a switched Ethernet transport network. Packet Delay Variation (PDV) is a generic term for packet networks. CPRI also has a (TDM-)frame structure, which is referred to as "CPRI frame"
- This presentation investigates the calculation possibilities of delay and FDV in the Ethernet transport network for frames of CPRI flows

#### EFFECTS OF FRAMF PREEMPTION

- Worst case delay: 124 Bytes
  - The serving time of 124 Bytes is the worst case delay that an express frame carrying CPRI traffic can suffer in a bridge due to preempting background traffic
  - It is 114.4 ns for 10 Gbps outbound link, it is 11.44 ns for 100 Gbps link
  - Details: http://www.ieee802.org/1/files/public/docs2015/cm-farkas-applicability-of-bu-and-bv-1115-v02.pdf
- Best case is 0, if no need to preempt
- Therefore, frame preemption delay causes FDV
- The per hop frame preemption delays are accumulated
- > FDV due to frame preemption can be calculated

 $FDV_{preemtion} = \sum_{i} t_{j}^{124B}$  i.e. by summing the service time of 124 Bytes for the outbound link of each hop j

Frame preemption may cause 572 ns FDV in a 5-hop diameter network comprising 10 Gbps links

### DELAY



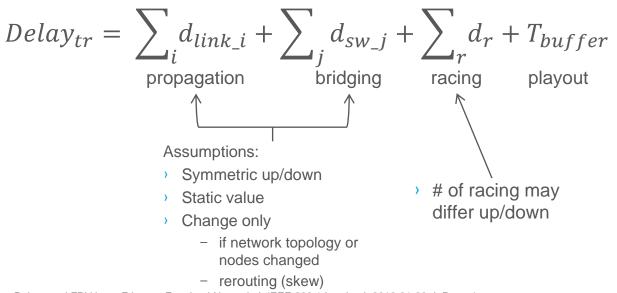
#### > Delay calculation per CPRI flow:

- Propagation delay: on passed link (inc. serialization); depends on link length (5usec/km)
- Bridging delay: Note: no queuing delay for CPRI
- Racing delay:

- on passed bridge; depends on bridge implementation (non-blocking!) racing event may occur at an egress port; depends on relative arrival
- time of racing frames and their size

Note: racing can be treated as a special queuing delay.

Playout buffer delay: re-shaper/de-FDV buffer; depends on configuration (T<sub>buffer</sub>)



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#### FRAME DELAY VARIATION (FDV)

- > FDV calculation per CPRI flow:
  - Propagation: no FDV caused by a point-to-point link
  - Bridging: implementation specific (non-blocking bridge is assumed) Note: no queuing FDV for time critical traffic. If TSN function(s) cause FDV it should be added for a given solution.
  - Racing: depends on solution characteristics
    Note: Racing can be treated as a factor causing special queuing FDV.
  - Playout: can eliminate FDV partly / entirely



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