IEEE P802.3cg 10BASE-T1S Relationship of PLCA to the Layered Stack Model

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Purpose

- The purpose of this presentation is to discuss the relationship of PLCA to the IEEE 802.3 layered stack model

Layered Architecture

- IEEE 802.3 adopts a layered architecture
- Each layer provides services to upper layers
- Each layer depends on the services from lower layers
- Services are provided through a defined service interface

- This architecture allows adaptability and innovation by substitution of a layer by one that functions differently (including better), but does not break the service interface contracts

IEEE 802.3 architecture

- IEEE 802.3 claims to “correspond closely” with ISO OSI, highlighting the major difference as splitting of the Data Link Layer into MAC and LLC.

1.1.3 Architectural perspectives

There are two important ways to view network design corresponding to the following:

a) *Architecture.* Emphasizing the logical divisions of the system and how they fit together.
b) *Implementation.* Emphasizing actual components, their packaging, and interconnection.

This standard is organized along architectural lines, emphasizing the large-scale separation of the system into two parts: the Media Access Control (MAC) sublayer of the Data Link Layer and the Physical Layer. These layers are intended to correspond closely to the lowest layers of the ISO/IEC Model for Open Systems Interconnection (see Figure 1–1). (See ISO/IEC 7498-1:1994.[1]) The Logical Link Control (LLC) sublayer and MAC sublayer together encompass the functions intended for the Data Link Layer as defined in the OSI model.

ISO/OSI reference

ISO/IEC 7498-1

Second edition
1994-11-15

Corrected and reprinted
1996-06-15

Information technology — Open Systems Interconnection — Basic Reference Model: The Basic Model

OSI definitions

- The Physical Layer has control over bit-level transmissions

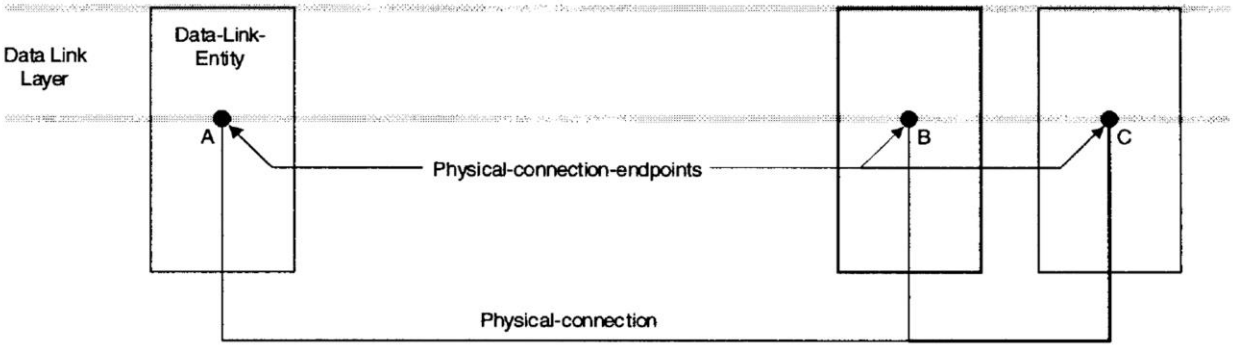
7.7 Physical Layer

7.7.1 Definition

7.7.1.1 data-circuit: A communication path in the physical media for OSI among two or more physical-entities, together with the facilities necessary in the Physical Layer for the transmission of bits on it.

7.7.2 Purpose

The Physical Layer provides the mechanical, electrical, functional and procedural means to activate, maintain, and de-activate physical-connections for bit transmission between data-link-entities. A physical-connection may involve intermediate open systems, each relaying bit transmission within the Physical Layer. Physical Layer entities are interconnected by means of a physical medium.



OSI principle

- A layer may enhance the service it provides to the layer above

5.3.3.1.2 Both the (N)-connection-mode service and the (N)-connectionless-mode service are characterised by the facilities which they offer to, and the quality of service seen by, the (N+1)-entities. For both the (N)-connection-mode service and the (N)-connectionless-mode service, functions may be provided by the (N)-layer to enhance the facilities offered to, and the quality of service seen by the (N+1)-entities over those which are offered to the (N)-layer by the (N–1)-layer and, if necessary, to convert between one mode of service and another.

Interface between layers

- The IEEE 802.3 architectural model defines an interface between the MAC sublayer and the Physical Layer

1.1.4 Layer interfaces

In the architectural model used here, the layers interact by way of well-defined interfaces, providing services as specified in Clause 2 and Clause 6. In general, the interface requirements are as follows:

a) The interface between the MAC sublayer and its client includes facilities for transmitting and receiving frames, and provides per-operation status information for use by higher-layer error recovery procedures.

b) The interface between the MAC sublayer and the Physical Layer includes signals for framing (carrier sense, receive data valid, transmit initiation) and contention resolution (collision detect), facilities for passing a pair of serial bit streams (transmit, receive) between the two layers, and a wait function for timing.

PLS service interface

- The (N-1)-entity Physical Layer provides services to the (N)-entity MAC through the PLS service interface

6. Physical Signaling (PLS) service specifications

6.1 Scope and field of application

This clause specifies the services provided by the PLS sublayer to the MAC sublayer for 1 Mb/s and 10 Mb/s implementations of this standard (see Figure 6–1). The services are described in an abstract way and do not imply any particular implementation.

The PLS_CARRIER, PLS_DATA_VALID, and the PLS_SIGNAL primitives provide information needed by the local MAC sublayer entity to perform the media access functions.

PLS overloading (CRS)

- The PLS_carrier.indication has a precedent of being augmented

22.2.1.3.2 Semantics of the service primitive

PLS_CARRIER.indication (CARRIER_STATUS)

The CARRIER_STATUS parameter can take one of two values: CARRIER_ON or CARRIER_OFF. The values CARRIER_ON and CARRIER_OFF are derived from the MII signal CRS.

For EEE capability, CARRIER_STATUS is overridden

PLS overloading (COL)

- The PLS_SIGNAL.indication has a precedent of being augmented

22.2.1.4.2 Semantics of the service primitive

PLS_SIGNAL.indication (SIGNAL_STATUS)

The SIGNAL_STATUS parameter can take one of two values: SIGNAL_ERROR or NO_SIGNAL_ERROR. SIGNAL_STATUS assumes the value SIGNAL_ERROR when the MII signal COL is asserted, and assumes the value NO_SIGNAL_ERROR when COL is deasserted.

22.2.2.12 COL (collision detected)

COL shall be asserted by the PHY upon detection of a collision on the medium, and shall remain asserted while the collision condition persists.

COL shall be asserted by a PHY that is operating at 10 Mb/s in response to a *signal_quality_error* message from the PMA.

b) The SQE message shall be sent whenever a jabber condition exists, as described in 16.3.6 or 18.3.1.6.

Collision avoidance policy

- The CSMA/CD MAC follows a policy of attempting to avoid collisions
- The Physical Layer service provides interface information in support of this policy
- A Physical Layer enhanced with PLCA improves the quality of this service
  - The MAC defers instead of creating a collision
  - This improves the MAC's ability to implement it's policy

4.1.2.1 Normal operation

In half duplex mode, Transmit Media Access Management attempts to avoid contention with other traffic on the medium by monitoring the carrier sense signal provided by the Physical Layer Signaling (PLS) component and deferring to passing traffic.

Once the collision window has passed, a transmitting station is said to have acquired the medium; subsequent collisions are avoided since all other (properly functioning) stations can be assumed to have noticed the signal and to be deferring to it.

Conclusion

- PLCA augments (enhances) the existing service indications provided by the Physical Layer to the CSMA/CD MAC sub-layer
- This is an improvement in the quality of the service provided by the Physical Layer to the CSMA/CD MAC sub-layer, following OSI principles