IEEE P802.11
Wireless Access Method and Physical Layer Specification

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TITLE: **DESCRIPTION OF MANAGEMENT FUNCTIONS**

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SUMMARY

The definition of management is started as a text description of the anticipated functions. The result is converted to definitions of the information that must pass through the 802.11 Station air-interface. This work is approached with global definitions which are then immediately edited by location of points of origin and use.

A further step (not undertaken) is describing these functions in the appropriate language for use in the standard.

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MAJOR MANAGEMENT FUNCTIONS

A listing of proposed management functions is as follows:

1) **Usage Accounting (no effect on 802.11 air-interface)**

Log--per User Usage Accounting in accumulated air-time/bytes-transferred usage and per time-band for each access type, for each type of shared facilities, and for each destination class

2) **Station Configuration Management**
   - a) Address LAN and E.164 Directory
   - b) Station Equipping Level Directory (e.g isochronous service and LAN rate availability, power source, mobility class)
   - c) Directory Update and Modification--Move, add, delete
   - d) Station Configuration Change
   - e) Log--Configuration Changes
   - f) Report--Current Status of Directories and Configuration

3) **Traffic Level and Performance Monitoring**
   - a) Report--Capacity Utilization
   - b) Report--Traffic Origin and Destination Analysis
   - c) Report--Overload, Delay or Congestion Occurrences
   - d) Report--Excess Error Rate, Lost Packets
   - e) Report--Shared Equipment Usage
   - f) Log--Abnormal Conditions

4) **Fault Management**
   - a) Routine Testing and Fault Detection/Reporting
   - b) Spontaneous Fault Identification and Remote Testing
   - c) Malfunction Correction by Reconfiguration
   - d) Power Source Transfer
   - e) Log--Fault Reports and Corrective Actions

The responsibility of the Standard is to provide at least a transmission provision for the management information and control that is necessary. It is highly desirable to design the format and conditions of use for the essential management functions, particularly those associated with recovery from mal-functions of Stations, so that these will be consistent with different suppliers of infra-structure and Station equipment.

A further challenge is in rigorously defining these functions in ISO acceptable format.

USAGE ACCOUNTING

Usage Accounting can be performed centrally. All of the usage of ISDN services will flow through a common point with a small number of D-channel processors. P-channel traffic will flow through or be visible to the Hub Controller.

Accordingly, the 802.11 air-interface is not affected by the need for usage accounting.

THE MANAGEMENT COMMUNICATION CHANNEL

It is recommended that a management communication channel be provided for those management services which must pass through the 802.11 air-interface. Further detail on each of the below-mentioned functions is given in later sections. The management function is better served by using regular packet messages addressed to/from a management entity in the Hub Controller.

Since the system is essentially a single channel, the dedication of time space is only possible with a "scheduling" function in the Hub Controller. Routine management functions can be provided as part of or an extension of the Registration and Polling function which now become indispensable.

Message types now anticipated are shown as follows:

Status Broadcast from Access-points

Each Station is aware of the presence of at least one Access-point when infrastructure is used. For unregistered Stations, the Invitation-to-Register message contains the Access-point and System Identifier. After registration, Polling and Invitation-to-Request messages provide the same information.

Access Control

Management of authorized access is exercised through the Registration process.

Interrogation of Stations

Routine Polling of Stations is a necessary procedure to detect Station malfunctions soon after they occur. Many Station malfunctions may disable the capability of any useful communication with that Station. Others may be definable and reportable.

A Station could have a transmit failure, and not be aware of it until an attempt to transmit a message was made.

Battery exhaustion might be unreportable.

Spontaneous Reports from Stations

Stations report fault indications after they occur spontaneously in response to the following conditions: 1) impaired ability to read incoming messages, 2) high incidence of invalid codes, or for other reasons.

Configuration Command to Station

Messages may be sent to stations concerning changes in identification parameters, authorized types of access or on any configuration matter.

CONFIGURATION MANAGEMENT

Some of the facts and parameters of configuration must pass through the 802.11 air-interface. There are decisions as to which how many of these should be autonomous functions of the management octets allocated in the TDM frame.

The configuration facts for each user include:

Identification Parameters

System Identifier
Access-point identifier
LAN long address
ISDN/POTS directory umber
Internet address

Services Access

Service access priority
Service access permitted
Service access equipped

Some of these parameters must be downloaded by a central manager. Other parameters are physical facts which can be assigned and then reported in status messages. Some of these entries may change frequently following individuals around, but others are fastened into the wall. There should be a provision for these parameters to pass through the air-interface for assignment and status reporting as is appropriate.

PERFORMANCE MONITORING

Records of substandard performance are essential to sizing of the network facilities and sometimes evidence of malfunctions, particularly in systems with automated "try-again" and alternate equipment.

An advantage of a common controller is the ability to monitor and log all transactions of the system at that point. If used correctly, most system performance criteria can be monitored including measurement of traffic carried and evidence of system average and peak utilization.

Something that cannot be centrally measured is the station originated traffic which is denied access. This event must be recorded at the station and the measure transmitted to the Central Manager as part of periodic "health" reports (probably to be incorporated in response to Poll).

Station Generated Records

Access records for both connection-type and packet traffic should be maintained independently. A possible matrix of the useful facts is shown below:

	Items redundant with central function
Access Attempts	
No. successful try 1:	x
No. successful try 2...N:	
Total delay of delayed accesses:	
No. abandoned without success:	
Log of chron time of unsuccessful access attempts:	
Traffic Carried	
Total Kbytes carried:	x
Total Packets:	x
Total Segments carried:	x
Connection-type Traffic	
No. calls attempted:	
No. calls completed:	x
No. calls abandoned:	
Holding time B-bandwidth:	x
Holding time C-bandwidth:	x

FAULT REPORTING, ISOLATION AND CORRECTION

The types of faults which are now of interest are those of the medium and the equipment and circuits of the PHY LAYER. These are mostly gross faults as compared with subtle faults that may be the result of software or events that happen infrequently. These faults may occur in the Station, Access-point or in the Hub Controller.

Faults may be reported after a malfunction, or they may be detected during a routine diagnostic procedure. Many types of faults may make it impossible for a station to initiate a report message or to respond to a query. With routine reporting, the absence of a "healthy" report is an alarm condition.

A singular case is an Access-point with no Stations. It is possible for an Access-point to have a receiver failure that is then not detectable. This may make mandatory a test Station in high reliability system plans.

Fault Isolation

The Poll is the primary method of detecting either Station or Access-point faults. Because of the distributed nature of the system the scope of possibilities for any one fault is limited.

Since Access-points may be separated from the Hub Controller by a wired medium, it is useful to differentiate faults in the transmission medium and those in the Access-point. A local loopback provision should be sufficient for this purpose.

Fault Correction

The first level of fault correction is isolation of out-of-control stations from the wireless channel. This is must be done autonomously within Stations since use of communication is undependable for faulty units.

For this reason, transmission duration and frequency limiters may be required as separate components that operate despite faults in other parts of the hardware.

Subtle Faults

The purpose in discussing these is to determine whether remote testing and isolation is feasible. It is possible for faults to occur in memories, address filters and selection circuits which do not disable but rather cause some single function to be inoperative.

It is interesting to consider a "health and confidence" test that can be centrally initiated to exercise major functions.

SECURITY TESTS

Certain message and response capabilities can be built into the Station and Hub Controller intended to detect imitation or unauthorized modifications of the Station equipment such as the programming of fraudulent addressing.

At this point, only the possible usefulness of this function is noted. It is possible that some aspects of this function would not be recorded in the 802.11 Standard.

INTEGRATION OF MANAGEMENT COMMUNICATION

It is possible to simply enhance the operational messages defined to include the necessary management functions.

A better course might be to define a special class of management messages which include the Registration and Polling functions. Organizationally, it would then be easier to add unforeseen management and security functions which are not necessarily mandatory. This would be consistent with developing the hierarchy of managed objects.