An Update to A Hybrid Wireless MAC Protocol Providing Asynchronous and Synchronous MSDU Data Delivery Services

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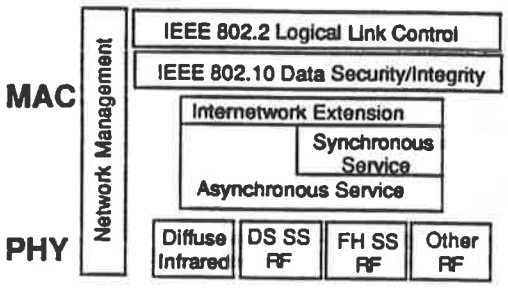
Agenda

- The Hybrid MAC LBT Protocol
  - Media independent: RF and IR
  - Primary support for asynchronous data traffic
  - Incremental support for synchronous data traffic
  - No required distribution system
  - Optional ESA distribution system provides
    - MSDU forwarding to/from wired LANs and between adjacent BSAs
    - Station roaming through the ESA distribution system
    - Access control
    - Power control
- Update for additional considerations
  - ESA configuration
  - Synchronous Service coordination
  - Authentication
  - Multichannel PHYs
  - Roaming and source routing distribution systems

Protocol Architecture



- PHY Layer
  - Half-duplex, peer-to-peer
  - Muliple media
- MAC Layer
  - Asynchronous Data Service Sublayer
    - Peer-to-peer
    - Augmented LBT with positive acknowledgement
  - Synchronous Data Service Sublayer
    - Peer-to-peer
    - Reservation TDMA
  - Internetwork Extension Sublayer
    - Forwarding via wired backbone
    - Roaming across wired backbone
    - Access Control
    - Power Control

PHY Layer

- Multiple media
  - ISM Band Spread Spectrum RF
    - Frequency hopping
    - Direct sequence
  - Diffuse infrared
  - Others
  - Single and multichannel
- Simple interface
  - Half-duplex interface
  - Receive data and clock (PHY » MAC)
  - Transmit data and clock (MAC » PHY)
  - Signal detect/Channel Busy (PHY » MAC)
  - Channel select (MAC » PHY)

Adaptive Configuration

- Adaptive access point configuration
  - Traffic routing: peer-to-peer or hierarchical
  - Offered services: AsynchOnly, AsyncSynch
- Traffic Routing
  - In some cases prefer all traffic in a coverage area to be delivered via access point - stations communicate to access point which then deliver MPDU to destination stations. This is a hierarchical configuration.
  - In other cases all traffic in a coverage area is delivered directly from source to destination station if possible with access point intervening only if source and destination out of range. This is a peer-to-peer configuration.
  - Hierarchical configuration has greater range and control but less efficient use of bandwidth.
  - Peer-to-peer is substantially more bandwidth efficient (2:1) but requires stations be closer together and access point cannot prevent illicit communications.

Adaptive Configuration - 2

- Service Offering
  - Some coverage areas will offer only the Asynchronous Service while others will offer both the Asynchronous Service and the Synchronous Service
  - Support both configurations
- Architecture
  - Support permutations of both at granularity of the access point
  - Configuration of access point is advertised in access point's announce MPDU

Peer, Hierarchical } X { AsyncOnly, AsyncSync

  - Station searches for access point providing the service it desires in the configuration desired during initialization and roaming

Synchronous Service Coordination

- Problem
  - Coordination of reserved bandwidth between overlapping Schedulers, particularly from disjoint administrations
  - Possible conflicting allocations for stations in the overlap
- Proposed Solution
  - Station in overlap detects conflicting allocation
  - Detecting station informs its Scheduler of conflict
  - Scheduler either
    - Reallocates independently until success
    - Coordinates with conflicting Scheduler(s)
    - Latter is possible only for Schedulers within the same ESA/Administration

Authentication

- Problem
  - Stations need to authenticate access points and other stations
  - Access points need to authenticate stations during registration and other access points during ESA configuration
  - Good judgement suggests minimal external input should be required
- Proposed Solution
  - Use digital signatures via public key encryption for stations and access points.

Security and Integrity

- Users of wireless networks perceive greater security and integrity threats since physical access control to the LAN no longer applicable
  - Security: protection against improper disclosure of transported information
  - Integrity; protection against improper modification of transported information
  - Must be provided for within standard
- Proposed Solution
  - Use 802.10 for security and integrity protocols end-to-end
  - Use an 802.11 specified encryption algorithm with 802.10 to insure interoperability

Multichannel PHYs

- Some PHYs can provide multiple channels
  - Desirable w.r.t. increasing capacity and robustness of WLANs
  - Adapt MAC protocols to utilized multichannel PHYs effectively
  - Effectiveness will be correlated to the degree of channel isolation provided by the PHY
- Proposed Solution
  - Three cases of interest: station initialization, station roaming, and ESA initialization/autoconfiguration
  - Assign channels to access points/coverage areas - a "microcellular" architecgture
  - Stations, upon initialization and roam, search for appropriate channels and the access point announce MPDUs in order to determine choice of channel
  - Access points, upon ESA initialziation, execute a TBS distributed algorithm to effectively assign access points to channels
  - These algorithms can work well with limited (≤ 10) numbers of well isolated PHY channels

Roaming and Source Routing

- Proposed ESA architecture supports roaming
  - ESA distribution system is a tree with access points as leaves with the trunks of the tree wired IEEE LANs interconnected with 802.2D conformant spanning tree bridges
  - Stations may roam between access points anywhere within ESA
  - MSDUs will follow and source and destination stations are unaware of routing of MPDUs within distribution system
- Problem with source routing bridges
  - Source routing process requires source and destination to explicitly discover and provide route through distribution system with every MPDU
  - A roaming station would be required to rediscover a route through ESA distribution system potentially every 30-60 seconds (100m @ 2 m/s) as access points and (possibly) the route through the distribution system changes
- Proposed Solutions
  - Let the station rediscover and require high level protocol to rediscover when detect route change by roam (MPDU loss)
  - Configure distribution system of wired LANs and source routing bridges to prevent source routing changes (e.g. all access points for ESA on same wired LAN)