IEEE 802.11
Wireless Access Methods and Physical Layer Specifications

TITLE: Text Changes to Draft Standard for Physical Layer Service Primitives

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Abstract

The current draft standard has a service primitive format that supports only an octet oriented data transfer between the MAC and PHY. This paper proposes text that will provide a frame format type of data transfer that is consistent with the DWF MAC and the multiple PHYs specified in the 802.11 Phy working groups. In addition, the format of this document and specification of service primitives is consistent with other ISO approved standards such as 802.3, 802.6 and FDDI.

1.0 Introduction

This submission proposes that the text within this document replace the text titled Physical Layer Service Primitivies in the 802.11 Draft Standard.

2.0 Example List of Primitives of other ISO approved Standards

2.1 PLS Service Primitivies for ISO/IEC 8802.3

peer-to-peer
PLS_DATA.request
PLS_DATA.indicate

sublayer-to-sublayer
PLS_CARRIER.indicate
PLS_SIGNAL.indicate

2.2 Physical Layer Interface Service Specification for ISO/IEC 8802.4

PHY-UNITDATA.request
PHY-UNITDATA.indicate

PHY-MODE.invoke
PHY-NOTIFY.invoke

2.3 Physical Layer Service Definition for 802.6

peer-to-peer
Ph-DATA.request
Ph-DATA.indication

sublayer-to-sublayer
Ph-TIMING-SOURCE.request
Ph-TIMING-MARK.indication
Ph-STATUS.indication

Physical Layer Service Primitives
Section 8

8.1 Introduction

8.1.1 Scope. This section describes the physical layer services provided to the 802.11 Wireless LAN MAC. Different physical layers are defined as part of the 802.11 standard. Each physical layer can consist of two protocol functions as follows:

(1) A physical layer convergence function which adapts the capabilities of the physical medium dependent system into the Physical Layer services. This function is supported by the Physical Layer Convergence Procedure (PLCP) which defines a method of mapping the 802.11 MAC layer Protocol Data Units (MPDU) into a framing format suitable for sending and receiving user data and management information between two or more nodes using the associated physical medium dependent system.

(2) A Physical Medium Dependent (PMD) system whose function defines the characteristics of, and method of transmitting and receiving data via a wireless media between two or more nodes.

Each physical medium dependent sublayer of a physical layer may require the definition of a unique PLCP. If the PMD sublayer already provides the defined Physical Layer services, the physical layer convergence function might be null.

8.1.2 Physical Layer Functions. The 802.11 physical layer architecture is shown in Figure 8-1. The physical layer contains three functional entities: the physical medium dependent function, the physical layer convergence function, and the physical layer management function. Each of these functions is described in detail in the following subsections.

The Physical Layer service is provided to the Media Access Control entity at the node through a Service Access Point (SAP) as shown in Figure 8-1 called the PHY_SAP. A set of primitives may also be defined to describe the interface between the physical layer convergence procedure sublayer and the physical medium dependent sublayer called the PMD_SAP.

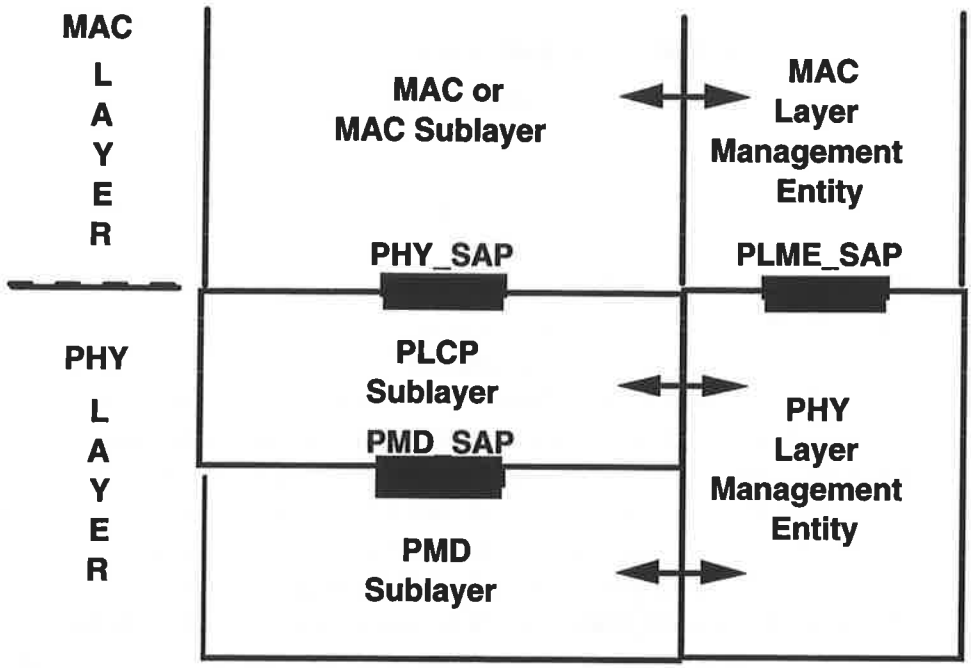

Figure 8-1 Protocol Reference Model

8.1.2.1 Physical Layer Convergence Procedure Sublayer. In order to allow the 802.11 MAC to operate with minimum dependence on the PMD sublayer, a physical layer convergence sublayer is defined. This function simplifies the physical layer service interface to the 802.11 MAC.

8.1.2.2 Physical Layer Management Entity (LME). The Physical LME performs management of the local Physical Layer Functions in conjunction with the MAC Management entity.

8.1.2.3 Physical Medium Dependent Sublayer. The physical medium dependent sublayer provides a transmission interface used to send or receive data between two or more nodes.

8.1.3 Service Specification Method and Notation. The models represented by state diagrams are intended as the primary specifications of the functions provided. It is important to distinguish, however, between a model and a real implementation. The models are optimized for simplicity and clarity of presentation, while any realistic implementation may place heavier emphasis on efficiency and suitability to a particular implementation technology.

The service of a layer or sublayer is the set of capabilities that it offers to a user in the next higher layer (or sublayer). Abstract services are specified here by describing the service primitives and parameters that characterize each service. This definition of service is independent of any particular implementation.

8.2. Physical Layer Service Specifications.

8.2.1 Scope and Field of Application. This section specifies the services provided by the Physical Layer to the 802.11 MAC. These services are describe in an abstract way and do not imply any particular implementation or exposed interface.

8.2.2 Overview of the Service. The Physical Layer function as shown in figure 8-1 is separated into to sublayers: the PLCP sublayer and the PMD sublayer. The function of the PLCP sublayer is to provide a mechanism for transferring MAC Protocol Data Units (MPDU) between two or more nodes over the PMD sublayer. This is accomplished by PLCP in the transmit direction by converting MPDUs into PLCP Protocol Data Units (PLCP_PDU). The formation of the PLCP_PDU is covered in each of the Phyiscal Layer PMD specific sections. In the receive direction, the PLCP is responsible for converting PLCP_PDUs back into MPDUs. The PLCP is also responsible for adding a Preamble to the PLCP_PDU at the transmitting node which is used by the receiving nodes for recovering the PLCP_PDU. All state machines required to control the sending or receiving of data via the PMD are also included in the PLCP.

8.2.3 Overview of Interactions. The primitives associated with the 802.11 MAC Sublayer to the Physical Layer fall into two basic categories:

(1) Service primitives that support MAC peer-to-peer interactions

(2) Service primitives that have local significance and support sublayer-to-sublayer interactions.

8.3 Basic Service and Options. The architecture of the 802.11 MAC is intended to be physical layer independent. Some physical layer implementations require medium management state machines running in the media access sublayer in order to meet certain PMD requirements. These physical layer dependent MAC state machines reside in a sublayer define as the MAC Management Entity (MME). The MAC MME in certain PMD implementations may need to interact with the Physical Layer ME as part of the normal PHY_SAP primitives. These interactions are defined by the Physical Layer Management Entity parameter list (PLME_parlist). The list of these parameters and the values they may represent are defined in the specific physical layer specifications for each PMD.

All of the service primitives described in this section are considered mandatory unless otherwise specified.

8.3.1 PHY_SAP Peer-to-Peer Service Primitives. The following table (table 8-1) indicates the primitives for peer-to-peer interactions.

Primitive	Request	Indicate	Confirm	Response
PHY_DATA	X	X		

Table 8-1. PHY_SAP Peer-to-Peer Service Primitives

8.3.2 PHY_SAP Sublayer-to-Sublayer Service Primitives. The following table indicates the primitives for sublayer-to-sublayer interactions.

Primitive	Request	Indicate	Confirm	Response
PHY_TXBUSY		X		
PHY_RXBUSY		X		
PHY_CS		X		

Table 8-2. PHY_SAP Sublayer-to-Sublayer Service Primitives

8.3.3 PHY_SAP Service Primitives Parameters. The following table shows the parameters used by one or more of the PMD_SAP Service Primitives.

Parameter	Associate Primitive	Value
LENGTH	PHY_DATA.request PHY_DATA.indicate	integer 0-max_length (see PHY specific
TXDATA	PHY_DATA.request	list of 0-max_length octets
RXDATA	PHY_DATA.indicate	list of 0-max_length octets
STATUS	PHY_TXBUSY.indicate PHY_RXBUSY.indicate PHY_CS.indicate	BUSY, IDLE
ERROR	PHY_DATA.indicate	Header_Violation Format_Violation No_Error Carrier_Lost
PLME_parlist	PHY_DATA.request PHY_DATA.indicate	PHY LME parameters see specific PHY

Table 8-3. PHY_SAP Service Primitive Parameters

8.4 PHY_SAP Detailed Service Specification. The following section describes the services provided by each PHY sublayer primitive.

8.4.1 PHY_DATA.request

8.4.1.1 Function. This primitive defines the transfer of data from the MAC sublayer to the local PHY entity.

8.4.1.2 Semantics of the Service Primitive. The primitive shall provide the following parameters:

PHY_DATA.request (LENGTH,TXDATA,PLME_parlist)

The LENGTH parameter is an integer value of 0 to max_length as specified in the PHY specific MIB. This parameter represents the number of octets in the MPDU being passed from the MAC sublayer to the local PHY entity. The TXDATA parameter is a list of octets which represent the MPDU the MAC is requesting to transmit. This list consists of 0-max_length octets as specified by the LENGTH parameter.

PLME_parlist (optional) This is an optional Physical Layer Management Entity parameter list specified in the Physical Layer Specifications for a specific PHY/PMD implementation.

8.4.1.3 When Generated. This primitive is generated by the MAC sublayer to request the transmission of an MPDU.

8.4.1.4 Effect of Receipt. The receipt of this primitive by the PHY entity will cause the PLCP transmit state machine within the PHY layer to begin the process of data transmission.

8.4.2 PHY_DATA.indicate

8.4.2.1 Function. This primitive indicates to the local MAC entity that the PHY sublayer has completed or terminated receiving an MPDU. In addition, this primitive also defines the transfer of data from the PHY sublayer to the local Mac entity.

8.4.2.2 Semantics of the Service Primitive. The primitive shall provide the following parameters:

PHY_DATA.indicate (LENGTH,RXDATA,RXERROR,PLME_parlist)

The LENGTH parameter is an integer value of 0 to max_length as specified in the PHY specific MIB. This parameter represents the number of octets in the MPDU being passed from the PHY sublayer to the local MAC entity. The LENGTH parameter will be 0 if the RXERROR parameter is any value other than No_Error. The RXDATA parameter is a list of octets which represent the MPDU the PHY sublayer received and is transferring to the MAC entity. This list consists of 0-max_length octets as specified by the LENGTH parameter. The RXERROR parameter can be one or more of the following values: Header_Violation, Format_Violation, Carrier_Lost, or No_Error. A number of error conditions may occur after the PLCP's receive state machine has detected what it thought may be a valid PLCP Header and issued an PHY_RXBUSY.indicate(BUSY). The following describes the parameter returned for each of those error conditions.

Header_Violation. This value is returned whenever an error occurs in the PLCP header. One error instance is that the Length Field in the PLCP_PDU header is not within the boundary of possible lengths. Another error condition which will return this value is the failure of the HEC field.

Format_Violation. This value is used to indicate that the format of the PLCP_PDU was in error.

Carrier_Lost. This value is used to indicate that during the reception of the current PLCP_PDU, the medium carrier was lost for more than 32 bit times. Data bit burst errors exceeding 32 bits in length may not be detect by CRC32. This indication should be used to invalidate the PLCP_PDU.

No_Error. This value is used to indicate that no error occurred during the receive process in the PLCP.

PLME_parlist (optional) This is an optional Physical Layer Management Entity parameter list specified in the Physical Layer Specifications for a specific PHY/PMD implementation.

8.4.2.3 When Generated. The PHY_DATA.indicate is generated by all receiving PHY sublayers to the local MAC entities in the network after a PHY_DATA.request is issued.

8.4.2.4 Effect of Receipt. The effect of receipt of this primitive by the MAC is unspecified.

8.4.3 PHY_TXBUSY.indicate

8.4.3.1 Function. This primitive is an indication by the PHY sublayer to the local Mac entity that the transmission of a MPDU has been started or completed by the PHY PLCP entity.

8.4.3.2 Semantics of the Service Primitive. The primitive shall provide the following parameters:

PHY_TXBUSY.indicate (STATUS)

The STATUS parameter can be one of two values: IDLE or BUSY. The value is IDLE whenever the PLCP's transmit state machine is not transmitting. The BUSY value indicates that the PLCP's transmit state machine is currently running.

8.4~~2~~.5.3.3 When Generated. This primitive is issued by the PHY sublayer to the MAC entity

whenever the PLCP's transmit state machine starts or ends a transmit cycle. A BUSY indication can be used by the MAC entity to confirm the reception of a PHY_DATA.request by the PHY sublayer and as an indication that the transmission of the MPDU has begun. An IDLE indication can be used by the MAC entity to determine when the transmission of the MPDU has been completed and as an indication when to start the Inter Frame Space timers.
8.4.3.4 Effect of Receipt. The effect of receipt of this primitive by the MAC is unspecified.

8.4.4 PHY_RXBUSY.indicate
8.4.4.1 Function. This primitive is an indication by the PHY sublayer to the local MAC entity that the reception of an MPDU has been started or completed by the PHY PLCP entity.
8.4.4.2 Semantics of the Service Primitive. The primitive shall provide the following parameters:

PHY_RXBUSY.indicate (STATUS)

The STATUS parameter can be one of two values: IDLE or BUSY. The value is IDLE whenever the PLCP's receive state machine is not running. The BUSY value indicates that the PLCP's receive state machine is currently receiving a MPDU.
8.4.4.3 When Generated. This primitive is issued by the PHY sublayer to the MAC entity whenever the PLCP's receive state machine starts or ends a receive cycle. A BUSY indication is issued by the PHY sublayer to the local MAC entity whenever the PHY PLCP identifies, synchronizes, and detects a valid PLCP_PDU header. An IDLE parameter is issued whenever the PLCP's receive state machine stops receiving due to the reception of a valid MPDU or an error .
8.4.4.4 Effect of Receipt. The effect of receipt of this primitive by the MAC is unspecified.

8.4.5 PHY_CS.indicate
8.4.5.1 Function. This primitive is an indication by the PHY sublayer to the MAC entity the the current state of the medium.
8.4.5.2 Semantics of the Service Primitive. The primitive shall provide the following parameters:

PHY_CS.indicate (STATE)

The STATE parameter can be one of two values: BUSY, IDLE. The parameter value will be BUSY if the channel assessment by the PHY sublayer results in the medium not being available. If the channel assessment by the PHY sublayer determines that the channel is available, the value of the parameter is IDLE.
8.4.5.3 When Generated. This primitive is generated every time the status of the channel changes from channel clear to carrier present or from carrier present to channel clear. This may include the period of time when the PHY sublayer is receiving or transmitting data.
8.4.5.4 Effect of Receipt. The effect of receipt of this primitive by the MAC is unspecified.