

Handouts for IEEE P802.11-93/85 presented May 1993

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IEEE P802.11-93/85

Title:

WHAT protocol evaluation - a response to IEEE P802.11-93/33.

Abstract:

This paper is an informal evaluation of the WHAT protocol in terms of the comparison criteria defined by Wim Diepstraten in 802.11 MAC Requirements and Comparison Criteria.

Presented by:

Phil Belanger
Xircom

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The answer is:

Yes!

Quite good.

or...

To be specified in a future contribution.

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WHAT Protocol MAC Services

Asynchronous data service is a necessity for almost all stations.

- exports an 802.2 LLC compatible service
- broadcast, multicast, and directed transfers are supported
- full IEEE 802 compatible 48 bit addresses are used

Time Bounded service is desirable for some stations.

- tuned for real time voice

Asynchronous and Time Bounded services can coexist.

Time Bounded service has minimal impact on complexity of Asynchronous only nodes.

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Network Structures

Ad-hoc Networks

Access Point in BSS, but no Distribution System

Multi Cell Infrastructure Networks

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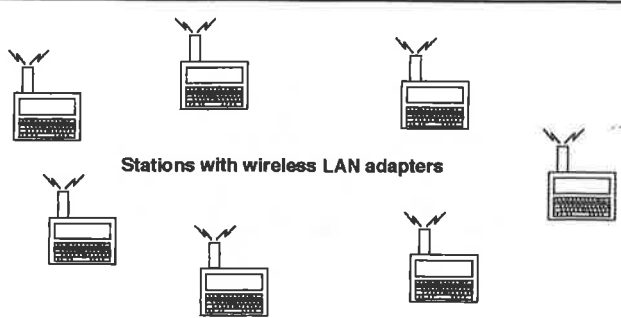
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Ad-hoc Networks



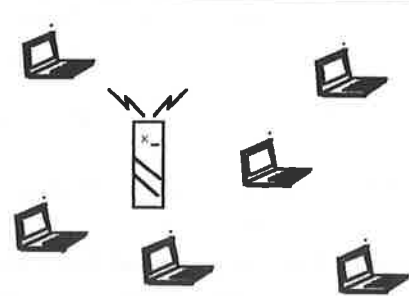
Stations with wireless LAN adapters

- *spontaneous creation*
- *direct, peer to peer communication*
- *distributed coordination function, no master node*

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Access Point in BSS, but no Distribution System.

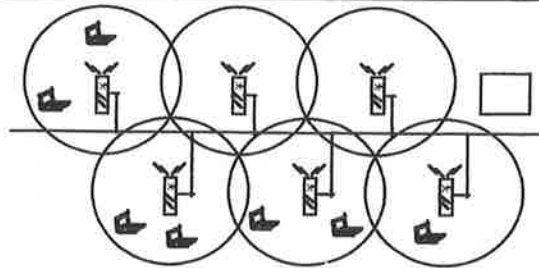


- *extends PHY range*
- *provides additional management functions*
 - PCF for Time Bounded service
 - improved power management and security
- *direct, peer to peer communications or indirect via Access Point*

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Infrastructure Networks

- **multiple BSS**
- **Access Points connected by Distribution System**
- **within a BSS direct, peer to peer or through Access Point**
- **BSS to BSS through the Distribution System**
- **BSS to Distribution System**

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Infrastructure Questions***Is direct peer to peer supported in infrastructure mode?***

- Yes, stations can communicate directly with each other in the presence of APs.

Can an ad-hoc network overlap in the same channel?

- Yes, a design center of the protocol.

Can any IEEE 802 LAN be used as the Distribution System?

- Yes, for Asynchronous service.

What are the unique functions needed from the DS?

- Support IEEE 802.2 compatible services including multicasts.
- If Time Bounded Service is to be supported throughout an ESA the DS must support an equivalent quality of service.

What is the reassociation algorithm? What are the provisions to support reassociation across routers and bridges?

- Reassociation algorithm will be specified in a later contribution
- Reassociation across routed subnetworks requires cooperation of higher (> MAC) level protocols.

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Multiple BSA Configurations***Can the MAC handle overlapping BSAs using a single channel?***

- Yes. The protocol automatically adjusts to traffic from other BSAs.
- The only affected stations are those in the overlap.
- No additional overhead or coordination is required to manage the overlap.

What are the provisions for spatial re-use of the spectrum?

- Spectrum reuse through coordinated overlap as above
- With infrastructure, APs configure to minimize channel overlap
- There is a PHY dependent field in the MAC header that could be used for adaptive power control if the PHY supports it.

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Multichannel Environments***Does the MAC support multichannel environments?***

- Yes. Designed to work well with a single channel, better with multichannel PHY.

What is the overhead involved to support this?

- Network management to collect and disseminate AP and channel configurations in support of registration and reassociation
- The MAC header has a field that identifies the channel being used.
- There is also a PHY dependent field that can be used to help stations synchronize with each other.

What channel management functions are needed?

- Enhanced registration and reassociation algorithms
- Tune to frequency x or channel y.

Reassociation algorithm will be specified in a subsequent contribution.**Xircom**

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Ad-hoc Networks***Can the MAC support ad-hoc networks? Yes.******Can ad-hoc and infrastructure networks overlap? Yes.***

- the same distributed coordination function is used for the asynchronous service of both types of networks
- stations in the overlap observe more traffic but continue to operate effectively
- With a multi-channel PHY, performance improves

Can a station be connected to an ad-hoc and infrastructure network at the same time? Yes, but...***Power savings in ad-hoc mode?***

- See next slide

What security services are available?

- named ad-hoc networks and data scrambling for privacy

Can multiple ad-hoc networks overlap in the same channel?

- Yes, and very happily. Infrastructure too ...

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MAC support for low power operations***Three levels***

- Intraframe - shut off unnecessary logic within adapter at appropriate times
- Interframe - shut off adapter logic based on adapter's observation of traffic patterns
- Host initiated - based on performance of specific high level protocols

Sleep/Wake protocol

- in ad-hoc mode, can be sent to peers
- in infrastructure mode, Access Point improves power savings through:
 - simple buffering
 - acts as an agent of the mobile unit

Cost of re acquiring the network

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MAC support for multiple PHYs***Support at least 1 to 20 Mbps.***

- Yes.

Need to support regulatory requirements in the different bands.

- this works

What are the generic provisions to support different PHYs?

- Bit and frame synchronization performed in PHY
- Multichannel definition and management.
- There is a field in the MAC header that can be used by different PHYs for their own purposes.
 - Power control
 - Synchronization
 - Bit rate
 - For elegance, could be positioned as part of PHY header

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MAC Access Function Requirements***What is the default coordination function?***

- Distributed CF for Asynch service
- Distributed/point CF for TB service

What is the limit for the number of stations that can be supported?

- Load dependent, no inherent limiting number of stations

How fair is the access method?

- Quite fair for ad-hoc Asynch service
- Quite fair for infrastructure services

What is the stability of the access method during high load?

- Simulation and experience indicate quite good.

What is the throughput capacity of the access method

- Data throughput of 80%+ of channel capacity at high, typical load

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More MAC Access Function Requirements***How robust is the access method of interference?***

- Very robust
- Copes with multiple microwave over: test for 2.4 GHz FHSS PHYs

What are the medium sharing characteristics for overlap between BSAs using the same channel?

- Graceful degradation based on overlapping load

What is the overhead associated with the access method?

- Per-frame overhead to increase reliability, robustness and stability with imperfect PHYs: e.g. 4-way handshake

What is the method to support mixed TB/async

- Addition of point/distributed CF for TB service within each BSS

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Yet More MAC Access Function Requirements***What is the bursty traffic performance?***

- Very good, a design center for the protocol
- Focus on minimizing average delay for typical traffic loads

Effect of TB on Asynchronous service

- Decreases channel capacity, increases average delay
- Roughly proportional to the amount of TB traffic

TBS robustness

- Adequate for voice, can be improved with additional overhead for positive acknowledgements.

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Access Method Independent Features

Security Provisions

- Station and AP mutual authentication
- Data scrambling

Mixed bitrate

- Protocol can use if PHY can provide

How does the MAC support the defined DSS functions?

- Well. See forthcoming contribution on reassociation.

Extra requirements for other 802 standards

- How does the Distribution System support TBS?

What parameters affect inter Access Point interoperability?

- Huh?

What are the managed objects of the MAC?

- TBS configuration
- Performance metrics
- Authentication certificates

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Conclusions

This list of criteria needs an editor!

- a good starting point, but...
- remove redundancies
- reorganize questions

Not all of the criteria should have equal weight.

It is easy to say "yes" to every point.

Saying yes to everything may not be good.

- creeping elegance

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