Specifying Reflections for SPMD

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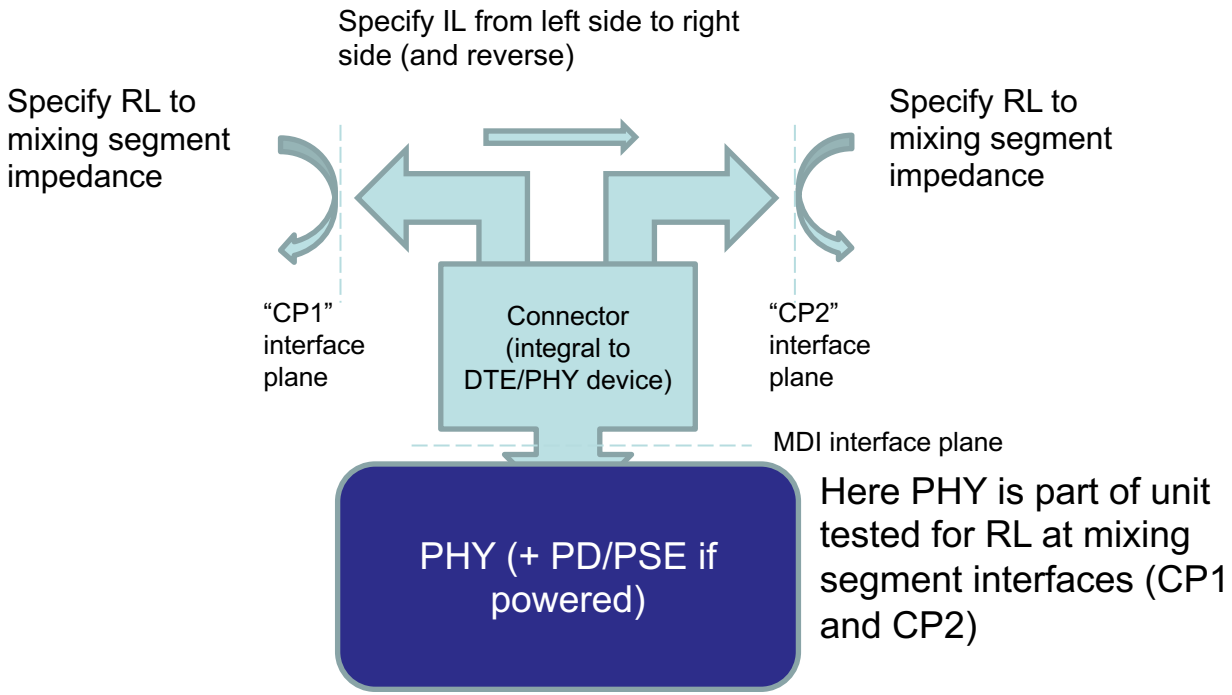
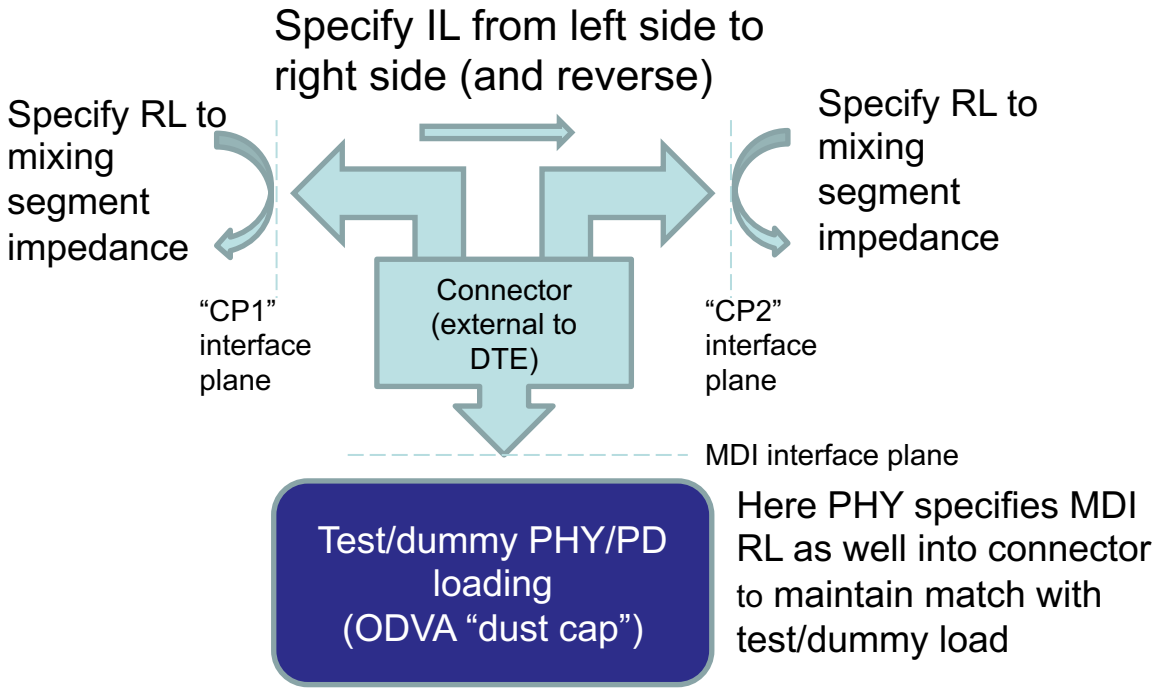
Issue

- Simulations are indicating that simple topological rules for mixing segments (e.g., node spacing) are proving elusive with expected node count and capacitance
- Simulations and analysis indicate that the reflections along the mixing segment trunk are the primary cause
  - These may be at a “T” or at the “IN/OUT” interfaces, and not the MDI, creating a specification interface point Ethernet hasn’t seen for a while

Reflection Specs at a node attachment

- Specify the MDI return loss for a connected PHY in ‘in and out’ mode
- Connection divides mixing segment into left & right
  - Two cases – connector integral to device, connector external to DTE





We've been here before (10BASE-2, Clause 10)

Well-controlled coax cable, well-matched segments, still has minimum spacing, node capacitance, and node limits lower inconsistent with 802.3da's objectives and use-cases.
(30 nodes, 0.5m spacing, 4% cable matching)

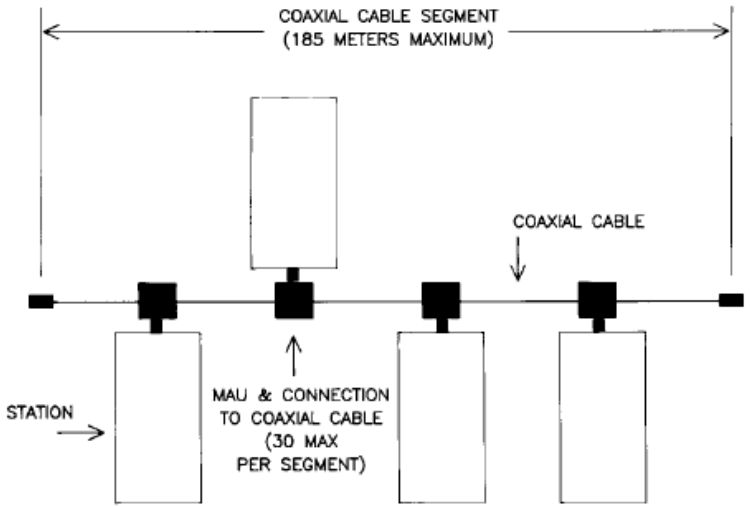


Figure 10–8—The minimum system configuration

Source: IEEE Std 802.3-2022

10.4.1.1 Input impedance

The shunt capacitance presented to the coaxial cable by the MAU circuitry (not including the means of attachment to the coaxial cable) is recommended to be not greater than 6 pF.

⋮

10.7.2.1 Cable sectioning

The 185 m maximum length coaxial cable segment will be made from a number of cable sections. As the variation on cable characteristic impedance is ±2 Ω on 50 Ω, a possible worst-case reflection of 4% may result from the mismatch between two adjacent cable sections. The MAU will add to this reflection by the introduction of its noninfinite bridging impedance.

The accumulation of this reflection can be minimized by observing a minimum distance between MAUs (and between cable sections). In order to maintain reflections at an acceptable level, the minimum length cable section shall be 0.5 m.

10.7.2.2 MAU placement

MAU components and their associated connections to the cable cause signal reflections due to their noninfinite bridging impedance. While this impedance has to be implemented as specified in 10.6, the placement of MAUs along the coaxial cable also has to be controlled to ensure that reflections from the MAU do not accumulate to a significant degree.

Coaxial cable sections as specified in 10.7.2.1 shall be used to connect MAUs. This guarantees a minimum spacing between MAUs of 0.5 m.

The total number of MAUs on a cable segment shall not exceed 30.

Why? – clumps are important

- 10BASE-2 connected computing nodes
  - Physically large, separated by human distances
- 10BASE-T1M is expected to connect sensors, actuators, and controllers
  - Can be physically small (e.g., keypads)
  - Often located in clumps with extended distance between them
- 10BASE-T1M powering (and spacing) can complicate compensation effects
  - Node capacitance may also vary significantly

10BASE-2 may provide a specification solution

- Shunt capacitance and spacing may be a problem for some configurations, BUT:
- 10BASE-2 specifies the magnitude of the reflection presented, which could be used by 802.3da to allow flexibility in capacitance

10.4 MAU–medium electrical characteristics

10.4.1 MAU-to-coaxial cable interface

10.4.1.1 Input impedance

The shunt capacitance presented to the coaxial cable by the MAU circuitry (not including the means of attachment to the coaxial cable) is recommended to be not greater than 6 pF. The magnitude of the reflection from a MAU plus the cable connection specified in 10.6.3 shall not be more than that produced by an 8 pF capacitance when measured by both a 25 ns rise time and 25 ns fall time waveform. The resistance presented to the coaxial cable shall be greater than 100 kΩ.

These conditions shall be met in both the power-off and power-on, not-transmitting states.

Source: IEEE Std 802.3-2022

This could allow use of compensated tee connections, in-and-out connections, or avoid them, depending on needs. It may also allow flexibility on powering

Recommendations

- Define interface point of T (or in/out) to mixing segment backbone
  - We can do this now – Request for contributions (this is just spec writing)
  - Will determine what needs to be specified at the interface, can help cabling bodies with connectors and other specifications
- Determine reflection magnitude limit at such an interface
  - Investigate the right balance point for maximum node capacitance, reflect that in MDI, under nominal conditions
  - Consensus model provides the tool for this
- Propose informative text explaining key example cases examined, including use of inductive compensation, tees vs. in/out connections, as well as options for clumping
  - We can do this now - Request for contributions (suggest what you think is useful)

DISCUSSION?

Thank you!