Media Independent MAC Enhancements for RF Management of Wireless 802 Networks

An Introduction

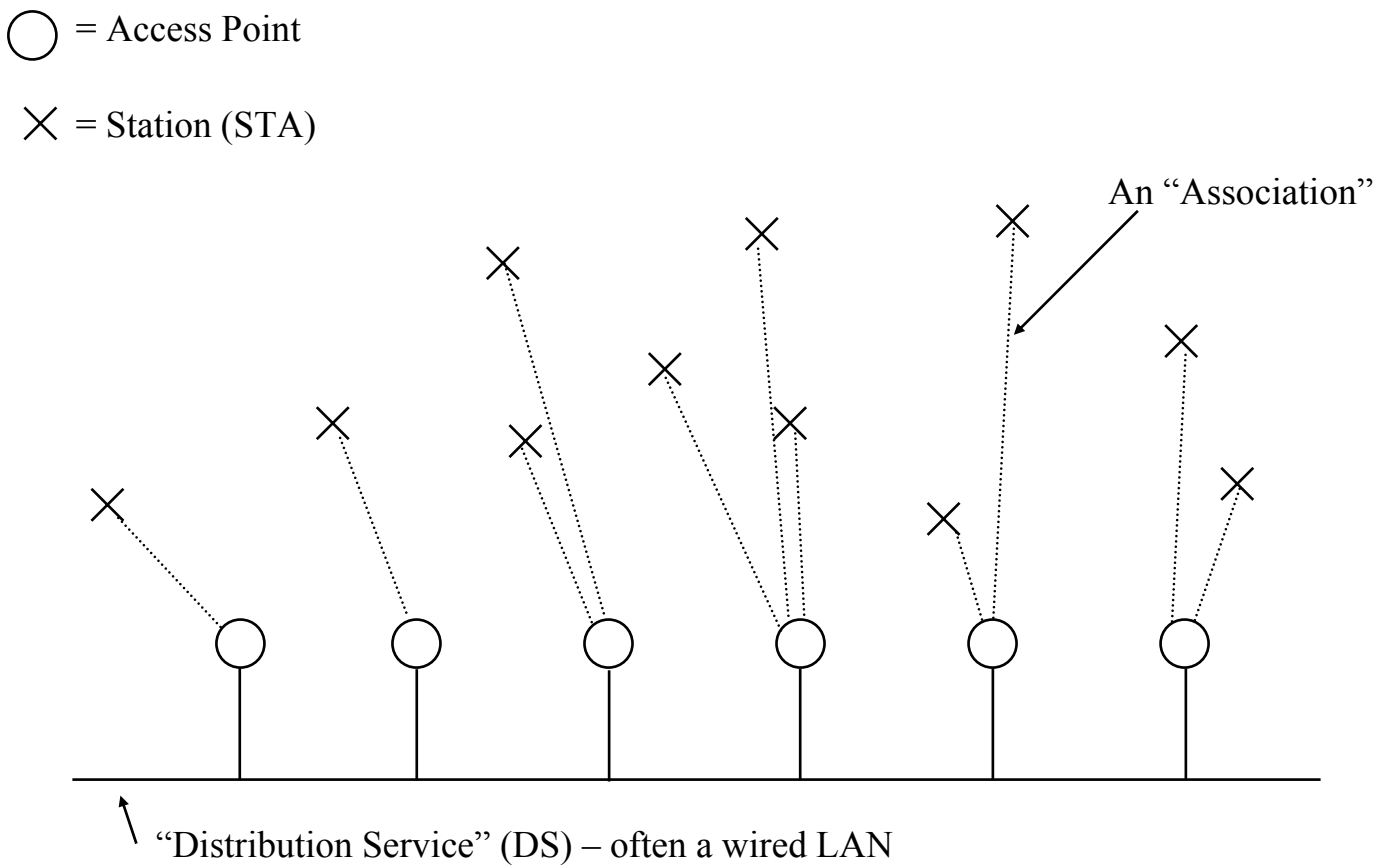
Overview

- Into to 802 Wireless Networks
- What is “RF Management”
- Why a standard is needed
- Why a common interface is needed
- What would such an interface look like in the IEEE 802 architecture

Brief Intro to IEEE 802 Wireless Networks

- Various MACs exist or are under development
  - E.g. 802.11, 802.15, 802.16, 802.20, 802.22
- I will talk about 802.11 *as an example*
- Infrastructure vs. Ad Hoc
  - I will talk about Infrastructure *as an example*

APs and STAs


= Access Point
= Station (STA)
An “Association”
“Distribution Service” (DS) – often a wired LAN

Overview (continued)

- APs can operate on one of several channels
  - E.g. 802.11 b/g supports 3 non-overlapping channels
  - E.g. 802.11 a supports 8 or more non-overlapping channels
  - Channel selection is not part of the standard
  - The vast majority of products come pre-configured to a channel (mostly the same one)
- STAs make associations with APs
  - How a STA chooses an AP is not part of the standard
- Transmit power of APs and STAs
  - Usually set at factory to a regulatory max (or less).
  - Sometimes manually adjustable
  - How a radio selects a transmit power level is not part of the standard.

What is RF Management?

- Sometimes it's useful to:
  - cause the APs to select different channels
    - To avoid "co-channel interference"
    - To distribute energy across the spectrum within a given geographical area
  - adjust the transmit power
    - See above
    - Enhanced privacy
  - direct STAs to associate to certain APs
    - For load balancing purposes
    - To manage interference issues
    - For other considerations of QoS
    - To enforce other sorts of policies
  - enquire of APs and STAs their sense of the RF environment
    - E.g. what other STAs and APs can you hear and at what signal strength?
    - Detection of "Rogue APs"
    - Detection of attempted intrusions
    - To gather locality information about APs or STAs
  - stuff we may not yet have considered

Why Standardization

- Different chip sets report signal strength in different ways
  - Sometimes just a relative signal strength (RSSI) in dB
  - Sometimes an absolute power measurement in dBm
- There is no standard interface to set transmit power
  - Management applications must muck about in the chip driver
  - Management applications must be ported individually to every bit of hardware
  - Optional OIDs for NDIS exist but doesn't address non-Windows devices
- There is no interoperability between different management applications
  - MIBs are not up to date
- Even if more attention were paid to MIBs, each is crafted individually by the different "dots"
  - Would be like having spanning tree for 802.3 and Source Routing for 802.5!
  - Boxes will be built that will interconnect different wireless technologies e.g. 802.16 to connect to the ISP, and 802.11 to connect to the home LAN.
- The lack of a standard RF management interface for different implementations of a given MAC as well as different wireless MACs discourages multi vendor, interoperable Wireless Network management

Why interoperability is so important for Wireless Networks

- All the usual reasons plus:
  - Radio waves do not respect administrative boundaries
    - Neighbors cannot cooperate on channel selection even if they wanted to
    - Increasingly dense deployments, and all the APs don't belong to the same owner!
    - You can control access but you can't control the laws of physics

Why 802.1

- This issue spans all wireless MACs
  - Requires input from all Wireless MACs
- This is architecture
  - 802.1 has the most protocol expertise
  - 802.1 has the most management expertise
- 802.1 is the logical place to develop standards which may make use of the interface

Examples of what the interface might look like

MA-UNITDATA.indication

Example modifications to the semantics of the 802.11 **MA-UNITDATA.indication** service primitive are underlined.

MA-UNITDATA.indication (
source address,
destination address,
routing information,
data,
reception status,
priority,
service class,
received power
)

The received power parameter specifies the signal strength, expressed in dBm, at which the MSDU was received.

MLME Example

MLME-SCAN.request (

Channel List
Scan Time
Quiet Channel
CTS Duration

)

MLME Example

MLME-SCAN.indication (

Channel List
BSS List

)

Contact

Floyd Backes
Propagate Networks, Inc.
125 Nagog Park Drive
Acton, MA 01720
+1.978.264.4884
fbackes@propagatenet.com