On the meaning of “interoperability” in objective #4 of 802.3da

Objective #4: “Support interoperability with Clause 147 multidrop”

Gergely Huszak (Kone)

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(v3)

Supporters

- George Zimmerman (CME Consulting)
- Peter Jones (Cisco)

Precursors (in order of appearance)

[1] 802.3da Clause 147 Multidrop Interoperability (Jason Potterf): Initial thoughts on interoperability

[2] FEC for 802.3da (Gergely Huszak and George Zimmerman): Introducing a FEC that is backward compatible with Clause 147

[3] Control of FEC in Multidrop: Introducing the MSL Client (George Zimmerman): a working idea to control FEC over a mixing segment

[4] 802.3da Clause 147 Multidrop Interoperability (Jason Potterf): Introducing a decision tree-based appraoch to understand need for and consequences of available options

Advantages of a backward compatible FEC

- The obvious: **Having a** per-frame settable impulse noise **FEC** with known minimum error and erasure correcting capabilities (with per-frame configurable length of minimum correctable error and erasure length)
- Being capable of handling localized noise: nodes that are vulnerable (e.g. due to their location) could use FEC, others would not need to
- Maintaining a **common language**: Clause 147 would be guaranteed to be understood by all PHYs on the mixing segment
- Ease of covering **spare-parts**: from the network's perspective, a .3da PHY could always be used to a .3cg-based node in both engineered network and those where many vendors interconnect their devices (e.g. in building control networks)
  - Note: FEC makes sense only if at least 2 nodes on the mixing segment support it, thus possibly requiring the bridge to be changed

Disadvantages of a backward compatible FEC

- Some messages (multi- and broadcasts) *may* need to be sent in both forms (2 frames instead of 1)
- A function is needed to maintain a table of peer FEC capabilities: default mode is no-FEC $\rightarrow$ switch to FEC for a peer if it is known to support FEC (802.3da + optional FEC)
- The FEC proposed is a burst FEC - if used for the design purpose of connection/disconnection and impulse noise, it cannot also be used for reach extension.
  - Code correction can be allocated purely to reach extension at the expense of burst correction reliability.

Possible ways out

A. Going without any FEC (listed as “Mixing segment extension (node count, distance, plug and play setup, etc.)” in slide #2/[4])
B. Going with the backward compatible FEC (listed as “Noise: Interoperable FEC is solution” in slide #2/[4])
C. Changing modulation **or** using a non-backward compatible FEC and line-coding scheme with – optionally (if needed) – implementing a different FEC

A. No FEC

- Advantage: **objective #4** (“Support interoperability with Clause 147 multidrop”) is a given
- Problems:
  - How to meet **objective #1** (“Define performance characteristics of a mixing segment for 10Mb/s multidrop single balanced pair networks supporting up to at least 16 nodes, for up to at least 50m reach.”)?
  - How to meet **objective #2** (“Maintain a bit error ratio (BER) at the MAC/PLS service interface of less than or equal to 10^{-10} on the new mixing segment.”) especially **in conjunction with objective #8** (“Support operation in the noise environments for building, industrial, and transportation applications”) **and objective #11** (“Support addition and removal of a node or set of nodes to a continuously operating powered mixing segment”)?
    - Note: while objective #2 and objective #8 may be met through other means (e.g. via sufficient cabling / shielding), objective #11 cannot be achieved through these means

B. Backward compatible FEC

- Advantage: **objective #4**, and **objective #2** in conjunction with **objective #8** and **objective #11** are handled
- Problem: The problems listed at **slide #5** (“Disadvantages of a backward compatible FEC”)
- Todo: develop preamble and postamble parts of the FEC scheme

C. Changing modulation or non-backward-compatible FEC.

- Advantage:
  - May allow meeting all objectives, including **objective #2 in conjunction with objective #1**
  - Better FEC (handling both impulse and stationary noise) may be considered
  - Other techniques supporting **objective #1** (reach extension) may be possible
- Problems:
  - No **common language**: might be solved by some protocol using “aging” (some presented before), in which case .3da PHY may switch to .3cg mode if needed or commanded
  - Creates several topics of interest:
    - Technical:
      - Selecting a new modulation and FEC encoding
      - Developing and specifying a modulation-selection protocol suitable for multidrop networks.
      - How text may be written to be friendly to low-complexity multi –protocol PHY architectures?
      - How to make modulation selection protocol (that also withstands churn) interoperable?
    - Non-technical:
      - Market acceptance
      - Affect on 10BASE-T1S technology and products
- Todo: see above

Conclusion

- If we assume that mixed-mode networks do not exist, then there is a new (3rd) path open for the project: **new modulation**
  - The new modulation creates large amount of technical and non-technical questions
- Interoperability may be maintained in all 3 cases, with different outcomes/difficulties
  - A. (no FEC, Clause 147 encoding): Easy interoperability, we need to work to get performance;
  - B. (Backward compatible FEC): preamble capability signaling and higher-level client need to be worked to manage mixed nodes (may involve other groups);
  - C. (new modulation/non-backward compatible FEC) - harder interoperability, PHY selection protocol needs to be worked.

Thank you for your kind attention

Any questions?