Making sense of Annex 178B

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Introduction

- There has been mixed views one what is ILT, path start-up, etc., as defined in Annex 178B in Draft 2.1

This contribution...

- Walks through some of the current definitions
- Proposes reallocations of functions differentiating between the link training on physical interfaces and the orderly start-up of a the physical links a pair of MAC sublayers.
- Does not go into deep function details but rather looks at the architecture top down.

Some definitions in Draft 2.1

Inter-Sublayer Link (ISL) definition in Draft 2.1

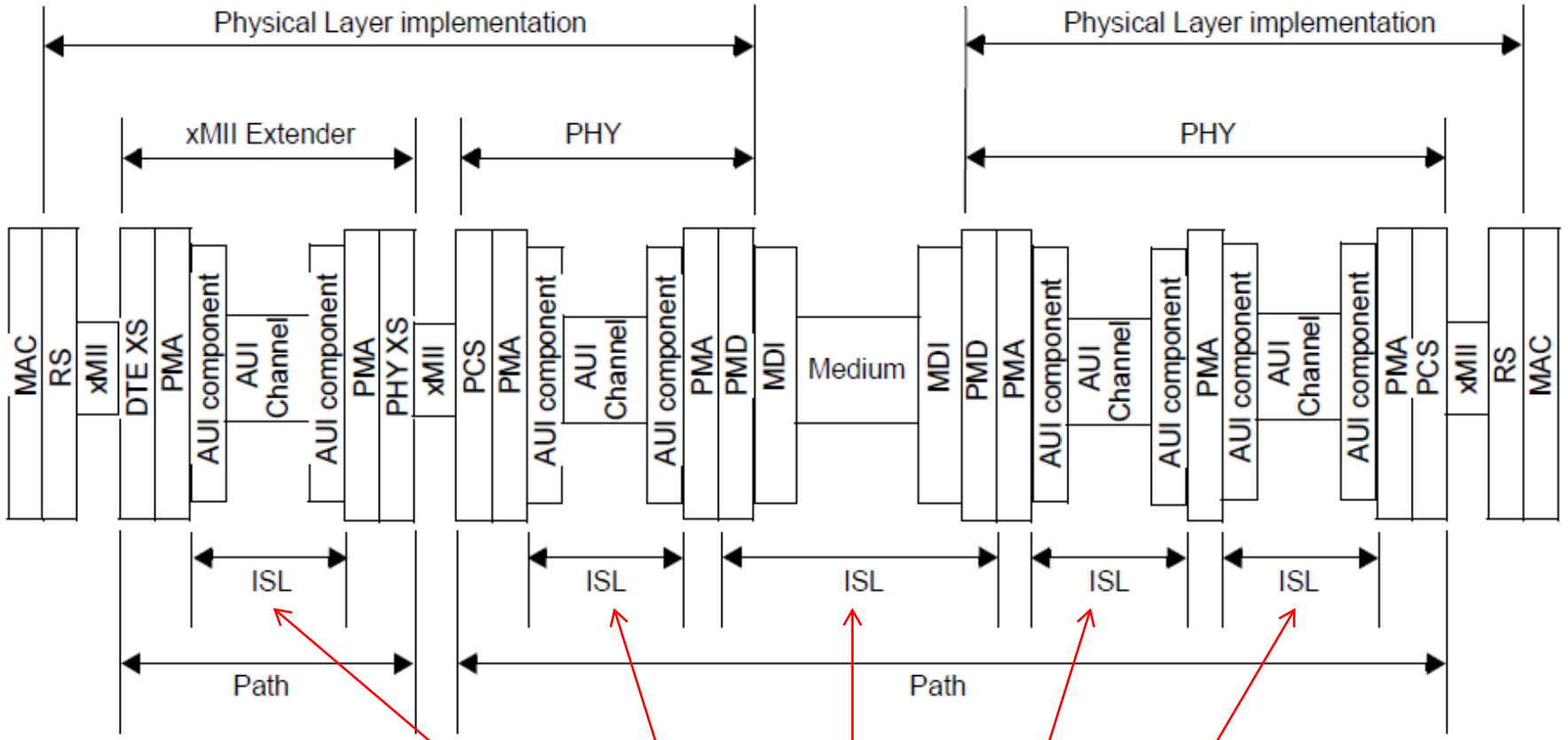


Figure 178B–1—ISL and Path

Inter-sublayer link (ISL)

An ISL is either an xAUI-n (a pair of AUI components and the AUI channel between) or a pair of PMDs (in different PHYs) and the medium between. See Figure 178B–1.

AUI component is equivalent to a PMD sublayer

AUI component

An AUI component is either a C2C component (e.g., see 176C.3) or a C2M component (e.g., see 176D.3). In a device with two AUI components the upper AUI component is the one facing toward the MAC sublayer and the lower AUI component is the one facing toward the Medium.

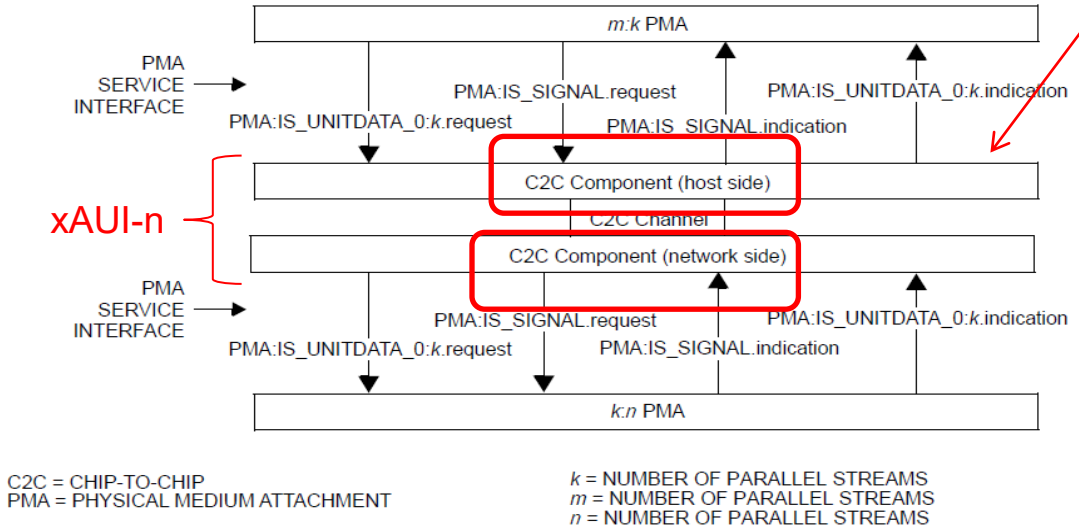


Figure 176C–3—Inter-sublayer service interfaces for a 200GAUI-1, 400GAUI-2, 800GAUI-4, or 1.6TAUI-8 C2C

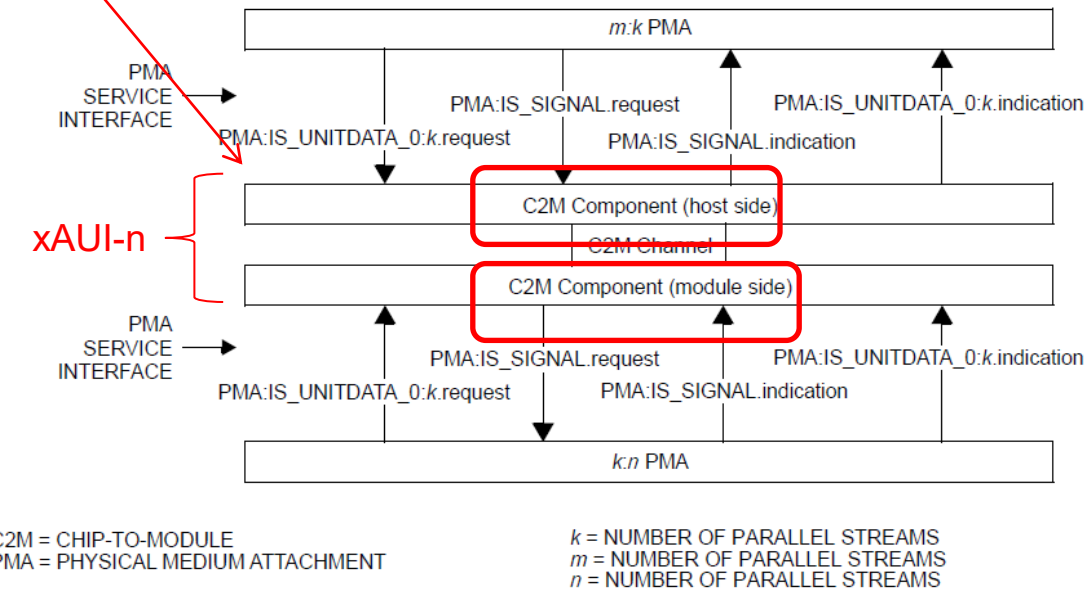


Figure 176D–3—Inter-sublayer service interfaces for a 200GAUI-1, 400GAUI-2, 800GAUI-4, or 1.6TAUI-8 C2M

176C.3 Functional specification

An *n*-lane C2C component is functionally equivalent to a corresponding *n*-lane PMD specified in Clause 178 (see 178.8) using PAM4 signaling at a nominal signaling rate of 106.25 GBd on each lane. The service interfaces are defined in 176C.4.

176D.3 Functional specification

An *n*-lane C2M component is functionally equivalent to a corresponding *n*-lane PMD specified in Clause 179 (see 179.8) using PAM4 signaling at a nominal signaling rate of 106.25 GBd on each lane. The service interfaces are defined in 176D.4.

“Path” definition in IEEE 802.3-2022

1.4.455 path: The sequence of segments and repeaters providing the connectivity between two DTEs in a single collision domain. In CSMA/CD networks there is one and only one path between any two DTEs.

1.4.279 data terminal equipment (DTE): Any source or destination of data connected to the local area network.

The term “path” is already defined above in IEEE 802.3-2022. It is effectively a network connection from MAC sublayer at one end to the MAC at the other end. Within the physical layer this would be RS to RS.

Path as defined in Clause 178B Draft 2.1

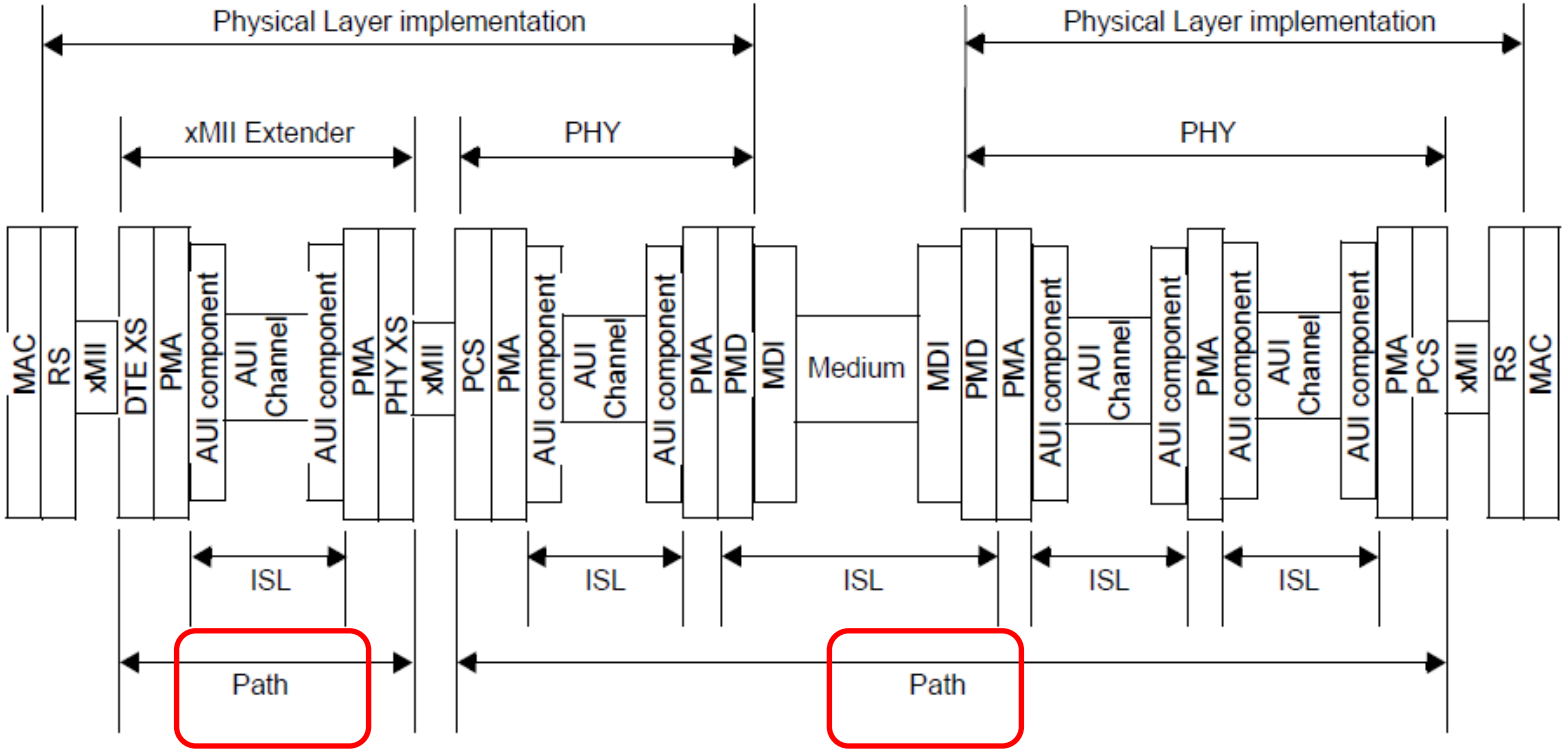


Figure 178B–1—ISL and Path

178B.3 Definitions

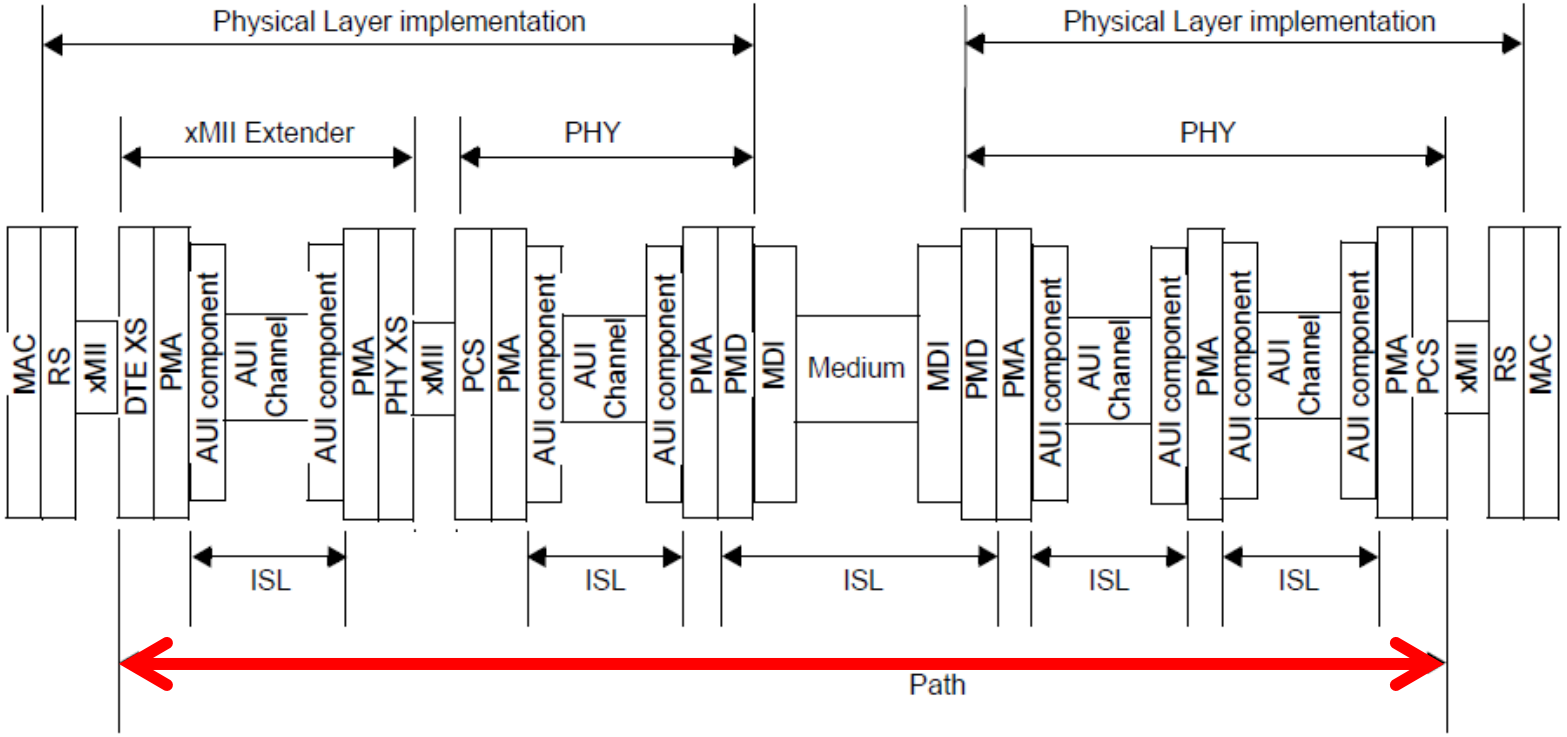
For the purpose of this annex, the following definitions apply. Subclause 1.4 should be referenced for terms not defined in this annex.

Path

The series of ISLs and sublayers between a pair of PCS sublayers or a pair of Extender Sublayers. See Figure 178B–1.

What to do…

Intended “Path” in Annex 178B is RS to RS



Although this is effectively the same as the general definition in 1.4.455, it might be helpful to rephrase it in the context of ILT and path start-up:

Path -- The sequence of ISLs and intermediate sublayers providing the connectivity between two Reconciliation Sublayers. See Figure 178B–1.

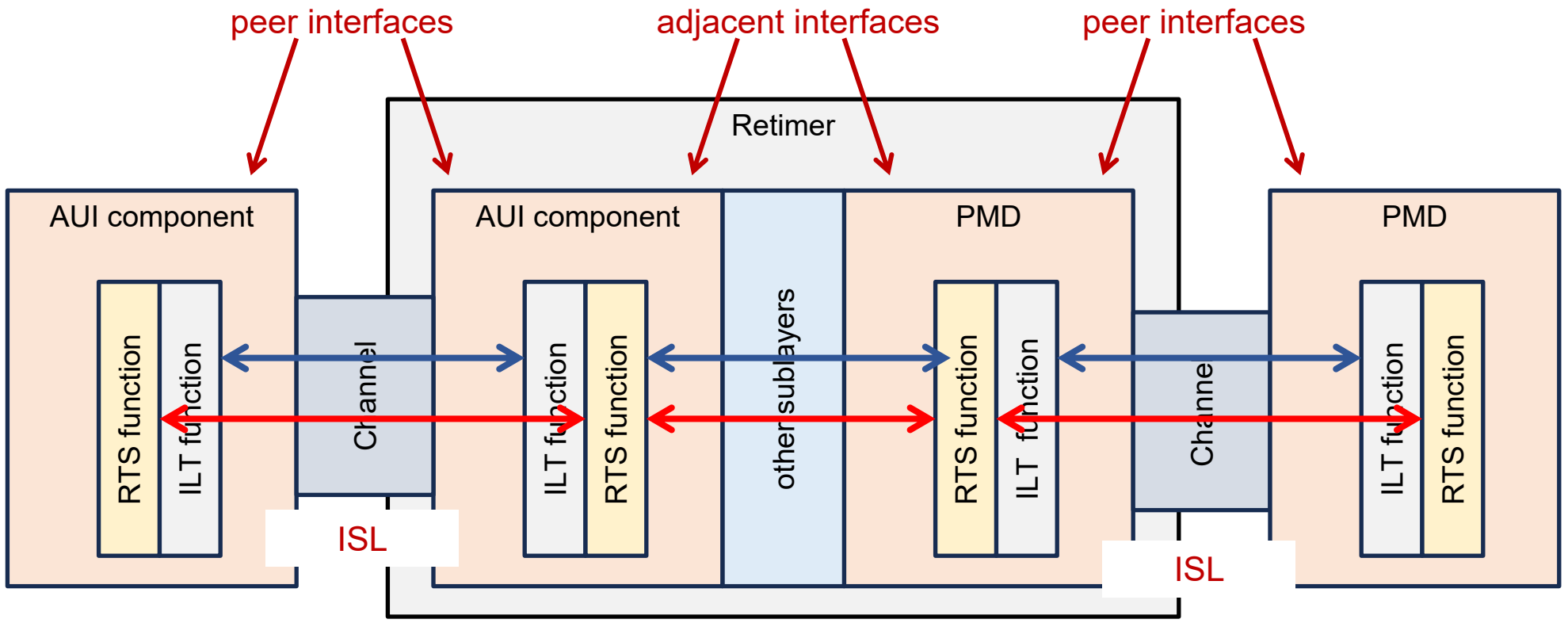
ILT and RTS function definitions

- The Inter-Sublayer Link Training (ILT) Function provides optimization of data signaling and coordinates the transition to data mode on an ISL.
- The Ready to Send (RTS) Function is defined as the controlled transfer of the RTS signal (that is necessary to support the Path Start-Up (PSU) process) across ISLs and sublayers.
- Note: The ILT function defined in Annex 178B includes a means of supporting the RTS function by means of an RTS status bit in the training frame.
- ISLs that are not specified to support ILT/RTS as defined in this standard may include equivalent capabilities however this is beyond the scope of this standard.

ILT and RTS specifications

- PMD types defined in clause 178 through 183 are specified to support the ILT function and the RTS function (as defined on the previous slide).
- The xAUI-n (the AUI component) defined in annexes 176C and 176D are specified to support the ILT function and the RTS function (as defined on the previous slide).
- The PCS (clauses 119, 172, 175), PMA (clauses 120, 173, 176), Inner FEC (clause 177), and DTE/PHY XS (clauses 119, 171) sublayers are specified to support the RTS function via the inter-sublayer service interface SIGNAL_OK parameter.
- Note: The task force has expressed interest in defining support for the RTS function for 800GBASE-LR1, 800GBASE-ER1, and 800GBASE-ER1-20 PHY types but no proposal has been adopted.

Functional separation of RTS and ILT



RTS signaling using ILT training frames.

RTS signaling using service interface parameter SIGNAL_OK.

RTS signaling using ILT training frames.

Path start-up (PSU) concepts

Path start-up (PSU) is the coordinated, orderly initialization of ISLs in a link and transition to data mode of the entire path.

Within the scope of this standard (Draft 2.1)...

- A path supports PSU if the physical layer at each end supports path start-up.
- A Physical Layer supports PSU if the PHY and xMII Extender (if included) both support path start-up.
- An xMII Extender supports PSU if every ISL and sublayer within it is specified to support RTS (and ILT if defined for the AUI/PMD).
- A PHY supports PSU if every ISL and sublayer within it is specified to support RTS (and ILT if defined for the AUI/PMD).
- An AUI component or PMD supports PSU if it supports ILT and RTS.

ILT function and RTS function specification allocation

178B.4, 178B.5, and 178B.7 include all specifications for both ILT function and RTS function (inter-mixed throughout).

The RTS function is defined by the following specifications:

(a) the RTS state diagram Figure 178B-6 and related variables, functions, etc.

(b) logic converting the per-lane ILT states to per-interface RTS states

(c) coding and decoding the SIGNAL_OK parameters

(d) formalizing the process within a retimer described in 178B.5.1.1

The ILT function is defined by specifications in those subclauses not listed for the RTS function above.

The path start-up protocol described in 178B.6 is facilitated by the combination of the RTS and ILT functions.

Proposed revisions to Annex 178B

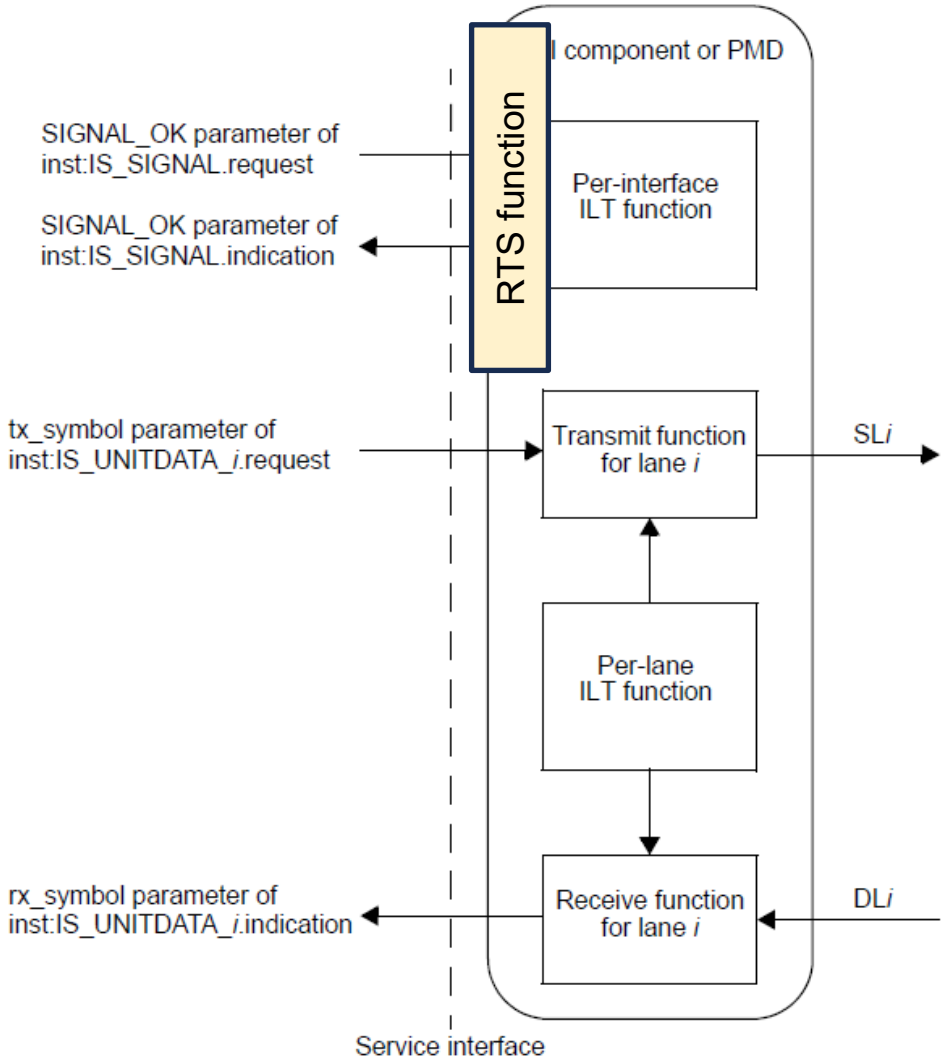
- Change the annex title to: “Path start-up functions for electrical and optical interfaces”
- Revise scope (178B.1), overview (178B.2), and definitions (178B.3) to account for the separation of ILT and RTS functionality as proposed in previous slides.
- Create a subclause tree for each of the following reorganizing specifications according to definitions on previous slides as follows:
  - Inter-sublayer link training (ILT) – new 178B.4
  - Ready to send (RTS) – new 178B.5
  - Retimer – new 178.6
  - Path start-up – new 178B.7 (was 178.6)
- Remove any specifications that define ISL functionality for ISLs that are not already explicitly specified to support RTS/ILT in Draft 2.1. See slide 12.
- Delete the definition of xAUI-n in 178B.3. This term is never used in Annex 178B.
- Update references from PMD clauses (178 through 183) and introduction clauses (116, 169, 174) appropriate, and elsewhere as appropriate.
- Any other consequences changes as appropriate.

Figure 178B-2

Figure 178B-2 would need to be updated to show:

- input SIGNAL_OK parameter is processed by the RTS function
- coordinates transmitter clock and data cutover
- the RTS status bit in the training frame is controlled by the RTS function

Update to the right is an approximate illustration.



SLi = source lane *i*
DLi = destination lane *i*

Figure 178B–2—ILT function in AUI components and PMDs

Thanks