IEEE P802.3da 10 Mb/s Single Pair Multidrop Segments Enhancement Task Force

MIXING SEGMENT RECOVERY/REDUNDANCY
TERMINATION

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v5

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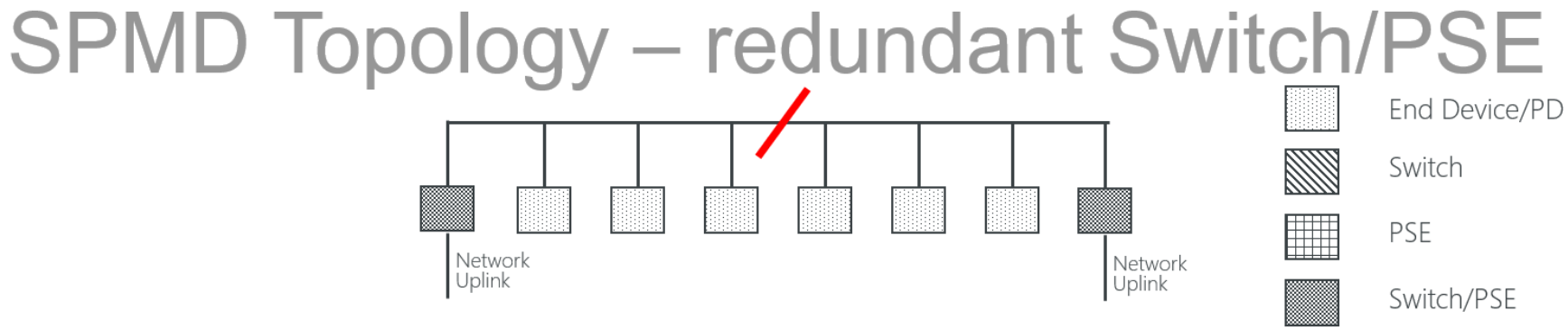
The problem: consequences of a **single** failure of the link

- Peter Jones (Cisco) presented earlier* on the **powering and switching** aspects of this (latter) problem and pointed out that by applying appropriate techniques, a single failure can be recovered from fully with respect to both powering and frame switching

Presentation of Peter Jones (Cisco), January 15, 2020 Teleconference Meeting, http://www.ieee802.org/3/SPMD/public/jan1520/spmd_01_011520.pdf

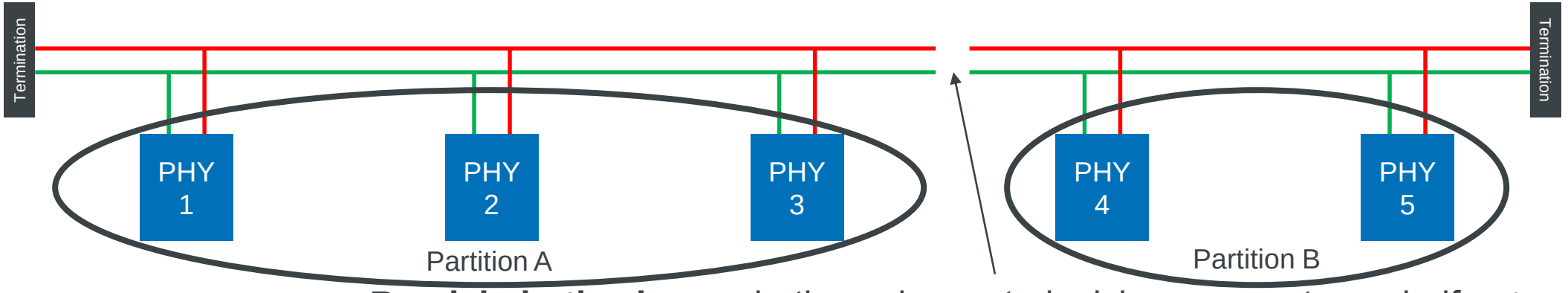


- In case of a single cabling issue, to maintain connectivity between the **2 neighboring partitions** of devices that remain galvanically connected via both conductors, termination shall be present at both ends of the newly formed 2 mixing segments → this is not a given

* See also backup slide #1

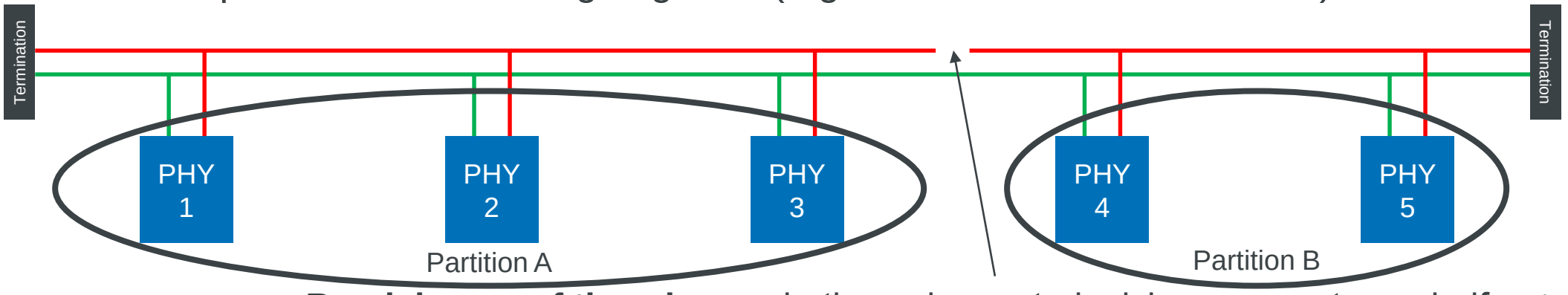
2 scenarios

- Complete separation of the mixing segment (e.g. broken cable, drop of connector):



Break in both wires → both newly created mixing segments are half-unterminated

- Partial separation of the mixing segment (e.g. broken or loose conductor):



Break in one of the wires → both newly created mixing segments are half-unterminated

Is our current PHY specified to work in this case?

- Pro:
  - As simple as it gets
- Con:
  - Outcome (extent of the effect) may greatly depend on details of receiver implementations (interoperability problem)
  - The change in the channel characteristics may be drastical, eliminating all margins or unknown amount of frame loss right off the bat
- Answer to the rhetoric question above is “**no**”
  - The clause 147 PHY is only specified to work on a compliant mixing segment
- Action required:
  - Simulate and/or measure mixing segment’s IL, RL and MC to understand the effect

Possible solutions
#1: change channel specs

- Details: write standard text so that losing one of the two terminations would be a normal condition
- Pro:
  - With respect to system and network design, possibly optimal solution
  - No interoperability concerns
- Con:
  - Possible increase in PHY complexity
- Additional consideration:
  - If it is implementable also for the case when no termination is present (whatsoever), would it not be an optimal solution (with respect to 10SPE in general) **not to require terminations at all**?

Possible solutions: change the PHY specs to run on the impaired segment
#2a: reduced “emergency” speed and/or modulation/line code

- Details: upon failure, the whole segment switches to a lower speed and/or more resilient channel code
- Pro:
  - Operation can be maintained without need for additional external components
- Con:
  - Normal system service is not be maintainable at lower speeds (added system design difficulty)
  - New MAC speed (or MAC pause/buffer mechanisms) required
  - Recovery may be difficult (oscillation problems)
  - Possible increase in PHY complexity
  - Not available to clause 147 PHYs

Possible solutions: change the PHY specs to run on the impaired segment
#2b: FEC?

- Details: design and implement a FEC that can compensate for worsened conditions
- Pro:
  - Normal operation can be maintained without need for additional external components
- Con:
  - May not be implementable: FEC is not the right solution for Inter-Symbol Interference (ISI), as increased distortion is likely to be pattern-dependent
  - Possibly large increase in PHY complexity
  - Backward compatibility is a question

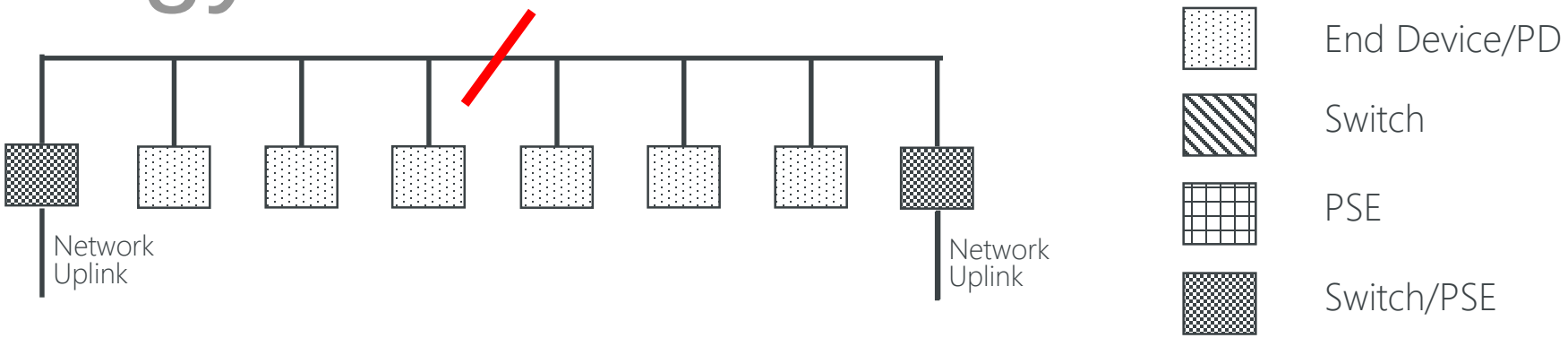
Possible solutions: self-healing channel
#3: apply 2 new terminations “on-the-fly” at the right places

- Details: upon failure, make the 2 nodes neighboring the conductor discontinuity apply local termination
  - Determining **location** of failure may require knowledge of the adjacent nodes
- Pro:
  - Channel characteristics can be maintained
  - Problem is analogous to adding a new node (or string of nodes) onto the end of a mixing segment
  - Installation practices are now immune to missing terminations (no need for explicit termination plugs)
- Con:
  - Switch-over takes time
  - Implementation of on-demand termination may add relative cost/complexity to each node

Thank you for your kind attention
Any questions?

Backup slides

SPMD Topology – redundant Switch/PSE



- This topology is a single mixing segment, with two Switch/PSEs
- This provides resilience against a single failure causing loss of network access or power.
  - Many protocols (e.g. VRRP, REP) make use of two uplink devices
  - PSEs are expected to run "active/standby", using software for role arbitration
  - If the active ceases to power the line, standby takes over ASAP.