CPRI over switched Ethernet

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Introduction

Background

→ "**CPRI requirements for Ethernet Fronthaul**" (802.1CM call, 24-11-15)
  → (http://www.ieee802.org/1/files/public/docs2015/cm-CPRI-requirements-1115-v01.pdf)
  suggests :- maximum FDV = 5 µs or 10% of the E2E latency
  → FDV (Frame Delay Variation) **==** PDV, but in IEEE 802 language

→ **FDV tolerance as an attribute of transport for a CPRI stream requires mechanisms for clock recovery and buffer control at the receiver :**
  → irrespective of the value of the maximum delay tolerance;
  → buffer sizes are modest in a CPRI context – 50 µs @ 10G < 64 KBytes

→ **Is maximum FDV = 5 µs or 10% of the E2E latency the right choice ?**
  → where maximum E2E latency is implementation-dependent but ~ 100 µs

→ **This contribution suggests an alternative way of looking at this specification issue.**

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Functional Requirement

→ **It is believed that the root functional requirement is to hold the <u>total one-way latency</u> between a RRH and a BBU to less than ~ 100 µs, to allow correct operation of the hybrid ARQ mechanism :**

→ discussion with CPRI required to determine the exact latency details

Transport Delay	Frame arrival jitter	margin

↑ emit |←------- maximum FDV -------→| ↑ readout   → time
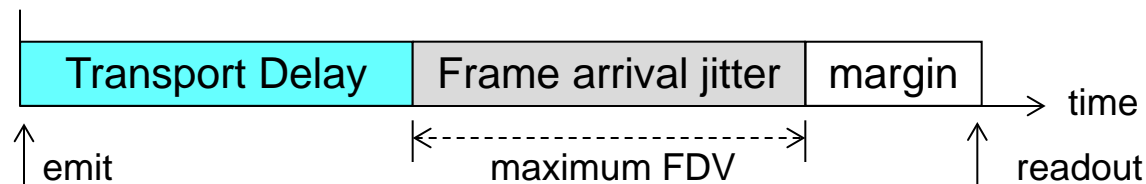
→ **This suggests that the parameter which ought to be specified is Total Fronthaul Delay = Transport Delay + maximum FDV + margin < 100 µs**

→ **This allows a trade-off between Transport Delay and maximum FDV :**

→ in "very short reach" deployments, FDV requirements are much relaxed

→ maximum possible reach can still be obtained when required, by the use of precision network timing techniques.

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Multiple Fronthaul profiles seem to have merit

We show a simple use case :

→ 2.4 Gbps CPRI bandwidth per RRH (e.g. 3-sector, single 20 MHz carrier)

→ 10 Gbps trunking, so 4 x RRH streams supported per trunk,

→ no pre-emption, and assume 1500 Byte packets, so unit of delay = 1.2 µs

→ may not be realistic – a deliberate "stress test"
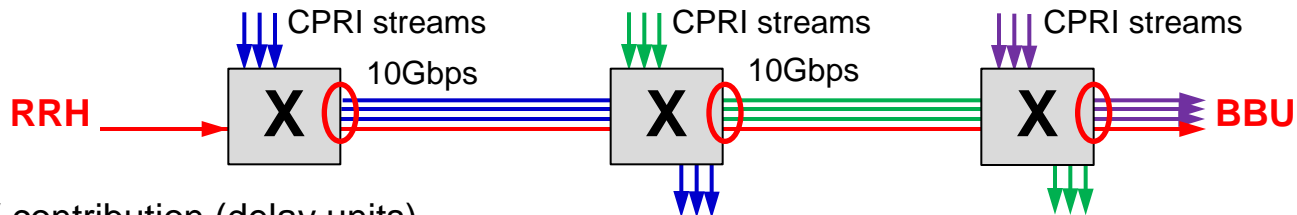
FDV contribution (delay units)

HoL blocking	1	1	1	= 3
** "race condition"	3	3	3	= 9
			12	= **14.4** µs

→ **In this scenario, an allowance of 5 µs for "margin" still leaves 80 µs (~ 16 km) available as a Transport delay budget**

** the term "race" is used as in "**Delays and PDV in an Ethernet Fronthaul Network**"
(**http://www.ieee802.org/1/files/public/docs2015/cm-farkas-delay-pdv-1215-v01.pdf**)

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Next steps ?

Suggest to CPRI Cooperation that in a switched Ethernet Fronthaul environment specification of the maximum RRH ⇔ BBU delay is the preferred parameter :

→ put Transport delay + FDV into the Ethernet Transport domain,

→ and let that domain sort it out

Extend the discussion on joint calls.

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