FRAME LOSS CONSIDERATIONS FOR FRONTHAUL

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RECAP

- http://www.ieee802.org/1/files/public/docs2016/cm-varga-CPRI-packetloss-considerations-0116-v02.pdf
  - Frame Loss Ratio (FLR) and Bit Error Ratio (BER) are meaningful only when the service is available → Availability should be distinguished from FLR and BER
  - No frame is lost due to congestion in a well-designed TSN network
  - Bit errors may cause frame loss (more on next slide)
  - Network failures may cause frame loss (more on slide 4)

- http://www.ieee802.org/1/files/public/docs2016/cm-CPRI-discussion-on-requirements-0416.pdf
  - IQ data: FLR < 10^{-9}

BIT ERRORS AND FRAME LOSS

- An Ethernet frame is dropped if its FCS fails
- Loss of an Ethernet frame causes bursty bit errors and increased error rate for an IQ data flow (compared to bit error of an optical link)
  - Smaller Ethernet frame size decreases the burst of bit errors
- There is a relationship between BER, FLR, and frame size

Per hop values

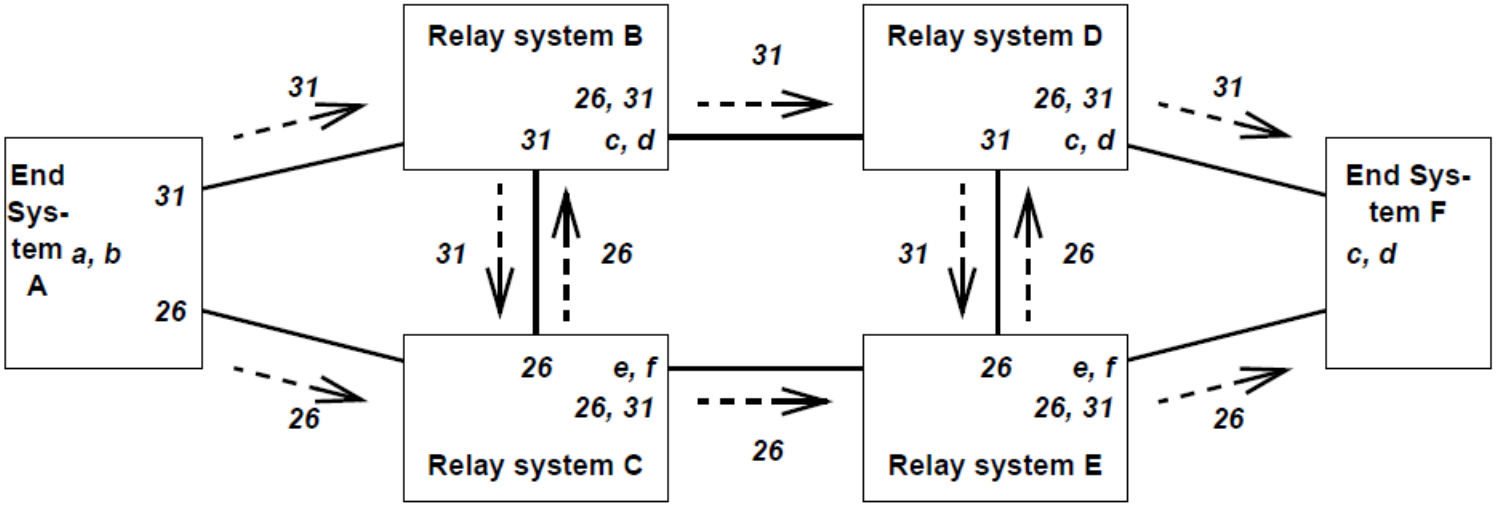
BER_{Link}	Frame size	FLR_{Link}
10^{-12}	200 bytes	1.6×10^{-9}
10^{-12}	1000 bytes	8×10^{-9}

NETWORK FAILURES

- Link or node failures may cause frame loss.
  - Note that FLR and service availability are distinguished
- Restoration is often used to resolve a failure if the network topology is redundant
  - A control protocol can restore the forwarding paths
  - Restoration time depends on many aspects, network topology, the given failure, etc.
  - Restoration time may vary from a couple of ms to 100s of ms
- Protection switching can be used to resolve a failure
  - There are techniques to provide 50ms failover time
- 802.1CB Frame Replication and Elimination for Reliability is designed to minimize loss, more details on next slide

802.1CB FRAME REPLICATION AND ELIMINATION FOR RELIABILITY

- It is 1+N redundancy for increased reliability (reduced FLR)
- Sequence numbering and replicating every packet, in the source end system and/or in relay systems in the network, and eliminating those replicates in the destination end system and/or in other relay systems



Key:

a: Add sequence numbers to Stream 31.
b: Split Stream 31 into Streams 26 and 31.
c: Merge Streams 26 and 31 into Stream 31.
d: Eliminate duplicates on Stream 31.
e: Merge Streams 26 and 31 into Stream 26.
f: Eliminate duplicates on Stream 26.
Each system's output ports marked with Streams transmitted and functions performed.

DISCUSSION

- 802.1CB can meet the FLR < 10^{-9} requirement for IQ data
  - Price: bandwidth
- Is it feasible to use 802.1CB for IQ data flows?
- Is the FLR < 10^{-9} requirement valid for all packets of IQ data?
- Is the FLR < 10^{-9} requirement only valid for some critical packets of IQ data?
  - If yes, then we may consider to use 802.1CB only for the critical data
  - What is the FLR requirement for the not that critical IQ data?
- Shall we introduce a new Profile (Profile C) that includes 802.1CB?

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