PROJECT 802 - LOCAL & METROPOLITAN AREA NETWORKS

Wireless LAN Medium Access Control (MAC)
and
Physical Layer (PHY) Specifications

Prepared by:
The Editors of IEEE 802.11

Abstract: (The abstract will be prepared by IEEE staff.)

Keywords:

Note: This is an internal working document of the IEEE 802.11 Working Group on Wireless Medium Access Control and Physical Layer. As such, it is not a standard and may be changed as a result of further work by IEEE 802.11.

Foreword

(This foreword is not part of the Proposed Standard P802.11, Wireless MAC and PHY)

This standard is part of a family of standards for Local Area Networks (LANS)...............

The following are now or have been voting members of the Wireless Medium Access Control and Physical Layer Working Group (P802.11). Those individuals who have served as editors are indicated by an asterisk next to their name:

Chair's Name, *Chair*

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Major Changes since: January 1993 (P802.11-92/140)

* Section I:
    - Front page - Copyright statement

* Section 1
- 1.1 Purpose - Issues 4.1, 4.2, 16.8 and 6.5.(ad-hoc, infrastructure, mobility, security/privacy/authentication). - 1.2 Definitions - Ad-hoc (Issue 4.3), Association (93/9), Authentication (93/9), Dissociation (93/9), Infrastructure (Issue 12.2-B), Integration (93/9), Privacy (93/9) and Re-association (93/9).

* Section 2
- Move sections within Section around
- 2.1 Mobility (Transition) - Issue 16.8
- 2.2 Infrastructure Network - Issues 5.3-A and 12.2-B

* Section 9
    - 9.1 Overview of Layer Management Functions - Issue 13.1.

Major Changes since: March 1993 (P802.11-93/20)

* Section 1
- 1.1 Purpose - Added scope and purpose of the standard based on the IEEE 802.11 PAR.

- 1.1 Purpose - added 2 functions supported by the standard:
    - Asynchronous and Time-bounded services, and
    - support of the coexistence of multiple overlapping networks (Issue 4.4)

* Section 2
    - section 2.2 - Infrastructure Network
        - 1st paragraph, added functions included in the infrastructure.
        - Added sentence to the 2nd paragraph (last sentence).
        - Added last paragraph - distribution system procedure performed at the MAC layer - Issue 5.4

(Editor's note: This section is based on Doc.:P802.11-92/4 and input from L. Van Der Jagt)

Contents

Wireless Medium Access Control and Physical Layer Specification

1. General

1.1 Purpose

The original Project Authorization Request (PAR) defines the scope of the IEEE 802.11 work as follows:

- To develop a medium access control (MAC) and Physical Layer (PHY) specification for wireless connectivity for fixed, portable and moving stations within a local area.

The PAR further defines the purpose as follows:

- To provide wireless connectivity to automatic machinery, equipment or, stations that require rapid deployment, which may be portable, or hand-held or which may be mounted on moving vehicles within a local area.

- To offer a standard for use by regulatory bodies to standardize access to one or more frequency bands for the purpose of local area communication.

Specifically the 802.11 standard:

- (Editor's note: Issues 4.1, 4.2 and 16.8) describes the functions and services required by an 802.11 compliant device to operate within an ad-hoc and infrastructure networks as well as the aspects of station mobility (transition) within those networks.

- describes the medium access control (MAC) procedures to support the asynchronous and time-bounded MAC service data unit (MSDU) delivery services.

- (Editor's note: Issue 4.4) supports the operation of an 802.11 compliant device within a wireless LAN which may coexist with multiple overlapping wireless LANs.

- (Editor's note: Issue 6.5) describes the requirement and service to provide security, privacy and authentication of 802.11 compliant devices.

1.2 Definitions

(Editor's note: Extracted from P802.11-92/57 doc., otherwise indicated in each definition))
access point (AP). Any entity that has station functionality and provides access to the distribution system.

ad-hoc network. (Editor's note: Issue 4.3) An ad-hoc network is a network created for a specific purpose, typically in a spontaneous manner. The principal characteristic of an ad-hoc network is that the act of creating and dissolving the network is sufficiently straightforward and convenient so as to be achievable by non-technical users of the network facilities (i.e. no specialized 'technical skills' are required with little

and/or no investment of time or additional resources required beyond the stations which are to participate in the (ad-hoc) network.

association. (Editor's note: P802.11-93/9) The service which enables the establishment of an initial association between a STA and an AP.

authentication. ~~A higher layer process by which one station convinces other stations of its 'identity'.~~ (Editor's note: P802.11-93/9) The service used to establish the identity of stations and APs to each other.

basic service area (BSA). The area within which members of a basic service set can communicate.

basic service set (BSS). A set of stations controlled by a single coordination function.

channel. (Editor's note - From work done by the PHY Group in 07/92) - An instance of medium use for the purpose of passing packet data units that can coexist with other instances of medium use.

Example	single channel	n-channel
	1 narrowband channel	FDM channels
	DSS with 1 code	DSSS with CDMA

coordination function (CF). That logical function which determines when a station operating within a basic service set transmits and received via the wireless medium.

disassociation. (Editor's note: P802.11-93/9) The service which removes an existing association.

distributed coordination function (DCF). A class of possible coordination functions where the same coordination function logic is active in every station at any given time.

distribution system (DS). A system used to interconnect a set of basic service sets to create an extended service set.

distribution system medium (DSM). The medium used by a distribution system (for basic service set interconnections).

distribution system services (DSS). The set of services provided by the distribution system which enable the MAC to transport MAC service data units between basic service sets within an extended service set.

extended service area (ESA). The area within which members of an extended service set can communicate. An extended service area is larger or equal to a basic service area.

extended service set (ESS). A set of interconnected basic service sets which appear as a single basic service set to the logical link control (LLC).

infrastructure. (Editor's note: Issue 12.2-B) The infrastructure includes distribution system (DS), access points (APs) and portals functions. An infrastructure contains one or more APs and zero or more portals in addition to a distribution system. Within the infrastructure there are two exposed interfaces:
        a) between STAs and APs; and
        b) between APs and DS.
Additionally, DS services are provided between pairs of 802.11 MACs.

integration. (Editor's note: P802.11-93/9) The service which enables delivery of MSDUs between the DS and an existing network.

MAC service data unit (MSDU). The MAC service data unit is information that is delivered as a unit between MAC service access points.

point coordination function (PCF). A class of possible coordination functions where the coordination function logic is active in only one station at any given time.

privacy. (Editor's note: P802.11-93/9) The functionality used to prevent the contents of messages from being read by other intended recipient.

re-association. (Editor's note: P802.11-93/9) The service which enables an established association (of a station) to be transferred from an AP to another AP.

registration. A process by which a station gets its 'identity' (address signature, certificates, etc.).

sign-on. The process by which one station identifies (and possibly authenticates) itself, and exchanges operational parameters in order to participate in a basic service set.

station (STA). Any device which contains an 802.11 conformant MAC and PHY interface to the wireless medium.

wireless medium (WM). The medium used to implement a wireless LAN.

1.3 Abbreviations

AP	=	access point
BSA	=	basic service area
BSS	=	basic service set
CF	=	coordination function
DCE	=	data communication equipment
DCF	=	distributed coordination function
DS	=	distribution system
DSM	=	distribution system medium
DSS	=	distribution system services
DTE	=	data terminal equipment
ESA	=	extended service area
ESS	=	extended service set
LLC	=	logical link control
MAC	=	medium access control
MSDU	=	MAC service data unit
PAR	=	project authorization request
PCF	=	point coordination function
PHY	=	physical layer
SAP	=	service access point
STA	=	station
WAN	=	wide area network
WM	=	wireless medium

1.4 References

[1] ISO 7498:1984, Information Processing Systems - Open Systems Interconnection - Basic Reference Model

1.5 Conformance Requirements

1.6 Conventions

Options. While the need for options within a standard is recognized, only the absolute minimum number of options should be specified. (editor's note: Issue 1.4)

2. General Description

2.1 Mobility (Transition)

(Editor's note: Issue 16.8)
There are three transition types of significance to 802.11 standard to describe the mobility of stations within a network:

1) *No-transition:* In this type, two-subclasses that are logically indistinguishable, are identified:
   I) Static - no motion
   II) Local movement - movement within PHY range of station and access point (e.g. movement within a basic service set).

2) *BSS-transition:* This type is defined as a station movement from one BSS in one ESS to another BSS within one ESS. The function supporting this transition is called 'Re-association'.

3) *ESS-transition:* This type is defined as a station movement from a BSS in one ESS to a BSS in another ESS. This case is supported only in the sense that the station can move. Maintenance of upper layer connections support by 802.11 cannot be guaranteed, in fact disruption of the service is most likely to occur.

2.2 Infrastructure Network

(Editor's note: Issue 5.3-A)
The infrastructure allows communication via a distribution system which enables the transport of MAC service data units (MSDUs) within an extended service set. The infrastructure includes the distribution system, access point(s) and portal functions. The infrastructure services required are:

- Association - the creation of a station-to-access point affiliation.
- Re-association - the station-to-access point transfer of affiliation.
- Dissociation - the dissolution of the affiliation.
- Authentication - the verification of identity.
- Privacy - the prevention of access to the 'payload' by other than the intended recipient of MSDUs.
- Integration - the ability to connect to existing networks.
- Network management - the usual functions associated with management of network.

(Editor's note: Issue 12.2-B) The interfaces of the infrastructure shall be exposed. Within an infrastructure two interfaces are identified:
   a) between station and access points (STA/AP); and
   b) between access points and the distribution system (AP/DS).
Additionally, distribution system services are provided between pairs of 802.11 MAC entities.

2.2.1 Distribution System Services

(editor's note: Issue 5.1)
As stated in the 'Definition' section (1.2) of this document, a distribution system is used to interconnect a set of basic service sets (BSS) to create an extended service set (ESS). The 'interconnection' between basic service sets may be provided by existing installed networks (e.g. LAN, WAN). Therefore, the internal functions of the distribution system (DS) shall not be specified; only the services that a distribution system provides to the WLAN are defined.
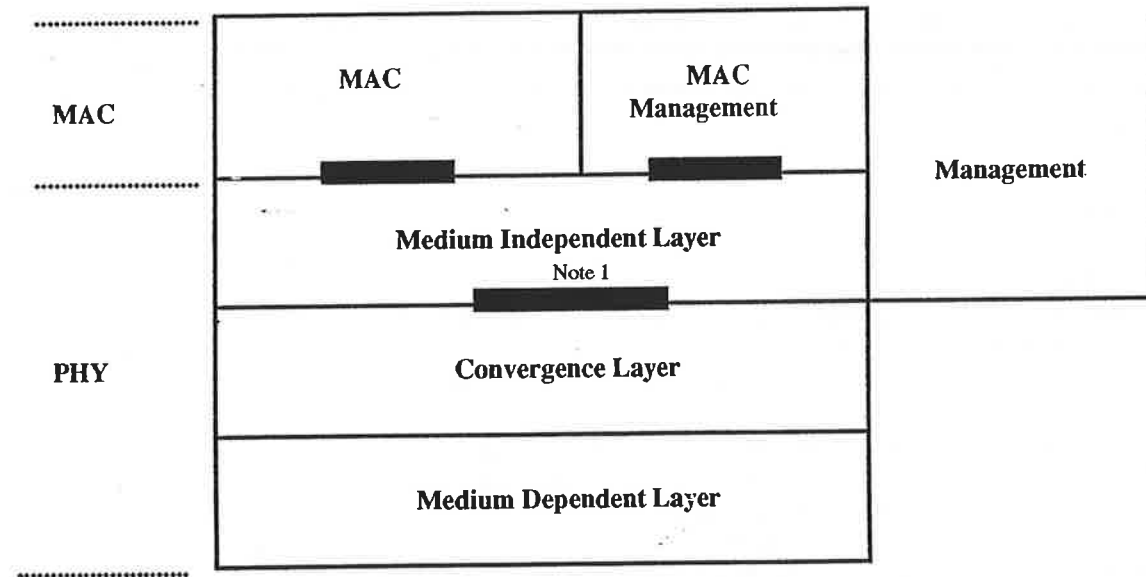
(editor's note: Issue 5.4)
The interface to the distribution system procedures are performed at the MAC layer level.

2.3 Reference Model

(editor's note: added as header for the model)
The standard presents the architectural view, emphasizing the separation of the system into two major parts: the MAC of the data link layer and the PHY. These layers are intended to correspond closely to the lowest layers of the ISO Basic Reference Model of OSI (ISO 7498 [1]).

(Editor's note: Model approved as the 'starting point' for further work - 07/92)

MAC	**MAC**	**MAC Management**	
	Medium Independent Layer Note 1		**Management**
PHY	**Convergence Layer**		
	Medium Dependent Layer		

Note 1 - Optional exposed DTE/DCE interface

General Overview of the 802.11 MAC and PHY Layers