

IEEE 802.11
Wireless Access Method and Physical Layer Specifications

Title: Wireless LAN Station Management Services

Steve Chen
Toshiba America Information Systems. Inc.
2 Musick
Irvine, CA 92713-9724
Tel: (714) 583-3273
Fax: (714) 583-3893
Email: stevec@tais.com

Issues Addressed: IEEE P802.11

- Issue # 12.1 What is the MAC/PHY interface?
 - Issue # 13.2 What is the architecture of the network management services?
 - Issue # 13.4 Is MAC/PHY exchange needed to supply network management function?
 - Issue # 13.5 What is the relationship between MAC, PHY and network management?
 - Issue # ???.? Is frequency selection of Frequency Hopping a MAC or PHY function?
-

Abstract

This paper provides inputs to the development of the MAC/PHY/Management Services interface model. At the July meeting in Minneapolis, we concluded a starting interface model between the MAC, PHY and Management Services logical modules. Based on that starting model, a Station Management model is presented in this paper. The Station Management services and structure are also described herein. It is hoped that this contribution will be helpful in our systematic decomposition process of standards development.

1. Introduction

At the July meeting in Minneapolis, we concluded a starting interface model between the MAC, PHY and Management Services logical modules. I believe the management functions will play a key role in the Wireless LAN station architecture we are about to define. The way in which we define the management functions will have great impact on the architecture and implementation complexity of the MAC and PHY. Based on the starting model, this paper presents a Station Management model for consideration. Also the pertinent management services, and structure are described in the following sections.

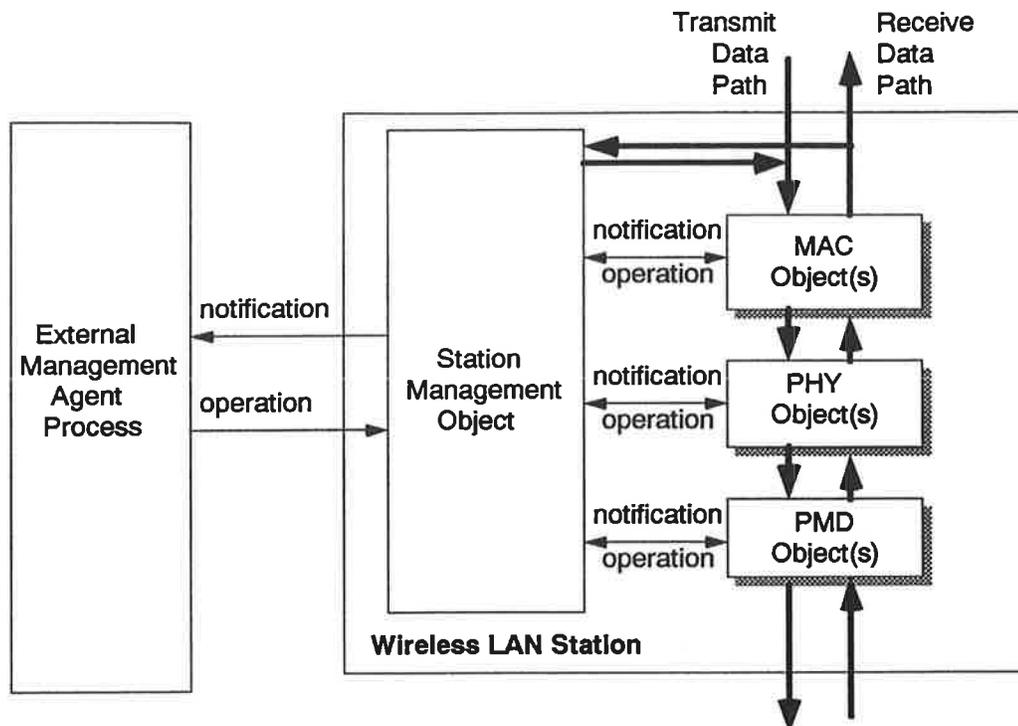
2. Station Management Model

Management services are provided by various entities within a Wireless LAN station. Station Management is proposed as an entity that provides majority of management services and control to other entities, like MAC or PHY, within a Wireless LAN station. I call it "Station Management" because in the P802.11 functional requirements document we define **station** as "the device which contains an 802.11 conformant MAC and PHY interface to the wireless medium". Station Management also receives a set of services from other entities within a Wireless LAN station.

I think there are three basic functional requirements for the Station Management model:

- Follow IEEE 802 Standard architecture and reference model (LAN&MAN/RM).
- Fulfill IEEE 802.11 functional requirements.
- Be consistent with the object oriented approach taken by OSI Management Standard.

The following diagram depicts the Station Management model. It shows the relationship between managed objects within a wireless LAN station.



Station Management Model

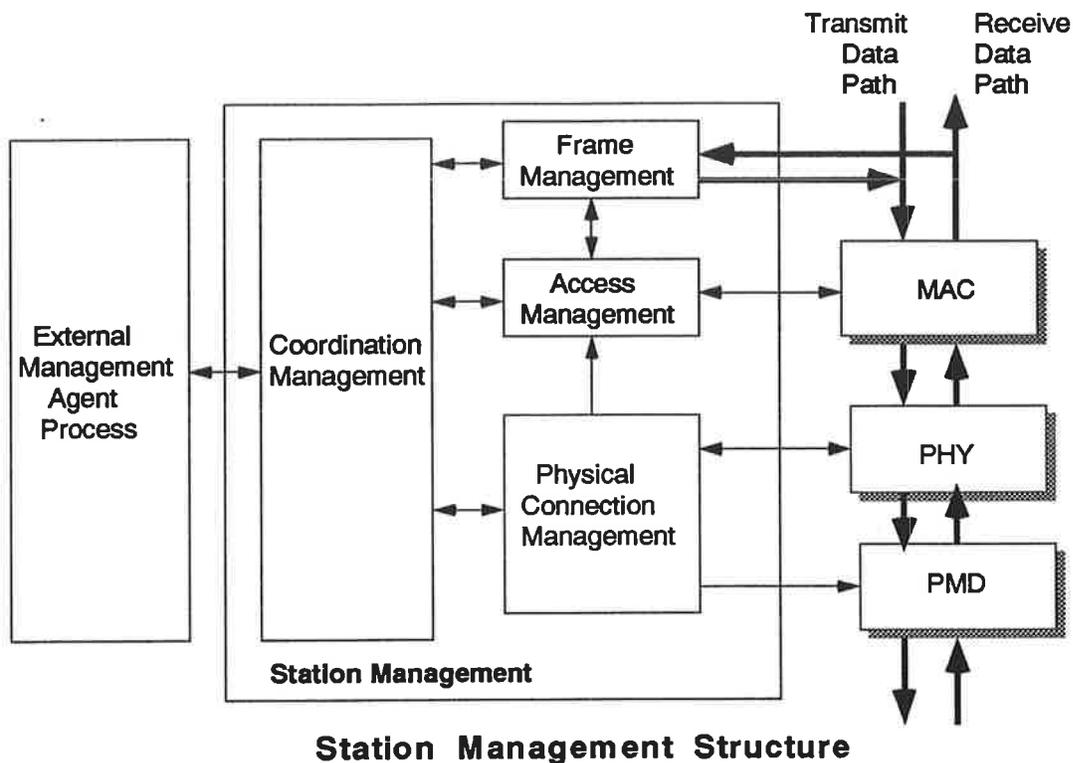
The Station Management object models the management information for a Wireless LAN station. The MAC management object models the management information required for the MAC entity within a station. The PHY and PMD managed objects model the management information required by the PHY and PMD entities respectively. The management of these management objects is done through Notifications and Operations. The notifications are unsolicited reports generated by a managed object. Operations are functions performed by a Management Agent. Get and Put are the two types of operation.

Please note, in the model, there is a data path between the MAC and Station Management Object. This means a frame-based protocol is suggested. Within the header of a MAC frame, a field (for example, frame type field) value can be used to identify the frame as a Station Management frame.

3. Station Management Structure

Station Management provides the control necessary at the station level to manage processes underway such that the station can work cooperatively in a Wireless LAN. It provides management services such as physical connection management (e.g. frequency synchronization), configuration management, a communication protocol for external authority or process, and collection of statistics. Based on the above model, the basic structure of Station Management is described in terms of component functions. The components are: Frame Management, Access

Management, Physical Connection Management, and Coordination Management. The following diagram depicts the relationship between components of Station Management. The relationship between each component and the MAC, PHY, PMD, and external Management Agent is also depicted in the diagram.



3.1 Frame Management

Frame Management provides the services for processing and control of Station Management frames. Station Management frames are different from regular MAC data frames. A field in the header of general MAC frame format identifies a Station Management frame. A Station Management frame is the mechanism that is used for peer to peer or layer to layer management. A specific protocol can be used to manage stations in a Wireless LAN on a peer to peer basis. The MAC entity identifies Station Management frames, indicates them to Frame Management component for further processing.

3.2 Access Management

This component function is to be defined. I think Access Management shall monitor MAC operations and take actions necessary to aid in achieving and maintaining an operational medium access. It really depends on the Wireless LAN topology and medium access method. Access

Management receives status information from the MAC and Physical Connection Management and reports the status of the MAC. Committee members are welcomed to provide their inputs to the completion of this section.

3.3 Physical Connection Management

Physical Connection Management provides management services to the configuration and operation of PHY and PMD. It receives status information from PHY, provides direct control to PMD(if necessary) and reports the status of PHY.

We have an outstanding issue about where to put the "frequency selection" function of a frequency hopping spread spectrum system. Should the selection function be in the MAC or PHY ? Physical Connection Management can help in addressing this issue. I think this issue is a typical example of why we need to consider having more functions in the Station Management. If the MAC provides the "frequency selection" function, we will add unnecessary complexity to the MAC state machine. Also it would be difficult to come up with a generic MAC to support more than one type of PHY. Future enhancement and update could also be a problem. If the PHY provides this "frequency selection" function, it will have to be able to recognize incoming control frames for frequency synchronization purposes. This means the PHY has to provide functions for address recognition, verification of frame check sequences, etc., which are typical IEEE 802 MAC functions. I believe the duplication of these functions in both of the MAC and PHY is very undesirable. Therefore, I suggest we leave this "frequency selection" function in the Physical Connection Management.

The physical layer "frequency synchronization" frame can be defined as one of the Station Management frames. Once a synchronization frame is received, it will be indicated to Frame Management by the MAC entity. Frame Management then notifies the Physical Connection Management entity, through Access Management, to perform necessary frequency control and selection functions.

In the P802.11 functional requirements document, it is specified that a single 802.11 MAC will be used to support multiple PHYs and a single MAC/PHY interface will be defined. Based on this requirement, I firmly believe any PHY control function, which is **essential and unique** to a particular type of PHY, shall be defined as a function of Station Management.

3.4 Coordination Management

The Coordination Management function coordinates the operation between the Frame Management, Access Management, and Physical Connection Management components of Station Management. It receives MAC/PHY status information from other management components, and provides management information to local and remote external Management

Agents. The local Management Agent gathers information that may be used by higher level management functions within the same station. A remote Management Agent resides on a different station in a Wireless LAN. A frame-based request/response management protocol is required for a remote Management Agent to gather management information from Coordination Management.

4. Conclusion and Suggestion

A basic Station Management model and its structure are presented in this contribution. Also the services of Station Management are described. My intention is to provide this as a basis for further discussion by committee members. It is also suggested that we define the approach and architecture for management services as soon as possible in this early stage of standards development. The object oriented Management Information Base(MIB) approach is not further discussed in this paper. Nonetheless, I believe the MIB approach should be at least consistent with OSI Management Standards. It is hoped that this contribution will be helpful in our systematic decomposition process of standards development.

5. References

1. IEEE P802.11 Issues Document. Doc #: IEEE P802.11-92/64
2. IEEE P802.11 MAC/PHY/Management Service Interfaces. Doc #: IEEE P802.11-92/69.
3. IEEE P802.11 Functional Requirements. Doc #: IEEE P802.11-92/57.
4. American National Standards, FDDI Station Management (SMT), ANSI X3T9/92-037.