old version

IEEE P802.11
Wireless Access Method and Physical Layer Specifications

IEEE P802.11 Issues Document
(Draft)

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INTRODUCTION

This document contains the issues that are being addressed by the IEEE P802.11 committee. This document is updated as new issues are added and current ones are resolved. The process used to open and close issues is described in the IEEE P802.11-92/58R1 document.

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TOPICS

Issues Status

Issue ID	Issue Key Words	Status	Decision
1.1	words 'must', 'shall'..intention when use them?	**CLOSE**	**Def.in Std.**
1.2	Develop weighted criteria list? Efficiency?	**CLOSE**	**Obsolete**
1.3	Priorities to make engineering trade offs?	**CLOSE**	**Obsolete**
1.4	Do we want to have options in the standard?	**CLOSE**	**Yes-when reqd.**
1.5	**Is protocol model (7/92) to be adopted?**	**open**	**In-Prog.**
2.1	**Standard support of physical environment.**	**open**	**In-Prog.**
3.1	MAC implementation complexity / 'time-to-market'.	**CLOSED**	**Obsolete**
4.1	Will the standard support Ad-Hoc networks?	**CLOSE**	**Yes**
4.2	Will the standard support infrastructure networks?	**CLOSE**	**Yes**
4.3	Definition of adhoc network?	**CLOSE**	**Issue 4.3**
4.4	Geographic coexistence of overlapping 802.11 networks?	**CLOSE**	**Yes**
4.5	Is STA member of adhoc & non-adhoc in same time?	**CLOSE**	**May be**
5.1	Specify DS or only the services it provides?	**CLOSE**	**Only Servcs.**
5.2	What is a conformant Distribution System?	open	none
5.3	What are the DS functions needed?	**open**	(2 sub-issues)
- 5.3A	Infrastructure required?	**CLOSE**	**P802.11-93/9**
- 5.3B	**Functions needed for infrastructure services?**	**open**	**In-Prog.**
5.4	Location of DS interface: MAC, PHY, both.	**CLOSE**	**MAC Layer**
5.5	**DS performance requirements.**	**open**	**In-Prog.**
5.6	**Direction of Association Transaction?**	**open**	**In-Prog.**
5.7	**Explicit Re-association required?**	**open**	**In-Prog.**
5.8	**Direction of Re-association Transaction?**	**open**	**In-Prog.**
5.9	**How to define AP presence?**	**open**	**In-Prog.**
6.1	Support requirement: Security, Auth., Regist., Privcy?	**CLOSE**	**In Func-Reqs**
6.2	PHY supports security functions?	**CLOSE**	**No**
6.3	Unauthorized access impact MAC throughput.	**CLOSE**	**No direct impact**
6.4	How Authentic.& Registr. be specified in 802.11?	**CLOSE**	**By 802.10**
6.5	Requirement for Security & Privacy?	**CLOSE**	**Yes**
6.6	Additional work (to 802.10) for Security	**CLOSE**	**Yes**
6.7	Re-association react with Authentication?	**CLOSE**	**No-interact.**
6.8	Re-association react with Privacy?	**CLOSE**	**802.10**
6.9	**Support of publicly avail.. privacy algo?**	**CLOSE**	**Yes**
6.10	**Security algo. include Wired LAN Privacy equivalent?**	**open**	**In-Prog.**
7.1	Cost influence on designs. Cost versus functionality.	**CLOSE**	**Obsolete**
7.2	Interoperability of low cost and reliable MAC?	**CLOSE**	**Obsolete**
8.1	Safety impact on decision.	CLOSE	2 sub-issues
- 8.1A	How does safety concerns impact our decisions?	open-NEW	none
- 8.1B	Do we let our decision making driven by time constraint?	**CLOSE-NEW**	**Obsolete**
9.1	**MAC throughput & throughput probability.**	**open**	**In-Prog.**
9.2	Coverage implications of MAC timing constraints.	**CLOSE**	**Obsolete**
9.3	MAC work in a min. and max. system.	**CLOSE**	**Yes**

15.1	**What is Time-bounded means? What are the bounds?**	**open**	**(2 Sub-issues)**
- 15.1A	**What does Time-bounded means?**	**open**	**In-Prog.**
- 15.1B	**What are the bounds?**	**open**	**In-Prog.**
15.2	BSS coexistence with Asynch and Time-bounded.	**CLOSE**	**Non-sense**
15.3	**Protocol above MAC to drive Time-bounded service.**	**open**	**In-prog.**
15.4	Unique services or functions to wireless networks.	**CLOSE**	**Obsolete**
15.5	Services outside MAC & PHY need to be specify.	**CLOSE**	**Yes**
15.6	**Partition of capacity Time-bounded & Asynch. service.**	**open**	**In-Prog.**
15.7	What is the common service Async. or Time-bounded?	**CLOSE**	**In Func. Reqs**
15.8	Do all stations & infrastructure support TB?	**CLOSE**	**No**
15.9	**MAC ability to service data, voice and video.**	**open**	**In-Prog.**
15.10	Service points for Time-bounded Services?	**CLOSE**	**MAC/LLC Bnd.**
15.11	**Classes of Time-Bounded services to specify?**	**open**	**In-prog.**
16.1	Roaming support for both Asynch and Time-bounded.	**CLOSE**	**Yes on both**
16.2	What is roaming? handoff?	**CLOSE**	(2 sub-issues)
- 16.2A	What is Roaming?	**CLOSE**	**Not 802.11**
- 16.2B	What is Handoff?	**CLOSE**	**Re-association**
16.3	**Requirement from 802.1 regarding roaming.**	**open**	**In-Prog.**
16.4	**What is graceful degradation mean?**	**open**	**In-Prog.**
16.5	**Parameters of mobile stations.**	**open**	**In-Prog.**
16.6	Standard support of seamless handover.	open	none
16.7	**What does seamless mean?**	**open**	**In-Prog.**
16.8	Service Transitions supported by standard?	**CLOSE**	**Issue 16.8**
16.9	**Requirements around station mobility?**	**open**	**In-Prog.**
17.1	Required Group addressing reliability?	**CLOSE**	**Obsolete**
17.2	Required Broadcast/multicast reliability.	**CLOSE**	**Obsolete**
17.3	Extent of Multicast (BSS, ESS).	**CLOSE**	**BSS & ESS**
17.4	**Support of Source Routing.**	**open**	**In-Prog.**
17.5	Addressing size. 802 Addressing ok?	**CLOSE**	**IEEE 802**
17.6	Effect of Global adrs. & Directory on MAC.	**CLOSE**	Non-sense
17.7	Is MAC supply packet number to PHY?	**CLOSE**	No
18.1	MAC work equally well with all PHY rates.	**CLOSE**	**Yes**
18.2	Is MAC driving multiple PHYs of different rates?	**CLOSE**	**Yes**
18.3	**Will the standard support PHY with variable rates?**	**open**	**In-Prog.**
18.4	**PHY rate variance relative to signal quality.**	**open**	**In-Prog.**
18.5	Is data rate agility only a PHY matter?	**CLOSE**	**MAC also**
18.6	**Effect of data density on bit rate.**	**open**	**In-Prog.**
18.7	**Shall MAC support Mult., Simultneous data rate?**	**open**	**In-Prog.**
19.1	Dependence of layers above MAC for recovery.	**CLOSE**	**Partially**
19.2	802.11 = other 802 for delivery reliability.	**CLOSE**	**(2 sub-issues)**
- 19.2A	Is 802.11 = other 802 for delivery reliability?	**CLOSE**	**No**
- 19.2B	How multicast affect 19.2A decision?	**CLOSE**	**Not as Reliabl.**
19.3	**Acceptable overhead for reliable frames.**	**open**	**In-Prog.**
19.4	**Can min.BER be assumed for a PHY?**	**open**	**In-Prog.**
19.5	**Is recovery mech. have to be in the MAC?**	**open**	**In-Prog.**
19.6	**What is the strategy for capacity control?**	**open**	**In-Prog.**
19.7	**Max. number of stations to be specified.**	**open**	**In-Prog.**
19.8	MAC Robustness in co-site dissimilar networks?	**CLOSE**	**As for Interfr.**
19.9	**How to address the range related to data density?**	**open**	**(2 sub-issues)**
- 19.9A	How standard specify min. and max. station coverage?	open	none

27.1	Are there code size limits to be specified?	**CLOSE**	**No**
28.1	How important is the physical size?	**CLOSE**	**Not consdr.**
29.1	**How does 802.11 addresses simulation?**	**open**	**In-Prog.**
Anx. A	Issues related to Func. Reqs.	open	none

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TOPICS

TOPIC: 'STANDARD' PROCESS

1

Issue Identification: 1.1 (Topic: 'Standard' Process).

- What do we mean by the words 'must', 'shall', 'may', should'?
- What is our intention when we use them in the drafting of documents?

Alternatives:

1) -

a) - MUST, SHALL, or MANDATORY: - The item is an absolute requirement for compliance to this standard.

b) - SHOULD: The item is highly desirable

c) - MAY or OPTIONAL: - This item is not compulsory and it is followed or ignored according to the needs of the implementor. If optional features are implemented they must be compliant with the standard.

d) - NOT APPLICABLE: - The item is outside of the scope of this standard

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened

January 1994: Alternative #1 and closing of the Issue by endorsing the Alternative: MAC: yes-38, no-0, Abstain-0.

Issue Status: CLOSE January 1994

Issue Identification: 1.2 (Topic: 'Standard' Process).

- Do we want to develop a weighted list of criteria (i.e.; delays, efficiency, etc.) ?
- What do we mean by efficiency?

Alternatives:
1). Obsolete Issue

Arguments:
Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: First opened
January 1994: Alternative #1 and closing the Issue by endorsing the alternative - MAC: unanimous

Issue Status: CLOSE January 1994

Issue Identification: 1.3 (Topic: 'Standard' Process).

- What are our priorities when we have to make engineering trade offs?

Alternatives:
1). Obsolete Issue

Arguments:
Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: First opened
January 1994: Alternative #1 and closing the Issue by endorsing the alternative - MAC: unanimous

Issue Status: CLOSED January 1994

Issue Identification: 1.4 (Topic: 'Standard' Process).

- Do we want to have options in the standard?
Editor's note: Ref: 23 (92/58R1)

Alternatives:
1) Yes
2) No
3) Yes - but Only the minimum

Arguments:

Pro:

3) - Options are a necessary evil and should be viewed as a last resort and are usually results of an inability to compromise. While the need is recognized, Only the absolute minimum of options should be specified (otherwise we would have a 'shopping' list instead of a standard).

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened
September 1992: - Alternatives, argument and straw poll from the MAC group:
- For alternative #1: 0
- For alternative #2: 0
- For alternative #3: 10
Recommendation to proposed alternative #3 to full 802.11 group.
November 1992: - Motion to close this issue by recommending the support of Alternative #3. Result: yes-22, no-0, abstention-1.

Issue Status: Close

Issue Identification: 1.5 (Topic: 'Standard' Process).

- Is the protocol model, as generated during the July 1992 meeting, to be adopted by 802.11 ?

Alternatives:

1) - yes
2) - no

References:

1) - P802.11-93/140 - MAC/PHY Functional Partitioning
2) - P802.11-93/115 - Protocol Layering Alternatives for Practical Implementation
3) - P802.11-93/204 - An Improved Reference Model for IEEE 802.11.

Arguments

General:

1.0) - Motion to revise our reference model as proposed in P802.11-93/140 (Reference #1) without the PHY convergence layer and adopt the described approach to refine the MAC/PHY interface and proposed to close this Issue (1.5) by referring to the adopted model. Modify the adopted model such that the Medium Independent sublayer is also removed. - Result (MAC/PHY Group) - Yes-20, no-8, abstain 2.

Amend the amended proposal by assuring that the DCE/DTE interface remains as an optional interface. - Result (MAC/PHY group) - Yes-26, no-9, abstain-9.

2.0) - Modify the current model with the NAC containing the following:
- MAC containing a PHY independent entity
- PMA (PHY Medium adaptation)
- PHY (Medium dependent)
- DTE/DCE interface between PMA/PHY

This proposal failed to pass during the plenary. - Result yes-9, no-4, abstain-4.

Pro:

2.1) - There should be a medium-dependent subdivision added to the MAC (suggested name: 'Physical Medium Adaptation Layer'), and the subdivision of the PHY should be eliminated. This is discussed in detail in the P802.11-93/115 document (Reference #2)

2.2) - There should be a PHY dependent layer added to the MAC and the exposed interface should be specify as placed between MAC and PHY.

2.3) - A reference model with improved features for describing the 802.11 MAC/PHY relationship is proposed in this document (Reference #3).

Con:

Related Issue Identification:

Issue Originator: Simon Black

Issue History:

July 1992: First opened
September 1993: Alternative #1 & #2, Reference #1 & #2, Argument_general #1.0 & 2.0, and Argument_pro #2.1 & 2.2.
November 1993: Reference #3 and Argument_pro #2.3

Issue Status: Open

TOPIC: ENVIRONMENT

2

Issue Identification: 2.1 (Topic: Environment).

- What physical environment the standard will support, including station speed ?

Alternatives:

Arguments:
Pro:

Con:

Related Issue Identification:
1) - 16.5 (Topic: Mobility)

Issue Originator:

Issue History:
May 1993: Date first open
January 1994: Attempt to close the Issue as 'obsolete' failed. Plan to address this Issue in March 1994.

Issue Status: Open

TOPIC: MARKETING

3

Issue Identification: 3.1 (Topic: Marketing).

What is the impact of the MAC implementation complexity in regard of 'time-to-market ?

Alternatives:

1) - See the CODIAC protocol proposal - Reference #1
2) - Obsolete Issue by adoption of the MAC protocol foundation (Reference #3).

References:

1) - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol
2) - P802.11-93/204 - An Improved Reference Model for IEEE 802.11.
3) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

General:

1): - (Reference #2) - An increase in complexity cannot help, and can hurt, "time-to-market." In a similar manner, an increase in complexity of the specification of the mechanisms needed to support a variety of diverse PHYs under a single MAC protocol cannot help, and can hurt, implementation complexity. While the standard does not define implementation, the simpler the descriptive model and the resulting specifications are , the greater the potential for simplified implementation.

Pro:

1.1) - The CODIAC protocol can be implemented in many levels of complexity. Where time-to-market is of primary concern; a simple implementation could be chosen to accomplish this.

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: Date first opened.
May 1993: Alternative #1, Reference #1 and Argument_pro #1.1
November 1993: Reference #2 and Argument_general #1.
January 1994: Alternative #2, Reference #3 and closing the Issue by endorsing the alternative - MAC: unanimous

Issue Status: CLOSED January 1994

TOPIC: NETWORK TYPES

4

Issue Identification: 4.2 (Topic: Network Types).

- Will the standard support infrastructure networks?

Editor's note: Ref: 5 (92/58R1)

Alternatives:

1) Yes - The standard shall support infrastructure networks.

References:

- P802.11-92/128 - IEEE 802.11 Distribution System Services Functionality

Arguments:

Pro:

1.1) - A distribution System (DS) is an infrastructure. Eliminating the infrastructure would limit the geographical coverage to PHY-to-PHY distance - which would be unacceptable.

1.2) - (related to 1.1) - A Distribution System is not an infrastructure. If there is a Distribution System in an Ad-hoc network, then, by definition, there is no such network as Ad-hoc.

1.3) - An infrastructure network is not the opposite of ad-hoc network.

Con:

Related Issue Identification:

1) - 4.1 (Network Types)
2) - 5.2 and 5.3 (Distribution System)
3) - 12.2-B (Interfaces)

Issue Originator:

Issue History:

May 1992: Date first opened
November 1992: - Alternative #1, Reference, Argument-pro #1.1 and #1.2 and Related Issue IDs.
January 1993: - Added Argument-pro #1.3 - Added Related Issue ID #3 - Closure of the Issue by accepting the Alternative (#1).-Result: yes-14, no-0, abstain-1.

Issue Status: Close

Related Issue Identification:
1) - 4.1 (Network Types)

Issue Originator:

Issue History:
January 1993: Date first opened - Alternatives #1 and 2 - Reference #1 - Argument-general #1 to 4 - Argument-pro #2.1 to 2.3 - Motion to accept Alternative #2 as the 802.11 definition of Ad-hoc Network.-Result: yes-12, no-1, abstain-1.

Issue Status: Close

Issue Identification: 4.4 (Topic: Network Types).

- Does the 802.11 standard will support geographic coexistence of multiple overlapping 802.11 networks?

Alternatives:

1) - Yes
2) - No

References:

1) - P802.11-93/40 - The Wireless Hybrid Asynchronous Time-bounded MAC Protocol

Arguments:

General:

1) - Method to accomplish this is not implied by decision to support it
2) - The issue cannot be equated to non-interference
3) Support cannot be constrained to mean guarantee

Pro:

1.1) - The WHAT protocol (see Reference #1) operates effectively even when there is no channel isolation for overlapping or adjacent BSAs. When traffic from different BSS is present on the same channel, STAs in the overlapping area behave as if their network is the union of the overlapping BSS. The result is that stations in overlapping areas perceive that their network is more congested that those in a single BSA. Of course this congestion can be reduced or eliminated if the PHY layer can provide channel isolation of adjacent BSAs.

Con:

Related Issue Identification:

Issue Originator:

Issue History:

January 1993: Date first opened.
March 1993: Alternatives #1 and 2 - Reference #1 - Argument_general #1 to 3 - Argument_pro #1.1 - Closure of the Issue (4.4) by endorsing Alternative #1; results: yes-23, no-0, abstain-0.

Issue Status: Close

Issue Identification: 4.5 (Topic: Network Types).

Can a station be a member of an ad-hoc and non-ad-hoc network at the same time?

Alternatives:

1) - Yes
2) - No
3) - May be

References:

1) - P802.11-93/40 - The Wireless Hybrid Asynchronous Time-bounded MAC Protocol

2) - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol

Arguments:

General:

1.0) - To be true it must be a single channel.
2.0) - It could always be implemented using Sleep function.
3.0) - Wired networks do not allow this (but wireless networks could).

Pro:

1.1) - There is a need for the standard to support this alternative.

1.2) - Yes. Station A can be registered with a controller/AP, and associated with that AP - a member of an infrastructure network. Station B may be registered with that controller/AP, but not associated with the AP, it is registered only for the purpose of conversing with other wireless stations - it is not a member of the infrastructure network. These two stations can converse without station A having to disassociate from the AP, so it retains its membership in the infrastructure network while forming an ad-hoc network with station B.

1.3) - Members of the network would have 2 network IDs.

2.1) - Multiple association has security impacts.

2.2) - At any point in time a STA is a member of one, and only one, BSS. A STA may be within range of both types of networks, but will participate in one or the other.

3.1) - A strong market requirement as not been defined, and this requirement should not be a primary factor on the MAC protocol selection, neither should it delay the standardization process.

3.2) - Implementations will provide this anyway (e.g Sleep mode).

3.3) - The 802.11 standard should be mute on this issue. The standard should not required simultaneous association within an ad-hoc and & non-ad-hoc networks. The standard should not specify anything to enable or disable this function.

Con:

Related Issue Identification:

1) - 4.1 (Network Types)
2) - 4.3 (Network Types)

Issue Originator: Dave Bagby

Issue History:

January 1993: Date first opened.
March 1993: Alternatives #1 and 2 - Reference #1 - Argument_pro # 1.1, 2.1 and 2.2 - Attempt to close the Issue; failed in MAC group; result: yes-9, no-8, abstain-0.
May 1993: Reference #1 - Argument_pro #1.2
July 1993: Alternative #3, Argument-general #1.0 to #3.0 and Argument-pro #3.1
September 1993: Argument-pro #1.3, 3.2 and 3.3 - Closing of the Issue by adopting Alternative #3; - *Motion: The standard shall be mute on this issue; the standard should not require simultaneity; not doing anything to explicitly enable or disable function.* - Results: yes-28, no-1, abstain-1.

Issue Status: Closed September 1993

TOPIC: DISTRIBUTION SYSTEMS

5

Issue Identification: 5.1 (Topic: Distribution Systems).

- Will the standard specify:
  a) - the 'internal' of the distribution system (DS)? or
  b) - only the services it provides?
  Editor's note: Ref: 42 (92/58R1)

Alternatives:

1) No - The internal functions of the Distribution System (DS) should not be specified.
2) Yes - The internal functions of the DS must be addressed.

References:

1) - MAC Minutes of 09/17/92
2) - P802.11-92/128 - IEEE 802.11 Distribution System Services Functionality.

Arguments:

See MAC Minutes of 09/17/92

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: Date first opened
July 1992: Discussion and Alternatives 1 and 2
November 1992: Added Reference - Motion to close the issue by proposing to endorse Alternative #1.
Results: Yes-21, no-1, abstain-1.

Issue Status: Close

Issue Identification: 5.2 (Topic: Distribution Systems).

- What is a conformant Distribution System (DS)?

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

- 23.1 (Topic: Conformance)

Issue Originator:

Issue History:

Date first opened: May 1992

Issue Status: Open

Editor's note: Ref: 44 (92/58R1)

Issue Identification: 5.3 (Topic: Distribution Systems).

- What are the Distribution System's functions needed?
Editor's note: Ref: 86 (92/58R1)

Alternatives:

1) Distribution System Services (DSS) must include the ability to deliver 802.11 MAC Service Data Units (MSDU) between Basic Service Sets (BSS) and non-802.11 LANs (via portals).

2) The DSS must provide some filter algorithm to avoid flooding all BSSs with all traffic; or possibly.

2a) An Access Point (AP) must transmit only MSDUs for stations that are associated with that AP.

3) The delivery of MSDUs is perhaps the only function required to be performed by the DSS - all other functions seems to be sub-functions that are needed in order to fulfill the primary function of a Distribution System (DS).

4) The DS must know or be able to find out the Station/Access point association (internal but not pass thru the interface) within the Extended Service Set (ESS).

5) If Time-bounded (TB) services imply a connection, then the DSS must be able to provide and maintain the connections between the stations.

6) [Is a DS a managed object or only the APs and/or Portals or none or what else?]

References:
- P802.11-92/128 - IEEE 802.11 Distribution System Services Functionality

Arguments:

Pro:

Con:

Related Issue Identification:
1) - 5.3-A (Distribution Systems)
2) - 5.3-B (Distribution Systems)

Issue Originator: Dave Bagby

Issue History:

May 1992: First opened
September 1992: Discussion and Alternatives ('brainstorming' ideas) 1 to 6.
November 1992: Added Reference
January 1993: Decision taken to split this issue (5.3) into two parts: 5.3-A - What are the infrastructures services? and 5.3-B What logical functions are needed to provide the defined infrastructure services?

Issue Status: Open

Issue Identification: 5.3-A (Topic: Distribution Systems).

- What are the infrastructure services required?

Alternatives:

1) The initial set of infrastructure services required is:
   - Association (creation of Station to Access Point mapping)
   - Re-association (movement of mapping)
   - Disassociation (remove mapping)
   - Authentication (identity verification)
   - Privacy (privacy of payloads)
   - Integration (ability to connect to existing LANs)
   - Network Management (usual network management functions)

References:

1) - P802.11-93/9 - 802.11 DS Service Transactions

Arguments:

Pro:

Con:

Related Issue Identification:

1) - 5.3 (Distribution Systems)

Issue Originator: Dave Bagby

Issue History:

January 1993: First opened - Alternative #1 - Agreed to adopt the Alternative (#1) as initial infrastructure services required.-Result: yes-13, no-0, abstain-1.

Issue Status: Close

Issue Identification: 5.3B (Topic: Distribution Systems).

What logical functions are needed to provide the defined infrastructure services?

Alternatives:

1) - These services are defined in closed Issue 5.3A as: association, re-association, disassociation, authentication, privacy, integration, and network management.

References:

1) - P802.11-93/9 - 802.11 DS Service Transactions

2) - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol

Arguments:

Pro:

1.1) - For any of these services which require exchange of information over the wireless medium, the CODIAC protocol proposes using MDATA frames. Because delivery of these frames is critical, they are transferred in the four-step transaction in the same manner as client data. These frame formats are yet to be fully defined.Association, re-association, disassociation, and integration all require an AP. These services are supported by the AP bit which is set in frames sent by the AP, which also serves to notify stations of its presence.

Con:

Related Issue Identification:

1) - 5.3 (Distribution Systems)
2) - 5.3B (Distribution Systems)
3) - 5.3A (Distribution System)

Issue Originator: Dave Bagby

Issue History:

January 1993: First opened - Reference #1 - Related Issue IDs #1 and 2.
May 1993: Alternative #1 - Reference #2 - Argument_pro #1.1

Issue Status: Open

Issue Identification: 5.4 (Topic: Distribution Systems).

~~- Is the interface of the Distribution System is performed at:~~
- In which layer entity the interface of the distribution system is performed?

Alternatives:
1) - the MAC Layer
2) - the PHY Layer
3) - both MAC and PHY

References:
1) - P802.11-93/40 - The Wireless Hybrid Asynchronous Time-bounded MAC Protocol

Arguments:
Pro:
1.1) - There is no relation between the wireless PHY and the Distribution System (DS).

Con:

Related Issue Identification:
- 12.2 (Topic: Interfaces)

Issue Originator: John Corey

Issue History:
May 1992: Date first opened
March 1993: Reference #1 - Argument_pro #1.1 - Closing the Issue (5.4) by endorsing Alternative #1; result: yes-25, no-0, abstain-2.

Issue Status: Close

Issue Identification: 5.5 (Topic: Distribution Systems).

- What are the performance requirements of the Distribution System (DS)?
Editor's note: Ref: 100 (92/58R1)

Alternatives:

1) None - The performance requirements of the Distribution System need not be specified.

References:

- P802.11-92/128 - IEEE 802.11 Distribution System Services Functionality.

Arguments:

Pro:

1) The performance requirements of the Distribution System need not be specified and should not be (since most sites will want to use their existing networks as their Distribution Systems). However, it is required that path metrics (between Access Points) be acquired in order to determine if the Distribution System can support Time-bounded services between different Basic Service Sets. This requirement interacts with Network Management issues.

Con:

Related Issue Identification:

1) - 13.1 (Management)

Issue Originator: John Corey

Issue History:

May 1992: Date first opened
November 1992: - Alternative #1, Argument-pro #1 and Related Issue ID.

Issue Status: Open

Issue Identification: 5.6 (Topic: Distribution Systems).

- What is the direction for the Association Service transaction?

Alternatives:

1) - From Station (STA) to Access Point (AP)
2) - From AP to STA
3) - Bidirectional

References:

1) - P802.11-93/9 - 802.11 DS Service Transactions
2) - P802.11-93/40 - The Wireless Hybrid Asynchronous Time-bounded MAC Protocol

Arguments:

Pro:

1.1) - Needed when Station (STA) is first powered on
1.2) - There is no need for a bi-directional service. If the Access Point (AP) causes a Disassociation, the Station can sign on with a different Access Point and cause a new Association. Only the Station knows which Access Point is the best one to choose for the new Association, so it does not make sense for an Access Point to cause an Association on behalf of a Station. If we require the Access Points to know about the real time signal strength of every Associated Station in relation to every Access Point; and communicate this information through the Distribution System in a timely manner, then we are making too many assumptions about the performance of the Distribution System. We cannot define the Distribution System; it already exists.
2.1) - See 'Re-association' in Reference #1
3.1) - Implied if association AP to STA decided to be necessary.

Con:

3.1) - See Alternative_pro #1.2
2.1) - See Alternative_pro #1.2

Related Issue Identification:

Issue Originator: Dave Bagby

Issue History:

January 1993: Date first opened - Alternatives #1 to 3 - Reference #1 - Argument-pro #1.1, 2.1 and 3.1.
March 1993: Reference #2 - Argument_pro #1.2 - Argument_con #3.1 and 2.1

Issue Status: Open

Issue Identification: 5.7 (Topic: Distribution Systems).

- Is the Explicit Re-association transaction required?

Alternatives:
1) - Yes
2) - No

References:
1) - P802.11-93/9 - 802.11 DS Service Transactions

Arguments:
Pro:
1.1) - Conceptually cleaner to perform an Explicit Re-association.
1.2) - Nicer for interaction with privacy level.
2.1) - This transaction can be accomplished with a Disassociate/Associate transaction pair.

Con:
2.1) - Probably translates into more message traffic in a protocol.

Related Issue Identification:
1) - 6.8 (Security)

Issue Originator: Dave Bagby

Issue History:
January 1993: Date first opened - Alternatives #1 and 2 - Reference #1 - Argument-pro #1.1, 1.2 and 2.1 - Argument-con #2.1.

Issue Status: Open

Issue Identification: 5.8 (Topic: Distribution Systems).

- What is the direction of the Re-association Transaction?

Alternatives:

Note 1: Based on the closure of Issue 5.7 - The following assumes that there is a Re-association transaction defined.

1) - From Station (STA) to Access Point (AP)
2) - From AP to STA
3) - Bidirectional

References:

1) - P802.11-93/9 - 802.11 DS Service Transactions

Arguments:

Pro:

3.1) - See note 1 - Station may wish to re-associate to another AP for reasons of signal quality and APs may whish to re-associate for reasons of signal quality, load balancing, or to fake an AP out of a network for service.

Con:

Related Issue Identification:

1) - 5.7 (Distribution System)

Issue Originator: Dave Bagby

Issue History:

January 1993: Date first opened - Alternatives #1 to 3 - Reference #1 - Argument-pro #3.1.

Issue Status: Open

Issue Identification: 5.9 (Topic: Distribution Systems).

How to determine that Access Points (APs) are present?

Alternatives:

1) - Discover:
- Listen (APs beacon) - hard for ad-hoc networks
- Ask (talk then listen) - may cause unnecessary traffic.

2) - Pre-configured knowledge
- Disadvantages from installation and configuration viewpoints.

3) - All frames are marked with an AP bit which indicates that they originate with an AP (Reference #3).

References:

1) - P802.11-93/9 - 802.11 DS Service Transactions

2) - P802.11-93/40 - The Wireless Hybrid Asynchronous Time-bounded MAC Protocol

3) - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol

Arguments:

General:

1) - The WHAT Protocol (see Reference #2) handle this in two ways:
a) Each MPDU that is transmitted by an Access Point is marked with a bit that indicates it was transmitted or relayed by an Access Point. A Station observing a Basic Service Set (BSS) that includes an Access Point will very quickly learn that the Access Point is present; and can attempt to sign on using a broadcast with the appropriate NETID.
b) When the network is idle, Access Points send out periodic Announce frames. Announce frames are also marked with the AP bit, so a receiving Station can distinguish an ad-hoc Basic Service Set from one that includes an Access Point.

Pro:

1.1) - Discover, Listen, if nothing is heard, then ask.

3.1) - If a station listens and does not hear frames from an AP, it can send a broadcast RTS with the Hierarchical bit set, which indicates that the RTS is intended for an AP only - this will cause any AP present to identify itself (Reference #3).

Con:

Related Issue Identification:

Issue Originator: Dave Bagby

Issue History:

January 1993: Date first opened - Alternatives #1 and 2 - Reference #1.
March 1993: Reference #2 - Argument_general #1 - Argument_pro #1.1
May 1993: Alternative #3 - Reference #3 - Argument_pro #3.1

Issue Status: Open

TOPIC: SECURITY

6

Note: - This section contains issues regarding Security, Authentication, Registration and Privacy.

Issue Identification: 6.1 (Topic: Security).

What is the support requirements for :
a) - Security,
b) - Authentication,
c) - Registration, and
d) - Privacy ?

Alternatives:

References:
1) P802.11-93/69 - Security in Wireless LAN

Arguments:
Pro:

Con:
1.0) - This issue may have to be re-opened since it sets the scope for subsequent issues.

Related Issue Identification:
1) - 6.2 (Security)
2) - 6.6 (Security)
3) - 6.8 (Security)

Issue Originator:

Issue History:

May 1992: Date first opened

July 1992 - The support for Authentication and Registration is specified in the Functional Requirement Document (IEEE P802.11-92/57), section Security. A related new issue to address Authentication and Registration was opened (Issue 6.4).

In addition, a new issue was opened (Issue 6.5) to address Security and Privacy.

May 1993 - Reference #1, Argument_Con #1.0

Issue Status: Closed - 07/92 (Editor note: Candidate for re-opening)

Issue Identification: 6.2 (Topic: Security).

- Does the PHY layer performs or supports the security functions?
Editor's note: Ref: 78 (92/58R1)

Alternatives:
1) - Yes
2) - No

References:
1) - P802.11-93/28 - IEEE 802.10 Standard for Interoperable LAN & MAN Security

Arguments:

Pro:
2.1) - Multiple PHYs would most likely required multiple security implementations.
2.2) - Application of IEEE 802.10b would result in a media independent solution.
2.3) - IEEE 802.10b is an approved standard and allows for flexibility regarding Security functions (i.e. private to open system can share the same media (BSA).
2.4) - IEEE 802.10b permits interoperability with other 802 LANs employing it.

Con:
1.1) - See Alternative_pro #2.1 and 2.4.

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: Date first opened
March 1993: Alternatives #1 and 2 - Argument_pro #2.1 to 2.4 - Argument_con #1.1 - Closure of the Issue (6.2) by endorsing Alternative #2; result: yes-22, no-0, abstain-2.

Issue Status: Close

Issue Identification: 6.3 (Topic: Security).

- How does unauthorized network access impact MAC throughput?

Editor's note: Ref: 1 (91/138) - Re-phrased 'Unauthorized network access impact on throughput' statement.

Alternatives:

1) - No direct impact

References:

1) - P802.11-93/28 - IEEE 802.10 Standard for Interoperable LAN & MAN Security

Arguments:

General:

1) - IEEE 802.10 protects against the ISO 7498-2 1988 threats of:
- Masquerade
- Replay
- Modification of messages.

Does not protect against the threats of :
- Denial of service; either intentional or unintentional (e.g. co-channel use, interference, lack of etiquette).

Pro:

1.1) - Unauthorized (failure of authentication) stations cannot access the network, therefore no direct impact on throughput.

Con:

Related Issue Identification:

1) - Issue 9.6 (Performance)

Issue Originator:

Issue History:

May 1992: Date first opened
March 1993: Alternative #1 - Reference #1 - Argument_general #1 - Argument_pro #1.1 - Closure of the Issue (6.3) by endorsing the alternative and transfer the issue to the 'Performance' (Topic 9) section of this document.

Issue Status: Close

Issue Identification: 6.4 (Topic: Security).

How will Authentication and Registration be specified in the 802.11 Standard ?

Alternatives:

1) - Submission P802.11-93/8 (see Reference #1) provides an initial high level frame work for addressing wireless network security in general which includes Authentication and Registration.

2) - Submission P802.11-93/2 (see Reference #2) proposes a high level scenario of the Registration procedure taking place between an Access Point (AP) and a Station (STA). Security features such as Authentication, access control and data masking key exchange are addressed.

3) - Authentication and Registration procedures using 802.10b could be provided as an annex to 802.11. Possible implementation might use RSA, DSS, IS-54 or something else. Request submissions by interested parties on actual implementations consistent with 802.10b SDE.

4) - No specification of Authentication or Registration at MAC level (Impact on Issue 6.1).

References:

1) - P802.11-93/8 - Wireless Network Security
2) - P802.11-93/2 - Registration Scenarios for Wireless LAN MAC Protocol.
3) - P802.11-93/28 - IEEE 802.10 Standard for Interoperable LAN & MAN Security
4) - P802.11-93/69 - Security in Wireless LAN

Arguments:

Pro:

3.1) - Strong feeling within the committee that 802.10 will be adequate to address 802.11 Security issues.

3.2) - The use of 802.10 mechanism is appropriate. However, a definition of a 802.10 minimal functionality and parameters remain undefined.

4.1) - The reason is that implicit authentication as provided by a MAC level confidentiality service is sufficient.

Con:

Related Issue Identification:

1) - 6.1 (Security)
2) - 6.5 (Security)

Issue Originator: Larry Van Der Jag

Issue History:

July 1992: Date first opened
January 1993: Alternatives #1 and 2 - References #1 and 2.
March 1993: Alternative #3 - Reference #3 - Argument_pro #3.1
May 1993: Alternative #4, Argument_pro #3.2 and #4.1, Closure of the Issue by adopting Alternative #3; result: yes-18, no-0, abstain-1.

Issue Status: Closed - May 1993

Issue Identification: 6.5 (Topic: Security).

- Is there a requirement for Security and Privacy?

Alternatives:

1) - Yes - Security, Privacy and Authentication are required to be supported.

References:

1) - P802.11-92/128 - IEEE 802.11 Distribution System Services Functionality
2) - P802.11-93/2 - Registration Scenarios for Wireless LAN MAC Protocol
3) - P802.11-93/8 - Wireless Network Security
4) - P802.11-93/10 - Time Bounded Implications Applied to Secure Services.

Arguments:

Pro:

1.1) -

Security: Security must be present in the initial design since the interaction of security concerns and hand-off prevent security from being easily added later. There is a need to prevent Security of existing wired networks from degrading when connected to a wireless network.

Authentication: Authentication is required. Without this function, information cannot be routed to mobile stations or control who uses the network.

Privacy: Provision for this function must be included. However, due to government concerns, the use of encryption must be optional (for export restriction reasons).

1.2) - The submissions #1, 2 and 3 referenced above imply that there is a requirement for Security and Privacy as they present the process in some details.

1.3) - The 802.11 standard is not required to specify Security, only the 'hooks' to use 802.10 specifications in the same manner as other MAC standards (i.e. 802.3 and 802.5) are able to use 802.10 to address Security requirements. If additional or different aspects of Security are required (for 802.11) a formal request will be made to 802.10 sub-committee.

Con:

Related Issue Identification:

1) - 6.1 (Security)
2) - 6.4 (Security)

Issue Originator: Larry Van Der Jagt

Issue History:

July 1992: Date first opened
November 1992: Alternative #1, Argument-pro #1.1 and Reference.
January 1993: References #2 to #4 - Arguments-pro #1.2 and 1.3 - Closure of the Issue by endorsing the Alternative (#1).-Result: yes-14, no-0, abstain-0.

Issue Status: Close

Issue Identification: 6.6 (Topic: Security).

Is there any additional work on Security that needs to be done by 802.11 in addition to the work that is done by 802.10 ?

Alternatives:

1) - Yes
2) - no

References:

1) - P802.11-93/28 - IEEE 802.10 Standard for Interoperable LAN & MAN Security
2) - P802.11-93/69 - Security in Wireless LAN

Arguments:

Pro:

1.1) - The answer should be yes: SDE can not serve the needs of a large majority of (wired/wireless networks) users because it forces them to retrofit SDE on their installed base. SDE is also overkill. Only a MAC level confidentiality service can provide the appropriate level of security at the appropriate levels of cost and (lack of) complexity. Such a service provides "authentication by implication" which is sufficient at MAC level.

2.1) - It is believed that document P802.11-93/28 (Reference #3) has answered that question, no, to majority of threats, but denial of services from Issue 6.3 still needs to be addressed, or this issue belongs somewhere else.

Con:

Related Issue Identification:

1) - 6.1 (Security)
2) - 6.5 (Security)
3) - 6.3 (Security)
4) - 6.4 (Security)

Issue Originator: Robert Crowder

Issue History:

July 1992: Date first opened
March 1993: Alternative #1 and 2 - Reference #1 - Argument_pro #2.1
May 1993: Reference #2, Argument_pro #1.1, Closure of the Issue by adopting Alternative #1; result yes-20, no-0, abstain-0.

Issue Status: Closed May 1993

Issue Identification: 6.7 (Topic: Security).

How does Re-association interact with Authentication?

Alternatives:

1) - Via third party Authentication service.
2) - IEEE 802.10 standard provides this interaction
3) - There is no interaction

References:

1) - P802.11-93/9 - 802.11 DS Service Transactions
2) - P802.11-93/28 - IEEE 802.10 Standard for Interoperable LAN & MAN Security
3) - P802.11-93/69 - Security in Wireless LAN

Arguments:

Pro:

1.1) - The standard should support the ability for a Station (STA) to ask the Distribution System (DS) to establish Authentication for itself to a requested set of Access Points (APs).

2.1) - The use of Security Associations set up in the Security Management Information Base, (SMIB) of 802.110 could provide for a way to effectively and efficiently handle re-associations for both authentication and privacy.

2.2) - 802.11 will define authentication transactions and 802.10 provides the mechanism for negotiation or finding pre-established security associations. Pre-authentication transaction mitigate possible performance impacts.

3.1) - Same as 6.8: (re-)association is medium access function, not a systems function. Therefore, there is no link between (re-)association and "authentication" or "access control". However, the results of authentication operations performed at, say, the application layer, can be used in the MAC layer to provide implicit authentication (if I have the right key than obviously I have been authenticated). Implicit authentication works within a logical group: changing groups may require re-authenticating to the new group.

Con:

Related Issue Identification:

1) - 6.8 (Security)

Issue Originator: Dave Bagby

Issue History:

January 1993: First Opened - Alternative #1 - Reference #1 - Argument-pro #1.1.
March 1993: Alternative #2 - Reference #2 - Argument_pro #2.1
May 1993: Alternative #3, Argument_pro #2.1 and #3.1, Closing of the Issue by adopting Alternative #3; result: yes-16, no-0, abstain-3.

Issue Status: Closed - May 1993.

Issue Identification: 6.8 (Topic: Security).

How does Re-association interact with Privacy?

Alternatives:

1) - IEEE 802.10 standard provides this interaction

2) - The only interaction is if the Access Point (AP) cannot support the current privacy algorithm. In this case it impacts the reassociation transaction (which could fail).

References:

1) - P802.11-93/9 - 802.11 DS Service Transactions
2) - P802.11-93/28 - IEEE 802.10 Standard for Interoperable LAN & MAN Security
3) - P802.11-93/69 - Security in Wireless LAN

Arguments:

General:

1) - Because the Privacy level can change dynamically, there is no gain by trying to pre-determine the Privacy level at the same time than third party Authentication.

2) - If a Re-association transaction includes the current Privacy level, it is very cheap to check that the new Access Point (AP) supports this privacy level.

Pro:

1.1) - The use of Security Associations set up in the Security Management Information Base, (SMIB) of 802.110 could provide for a way to effectively and efficiently handle re-associations for both authentication and privacy.

Con:

Related Issue Identification:

1) - 6.7 (Security)

Issue Originator: Dave Bagby

Issue History:

January 1993: First Opened - Reference #1 - Arguments-general #1 and 2.
March 1993: Alternative #1 - Reference #2 - Argument_pro #1.1
May 1993: Alternative #2, Reference #3, Closure of the Issue by adopting Alternative #1; result: yes-16, no-0, abstain-3.

Issue Status: Closed May 1993.

Issue Identification: 6.9 (Topic: Security).

Shall the 802.11 standard specify one or more publicly available privacy algorithms which all stations shall be required to support?

Alternatives:

1) - Yes
2) - No

References:

Arguments:

General:

1) - While support of 'all' privacy algorithms is ok, all stations are required to support a public algorithm.

2) - If (1) above is true, which algorithm (s) is the default? - possibly a 'null' security algorithm (see Argument_pro #1).

Pro:

1.1) - One privacy option shall be 'null'.

1.2) - The minimal requirement shall be a 'null' privacy option. In addition the 802.11 committee will request the list of standardized algorithms from 802.10 and evaluate if there is an algorithm that 802.11 needs to include in the minimal supported set (or possibly offer one on their own to 802.10 for cataloging should 802.11 decide to proceed with this option).

Con:

Related Issue Identification:

Issue Originator: Bob Crowder

Issue History:

March 1993: Date first opened - Alternatives #1 and 2 - Argument_general #1 and 2 - Argument_pro #1.1.
May 1993: Argument_pro #1.2, Closing of the Issue by endorsing alternative #1; result: yes-16, no-0, abstain-3.

Issue Status: Closed May 1993.

Issue Identification: 6.10 (Topic: Security).

Shall the minimal Security algorithms set be expended to include a Privacy equivalent to wired LANs?

Alternatives:

1) - Yes

References:

Arguments:

General:

1.0) - Most users will require a level of security for their wireless LANs that they perceive to be equivalent to the physical security of their wired LANs. We must provide this at the MAC layer as customers cannot be required to retrofit existing LANs.

2.0) - The desired properties of a candidate encryption algorithm include but are not limited to:

a) - Strong (see General #1.0 above; is this a function of key size?)

b) - Self-synchronizing (loss of packets must not require re-synchronization).

c) - Efficient (must not significantly add to processing overhead)

d) - Exportable/ImportableLicensable according to IEEE guidelines.

Pro:

1.1) - Authentication is of little value without an integrity or confidentiality service. Confidentiality is often easier to implement.

1.2) - A common encryption algorithm is necessary for interoperability.

1.3) - Encryption, when done properly, can provide the services of confidentiality, integrity, and Authentication. Thus, return on investment is high.

Con:

1.1) - Known strong encryption algorithms:

a) - may need to be licensed;

b) - may be computationally complex; or

c) - may add excessive packet overhead.

1.2) - At this time, the privacy equivalent of wired LAN has not been quantified (e.g.; 20 bit, 40 bit key, etc).

1.3) - Known strong algorithms have problem with Export/Import restrictions.

Related Issue Identification:

1) - 6.4 (Security)

2) - 6.6 (Security)

3) - 6.9 (Security)

Issue Originator: D. Bagby

Issue History:

May 1993: Date first opened.

July 1993: Alternative #1, Argument-general #1.0 and #2.0, Argument-pro #1.1 to #1.3 and Argument-con #1.1 to #1.3.

Issue Status: Open

TOPIC: COST

7

Issue Identification: 7.1 (Topic: Cost).

- How does cost of goods influence our designs?
- Is cost proportional to functionality?
- Can it be measured?

Alternatives:

1) - Obsolete Issue

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: Date first opened

January 1994: Alternative #1 and closing the Issue by endorsing the alternative - MAC: unanimous

Issue Status: CLOSED January 1994

Issue Identification: 7.2 (Topic: Cost).

- How interoperability of 'low cost' and 'reliable MAC' is to be addressed?

Alternatives:
1) - Obsolete Issue

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: Date first opened
January 1994: Alternative #1 and closing the Issue by endorsing the alternative - MAC: unanimous

Issue Status: CLOSED January 1994

TOPIC: SAFETY

8

Issue Identification: 8.1 (Topic: Safety).

- How does safety concerns impact our decisions?
- Do we let our decision making be driven by time constraints?

Alternatives:

Arguments:

General:

1.0) - Splitting the Issue into 2 related Issues:

8.1A) - How does safety concerns impact our decisions?

8.1B) - Do we let our decision making be driven by time constraint?

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: first open

January 1994: - Argument-General #1.0 and closing the Issue 8.1

Issue Status: CLOSE January 1994

Issue Identification: 8.1A (Topic: Safety).

How does safety concerns impact our decisions?

Alternatives:

Arguments:
General:

Pro:

Con:

Related Issue Identification:
1) - 8.1 (Safety)

Issue Originator: MAC Group

Issue History:
January 1994: - Date first open

Issue Status: Open

Issue Identification: 8.1B (Topic: Safety).

Do we let our decision making be driven by time constraint?

Alternatives:
1) - Obsolete issue

Arguments:
General:

Pro:

Con:

Related Issue Identification:
1) - 8.1 (Safety)

Issue Originator: - MAC Group

Issue History:
January 1994: Date first open and closed by endorsing the Alternative. MAC: unanimous

Issue Status: CLOSED January 1994

TOPIC: PERFORMANCE

9

Issue Identification: 9.1 (Topic: Performance).

- How will the standard address:
  a) - MAC throughput?
  b) - throughput probability?

Alternatives:

1) - The throughput performance may be addressed via a an optional Data Compression function.
2) - Obsolete Issue

References:

1)- P802.11-92/123 - "Mathematica" Based Integrated MAC/PHY Performance Simulation Framework Including Capture Effect.
2) - P802.11-93/1 - Application of "Mathematica" Based Simulation Template to Demand Assigned MAC Described in IEEE P802.11-92/39 ("The IBM MAC Proposal").
3) - P802.11-93/29 - Wireless LAN MAC Protocol: Data Compression as a MAC Option to Improve Effective Throughput.

Arguments:

Pro:

1.1) - The function (compression) would be optional, at the MAC Layer, because it may be performed by higher layers.
1.2) - Any compression function will increase the [MAC] performance.

Con:

1.1) - Compression on a packet basis may not provide a very useful compression ratio.

Related Issue Identification:

1) - 29.1 (Simulation)
2) - 9.1 (Performance)

Issue Originator:

Issue History:

May 1992: First opened
November 1992: Reference and Related Issue.
January 1993: Reference #2
March 1993: Alternative #1 - Reference #3 - Argument_pro #1.1 and 1.2 - Argument_con #1.1.
January 1994: Alternative #2 - Attempt to close the Issue as 'obsolete' failed.

Issue Status: Open

Issue Identification: 9.2 (Topic: Performance).

What are the area coverage implications of MAC timing constraints?

Alternatives:

1) - No timing constraints are imposed by this protocol that would limit coverage area of LAN dimensions.
2) - Obsolete Issue

References:

1) - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol

Arguments:

Pro:

1.1) - On the assumption that this issue arose from the Ethernet maximum cable length specification which is driven by the timing constraints of CSMA/CD.

Con:

Related Issue Identification:

1) - 10.4 (Topic: Coordination)

Issue Originator:

Issue History:

May 1992: First opened
May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1.
January 1994: Alternative #2 and closing the Issue by endorsing Alternative #2 - MAC: unanimous

Issue Status: CLOSED January 1994

Issue Identification: 9.3 (Topic: Performance).

Is the same MAC must work in a minimum system and maximum system (network size independence)?

Alternatives:

1) - Yes

References:

1) - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol
2) - P802.11-93/115 - Protocol Layering Alternatives for Practical Implementation
3) - P802.11-93/140 - MAC/PHY Functional Partitioning

Arguments:

Pro:

1.1) - Not just to work in minimum and maximum system, but to work efficiently in both is the goal of the CODIAC protocol (Reference #1).

1.2) - The same MAC must support minimum and maximum system configurations.

Con:

Related Issue Identification:

1) - 5.5 (Topic: Distribution Systems)

Issue Originator:

Issue History:

May 1992: Date first open
May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1.
September 1993: Reference #2 & #3 and Argument_pro #1.2
January 1994: - Close the Issue by endorsing Alternative #1. - MAC: Unanimous

Issue Status: CLOSE January 1994

Issue Identification: 9.4 (Topic: Performance).

- How will the standard address attenuation ?

Alternatives:

References:
1) - P802.11-92/123 - "Mathematica" Based Integrated MAC/PHY Performance Simulation Framework Including Capture Effect.

Arguments:

Pro:

Con:

Related Issue Identification:
1) - 29.1 (Simulation)

Issue Originator:

Issue History:

May 1992: First opened
November 1992: Reference and Related Issue.
January 1994: - Attempt to close the Issue failed.

Issue Status: Open

Issue Identification: 9.5 (Topic: Performance).

~~- Shall the 802.11 standard requires optional data compression at the MAC layer level?~~

- Shall the 802.11 standard provides the option for data compression at the MAC Layer level?

Alternatives:

1) - Yes
2) - No

References:

1) - P802/11-93/29 - Wireless LAN MAC Protocol: Data Compression as a MAC Option to Improve Effective Throughput

Arguments:

General:

1.0) - If the function is good enough to warrant an option, why not be provided all the time? - the effect of compression on compressed data can become data 'expansion' - this is not an option but a feature which can be 'turned on/off'.

2.0) - If performed 'before' MAC in data flow, why is it a MAC option? - compression must be symmetrical and because of different vendor options, the compression function need to be in the MAC.

3.0) - Compression performed above MAC works with a larger data stream and thus more efficient.

4.0) - Requirement for public compression as first choice.

5.0) - Miscellaneous questions:
- impact of compression on transfer delay.
- interaction of compression and privacy - compression first, then cypher.
- compression imply the requirement for fragmentation facilities - do not know how much the data will compress.

6.0) - Assessment of Compression function:

	Amount of Compression	Complexity	System Impact (memory)	Latency
Packet by Packet	Low (1.18-1.86)	Low	Low	Low
Multiple Compres. History	High (1.44-2.38)	High	High	Low
Block Buffering	High	Medium	Medium	High

Pro:

1.1) - A field for Compression and a unique algorithm. identification field should be provided in the MAC frames. - Example of procedure:

```
Obtain Association
If Association is not found then
    Notify local management
Else
    If Compression requirement = true then
        Invoke Compression function

    If Secure Data Exchange (SDE) is required then
        Append CRC & PAD
        Encipher function

Continue processing
```

Con:

Related Issue Identification:
1) - 9.1 (Performance)

Issue Originator:

Issue History:
March 1993: Date first opened - Alternative #1 - Reference #1 - Argument_general #1 to 5
September 1993: Alternative #2, Argument_general #6.0, Argument_pro #1.1 and closing of the Issue by endorsing Alternative #1 with the following motion: - *Motion: Compression will be supported by providing the necessary management hooks to invoke the mechanism of 802.10 and we will formally request that 802.10 to extend their work to include support of compression. If 802.10 declines, we will have to revisit this topic.* - Results: yes-25, no-5, abstain-1.

Issue Status: - Closed - September 1993.

Issue Identification: 9.5A (Topic: Performance).

- How should Compression be supported and specified?

Alternatives:

1) - yes
2) - no

References:

Arguments:

Pro:

1.1) - Field for compression and an unique algorithm identification be allocated in the MPDU.

Con:

Related Issue Identification:

Issue Originator: MAC Group

Issue History:

September 1993 - Date first opened - Alternative #1 and #2, Argument_pro #1.1

Issue Status: Open

Issue Identification: 9.5B (Topic: Performance).

Should the default Compression algorithm should be 'none'?

Alternatives:
1) - yes
2) - no

References:

Arguments:
General:
1.0) - Compression should not be an 802.11 issue but rather an 802.10 as for Security.

Pro:

Con:

Related Issue Identification:

Issue Originator: MAC Group

Issue History:
September 1993 - Alternative #1 and #2, Argument_general #1.0

Issue Status: Open

Issue Identification: 9.6 (Topic: Performance).

- How does 'interference' impact MAC throughput?

Alternatives:
1) - Refer to Issue 9.1

References:

Arguments:
General:

Pro:
1.1) - This Issue is already addressed in Issue 9.1

Con:

Related Issue Identification:
1) - 9.1 (Performance)

Issue Originator: MAC Group

Issue History:
March 1993: Date first opened
January 1994: Close the Issue by endorsing Alternative #1. - MAC: unanimous

Issue Status: CLOSED January 1994

TOPIC: COORDINATION

10

Issue Identification: 10.1 (Topic: Coordination).

~~What is a Coordination Function (CF) ?~~
What Coordination Function (CF) will be specified in the standard?

Alternatives:

1) - A Distributed Coordination Function (DCF).
2) - Point Coordination Function (PCF)
3) - Both, DCF and PCF (same alternatives as specified in Issue 10.2B).

References:

1) - P802.11-93/40 - The Wireless Hybrid Asynchronous Time Bounded MAC Protocol.
2) - P802.11-93/70 - A Distributed Access Protocol Proposal Supporting Time Bounded Services.
3) - P802.11-93/10a1 - Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications (Draft)
4) - P802.11-93/3 - What are Adhoc Wireless LANs? - A Viewpoint.
5) - P802.11-93/70 - A distributed Access Protocol Proposal Supporting Time-bounded Services.
6) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.
7) - P802.11-94/16 - Review of MAC Issues List
8) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

General:

1.0) - Selection is dependent on the selected MAC protocol or the protocol selection is dependent on the coordination alternative selected.

2.0) - Proposed to change the CF definition (see Reference #3). CF should include protocol flow control of all contention resolutions (Slotted aloha / CSMA) and also data packet delivery for local network management and interface to the access point.

3.0) - The current definition of CF should be retained (see Reference #3).

4.0) The issue of coordination appears to be at the heart of the difference between the 802.11 MAC proposals. From this point was derived the decision to select one MAC proposal for the foundation to the 802.11 MAC standard.

5.0) Attempt to distinguish between PCF and Point/Centralized-Control functions (e.g. Power Management, Store/forward functions, Distribution System access, channel option, network planning) - Counter argument: This has nothing to do with coordination function.

Pro:

1.1) - A DCF should be specified as the default mode of operation. A DCF is simple to implement, sufficient for asynchronous service, and well suited to ad-hoc networks. A PCF should be added as an optional extension when Time-bounded service is required. The WHAT protocol (Reference #1) is an example of this approach.

1.2) - A DCF should be specified as the primary mode of operation. A DCF based on CSMA/CA + Ack as proposed in this document (Reference #2) has good medium sharing characteristics without added control overhead. The throughput efficiency is high and stable for high loads. It is well suited for Ad-Hoc operation, and allows overlap of infrastructure and Ad-Hoc, even on the same channel. It does fully support single channel PHY's.

1.3) - DCF facilitates ad-hoc networks better because it does not require a controller (From Alternative 2b of Issue 10.3 (Reference #2)).

1.4) - DCF is lower overhead and possibly lower access delay (in small population BSAs) (From Alternative 2e of Issue 10.3 (Reference #2)).

1.5) - Distributed Coordination function is better to deal with other transmitter in a Basic Service Area.

2.1) - A PCF can be built on top of the proposed CSMA/CA access method (Reference #2), allowing full coexistence and efficient sharing between Asynchronous and Time Bounded Services. Reserved but unused Isochronous bandwidth is fully available for the Asynchronous service, without any control overhead. The proposed Time Bounded Service (Reference #2) implementation using the CSMA/CA access method with priority does not burden the implementation of an Asynchronous Service only MAC.

2.2) - It is easy to manage the assignment of PCF in ad-hoc networks (see Reference #4).

2.3) - PCF lends itself to network planning topology.

2.4) - Having PCF access to the media can be tailored to the traffic nature of channel utilization optimization.

2.5) - PCF lends itself to power management.

2.6) - The quality of Time-bounded service is higher with PCF than the one provided by DCF.

2.7) - PCF is required for Time-bounded services (TBS) support (From Alternative 2a of Issue 10.3 (Reference #2)).

2.8) - PCF is better for high population networks, deterministic media access to avoid collisions (From Alternative 2d of Issue 10.3 (Reference #2)).

3.1) - By using DCF as the basic CF, with a PCF on top of it for Time Bounded service, there is no issue related to overlap of Ad-Hoc and infrastructure networks. For the same reason there is no issue for the MAC to operate on a single channel PHY, because of the medium sharing characteristics of the DCF (From Argument-pro 1.1 of Issue 10.3 (Reference #2)).

3.2) - Both types of coordination function are defined in the MAC Foundation (reference #8).

Con:

2.1) - There are difficulty to manage the assignment of PCF in ad-hoc network

2.2) - It is very difficult to manage assignment of PCF in a mobile station in a high mobility situation.

2.3) - Ad-hoc network require special function to become the PCF, opposed to the DCF which does not require any special function.

2.4) - PCF does not work without single channel PHY in overlapping BSAs

Related Issue Identification:

1) - 10.2B (Coordination)
2) - 10.3 (Coordination)

Issue Originator: Larry Van Der Jagt

Issue History:

May 1992: First opened
July 1992: Rephrase the Issue
March 1993: Alternative #1 - Reference #1 - Argument_pro # 1.1
May 1993: Alternative #2 - Reference #2 - Argument_pro #1.2 and #2.1
July 1993: Alternative #3, Argument-general #1.0 to #3.0, Argument-pro #2.2 to #2.8 and #3.1, Argument-con #2.1 to #2.3 and References #3 to #6.
September 1993 - Argument_General #4.0 & #5.0, Argument_pro #1.5 and Argument_con #2.4.
January 1994: Reference #7 & #8, Argument-pro #3.2 and closing the Issue by endorsing Alternative #3. MAC: Yes-37, no-0, Abstain-3.

Issue Status: CLOSED January 1994

Issue Identification: 10.2 (Topic: Coordination).

What are the event that causes switching between multiple Coordination Functions (CF) ?

Does multiple Coordination Functions (CF) need to be specify ?

Alternatives:

References:

Arguments:

General:

1.0) - Splitting of the Issue into 2 related issues:

10.2A - What are the event that causes switching between multiple Coordination Functions (CF) ?

10.2B - Does multiple Coordination Functions (CF) need to be specify ?

Pro:

Con:

Related Issue Identification:

1) - 10.1A - (Coordination)
2) - 10.1B - (Coordination)

Issue Originator: Larry Van Der Jagt

Issue History:

May 1992: First opened

Issue Status: Open

Issue Identification: 10.2A (Topic: Coordination).

What are the event that causes switching between multiple Coordination Functions (CF)?

Alternatives:

1) The following functions causes switching between multiple CFs:

- Hand-off: The process of passing control of the Mobile Station's activities from one Coordination Function to another, whether or not the Coordination Functions are members of the same Administrative Domain or not.

- Ranging: The act of a Mobile Station which is transiting from one Service Area to another while Signed-on and in session.

- Roaming: A form of Registration used for Mobile Stations which will use a network on a temporary basis.

2) - There are no multiple CF's needed as basic access method.

3) - Switching from Distributed Coordination Function (DCF) to Point Coordination Function (PCF).

References:

1) - P802.11-92/126 - The Use of Terms for Expressing the Concepts of "Roaming", "Hand-off", "Registration" and "Identification" in WLAN Systems.

2) - P802.11-93/70 - A Distributed Access Protocol Proposal Supporting Time Bounded Services.

3) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol

Arguments:

General:

1.0) - If the coordination function Alternative selected in Issues 10.1 and/or 10.2B (Related Issues #2 and #3) is 'both' PCF and DCF, than the text of this Issue should changed to 'What event causes a Basic Service Set (BSS) to switch between PCF and DCF?'

2.0) - A new Issue should be open (Related Issue #4) which states 'What are the events that causes a station to switch BSS within an ESS?'.

Pro:

2.1) - A Point Coordination Function (PCF) can be used as described for the Time Bounded Service (Reference #2), but it is built on top of the DCF. So the DCF is the basic CF. Therefore Switching is not applicable.

3.1) - Request for Time-bounded service from a station to a controller which supports Time-bounded services.

3.2) - Detection of high traffic causing high rate of collisions.

Con:

Related Issue Identification:

1) - 10.2B (Coordination)

2) - 10.1 (Coordination)

3) - 10.2B (Coordination)
4) - 10.5 (Coordination

Issue Originator:

Issue History:

May 1992: First opened
November 1992: Alternative #1 and Reference #1.
May 1993: Alternatives #2 and #3 - References # 2 and #3 - Argument_pro #2.1, #3.1 and #3.2.
July 1993: Argument-general #1.0 and #2.0 (decision to open a new Issue 10.5)

Issue Status: Open

Issue Identification: 10.2B (Topic: Coordination).

Do multiple Coordination Functions (CF) need to be specified?

Alternatives:

1) - Yes
2) - See Alternative #2 of Issue 10.2A
3) - Both Distributed Coordination Function DCF) and Point Coordination Function (PCF)

References:

1) - P802.11-92/126 - The Use of Terms for Expressing the Concepts of "Roaming", "Hand-off", "Registration" and "Identification" in WLAN Systems.
2) - P802.11-93/70 - A Distributed Access Protocol Proposal Supporting Time Bounded Services.
3) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol
4) - P802.11-94/16 - Review of MAC Issues List
5) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

General:

1.0) - It is proposed to close this Issue because the Issue is addressed as an Alternative of Issue 10.1 (Both PCF and DCF should be specified in the standard) (see Related Issue #2).

Pro:

2.1) - See Alternative_pro #2 of Issue 10.2A

3.1) - Both Distributed Coordination Function (DCF) and Point Coordination Function (PCF) are required to support efficient operation with network size independence for asynchronous service. PCF is required for TBS, but this should not be forced on small population and ad-hoc networks.

3.2) - Both types of coordination function are defined in the MAC Foundation (reference #5).

Con:

Related Issue Identification:

1) - 10.2A (Coordination)
2) - 10.1 (Coordination)

Issue Originator:

Issue History:

May 1992: First opened
November 1992: Alternative #1 and Reference #1
May 1993: Alternatives #2 and #3 - Reference #2 and #3 - Argument_pro #2.1 and #3.1
July 1993: Argument_general #1.0 proposing to close the Issue at the September 1993 meeting.
January 1994: Reference #4 & #5, Argument-pro #3.2 and closing the Issue by endorsing Alternative #3. MAC: Yes-36, no-0, Abstain-5.

Issue Status: CLOSED January 1994

Issue Identification: 10.3 (Topic: Coordination).

What are the issues surrounding the Point Coordination Function (PCF) and Distributed Coordination Function (DCF) arguments ?

Alternatives::

1) - No issue related to overlapped ad-hoc and infrastructure network.

2) - The following is a list of issue addressing the overlapped of ad-hoc and infrastructure network:
   a) - PCF is required for Time-bounded services (TBS) support.
   b) - DCF facilitates ad-hoc networks better because it does not require a controller.
   c) - PCF is better than DCF for minimizing power consumption of portable stations.
   d) - PCF is better for high population networks, deterministic media access to avoid collisions.
   e) - DCF is lower overhead and possibly lower access delay (in small population BSAs).

References:

1) - P802.11-93/70 - A Distributed Access Protocol Proposal Supporting Time Bounded Services.
2) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol
3) - P802.11-94/16 - Review of MAC Issues List

Arguments:

General:

1.0) - The alternatives and arguments of this are directly related to Issue 10.1. Therefore, the Alternatives and Arguments of this Issue are transferred to Issue 10.1 and closure of this Issue is recommended.

2.0) - This issue was used to keep track of the various arguments in support of PCF and DCF. Given that the standard should support both, this particular issue should be closed.

Pro:

1.1) - By using DCF as the basic CF, with a PCF on top of it for Time Bounded service, there is no issue related to overlap of Ad-Hoc and infrastructure networks. For the same reason there is no issue for the MAC to operate on a single channel PHY, because of the medium sharing characteristics of the DCF.

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: Date first opened
May 1993: Alternative #1 and #2 - References #1 and #2 - Argument_pro #1.1.
July 1993: Argument_general #1.0 proposing to close this Issue at the September 1993 meeting.
January 1994: Reference #3 Argument-general #2.0 and closing the Issue by endorsing the Argument_general #2.0. MAC: Yes-37, no-1, Abstain-1.

Issue Status: CLOSED January 1994

Issue Identification: 10.4 (Topic: Coordination).

- What are the requirements concerning service area ?

Alternatives:
1) - Obsolete Issue

Arguments:
General:
1.0) - As no special requirement for service area, which are not already specified for Basic Service Set (BSS), can be identified, closure of this Issue is recommended.

Pro:

Con:

Related Issue Identification:
1) - 10.2A (Coordination)

Issue Originator:

Issue History:
May 1992: Date first opened
July 1993: Argument_general #1.0 proposing to close the Issue at the September 1993 meeting.
January 1994: Alternative #1 and closing the Issue by endorsing the alternative - MAC: unanimous

Issue Status: CLOSED January 1994

Issue Identification: 10.5 (Topic: Coordination).

- What are the events that causes a station to switch Basic Service Set (BSS) within an Extended Service Set (ESS)?

Alternatives:

1) - The following functions causes switching between multiple BSSs:
   a) - Change in quality of service (QOS):
      i) - Hand-off
      ii) - Ranging
      iii) Roaming
   b) Explicit station configuration changes:
      i) - User initiated request
      ii) BSS Management
   c) - Both, changes in QOS and station configuration changes

Arguments:

General:

Pro:

Con:

Related Issue Identification:

Issue Originator: Alex Belfer

Issue History:

July 1992: Date first opened and Alternative #1

Issue Status: Open

Issue Identification: 10.6 (Topic: Coordination).

Should the standard specify means by which a Distributed Coordination Function (DCF) can cooperate with a Point Coordination Function (PCF) when a PCF is detected?

Alternatives:
1) - Yes

References
1) - P802.11-94/16 - Review of MAC Issues List
2) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:
General:

Pro:
1.1) - The MAC Foundation (Reference #2) describes specific ways in which this can be done. Even if the specifics in this regard undergo modifications in the final standard, the answer to this question should still be "yes'.

Con:

Related Issue Identification:
1) - 10.1 (Coordination)
2) - 10.2 (Coordination)
3) - 10.2A (Coordination)
4) - 10.2B (coordination)
5) - 10.3 (Coordination)

Issue Originator: K. Lynn

Issue History:
September 1993: Date first opened.
January 1994: Reference #1 & #2, Argument-pro #1.1 and closing the Issue by endorsing Alternative #1 MAC: Yes-38, no-0, Abstain-0.

Issue Status: CLOSED January 1994

TOPIC: ACCESS POINT

11

Issue Identification: 11.1 (Topic: Access Point).

- What is the definition of an Access Point (AP) ?
Editor's note: Ref: 17 (92/58R1)

Alternatives:

The definition of an Access Point (AP) is specified in the Functional Requirements document (P802.11-92/57) in the 'Definitions' section.

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened
July 1992: Agreed on the Alternative

Issue Status: Closed

Issue Identification: 11.2 (Topic: Access Point).

- What are the internetworking requirements with existing wired networks ?
Editor's note: Ref: 22 (92/58R1)

Alternatives:

1) The requirement is that information be able to be exchanged with existing wired networks - this is the reason for the existence of the Integration Service.

Editor's note: According to 92/128, Integration is defined as 'The service which enables delivery of MSDUs between the Distribution System and an existing network'.

References:

- P802.11-92/128 - IEEE 802.11 Distribution System Services Functionality

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened
November 1992: Alternative #1 and Reference

Issue Status: Open

Issue Identification: 11.3 (Topic: Access Point).

Is there a need for multiple Access Points (APs) per Basic Service Set (BSS) ?

Alternatives:
1) - No

References:
1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol
2) - P802.11-94/16 - Review of MAC Issues List
3) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

Pro:

1.1) - Although no need is envisioned, no reason for preclusion is seen. With the CODIAC protocol (Reference #1) only one controller per centralized mode BSS is required, but any number of stations could be APs.

1.2) - The MAC Foundation (Reference #3) requires a single AP per BSS in infrastructure configurations. This ensures that all stations within a given BSS can be properly coordinated and synchronized.

Con:

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: Date first opened
May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1
January 1994: Reference #2 & #3, Argument-pro #1.2 and closing the Issue by endorsing Alternative #1 MAC: Yes-28, no-2, Abstain-11.

Issue Status: CLOSED January 1994

Issue Identification: 11.4 (Topic: Access Point).

Can it be stated that in the case of the presence of a station acting as an Access Point (AP), it always contains the Point Coordination Function (PCF) if a PCF is present?

Alternatives:
1) - No

References:
1) - P802.11-94/16 - Review of MAC Issues List

Arguments:
Pro:
1.1) - Although it is unlikely that a real implementation will place the PCF elsewhere, strictly speaking it is not required that the PCF always be collocated with the AP.

Con:

Related Issue Identification:

Issue Originator: D. Bagby

Issue History:
May 1993: Date first opened
January 1994: Alternative #1, Reference #1, Argument-pro #1.1 and closing the Issue by endorsing Alternative #1 MAC: Yes-32, no-2, Abstain-3.

Issue Status: CLOSED January 1994

Issue Identification: 11.5 (Topic: Access Point).

Will AP provides relay of packets to other device within a BSS?

Alternatives:

References:
1) - P802.11-93/208 - A Complete Description of Frame Prioritization in a CSMA/CA MAC Protocol.

Arguments:
Pro:

Con:

Related Issue Identification:

Issue Originator: MAC Group

Issue History:
January 1994: Date first open and Reference #1.

Issue Status: Open

Issue Identification: 11.6 (Topic: Access Point).

Will the MAC support the functionality of more than one AP per BSS?

Alternatives:

References:

Arguments:
Pro:

Con:

Related Issue Identification:

Issue Originator: MAC Group

Issue History:
January 1994: Date first open

Issue Status: Open

TOPIC: INTERFACES

12

Issue Identification: 12.1 (Topic: Interfaces).

What is the MAC/PHY interface ?

Alternatives:

1) - A Parametric MAC-PHY Interface Model (Document P802.11-92/99). The paper defines a first cut of defining 'a universal MAC structure, or "load-able" state machine topology. The initial means to conceptualize this MAC structure is by defining a set of PHY independent primitives at the MAC-PHY interface'.

2) Document P802.11-92/100 - Proposed WLAN Architecture.
The paper addresses the following interfaces and Service Access Points (SAPs):
- MAC/PHY logical interface with a MAC-PHY / Medium Independent PHY Layer SAP boundary and a Local Management (PHY specific) / Medium Independent PHY Layer SAP boundary..
- DTE/DCE Interface optional exposed at the Medium Independent PHY Layer / PHY boundary

3) Document P802.11-92/125 - MAC/PHY Interface Specifics in Support of the Use of a Parameter Service Access Point Approach to PHY Independence.
This paper proposes "two Service Access Points between the MAC and PHY":
- The Data Service Access Point (DSAP). It "supports the transmission of normal data packets called MAC Protocol Data Units (MPDU)".
- The Parameter Service Access Point (PSAP). It "supports interactions between the MAC and PHY that can happen on a frame by frame basis in order to improve the ability of stations to access the medium.

4) - Separate data and Management paths support the Data Service Access Point (DSAP and the parameter Service Access Point (PSAP).

5) - MAC/PHY service primitives at the PHY Service Access Point (SAP) (Reference #5):
- PH-DATA-Request (Class, data)
- PH-DATA-indication (class, data)
- PH-DATA-confirm (Status)

6) - The MAC/PHY interface is generally a DTE/DCE interface of the type discussed previously (Reference #6) for the 'optionally exposed interface' between the 'convergence layer' and the 'medium independent layer' within PHY.

7) - The bulk of the paper (Reference #7) describes this MAC/PHY interface

8) - (Reference #8) - The MAC/PHY Interface is the (optionally exposed) DTE/DCE interface that is located between the Physical Medium Adaptation layer of MAC and the Convergence layer of PHY. This interface provides data and parameter transfer facilities that are functionally, electrically and mechanically (if exposed) medium-independent. However, the information transferred over this interface may be medium-dependent subject to the functions performed in the Physical Medium Adaptation layer.

References:

1) - P802.11-92/99 - A parametric MAC-PHY Interface Model
2) - P802.11-92/100 - Proposed WLAN Architecture
3) - P802.11-92/125 - MAC/PHY Interface Specifics in Support of the Use of a Parameter Service Access Point Approach to PHY Independence.
4) - P802.11-93/146 - The Need for MAC Data Delimiters in the PHY.

5) - P802.11-92/162 - MAC-PHY Service Primitives - Proposed Starting Point Text for Section 6 of Document P802.11/20 [Draft 802.11 Standard].
6) - P802.11-93/115 - Protocol Layering Alternatives for Practical Implementation.
7) - P802.11-93/140 - MAC/PHY Functional Partitioning
8) - P802.11-93/204 - An Improved Reference Model for IEEE 802.11.

Arguments:

Pro:

1.1) - The solution proposed (P802.11-92/99) 'is put forward to overcome the dependency of MAC in PHY implementation techniques. In this way, the idea of a universal MAC can accomplished. The solution also frees the constraints placed on the system implementors to adopt a particular FY (?) structure so as to utilize the common MAC hardware. Thus, diverse PHY media such as IR, Sonics and Radio can benefit from the scale economy in the MAC hardware production.

2.1) - This paper (P802.11-92/100) captures the sense of the July [1992] discussion.

3.1) - The solution proposed (P802.11-92/125) that with 'this simple method a significant amount of flexibility is introduced into the MAC/PHY interface and into the MAC's ability to successfully achieve media access':
- Low cost in terms of MAC complexity
- Flexibility to take advantage of emerging technologies
- Critical to achieving the operation of multiple PHYs using a single MAC.

4.1) - It is agree with support of the parametric MAC-PHY interface model in concept if not in detail. A similar model of this type of interface is the PCMCIA Socket Services.

6.1) - The function at the MAC/PHY interface as described in Reference #6 are:
- Serial transmit and receive bit streams, using clocks provided by the PHY;
- Direct control and status signals fro transmitter and receiver enable clear-to-send, carrier-sense, and receive-data-enable;
- Serial command transfers from MAC to PHY for functions such as:
  - setting power levels;
  - setting transmit bit rate;
  - setting receive thresholds and acceptable quality levels;
  - defining Listen-Before-Talk (LBT) deferrals;
  - setting frequencies; and
  - requesting a status transfer; and
- Serial status transfers from PHY to MAC pursuant to request fro information such as receive signal quality, receive bit rate, and PHY specific parameter values.

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened
November 1992: Alternatives #1, 2 and 3, Argument-pro #1, 2 and 3 and References 1 to 3.
July 1993: Alternative #4 and Argument_pro #4.1.
September 1993: Reference #4, #5, #6 and #7. Alternative #5, #6 and #7, Argument_pro #6.1. The 802.11 committee agreed that the service primitives described in Alternative #5 and in Reference #5 shall be included in the 802.11 Draft Standard - *Motion: Move to adopt the service primitives as described in Document 93/162 (reference #5) as the service primitives for the PH SAP associated with*

data transfer between MAC and PHY. Those primitives have previously been described in P802.11-92/96, -92/119. - Result (in joint MAC/PHY group): yes-42, no-0, abstention-0.
November 1993: Alternative #8 and Reference #8.

Issue Status: Open

Issue Identification: 12.1A (Topic: Interfaces).

What is the MAC Management/PHY interface?

Alternatives:

1) - (Reference #1) - The MAC Management/PHY interface takes place through the Physical Medium Adaptation Layer. The PMA layer accepts MAC Management information presented at the Parameter Service Access Point (PSAP) in a medium-dependent manner for transfer across the DTE/DCE interface to PHY.

References:

1) - P802.11-93/204 - An Improved Reference Model for IEEE 802.11.

Arguments:

Pro:

Con:

Related Issue Identification:

1) - 12.1 (Interfaces)

Issue Originator: - F.Y. Simon

Issue History:

September 1993: Date first opened
November 1993: Alternative #1 and Reference #1.

Issue Status: Open

Issue Identification: 12.1B (Topic: Interfaces).

What is the Station Management/PHY interface?

Alternatives:

Arguments:
Pro:

Con:

Related Issue Identification:
1) - 12.1 (Interfaces)

Issue Originator: - F.Y. Simon

Issue History:
September 1993: Date first opened

Issue Status: Open

Issue Identification: 12.2 (Topic: Interfaces).

- What interfaces are exposed:
  - MAC/PHY ?
  - Distribution System Services (DSS) ?
  - Distribution System Media (DSM) ?

Editor's note: Ref: 29 (92/58R1)

Editor's note: 11/92 - Break-up of the issue in 3 parts: 12.2_A, 12.2_B, 12.2_C

12.2_A - MAC/PHY?

Alternatives:

1) Yes - but optional

Arguments:

Pro:

1) Standards defines interfaces, implementation can expose or not expose the interface based on implementation choices - vendors cannot be forced to expose an interface.
However, if the interface is exposed, it must conform to the standard specified interface to claim conformance to the standard.

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened

November 1992: Alternative #1, Argument-pro #1 and closure of the Issue by a motion to recommend that 'DTE/DCE interface be defined and exposable and that this interface be between the Medium Independent PHY layer and the PHY medium Dependent layer'. Result: yes-23, no-0, abstention-2

Issue Status: Close

12.2-B - ~~Distribution System Services?~~

- Are the infrastructure interfaces exposed? (see Argument-pro #1.2 below).

Alternatives:

1) - Yes - The interfaces to the Distribution System Services (DSS) need to be exposed.

References:

- P802.11-92/128 - IEEE 802.11 Distribution System Services Functionality

Arguments:

Pro:

1.1) - The closure of Issue 5.1 (Distribution Systems) mandates that the standard will specify the Distribution System (DS) interfaces. Therefore, for this specification to be useful, the interfaces must be exposed.

1.2) - To make this Issue (12.2-B) more accurate, the current Issue statement is to be replaced by: 'Are the infrastructure interfaces exposed?' where infrastructure is defined as follow:

The infrastructure includes Distribution System (DS), Access Points (APs) and Portals functions. An infrastructure contains one or more APs and zero or more Portals in addition to a DS. Within the infrastructure there are two exposed interfaces:

a) - between Stations (STAs) and APs; and

b) - between APs and DS.

Additionally, DS services are provided between pairs of 802.11 MACs.

Con:

Related Issue Identification:

1) - 5.4 (Distribution Systems)

2) - 5.1 (Distribution Systems)

Issue Originator:

Issue History:

May 1992: First opened

November 1992: Alternative #1, Reference and Related Issue.

January 1993: Change of the Issue statement - Arguments-pro #1 and 2 - Adoption of the Alternative (#1) and the definition of Infrastructure (see argument-pro #1.2).-Result: yes-13, no-0, abstain-2.

Issue Status: Close

12.2_C - Distribution System Media?

Alternatives:

1) No - It is not necessary for this to be exposed; the standard will not specified the 'internal' of the Distribution System (DS) (see Issue 5.1).

References:

- P802.11-92/128 - IEEE 802.11 Distribution System Services Functionality

Arguments:

Pro:

Con:

Related Issue Identification:

- 5.1 (Distribution Systems)

Issue Originator:

Issue History:

May 1992: First opened

November 1992: Alternative #1, Reference and Related Issue.

Issue Status: Open

Issue Identification: 12.3 (Topic: Interfaces).

What is the intelligence level at the MAC/PHY interface ?

Alternatives:

1) - Dumb interface
2) - Smart interface
3) - Half-dumb interface
4) - Simple
5) - Unintelligent

References:

1) - P802.11-93/40 - The Wireless Hybrid Asynchronous Time-bounded MAC Protocol
2) - P802.11-93/115 - Protocol layering
3) - P802.11-93/140 - MAC/PHY Functional Partitioning
4) - P802.11-93/146 - The need for MAC data Delimiters in the PHY Partitioning Alternatives for Practical Implementation
5) - P802.11-93/204 - An Improved Reference Model for IEEE 802.11.

Arguments:

General:

1.0) - The function distribution between MAC and PHY should be such that :
- The PHY should generate the preamble upon a MAC command.
- The PHY should generate and detect the start and end delimiters, and should indicate this to the MAC.
- The PHY should be able to detect the proper bit rate of an incoming signal, when it is supporting multiple bit rates.
- A signalling field in the PHY preamble will allow future enhancements and proprietary functionality in the PHY.

2.0) The MAC/PHY interface should assume a "dumb" PHY. A single MAC can be designed to work effectively with different "dumb" PHY implementation.

Pro:

1.1) - Dumb is simple, easy to implement, assumed cheap.
1.2) - Dumb must, at least, detect Service Request type
1.3) - [Dumb] is desirable to have the PHY 'blind' to the type of data that passes thru it. - PHY must not be required to understand the meaning of bits that passe thru it.
1.4) - Minimum needs:
- Received signal quality
- Transmit level
- Handshake
- Desire to minimize DC power consumption

2.1) - Smart is flexible
2.2) - Smart may be required if the interface has options
2.3) - Smart may be required for one MAC for multiple PHY requirement
2.4) - Real time constraints motivate more smarts in the PHY
4.1) - A few generic primitives with parameters to control specific PHYs.
5.1) - The MAC-PHY interface is an 'unintelligent' interface, permitting a single, 'intelligent' MAC with a replaceable PHY adaptation function to directly attach, both logically and electrically, to a plurality of different PHY types.

5.2) - (Reference #5) - The MAC/PHY interface is an "unintelligent" interface, permitting the common MAC, adapted through the Physical Medium Adaptation layer to encompass the intelligence. This facilitates simple attachment of a wide variety of different PHY types.

Con:

3.1) 'Half-dumb' should not be considered - 'Dumb is Dumb'

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened
November 1992: Alternatives #1 to #3, Arguments #1.1 to #1.4 and #2.1 to #2.4 and Argument #3.1.
March 1993: Alternative #4 - Reference #1 - Argument_pro #4.1.
September 1993: Alternative #5, Reference #2 to #4, Argument_general #1.0 & #2.0 and Argument_pro #5.1.
November 1993: Reference #5 and Argument_pro #5.2

Issue Status: Open

Issue Identification: 12.4 (Topic: Interfaces).

Is the layer that provides the PHY independence the same as the MAC/PHY interface ?

Alternatives:

1) - The Issue is also addressed in Issue 12.1; Alternatives #1, 2 and 3.
2) - No

References:

1) - P802.11-92/99 - A parametric MAC-PHY Interface Model
2) - P802.11-92/100 - Proposed WLAN Architecture
3) - P802.11-92/125 - MAC/PHY Interface Specifics in Support of the Use of a Parameter Service Access Point Approach to PHY Independence.
4) - P802.11-93/115 - Protocol Layering Alternatives for Practical Implementation.
5) - P802.11-93/140 - MAC/PHY Functional Partitioning
6) - P802.11-93/204 - An Improved Reference Model for IEEE 802.11.

Arguments:

Pro:

2.1) - (Reference #4) - The independence is implemented in a subdivision of MAC dedicated to PHY adaptation. This permits processing of the relevant information from received frames, after MSDU acceptance and validation by the receiving MAC. This is done without an extra mechanism to return this data to PHY for processing.

2.2) - (Reference #5) - The PHY independence is achieve in a PHY dependent sub-layer within the MAC. This must be a sub-layer because it adds and removes fields in the MSDU header. This must be a MAC function because it involves transfer of the PHY specific information to a peer sublayer and the information is best sent in the protected portion of an MPDU. It also requires formatting and interpreting the MSDU header, which should only be done by the MAC.

2.3) - (Reference #6) - This independence is implemented in a Physical Medium Adaptation layer within MAC. There is also a provision for medium-independent interface functions in the Convergence layer within PHY to facilitate a common representation of items that are common to a plurality of PHYs. This partitioning permits generation of PHY-specific MPDUs for transmission and the processing of PHY-specific information from received MPDUs above the address recognition and FCS validation level. This is done without requiring the passing of information from MAC to PHY and back to MAC to achieve the necessary PHY-specific processing.

Con:

Related Issue Identification:

1) - 12.8 (Topic: Interfaces)
2) - 12.1 (Topic: Interfaces)

Issue Originator: Dave Bagby

Issue History:

May 1992: First opened
November 1992: Alternative and Related Issue #2
September 1993: Alternative #2, References #4 & #5, and Argument_pro #2.1 & #2.2.
November 1993: Reference #6 and Argument_pro #2.3.

Issue Status: Open

Issue Identification: 12.5 (Topic: Interfaces).

- What entities (other than LLC) will the standard support as MAC layer user ?
Editor's note: Ref: 87 (92/58R1)

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator: John Corey

Issue History:
May 1992: First opened

Issue Status: Open

Issue Identification: 12.6 (Topic: Interfaces).

- What are the MAC services provided to the LLC ?
Editor's note: Ref: 38 (92/58R1)

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: First opened

Issue Status: Open

Issue Identification: 12.7 (Topic: Interfaces).

- What is the definition of the MAC/LLC interface for Time-bounded services ?
Editor's note: Ref: 36 (92/58R1)

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:
- 15.3 (Topic: Services)

Issue Originator:

Issue History:

May 1992: First opened

Issue Status: Open

Issue Identification: 12.8 (Topic: Interfaces).

Does a PHY independence layer need to be specify in the MAC ?

Alternatives:

1) - Yes
2) - No

References:

1) - P802.11-93/40 - The Wireless Hybrid Asynchronous Time-bounded MAC Protocol
2) - P802.11-93/115 - Protocol Layering Alternatives for Practical Implementation.
3) - P802.11-93/140 - MAC/PHY Functional Partitioning
4) - P802.11-93/204 - An Improved Reference Model for IEEE 802.11.

Arguments:

Pro:

1.1) - See Reference #2
1.2) - See Reference #3
1.3) - See Reference #4

Con:

Related Issue Identification:

- Issue 12.1 (Interfaces)

Issue Originator:

Issue History:

May 1992: First opened
November 1992: Related Issue ID.
March 1993: Alternatives #1 and 2 - Reference #1.
September 1993: References #2 & #3 and Argument_pro #1.1 & #1.2.
November 1993: Reference #4 and Argument_pro #1.3.

Issue Status: Open

Issue Identification: 12.9 (Topic: Interfaces).

Should data and control information be passed simultaneously across the MAC / PHY logical interface ?

Alternatives:

1) - Yes
2) - No

References:

1) - P802.11-93/115 - Protocol Layering Alternatives for Practical Implementation.
2) - P802.11-93/140 - MAC/PHY Functional Partitioning
3) - P802.11-93/204 - An Improved Reference Model for IEEE 802.11.

Arguments:

Pro:

1.1) - It was decided that there should be two separate, independent, bidirectional information paths between the MAC and PHY, one for data and one for management/control. This implies that data and control information can be passed simultaneously.

1.2) - See Reference #1

1.3) - See Reference #2

1.4 - (Reference #3) - Two separate SAPs are available for this purpose, a Data Service Access Point (DSAP) for data and a Parameter Service Access Point (PSAP) for parameters and management information.

Con:

Related Issue Identification:

Issue Originator: Dave Bagby

Issue History:

May 1992: Date first opened
July 1993: Alternative #1 and #2 and Argument_pro #1.1.
September 1993: References #1 & #2 and Argument-pro #1.2 & #1.3.
November 1993: Reference #3 and Argument_pro #1.4.

Issue Status: Open

Issue Identification: 12.10 (Topic: Interfaces).

What specific parameters the MAC requires from the PHY?

Alternatives:

References:
1) - P802.11-93/147 - The Importance of Short Rx-Tx Turnaround time.

Arguments:
Pro:

Con:

Related Issue Identification:

Issue Originator: - W. Diepstraten

Issue History:
September 1993: Date first opened - Reference #1.

Issue Status: Open

TOPIC: MANAGEMENT

13

Issue Identification: 13.1 (Topic: Management).

- What control and observation features are needed for network management support ?

Editor's note: Ref: 8 (92/58R1)

Alternatives:

1) The model described in the submission P802.11-92/98 provides the base for the set of logical functions which makes up the "station network Management". This model can be related to the overall 802.11 model (replicated in the Proposed Draft Standard - P802.11-92/122) by placing it in the 'side management layer' at the MAC and Medium Independent layers level. The components specified in the WLAN Station Management Model are (see P802.11-92/98): Coordination Management, Frame Management, Access Management and Physical Connection Management.

i) - Coordination Management: See section 3.4 of P802.11-92/98

ii) - Frame Management: See section 3.1 of P802.11-92/98

iii) - Access Management: In addition to the functions that "monitor MAC operations and take action necessary to aid achieving and maintaining operational medium access", this component must also support the following functions:

* Registration and Authentication support required by a station to access a wireless LAN network. This requirement is stated in the 802.11 Functional Requirements - P802.11-92/57.

* Security support, additional to 802.10 if required (pending closure of Issue 6.6 - Security), must be provided within this component.

* Configuration of attributes related to the access support must be provided in this component.

* "Medium access method" dependent functions must also be supported in this component. Time-slot allocation and period boundary adjustment as described in the 'Medium Access Protocol for Wireless LAN - P802.11-92/39' are example of attributes to be controlled by such functions.

iv) - Physical Connection Management (PCM): See section 3.3 of 802.11-92/98. In addition to the "frequency selection" described in this section, there must be functions addressing the 'Interference Management' which are very much inter-related with the "frequency selection" functions. The 'Interference Management' is needed in one form or another regardless of the underlying PHY type.

The 'Interference Management' function allows the detection and characterization of the interferences (i.e. narrow band interference or overlapping cells from the same or adjacent networks). This function also initiates the necessary corrective actions to be executed by the physical layers.

2) The following functions are extracted from paper P802.11-92/126:

* Registration: a process by which a Station's address is logged with the domain administrator to allow it to be identified when SIGNING-ON.

* Location function: an administrative function used to find a Station which is signed-on.

* Tracking function: an administrative function used by the Coordination Function (CF) to determine if a mobile Station is about to transit in its Service area.

References:

1) - P802.11-92/98 - Wireless LAN Station Management Services
2) - P802.11-92/124 - Issue 13.1 Management - Alternatives and Argument
3) - P802.11-92/126 - The Use of Terms for Expressing the Concepts of "Roaming", "Hand-off", "Registration" and "Identification" in WLAN Systems.

Argument:

Pro:

1) - The Management model and associated components described in 802.11-92/98 and the additional functions described in the Alternative above, provides:

a) Management services to the WLAN MAC and PHY layers.

b) Allows for the definition of the five management disciplines normally applied when managing a station: Configuration, Fault, Performance, Security and Accounting management.

c) Conforms to the IEEE 802.1B LAN/MAN Management for the LAN station interaction with an external management station.

Related Issue Identification:

- Issue 6.6 - Security.

Issue Originator:

Issue History:

May 1992: First opened
November 1992: Alternatives #1 and 2, Argument-pro #1 and references 1 to 3. A motion was proposed to accept the model defined in P802.11-92/98 and functions specified in P802.11-92/124 as the initial WLAN Management model. Result: yes-9, no-0, abstention-12; this issue remains open.
January 1993: Adoption of the Alternative (#1) as the initial 802.11 Network Management model and set of Management functions.-Result: yes-12, no-0, abstain-1.

Issue Status: Close

Issue Identification: 13.2 (Topic: Management).

- What is the architecture of the network Management services:
- within the layer ?
- separate layer ?

Editor's note: Ref: 37 (92/58R1)

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened

Issue Status: Open

Issue Identification: 13.3 (Topic: Management).

What support will the standard provide for power management:
- Direct Current (DC) power ?
- Radio Frequency (RF) power ?

Alternatives:
1) - Sign-on at turn-on.
2) - Coordinate turn-on with Access Point (AP).

Arguments:

General:

1.0) There is a need split the Issue into 2 related issues:
- 13.3A) - What support will the standard provide for DC power management?
- 13.3B - What support will the standard provide for RF power management?

Pro:

1.1) - Registration function has to exist anyhow.

2.1) - Station (STN) behaves predictably - Access Point (AP) can hold store and forward MAC Service Data Units (MSDUs)

Con:

1.1) - Access Point (AP) doesn't know if the station has gone - i.e.; when to free buffers.

1.2) - Must have fast registration to avoid power waste.

2.1) - MAC is more complex.

Related Issue Identification:
1) - 13.3A (Management)
2) - 13.3B (Management)

Issue Originator:

Issue History:

May 1992: First opened
July 1992: Alternatives, Pro, and Con provided by John Deane.
May 1993: Argument_general #1.0 - splitting of the Issue into two related issues 13.3A and 13.3B
January 1994: Decision to close this Issue as it is splitted into 2 related Issues - 13.3A and 13.3B.
MAC: Unanimous

Issue Status: CLOSE January 1994

Issue Identification: 13.3A (Topic: Management).

What support will the standard provide for DC power management?

Alternatives:

1) - Implementation dependent
2) - The MAC should provide specific Power Management Functionality such as:
   a) - Temporary buffering functions
   b) - Transmitter and receiver synchronization

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.
2) - P802.11-93/94 - The Importance of Power Management Provisions in the MAC.
3) - P802.11-94/16 - Review of MAC Issues List
4) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

Pro:

1.1) - Some implementations are more concerned with power consumption than others. The CODIAC protocol (Reference #1) allows implementations to trade off power consumption requirements with overhead and access delay. These features are described in the main text of this document.

2.1) - The MAC should provide specific Power Management functionality like temporary buffering and transmitter and receiver synchronization, to allow stations to go into sleep without loss of service.

2.2) - Buffering and synchronization functions are key to the power management mechanism in the MAC Foundation (Reference #4), allowing application independent power management.

Con:

1.1) - See Argument-pro #2.1

Related Issue Identification:

1) - 13.3 (Management)
2) - 13.6 (Management)

Issue Originator: C. Heide

Issue History:

May 1993: Date first opened - Alternative #1 - Reference #1 - Argument_pro #1.1.
July 1993: Alternative #2, Reference #2, Argument_pro #2.1 and Argument_con 1.1.
January 1994: Reference #3 & #4, Argument_pro #2.2 and closing the Issue by endorsing Alternative #2 MAC: Yes-32, no-0, Abstain-5.

Issue Status: CLOSED January 1994

Issue Identification: 13.3B (Topic: Management).

What support will the standard provide for RF power (signal strength) management?

Alternatives:

1) - Modify the structure of the CODIAC protocol proposal (Reference #1) superframe structure.

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol

Arguments:

Pro:

1.1) - (Reference #1) - One way in which the centralized mode may be used to aid in signal strength management - Change the structure of the superframe a little. It is still composed of periods delimited by synchronization frames, but do two RSYNCs and two DSYNCs, each containing the same superframe number. Send an RSYNC from the first transceiver, get the request list from it. Send an RSYNC from the second transceiver, get the request list from it. Use the quality-of-signal information associated with each request to determine which transceiver is better for communicating with which station. Then do a DSYNC from one transceiver and service the stations that have better quality from it, then a DSYNC from the other and service the other stations. This method has high overhead, because the request period was done twice. The total data period is only longer by one extra DSYNC.

This leads to the conclusion that the superframe can be composed of as many request periods and data periods as desired. The sync frames should contain a superframe numoer, so that stations know when to retransmit because they didn't get serviced in this superframe.

Con:

Related Issue Identification:

1) - 13.3 (Management)
2) - 13.6 (Management)

Issue Originator: C. Heide

Issue History:

May 1993: Date first opened - Alternative #1 - Reference #1 - Argument_pro #1.1.

Issue Status: Open

Issue Identification: 13.4 (Topic: Management).

- Is MAC/PHY exchange needed to supply network management information ?
Editor's note: Ref: 80 (92/58R1)

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:
- 12.1 (Topic: (Interfaces)

Issue Originator:

Issue History:

May 1992: First opened

Issue Status: Open

Issue Identification: 13.5 (Topic: Management).

- What are the logical and physical functions required to communicate to the Management layer ?
- What is the relationship between MAC, PHY and network Management ?

Editor's note: Ref: 88 (92/58R1)

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

1) - 13.2 (Topic: Management)
2) - 12.1 (Topic: Interfaces)

Issue Originator:

Issue History:

May 1992: First opened
November 1992: Related Issue #2

Issue Status: Open

Issue Identification: 13.6 (Topic: Management).

How will the MAC standard address Power Consumption ?

Alternatives:

1) - See Alternative #1 of Issue 13.3A

2) - The MAC protocol should allow stations to have their transceivers off most of the time when there is no traffic addressed to them. Also, the MAC protocol should provide a way for suspending an association (without de-associating), allowing for immediate reassociation when the station resumes operation.

3): See Reference #4 - MAC Foundation specification

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol
2) - P802.11-93/136 - Opinions on Issues 13.6 and 17.3 and New Issues
3) - P802.11-94/16 - Review of MAC Issues List
4) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

Pro:

1.1) See Argument #1.1 of Issue 13.3A
2.1) See Reference #2
3.1) - See Reference #4

Con:

Related Issue Identification:

1) - 13.3 (Management)
2) - 13.3A (Management)

Issue Originator:

Issue History:

May 1992: Date first opened
May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1
September 1993: Alternative #2, Reference #2 and Argument_pro #2.1.
January 1994: Reference #3 & #4, Argument_pro #3.1 and closing the Issue by endorsing Alternative #3 MAC: Yes-29, no-1, Abstain-7.

Issue Status: CLOSED January 1994

Issue Identification: 13.7 (Topic: Management).

Is MAC support required for Power Control ?

Alternatives:

1) - Yes - Assuming that Power Control means control of signal strength.

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol
2) - P802.11-93/140 - MAC/PHY Functional Partitioning

Arguments:

Pro:

1.1) - See Argument_pro #1.1 of Issue 13.3B

1.2) - Determining signal strength requires the interpretation of the MSDU content exchanged with a given station. The PHY must not be required to do this. While the MAC may not be aware that communication 'improvement' is directly related to signal strength, it is, however, a MAC support.

1.3) - See Reference #2

Con:

Related Issue Identification:

1) - 13.3 (Management)
2) - 12.1 (Interfaces)
3) - 13.3B (Management)

Issue Originator:

Issue History:

May 1992: First opened
November 1992: Related Issue #2
May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1 and #1.2
September 1993: Reference #2 and Argument-pro 1.3.

Issue Status: Open

Issue Identification: 13.8 (Topic: Management).

Is MAC support required for antenna diversity ?

Alternatives:

1) - Yes

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol

2) - P802.11-93/140 - MAC/PHY Functional Partitioning

Arguments:

Pro:

1.1) - See Argument_pro #1.1 of Issue 13.7.

1.2) - See Reference #2

Con:

Related Issue Identification:

1) - 12.1 (Interfaces)

2) - 13.7 (Management)

Issue Originator:

Issue History:

May 1992: Date first opened

November 1992: Related Issue

May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1

September 1993: Reference #2 and Argument-pro #1.2.

Issue Status: Open

TOPIC: CONNECTION TYPES

14

Issue Identification: 14.1 (Topic: Connection Types).

- What does the support of the following connection types means to the LLC ?
  - Connection without ACK,
  - Connectionless, and
  - Connection with ACK

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

Date first opened: May 1992

Issue Status: Open

Editor's note: Ref: 7 (92/58R1).

Issue Identification: 14.2 (Topic: Connection Types).

- What are the trade-off in efficiency between a connection oriented protocol versus running Time-bounded data over connectionless protocol ?

Alternatives:
1) - Not Relevant

References:
1) - P802.11-94/16 - Review of MAC Issues List
2) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:
Pro:
1.1) - Time bounded services are only provided via a connection-oriented service as described in the adopted MAC Foundation (Reference #2).

Con:

Related Issue Identification:
1) - 15.1 (Topic: Services)

Issue Originator:

Issue History:
May 1992: First opened
January 1994: Reference #1 & #2, Argument_pro #1.1 and closing the Issue by endorsing Alternative #1 MAC: Yes-26, no-3, Abstain-7.

Issue Status: CLOSED January 1994

Issue Identification: 14.3 (Topic: Connection Types).

- Where shall the connection oriented and connectionless services be integrated:,
- the MAC, or
- the LLC, or
- somewhere else ?

Alternatives:

1) - MAC

References:

1) - P802.11-94/16 - Review of MAC Issues List
2) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

Pro:

1.1) - Taking 'connection-oriented' here to mean 'Time-bounded', the MAC protocol must distinguish between frame types and provides a different access method for the different service types. Consequently, as specified in the MAC Foundation (Reference #2) the MAC must be aware of both types and provide integration.

Con:

Related Issue Identification:

Issue Originator: Chandos Rypinsky

Issue History:

May 1992: First opened
January 1994: Alternative #1, Reference #1 & #2, Argument_pro #1.1. Attempt to close this issue failed - MAC: Yes-4, No-29, Abstain-3.

Issue Status: Open

Issue Identification: 14.4 (Topic: Connection Types).

Ability to establish peer-to-peer connectivity without prior connection (eg. without "knowledge of the presence of your peers").

Alternate Issue text: - can a station initiate communications with another station without knowing that it is present, and what its wireless address is?

Alternatives:

1) - Yes

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol
2) - P802.11-94/16 - Review of MAC Issues List

Arguments:

Pro:

1.1) - (Reference #1) In the RTS frame contains the 48-bit address of the intended destination station. In distributed mode this frame is broadcast, so the destination station can respond if it is there. In centralized mode the RTS is sent to the controller, and it can use its knowledge of registered stations to determine the wireless address of the destination. Also, use of the AP bit and the Hierarchical bit allow stations to identify APs without any prior knowledge.

1.2) - In particular, this is possible for ad hoc communication between stations.

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: Date first opened
May 1993: Alternate Issue text - Alternative #1 - Reference #1 - Argument_pro #1.1.
January 1994: Reference #2 Argument_pro #1.2 and closing of the Issue by endorsing the Alternative - MAC: Yes-35, No-1, Abstain-2

Issue Status: CLOSE January 1994.

TOPIC: SERVICES

15

Issue Identification: 15.1 (Topic: Services).

- Part 1 - What does Time-bounded means ?
- Part 2 - What are the bounds

15.1-A - What does Time-bounded means ?

Alternatives:

1) It means a time-bounded service
2) The term time bounded itself
3) The service transfers data from a natural process and thus certain time constrained performance criteria must be met for the service to be useful.

References:

- P802.11/92-109 - Communications Requirements of Multimedia Applications: A Preliminary Study.
- P802.11/92-110 - Wireless Networking Requirements of Multimedia Applications
- P802.11/92--129 & 101 - Time Based Services - Quality of Service on Wireless LANs

Arguments:

This is what everyone means and is concerned over (see P802.11/92-109 and -110).
3) This is not a self-referencing definition and it is useful in defining requirements of the MAC

Tentative Definitions:

1) Time-bounded service: A service class for which the data being carried is subjected to requirements with respect to the absolute delay and/or delay variance.

2) A time-bounded service, as supported by 802.11, is insensitive to a defined amount of transfer delay. However, when this value is exceeded the value of the message becomes zero.
A non-time-bounded service, as supported by 802.11, is transferred as promptly as possible but the value of the message is only slightly diminished by peak delays exceeding average delay many times.

3) The time-bounded service provides a mechanism for the transport of data between two service access points with controlled absolute delay and delay variance.

4) The time-bounded service provides a mechanism for the transport of data between two service access points with controlled worst case delay.

5) The time-bounded service provides a mechanism for guaranteed bandwidth availability over a predetermined time interval.

6) The time-bounded service is designed to meet the special demands of applications that require data transmission with controlled absolute delay and delay variance.

7) Time-bounded service: A service class for which bandwidth is reserved and the data being carried is subjected to requirements with respect to bandwidth, the absolute delay and/or delay variance.

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: Date first opened
September 1992 - Discussion - Alternatives 1 & 2 and Arguments, including tentative definitions: 1 to 6
Nov 1992 - Discussion - Alternative 3 & Definition 7 added
January 1994: - Decision to let this Issue open.

Issue Status: Open

Issue Identification: 15.1 (Cont'd)

15.1-B - What are the bounds ?

Alternatives:

1) - The following is extracted from P802.11-92/107.
In attempting to determine the bounds tor "time-bounded" services, it is helpful to consider a list of potential applications which will have time-bounded characteristics:

* telephony/teleconferencing
* audio recording/playback
* telephone answering machine/voicemail
* shared still pictures with telephony
* shared still pictures allowing mouse and/or keyboard alteration with telephony
* Motion video with audio record/playback
* motion videoconferencing
* motion videoconferencing with lip synchronized audio
* medical telemetry

industrial automation and control

Each of these applications has different user requirements with respect to the value of the bounds for END-TO-END delay and/or PERMISSIBLE VARIATION in END-TO-END delay and/or PERMISSIBLE VARIATION between END-TO-END delay for different components of the data (e.g. between video and audio). Hence it will be helpful if different applications have the capability to request different **Quality of Service** attributes when establishing a connection on the network. [For example, to the user, this may involve a decision on cost versus resolution or color/black and white pictures. This would impact the 802.11 standard by imposing a requirement for a mechanism of reserving multiple Time-bounded channels.]

Once the END-TO-END bounds are known for a particular application, there remains the problem of determining the budget that is allocated to the wireless LAN versus the budget that is to be allocated to the connection to the Wide Area Network (WAN) and to the WAN itself and versus the budget that is consumed by the end users station (by delays imposed by system software and hardware). These network and system budgets are outside scope of 802.11 but have been examined in order to allocate appropriate budgets for time-bounded services over the 802.11 wireless network.

The process of this work (see P802.11-92/107) has included:

1. An examination of the human factors characteristics for the set of applications listed for which we expect the use time-bounded services and development of the END-TO-END bounds. Much of this work has been done, especially for telephony applications and is codified in existing telephony standards.

2. An examination of budgets for existing networks delays (again, this information already exists) and a reasonable estimation of internal system budgets for presentation of "time-bounded" data to the end user. (Existing systems are not always reasonable.)

3. An INFORMED allocation of budgets for bounds in "time-bounded" networks has been made with the knowledge of what application types can be supported with which choice of bounds.

2) - The following is derived from P802.11-92/129.
1. The Data Rate TBS QOS requirement is:

Q1 SP = 64 Kbs
Q1 VD Broadcast <= 5 Mbs
This service (un-compressed, Broadcast quality video) is obviously outside the scope of WLAN. It is provided by dedicated bandwidth on Broadband LANs along with 802.3 & and 802.4 in separate frequency bands.
Q1 VD Slow Scan >= 160 Kbs
Q1 IA Mechanical <= 160 Kbs
Q1 IA Tank Level >= 0.160 Kbs

2. The second TBS QOS requirement is:
Q2. Regular (Cyclic) Media Access for timely reconstruction of or control actions on the variable.
Q2a. The samples of the variable must be conveyed at regular, cyclic periods that allow "faithful, timely reconstruction.
Q2 SP = Transmit opportunities every ~125 us
Q2 VD Slow Scan = Transmit opportunities <= every 2*N sec to allow for limited data frame size & complete video frames each 2 secs. N= data frames per video frame
Q2 IA Mechanical = Transmit opportunities >= every 10 ms
Q2 IA TankLevel = Transmit opportunities <= every 10 sec

3. The third TBS QOS requirement, which applies only to "real time data" is:
Q3. Acceptable levels of Jitter between transmission opportunities to allow "faithful" reconstruction or control action.
This requirement only applies when the reconstructed variable will be used in "real time", eg. feedback is present.
Jitter allowed is proportional to the user's sense of time.
Q3a. Normally jitter can be about 20% of specified time between Transmit opportunities.
Q3 SP for further study
Q3 VD Slow Scan - video frame jitter <= 0.2 sec
Q3 IA Mechanical >= 2 ms
Q3 IA Tank Level <= 1 sec
Q3 IA ?? = ??

4. The fourth TBS QOS requirement, which applies only to "real time data" is:
Q4. Discard of "Late Data" None of the reconstruction or control algorithms for TBS are designed to cope with data that arrive out of order or significantly beyond the designed time window (the transmission interval).
Q4a This data may be discarded by the MAC

The sixth TBS QOS requirement is:
Q6. Call Duration
Q6 SP 5 sec to M hrs - M = "longest "reasonable call duration
Q6 VD 10 min to infinite (security monitor)
Q6 IA 4 hrs to infinite

References:

1) - P802.11-92/109 - Communications Requirements of Multimedia Applications: A Preliminary Study.
2) - P802.11-92/110 - Wireless Networking Requirements of Multimedia Applications
3) - P802.11-92/107 - Alternatives to issues Related to Time Bounded Services.
4) - P802.11-92/129 & 101 - Time Based Services - Quality of Service on Wireless LANs
5) -)802.11-92/129 - Time Based Services QOS Requirements on Wireless LAN

Arguments:

Related Issue Identification:

Issue Originator:

Issue History:

September 1992: Alternative #1 and References 1 to 4
November 1992: Alternatives #2 and Reference 5

Issue Status: Open - pending work on 15.1-A

Issue Identification: 15.2 (Topic: Services).

- What does 'coexist with a Basic Service Set (BSS) means for both types of services:
  - Asynchronous, and
  - Time-bounded ?

Editor's note: Ref: 18 (92/58R1).

Alternatives:

The questions stated in this 'Issue' are meaningless. - a Basic Service Set (BSS) is independent to the types of service provided.

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened

September 1992 - Alternative and straw poll vote for the alternative:

- For - 8
- Opposed - 1
- Abstain - 0

November 1992: - Motion to close this issue by accepting the only Alternative specified. Result: yes-22, no-0, abstention-2; Issue closed.

Issue Status: Close

Issue Identification: 15.3 (Topic: Services).

~~- What protocols above the MAC would drive the Time-bounded services ?~~

- What is the MAC service interface to Time Bounded Services (TBS)? and is it different from the Link Layer Connection (LLC) interface?

Alternatives:

1) - (See 802.11-92/107 - Alternatives to Issues Related to Time-bounded Services). Two protocols are needed above the MAC:
   a) - Data or in-band protocol
   b) - Call control or out-of-band

2) - 802.2 LLC Type 2.

References:

1) - P802.11/92-107 - Alternatives to Issues Related to Time-bounded Services.

Arguments:

Pro:

Con:

Related Issue Identification:

1) - 15.8 (Topic: Services)
2) - 12.7 (Interfaces)

Issue Originator:

Issue History:

May 1992: First opened
September 1992: Alternatives 1 & 2.
January 1994: New Issue statement

Issue Status: Open

Issue Identification: 15.4 (Topic: Services).

What are the services or functions unique to wireless networks ?

Alternatives:

1) - The "mobile Connectivity" requirement is unique to wireless networks. The requirement refers to the ability to transparently handle intermittent connectivity as a unit transitions cells.

2) - "Hidden Station" characteristic is also a unique problem to wireless LANs.

3) - The 802.11 standard must provide a level of security equivalent to wired network physical security to avoid compromising security assumptions of existing LANs.

4) - Overlapping networks.

5) - (Reference #2) - MAC-visible, time-variant medium usage.

6) - Obsolete Issue

References:

1) - P802.11-92/128 - IEEE 802.11 Distribution System Services Functionality
2) - P802.11-93/204 - An Improved Reference Model for IEEE 802.11.
3) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

Pro:

3.1) - The Alternative (#3) is expected to be low cost.

3.2) - The Alternative (#3) is acceptable as long as the feature is optional. Making the Alternative mandatory may prevent exportation of 802.11 compliant systems.

5.1 - (Reference #2) - In the addition of the items already listed for this Issue (Alternatives #1 to #4), the existence of MAC-visible, time-variant medium usage as a characteristic of a PHY is unique to wireless networking (and unique to Frequency Hopping PHYs among those currently under consideration by 802.11).

6.1) - The MAC Foundation decision makes this Issue obsolete

Con:

3.1) - The implementation of the Alternative (#3) may be costly at higher PHY rates.

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened
November 1992: Alternatives #1 and 2 and Reference.
January 1993: Alternative #3 - Arguments-pro #3.1 and 3.2 - Arguments-con #3.1 - Taken a 'straw poll' regarding Alternative #3:

- How many would like Alternative #3 as a mandatory minimum requirement?: result - 5
- How many would like Alternative #3 as an optional minimum requirement?: result - 12
- How many do not want Alternative #3?: result - 1

May 1993: Alternative #4.
November 1993: Alternative #5, Reference #2 and Argument_pro #5.1.
January 1994: Alternative #6, Reference #3, Argument_pro #6.1 and closing the Issue by endorsing the Alternative #6 - MAC: Yes-24, No-2, Abstain-11

Issue Status: CLOSED January 1994

Issue Identification: 15.5 (Topic: Services).

- Are there any services outside the MAC/PHY that need to be specified in order to operate ?

Alternatives:
1) - Yes

References:
1) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

Pro:
1.1) - The MAC Foundation (Reference #1) specifies the services needed that outside of the MAC/PHY.

Con:

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: First opened
January 1994: Alternative #1, Reference #1, Argument_pro #1.1 and closing the Issue by endorsing the Alternative #1 - MAC: Unanimous

Issue Status: CLOSED January 1994

Issue Identification: 15.6 (Topic: Services).

What is the algorithm for managing the partitioning of capacity between Time-bounded and Asynchronous services ?

Alternatives:

1) - Implementation dependent.

2) - The AP should partition the capacity mix.

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.

2) - P802.11-93/70 - A Distributed Access Protocol Proposal Supporting Time Bounded Services.

Arguments:

Pro:

1.1) - That should be left to the discretion of the implementation. The CODIAC protocol (Reference #1) allows different implementations to tailor servicing of stations to their needs while still remaining compatible.

2.1) - Given an Isochronous framing Period (IFP) the bandwidth per Isochronous connection is defined by a maximum frame size. This is the maximum that a station can occupy per IFP, but a variable length up to the reserved maximum is possible. An AP should limit the maximum assigned total Isochronous bandwidth such that at least one maximum size Asynchronous frame does still fit in the IFP period.

In addition an AP should reserve some spare capacity to allow stations with existing connections to re-associate with the AP, so that the connection can be maintained.
New connection setups can be refused when the system is already using the reserved (for re-association) capacity.

Con:

Related Issue Identification:

Issue Originator: Chandos Rypinski

Issue History:

May 1992: First opened
May 1993: Alternatives #1 and #2 - References #1 and #2 - Argument_pro #1.1 and #2.1.

Issue Status: Open

Issue Identification: 15.7 (Topic: Services).

- What is the common service:
  - Asynchronous, or
  - Time-bounded ?

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened

July 1992: The Functional Requirement document (IEEE P802.11-92/57), section Data Service Types specifies that 'All 802.11 implementations will support the Asynchronous class service.' It was agreed by the committee that the statement can be interpreted as Asynchronous service is the common service.

Issue Status: Closed - 07/1992

Issue Identification: 15.8 (Topic: Services).

Do all stations and all infrastructures support the Time-bounded service ?

Alternatives:

1) - Alternatives are dependent of the definition of 'support'
2) - Yes
3) - no

References:

1) - P802.11/92-107 - Alternatives to Issues Related to Time-bounded Services.

2) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.

3) - P802.11-93/70 - A Distributed Access Protocol Proposal Supporting Time Bounded Services.

Arguments:

General:

1.0) - All support (802.11 MAC proposals) Time-bonded (TB) services. - To simplify task, could the TB services be left for further study by the committee at this time? - (providing that hooks are provided in the MAC proposals on the table).

The group (Issue work group) agrees that hooks for time bounded services shall be included in the first release of the MAC and when fully specified, TB services are an option. These hooks are a mechanism whereby the MAC can cause the transfer of isochronous MSDUs in a manner which has an acceptable low probability of collision or deferral. This results in bounded absolute delay and delay variance. The "hook" also includes a MAC field that specifies TB or Asynchronous data type.

Pro:

1.1) - The issue is inter-related to how the Time-bounded interface is defined (see Issue 15.3 - What protocols above the MAC would drive the Time-bounded Services?).

1.2) - Possible related new issue: 'Do we define the MAC to service existing 'clients' of the MAC or do we define a MAC that is independent ?'.

1.3) - Sub-issue: 'Where is the Asynchronous / Time-bounded multiplexer resides (below or above the MAC)?' - See picture from Document P802.11-91/21.

1.4) -

a) - Stations:

The CODIAC protocol (Reference #2) requires that all non-controller stations be well behaved in both operating modes. This means a station must be:

i) - capable of communicating in both modes;

ii) - capable of communicating by the distributed mode rules only, but it must be quiet in the presence of a controller; or

iii) - capable of communicating by the centralized mode rules only, but it knows it must be quiet when it does not hear a controller.

This means that for non-controller stations "supporting" (where "supporting" means not precluding other stations from using TBS) TBS with the CODIAC protocol is a given, because TBS is provided by centralized mode operation .

For controller stations, whether they can operate in both modes should be an implementation decision. However if a station requests TBS, there should be a specific negative response to that request if the service cannot be provided (not yet defined).

b) Infrastructures:
Yes, where the definition of support is to handle in a well behaved manner - i.e. where a station requests TBS there should be a negative response to that request if the service is not provided.
If support = provide, then No.

Summary - in agreement with Pro arguments 3.1 and 3.5

2.1) - All stations support it - as all MACs are the same but the functions above the MAC are out of 802.11 scope.

2.2) - Responding 'no' to the question imply that the creation of an option is required (see Issue 1.4 - related to options).

3.1) - The lack of time-bounded service support should not preclude offering of time-bounded by other stations.

3.2) - The station implementation cost may be an issue.

3.3) - Constraints to fit, at the minimum, the existing 802.2 pieces. Additional capability may be provided as well.

3.4) - Distribution System implementation based on existing 802.x LANs (which do not have inherent support for Time-bounded services) must not be excluded.

3.5) - If a station ask for an optional service, it is preferable to receive an explicit response indicating that the service is not supported rather than ignore the request.

3.6) - Responding 'yes' to the question imply the use of infrastructure that does not exist today.

3.7 - Time Bounded Services are only supported in Infrastructure networks, and will need an AP. Not all stations within an ESA with infrastructure need to support Time Bounded Services. Its service is optional, and dependent on the PHY isolation.

When Time Bounded service is supported within an ESA, then all AP's covering the area of operation need to support Time Bounded Services to assure continuous operation, but there can be a mix of stations that do and do not support Time Bounded Services.

3.8) - we already decided that Time bounded (TB) is an option conformant station, not implementing TB will not cause interoperability problems with stations that do implement TB.

Con:

2.1) - See Arguments-pro #3.1
2.2) - See Arguments-pro #3.2
2.3) - See Arguments-pro #3.3
2.4) - See Arguments-pro #3.4
2.5) - See Arguments-pro #3.5
2.6) - See Arguments-pro #3.6
3.1) - See Arguments-pro #2.1
3.2) - See Arguments-pro #2.2

Related Issue Identification:

1) - 15.3 - Service
2) - 1.4 - 'Standard' Process

Issue Originator: Simon Black

Issue History:

May 1992: First opened
September 1992: Arguments 1 to 9
January 1993: - Alternatives #2 and 3 - Arguments-pro #2.2, 3.5 and 3.6 - Arguments-con #2.5, 2.6 and 3.2.
May 1993: References #2 and #3 - Argument_pro #1.4 and #3.7
September 1993: Argument_general #1.0.
January 1994: Argument_pro #3.8 and closing the Issue by endorsing the Alternative #3 - MAC: Yes-31, No-3, Abstain-6.

Issue Status: CLOSED January 1994

Issue Identification: 15.9 (Topic: Services).

How will the standard address the MAC ability to service various traffic:
- Data,
- Voice, and
- Video ?

Alternatives:
1) - See the CODIAC Protocol proposal - Reference #1
2) - Data service is always available

References:
1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.

2) - P802.11-93/70 - A Distributed Access Protocol Proposal Supporting Time Bounded Services.

Arguments:
Pro:
1.1) - The CODIAC protocol (Reference #1) supports asynchronous and time-bounded services. The centralized mode can be implemented to support the requirements of various TBS time constraints.

2.1) - The MAC can support different Time bounded service levels, depending on the PHY speed and characteristics. The MAC should support a range of PHY speeds. The Time Bounded Service levels can distinguish between Voice and Video, or any lower multiple of the primary Time Bounded Service (as a integer multiple of the IFP)

Con:

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: First opened
May 1993: Alternatives #1 and #2 - References #1 and #2 - Argument_pro #1.1 and #2.1
January 1994: Decision to leave the Issue open - more work required.

Issue Status: Open

Issue Identification: 15.10 (Topic: Services).

- Between what service points is the Time-bounded service provided ?

Alternatives:

1) MAC/LLC boundary to MAC/LLC boundary (MAC_SAP to MAC_SAP).
2) MAC/PHY boundary to MAC/PHY boundary (PHY_SAP to PHY_SAP).

Arguments:

Pro:

1) The only one that make sense. It is the natural interface point. It is also the limits of the 802.11 scope.

2) Isolates performance implication from MAC layer.

Con:

1) Implies performance requirements on all 802.11 MAC and implementations (assuming Time-bounded service provided).

2) Not useful in providing Time-bounded service.

Related Issue Identification: Issue 15.1 - Topic: Services

Issue Originator: Simon Black

Issue History:

September 1992 - First opened - Alternative 1 & 2 - arguments and Straw-poll:
- For alternative #1 - 8
- For alternative #2 - 0
- Abstain - 1

To be forwarded to 802.11 Plenary with recommendation for alternative #1

November 1992: - Motion to close the issue by accepting Alternative #1. Result: yes-21, no-0, abstention-1. Issue closed

Issue Status: Close

Issue Identification: 15.11 (Topic: Services).

What are the classes of Time-bounded service will the 802.11 standard specifies in addition to the required Asynchronous service ?

Alternatives:

1) - Class 1: Best effort delivery, connectionless (i.e File transfer or Email) (the asynchronous service).

2) - Class 2: Time based reservation class (i.e. Video Conference).

3) - Class 3: Non-time-based reservation class, connection oriented (i.e Image browsing)

4) - Basic Voice Service class would be the default when supported

References:

1) - P802.11/92-109 - Communications Requirements of Multimedia Applications: A Preliminary Study.

2) - P802.11/92-110 - Wireless Networking Requirements of Multimedia Applications

3) - P802.11-93/70 - A Distributed Access Protocol Proposal Supporting Time Bounded Services.

Arguments:

Pro:

4.1) - Due to the variable frame size flexibility of the methodology described in this paper (Reference #3), this will automatically serve all lower ranges, although they can be specified as separate levels (using a longer IFP, being an integer multiple of the basic IFP).

A separate Video class may be needed.

Con:

Related Issue Identification:

1) - Issue 15.1 - (Services)

Issue Originator: Tim Kwok

Issue History:

September 1992: First opened - Alternatives #1 to #3
May 1993: Alternative #4 - Reference #3 - Argument_pro #4.1
January 1994: Decision to leave the Issue open as more work is needed to close it.

Issue Status: Open

TOPIC: MOBILITY

16

Issue Identification: 16.1 (Topic: Mobility).

- Will the standard support roaming for both:
- Asynchronous, and
- Time-bounded services ?

Alternatives:

1) - Yes on both

References:

1) - P802.11-94/16 - Review of MAC Issues List
2) - P802.11 PAR

Arguments:

Pro:

1.1) - Specific mechanism to provide roaming support for time bounded services (TBS) has not been much discussed within the committee, but it should be a requirement.

Con:

Related Issue Identification:

- 17.7 (Topic: Services)

Issue Originator:

Issue History:

May 1992: First opened

January 1994: Alternative #1, Reference #1 & #2 Argument_pro #1.1, and closing the Issue by endorsing Alternative #1. MAC: Yes 39, No-0, Abstain-0

Issue Status: CLOSE January 1994

Issue Identification: 16.2 (Topic: Mobility).

- What is Roaming ?
- What is Handoff ?

Editor's note: Ref: 12 and 93 (92/58R1).

16.2-A - What is Roaming?

Alternatives:

1) - Roaming is a form of Registration used for Mobile Stations which will use a network on a temporary basis.

2) - Roaming is the action taken by a station crossing Extended Service Set (ESS) boundaries.

References:

- P802.11-92/126 - The Use of Terms for Expressing the Concepts of "Roaming", Hand-off", "Registration" and "Identification" in WLAN Systems.

Arguments:

Pro:

2.1) - The term refers to concepts outside the scope of 802.11 standard which it cannot support either support or effect.

Con:

Related Issue Identification:

1) - 10.2 (Coordination)
2) - 16.8 (Mobility)

Issue Originator: John Corey

Issue History:

May 1992: First opened
November 1992: Alternative, Reference and Related Issue ID.
January 1993: Alternative #2 - Arguments-pro #2.1 - Adoption of the concept that 'Roaming' is outside 802.11 scope (see Argument-pro #2.1).-Result: yes-13, no-0, abstain-0.

Issue Status: Close

16.2-B - What is Handoff?

Alternatives:

1) - Hand-off is the process of passing control of the Mobile Station's activities from one Coordination Function (CF) to another, wether or not the CFs are members of the same Administrative Domain or not.

2) - The term 'Re-association' (see Reference #2) is used to described the transition between Basic Service Set (BSS) and Extended Service Set (ESS).

References:

1) - P802.11-92/126 - The Use of Terms for Expressing the Concepts of "Roaming", Hand-off", "Registration" and "Identification" in WLAN Systems.
2) - P802.11-93/9 - 802.11 DS Service Transactions

Arguments:

Pro:

Con:

Related Issue Identification:

1) - 10.2 (Coordination)
2) - 16.8 (Mobility)

Issue Originator: John Corey

Issue History:

May 1992: First opened
November 1992: Alternative, Reference and Related Issue ID.
January 1993: Alternative #2 - Reference #2 - Adoption of Alternative #2 to described Hand-off.- Result: yes-11, no-0, abstain-2.

Issue Status: Close

Issue Identification: 16.3 (Topic: Mobility).

Is anything required from IEEE 802.1 regarding roaming ?

Alternatives:

1) - Yes / no [?]
2) - AP to AP protocol

References:

1) - P802.11-92/126 - The Use of Terms for Expressing the Concepts of "Roaming", Hand-off", "Registration" and "Identification" in WLAN Systems.
2) - P802.11-93/136 - Opinions on Issues 13.6 and 17.3, and New Issues

Arguments:

Pro:

1.1) - This issue is addressed in document P802.11-92/126, in section 'Terms'. 'One of the important terms will be the one which describes the agent which will implement some of [the] mobility services. here (in 92/126) the term Administrator will be used to differentiate it from 802.1 network management functions, and Domain to indicate that there is a composite of network segments which may be administrated by an agent. Administration differs from 802.1 network management in two ways:

- It is mandatory
- It must operate over the Distribution System (DS) and directly manage the PHY in real-time (perhaps managing frequencies or code sequences, power levels, antenna switching or other PHY related service area functions)'.

2.1) - It is believed (see Reference #2) that such protocol must be defined, some of the functions of the protocol are:

- Exchange Association Information: If a station moves from one BSS to another, and reassociates with a new AP, the new AP will need to notify the previous AP (or all the APs) about the new association.
- Preauthentication: This function should be allowed.

Related Issue Identification:

1) - 16.9 (Mobility)

Issue Originator:

Issue History:

May 1992: First opened
November 1992: Alternative #1, Argument #1 and Reference
September 1993: Alternative #2, Reference #2 and Argument_pro #2.1.

Issue Status: Open

Issue Identification: 16.4 (Topic: Mobility).

What does graceful degradation mean ?

Alternatives:

1) - As a station moves out of range of a PCF its performance may degrade, but in doing so it should not interfere with the operation of other stations still in the PCF.

2) - As traffic increases in a BSA performance of each individual station should degrade gradually, the BSA should not just hit a point where it ceases to function.

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened
May 1993: Alternatives #1 and # 2.
January 1994: Decision to leave the Issue open as more work is needed to close it.

Issue Status: Open

Issue Identification: 16.5 (Topic: Mobility).

- What are the parameters of mobile stations ?
- What values do we support ? (speed etc.)

Alternatives:

References:
1)- P802.11-94/16 - Review of MAC Issues List

Arguments:
General:
1.0) - The standard should not distinguish between mobile and stationary stations - all stations are potentially mobile.

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: First opened
January 1994: Reference #1, Argument_general #1.0. Attempt to close this Issue failed MAC: Yes-6, No-15, Abstain-10

Issue Status: Open

Issue Identification: 16.6 (Topic: Mobility).

- If 1.2/1.3/1.4 supported, then does the standard needs to support seamless 'handover' ?
Editor's note: '1.2/1.3/1.4' seems to relate to item 73 (92/58R1) needs help to clean up this.
Editor's note: Ref: 74 (92/58R1).

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

- 25.4 (Topic: Channel)

Issue Originator:

Issue History:

May 1992: First opened

Issue Status: Open

Issue Identification: 16.7 (Topic: Mobility).

- What does 'seamless' mean ?
Editor's note: Ref: 75 (92/58R1).

Alternatives:
1) This issue is addressed in Document P802.11-92/126, Section Hand-off. Hand-off should appear to be "seamless", a term which means "invisible to the user".

References:
- P802.11-92/126 - The Use of Terms for Expressing the Concepts of "Roaming", Hand-off", "Registration" and "Identification" in WLAN Systems.

Arguments:
Pro:

Con:

Related Issue Identification:
- 16.2-B - Mobility

Issue Originator:

Issue History:
May 1992: First opened
November 1992: Alternative, Reference and Related Issue ID

Issue Status: Open

Issue Identification: 16.8 (Topic: Mobility).

~~- How will the standard address the ability for the MAC to support handoff between service areas ?~~

~~Editor's note: Ref: 18 (91/138). Re phrased from the 'The ability to support handoff between service areas' aka ROAMING' statement.~~

- What service transitions will the standard support?

Alternatives:

1) - This issue is addressed in Document P802.11-92/126, Section "Terms". 'There would be inter-domain signalling to set up services for Roaming and Roving and to provide the cross-domain identification of the Roamer and Rover, again this would occur over the Distribution System (DS) and a common carrier'.

2) - This is simply a matter of Authentication when Re-associating.

3) - There are three service set transitions of significance to 802.11:

a) No Transition: In this type 2 sub-classes that are logically indistinguishable:

I) Static - no motion

II) Local movement - within PHY range of station and Access Point (AP) (e.g. movement within a Basic Service Set (BSS) supported functionality.

b) BSS Transition: This case is defined as a Station movement from one BSS to another BSS within one ESS. The function supporting this transition is called 'Re-association' (see Reference #2).

c) ESS Transition: This case is defined as a Station movement from a BSS in one ESS to a BSS in another ESS. This case is supported only in the sense that you can move. Maintenance of upper layer connections support by 802.11 cannot be guaranteed, in fact disruption of the service can be probably guaranteed.

References:

1) - P802.11-92/126 - The Use of Terms for Expressing the Concepts of "Roaming", Hand-off", "Registration" and "Identification" in WLAN Systems.

2) - P802.11-93/9 - 802.11 DS Services Transactions

Arguments:

Pro:

2.1) - There is no distinction between Roaming and Hand-off from the viewpoint of 802.11.

2.2) - Either Authentication is acquired for the next Access Point (AP) or it is denied, the owner of the AP is not relevant.

Con:

Related Issue Identification:

1) - Issue 16.2-B

Issue Originator:

Issue History:

May 1992: First opened

November 1992: Alternative, Reference and Related Issue ID.

January 1993: Redefined the Issue statement. - Alternatives #2 and 3 - Arguments-pro #21. and 2.3 - Adoption of Alternative #3.-Result: Yes-13, no-0, abstain-0.

Issue Status: Close

Issue Identification: 16.9 (Topic: Mobility).

- What are the requirements of the following functions related to Station Mobility ?
  - Coordination in ESS
  - Security
  - Management
  - Location

Alternatives:

1) - Network Layer Requirements - There are two basic requirements:
   a) - MAC Layer address of any Base Station from which the mobile station is currently associated.
   b) - The network layer should be notified whenever the mobile station experiences either an Association or a De-association event with respect to the Base Station.

References:

1) - P802.11-93/64 - Network Layer Requirements

Arguments:

Pro:

1.1) - There are two basic requirements from the network layer related to Mobility:

a) - The Network Layer protocol running in the Mobile Station should be able to obtain the MAC Layer address of any Base Station from which the mobile station is currently accepting service, if that MAC layer address is available to the MAC layer protocol.

b) - The Network Layer should be notified whenever the Mobile Station experiences either an Association event, or a De-association event, with respect to the Base Station.

With these two provisions, the protocol above Layer 2 can more effectively take the appropriate measures to insure continuous network connectivity.

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: Date first opened
May 1993: Alternative #1, Reference #1 and Argument-pro #1.1

Issue Status: Open

TOPIC: ADDRESSING

17

Issue Identification: 17.1 (Topic: Addressing).

- What level of reliability for Group Addressing is required ?

Alternatives:

Arguments:

General:

1.0) - This Issue is addressed by the following Issues: 17.3, 17.5, 19.2A and 19.2B - No need to keep this Issue open.

Pro:

Con:

Related Issue Identification:

1) - 19.2 (Reliability)
2) - 17.3 (Addressing)
3) - 17.5 (Addressing)
4) - 19.2A (Reliability)
5) - 19.2B (Reliability)

Issue Originator:

Issue History:

May 1992: First opened
January 1994: Argument_general #1.0. Issue closed as obsolete MAC: Unanimous

Issue Status: CLOSED January 1994.

Issue Identification: 17.2 (Topic: Addressing).

What level of reliability for Broadcast (Multicast) Addressing is required ?

Alternatives:

1) - These are not inherently reliable delivery mechanisms.
2) - Multichannel system negative acknowledgement could use a spare channel for error correction.

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.

Arguments:

General:

1) - Refer to Issue 17.1

Pro:

1.1) - Multicast and broadcast reliability is directly tied to the MSDU error rate, as they cannot be acknowledged. This is the case for all LANs, wired and wireless.

1.2) - Higher level protocol above MAC or application should handle missing packets and errors in transmission.

Con:

Related Issue Identification:

1) 17.1 (Addressing)

Issue Originator:

Issue History:

May 1992: First opened
May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1
September 1993: Alternative #2 and Argument_pro #1.2.
January 1994: Argument_general #1.0. Issue closed as obsolete MAC: Unanimous

Issue Status: CLOSED January 1994.

Issue Identification: 17.3 (Topic: Addressing).

What is the extent of Multicast ? ~~(Basic Service Set (BSS), Extended Service Set (ESS)).~~

Alternatives:

1) - Basic Service Set (BSS)
2) - Extended Service Set (ESS)
3) - Both BSS and ESS

References:

1) - P802.11-93/40 - The Wireless Hybrid Asynchronous Time-bounded MAC Protocol
2) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.
3) - P802.11-93/136 - Opinions on Issues 13.6 and 17.3, and New Issues.
4) - P802.11-94/16 - Review of MAC Issues List

Arguments:

Pro:

3.1) - A Station should be explicitly control the scope of multicasts. The WHAT protocol (Reference #1) provides this capability with the 'hierarchical' bit.

3.2) - Both ESS and BSS multicast should be supported, a station should be able to explicitly control the scope of multicast (this supports the position of document 93/40 on the WHAT protocol-Reference #2). The hierarchical bit provides this capability.

3.3) - Data PDUs and MAC PDUs should be differentiated. Data PDUs are regular data, so their extent is independent of the actual location (current BSS0, hence Multicast Messages should be forwarded to the whole ESS (unless an implementation dependent filtering function is used in the Access Point.

MAC Control PDUs may (and probably should, depending on the PDU's content) be limited to the BSS.

3.4) - The standard should support a Distribution System consisting of standard 802 LANs connected by 802 compatible bridges, and in such configuration the scope of a multicast must include the Extended Service Set (ESS).

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened
March 1993: Alternative #2 - Reference #1 - Argument_pro #3.1.
May 1993: Reference #2 - Argument_pro #3.2
September 1993: Reference #3, and Argument_pro #3.3.
January 1994: Reference #4 Argument_pro #3.4, and closing the Issue by endorsing Alternative #3.
MAC: Yes-36, No-0, Abstain-0

Issue Status: CLOSE January 1994

Issue Identification: 17.4 (Topic: Addressing).

- Will the standard support Source Routing ?

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: First opened
January 1994: Decision to leave this Issue open.

Issue Status: Open

Issue Identification: 17.5 (Topic: Addressing).

What is meant by addressing?

Alternatives:

1) - Size
2) - IEEE 802
3) - Media Link Framing (MLF) address (Reference #4)

References:

1) - P802.11-93/40 - The Wireless Hybrid Asynchronous Time-bounded MAC Protocol
2) - P802.11-93/22 - Further Exploration of Transactions and Name Spaces
3) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.
4) - P802.11-93/61 - Wireless LAN MAC Protocol: MAC-to-MAC Interface.
5) - P802.11-94/16 - Review of MAC Issues List
6) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

Pro:

2.1) - Wireless Stations should be identified by 48 bit unique IDs that are compatible with other IEEE 802 standards. All asynchronous service MPDUs carry the full 48 bit address in the WHAT protocol (see Reference #1). Time-bounded MPDUs use a short local identifier. However, the Call Setup message for Time-bounded connections contains the full 48 bit addresses of the source and destination.

2.2) - IEEE 802 addressing is required (supports the position of document 93/40 on the WHAT protocol - Reference #1). Wireless stations should be identified by 48 bit unique IDs that are compatible with other IEEE 802 standards. The 48 bit addresses of source and destination stations are contained in the four step transaction of the CODIAC protocol (Reference #3).

2.3) - In the MAC Foundation (Reference #6), all nodes are assumed to have a unique 48 bit IEEE address, and all (asynchronous) data transfers include such addresses. The MAC Foundation includes other identifiers besides IEEE 802 addresses (such as Basic Service Set identification (BSS-ID and Extended Service Seyt Identifier (ESS-ID) but these are used for specialized purposes separate from the addressing function or uniquely identify a station.

3.1) - With a one byte coding, there exist 255 different MLF addresses. This set is divided into several subsets according to table 2 of paper P802.11-93/61 (see Reference #4). The justification of defining some addresses ranges for Access Point(AP), for mobile stations and ad-hoc network are:

a) - it speeds up the connection establishment time: indeed a Mobile Station willing to 'get in touch' with an AP can take into account only the MPDU packets originating from an AP.

b) - In the same time, if an ad-hoc network is co-located with other wireless networks, it helps to discriminate between both; a mobile station pertaining to an ad-hoc network can easily discard any information that does not originate from a station of the same ad-hoc network.

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened
March 1993: Reference #1 and 2 - Argument_pro #2.1
May 1993: Reference #3 - Argument_pro #2.2
July 1993: Alternative #3, Reference #4 and Argument_pro #3.1
September 1993: Recommend Alternative #2 (IEEE 802 - 48 bit address).
January 1994: Reference #6, Argument_pro #2.3.
Closing of the Issue by endorsing #2 Alternative - MAC: Yes-34, No-0, Abstain-3.

Issue Status: CLOSE January 1994

Issue Identification: 17.6 (Topic: Addressing).

How does Global Addressing and Directory services affect the MAC ?

Alternatives:

Arguments:

General:

1.0) - This is not a Layer 2 issue.

2.0) - The MAC entity should have a 48 bit address to be identifiable in global networks.

3.0) - The intent of addressing Global addressing in this Issue, is not understood by the committee.

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened

September 1993: - Argument_general #1.0, #2.0 and #3.0 - Close the Issue by concluding that this Issue is not a Layer 2 issue and it does not affect the MAC. - Result yes-31, no-0, abstain-0.

Issue Status: Close (September 1993)

Issue Identification: 17.7 (Topic: Addressing).

Does the MAC supply a packet number to the PHY ?

Alternatives:
1) - No

Arguments:
Pro:
1.1) - The MAC entity does not provide a packet number recognizable by the PHY layer - the PHY entity cannot interpret packet numbers.

Con:

Related Issue Identification:
- 12.1 (Topic: Interfaces)

Issue Originator:

Issue History:
May 1992: First opened
September 1993: - Alternative #1, Argument_pro #1.1 - Closing of the Issue by adopting Alternative #1. Results: yes-33, no-0, abstain-0.

Issue Status: Closed (September 1993)

TOPIC: DATA RATES

18

Issue Identification: 18.1 (Topic: Data Rates).

Should the MAC work equally well at all PHY data rates ?

Alternatives:

1) - Yes
2) - No

References:

1) - P802.11-94/16 - Review of MAC Issues List
2) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

Pro:

1.1) - It is known now that all the PHY data rates are going to be about 1 Mbps as opposed to the original PAR range of 1-20 Mbps. Therefore this question isn't relevant until the state of the art of the PHY layers advances.

1.2) - The MAC Foundation (Reference #2) includes provisions allowing the support of various data rates. Although the MAC will obviously have higher performance with higher data rates, there should be no significant data-rate dependencies within the MAC.

Con:

Related Issue Identification:

1) - 18.2 (Data Rates)

Issue Originator:

Issue History:

May 1992: Date first opened
July 1993: Alternatives #1 and #2, Argument_pro #1.1 and Proposal to close the Issue at the September meeting by adopting Alternative #1.
January 1994: Reference #1 & 2, Argument_pro #1.2 and closing of the Issue by endorsing Alternative #1 - MAC Yes-37, No-0, Abstain-0.

Issue Status: CLOSE January 1994

Issue Identification: 18.2 (Topic: Data Rates).

Will the standard support one MAC driving multiple PHYs of different rates ?

Alternatives:

1) - Yes
2) - No

References:

1) - P802.11-93/115 - Protocol Layering Alternatives for Practical Implementation.
2) - P802.11-93/140 - MAC/PHY Functional Partitioning
3) - P802.11-94/16 - Review of MAC Issues List
4) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

Pro:

1.1) - If one accepts the PAR demand for one MAC and one accepts that the different MAC's may decide on different data rates then the answer is yes. Since we know that the range of data rates is small this should not present implementation problems.

1.2) - The use of a PHY adaptation layer at the bottom of the MAC (see Reference #1) allows such multiple-PHY support, provided that the necessary parameters regarding the PHY capabilities can be requested by this PHY adaptation layer via the MAC/PHY interface.

1.3) - A single MAC should support multiple PHYs with different rates. Preamble length and other parameters reported by the PHY.

1.4) - The MAC Foundation (Reference #2) includes provisions to accommodate different rates.

Con:

Related Issue Identification:

1) - 18.1 (Data Rates)

Issue Originator:

Issue History:

May 1992: Date first opened
July 1993: Alternatives #1 and #2, Argument_pro #1.1 and proposal to close the Issue at the September meeting by endorsing Alternative #1.
September 1993: - Reference #1 & #2 and Argument_pro #1.2 & #1.3.
January 1994: Reference #3 & #4, Argument_pro #1.4 and closing of the Issue by endorsing Alternative #1 - MAC Yes-35, No-0, Abstain-1.

Issue Status: CLOSE January 1994

Issue Identification: 18.3 (Topic: Data Rates).

Will the standard support PHY with variable rates ?

Alternatives:

1) - Yes
2) - No

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.
2) - - P802.11-93/140 - MAC/PHY Functional Partitioning
3) - P802.11-93/146 - The Need for MAC Data Delimiters in the PHY.

Arguments:

Pro:

1.1) (See Reference #1) - RSYNC frames could be issued at different rates within a superframe, or different superframes could be issued. PSYNC could be issued at one rate while communication was going on at another.
Little consideration has been given to this issue at this time. However, this is a very important issue. First generation wireless LANs will be released at lower speeds than forthcoming generations, but they must coexist - it is not desirable tell customers they must upgrade their equipment because the company across the hall installed a newer, higher speed LAN.

1.2) - This group (July 93 'Data Rate' work group) can see no reason why the MAC should not support a PHY that is capable of operation at more than one rate. As we see the 802.3 parameter being changed to be specified in bits so that it is data rate independent so 802.11 should prepare for multiple data rates by scalable specifications.

1.3) - (Reference #3) - It is important that the MAC can support this (PHY with variable rates) in view of the migration requirements toward future higher speed PHY's, within the same band. This should allow for mixed operation where higher speed products can be build that are backward compatible with a currently developed standard. This functionality would further be applicable in environments that can take advantage of dynamic speed switching.

1.4) See Reference #2

Con:

Related Issue Identification:

1) - 18.2 (Topic: Data Rates)

Issue Originator:

Issue History:

May 1992: Date first opened
May 1993: Alternative #1 - Argument_pro #1.1
July 1993: Alternative #2, Argument_pro #1.2 and proposal to close the Issue at the September 1993 meeting by endorsing Alternative #1.
September 1993: Reference #2 & #3 and Argument_pro #1.3 & #1.4.

Issue Status: Open

Issue Identification: 18.4 (Topic: Data Rates).

Will the standard allow PHY data rate to vary as function of signal quality ?

Alternatives:

1) - Yes
2) - No

References:

1) - P802.11-93/140 - MAC/PHY Functional Partitioning

Arguments:

General:

1.0) - If the standard allows PHY data rate to vary, the criteria for changing should be up to the implementer.

2.0) - The PHY data rate may be varied if the PHY is capable of multiple rates (see Issue 18.3). However, if the issue means 'can the PHY make its own decision to adjust data rate based on signal quality' then the answer is NO. The MAC may decide to tell the PHY to change data rate based on signal quality indication.

Pro:

1.1) - (Reference #1) - The MAC must tell the PHY to change the data rate based on information presented to the MAC by the PHY. The PHY must not make this decision independently. The MAC needs to understand the timing of MPDU transmissions and not in position to know if the PHY is independently making these decisions.

Con:

Related Issue Identification:

1) - 18.3 (Data Rates)
2) - 18.5 (Data Rates)

Issue Originator:

Issue History:

May 1992: First opened
May 1993: Argument_general #1.0
July 1993: Alternative #1 and #2 and Argument_general #2.0.
September 1993: Reference #1 and Argument_pro #1.1.

Issue Status: Open

Issue Identification: 18.5 (Topic: Data Rates).

Is data rate 'agility' only a PHY matter ?

Alternatives:

1) - No
2) - Yes

References:

1) - P802.11-93/140 - MAC/PHY Functional Partitioning

Arguments:

General:

1.0) A new issue should be open: Shall 802.11 MAC support multiple, simultaneous data rates phys? (see Issue 18.7)

Pro:

1.1) - If stations are functioning at various speeds the MAC must maintain (somehow) the mapping of stations to speeds because the PHY cannot interpret address fields on MSDUs.

1.2) - The standards for different PHY's may specify multiple data rates or a fixed data rate. However the decision to operate at or change data rates (for multiple rate PHY's) is made by the MAC.

1.3) - (Reference #1) - The MAC must decide when to switch data rates (Pro #1.2). However, the data rate indication must occur in the PHY preamble to allow proper clocking, bit alignment, and other PHY functions.

Con:

Related Issue Identification:

1) - 18.4 (Data Rates)
2) - 18.7 (data Rates)

Issue Originator:

Issue History:

May 1992: First opened
May 1993: Alternative #1 - Argument_pro #1.1.
July 1993: Alternative #2 and Argument_pro #1.2.
September 1993: - Argument_general #2.0, Argument_pro #1.3, Agree to close the Issue by adopting Alternative #1 - Result yes-33, no-0, abstain-0.

Issue Status: Close (September 1993)

Issue Identification: 18.6 (Topic: Data Rates).

How is data density affected by the bit rate (1 to 20 mbit/s) ?

Alternatives:

Arguments:

General:

1.0) - The Issue is viewed as meaningless and it is proposed to close it.

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: Date first opened
July 1993: Argument_general #1.0 proposing to close the Issue at the September 1993 meeting.

Issue Status: Open

Issue Identification: 18.7 (Topic: Data Rates).

Shall 802.11 standard supports multiple, simultaneous data rate PHYs?

(editor's note: It seems that this Issue is equivalent to 18.2)

Alternatives:

1) - Yes

Arguments:

General:

1.0) - (Taken from Meeting discussion) - The increase rate is only relative to old generation equipment (migration)

- Fall-back rate is a separate issue.
- Conformance questions: Are all rates required? some optional?
- Cost: The increase of rate is presumed to add cost; one must get 'something for his/her money'.
- Throughputs: Is units of throughput are different or the same than performance?

2.0) - explore each MAC proposal in the ability to handle multiple, simultaneous PHY data rates.

- WHY?
  1.) Increase rate in next generation
  2.) Lower speed to increase reliability

Classifications:

- Class 1.) - BSS (other rates in other BSS within ESS) (only works in multi-channel environ.)
- Class 2a.) - per station (stations are fixed at different rates.)
- Class 2b.) - per station (stations are capable of lowest common rate.)
- Class 3.) - within a frame (Wim contends this the level 2.)

Class 3:

- Common data rate at beginning of frame (NCR PHY specific fields) - not differing in frame, just preamble.
- "preamble" includes start delimiter and PHY specific information.
- Function could include speed determination. (i.e. 1 or 2 Mb/s). MAC of Transmitter needs to know data rate to use (tells the PHY).
- Multi-cast packets within BSS are retransmitted by AP at Lowest common denominator of STA associated with AP.

Class 1:

- Class 1 is simply a PHY type. MAC knows based on ID of PHY.
- What about PHY capable of multiple rates?
  - multi-rates is desirable. sooner or later we will have higher data rates -- a fact. However, APs assume all station can hear it. If multi-rates at same time this is a problem. Think of N data rates.
  - IBM protocol will not take advantage of higher rates due to fixed slot times.
  - Same holds true for Gaps. Need to be smaller for higher data rates. Technically dependent.

Class 2:

- Contends that Class 2 is not viable.
- Can we put hooks in now to accommodate future rates?
- Not necessary; dual mode devices can be made in channelized systems without any.

- What are our options to address this?
- Channelize (easiest coexistence means)
- core rate negotiation (works in single channel PHY)

Issues/Problems:

Multicast/Broadcast: All stations must be able to receive Multicast without having to send "n" copies where "n" is number of rates. Definition is interoperability (same as Ad-Hoc).

Coexistence: Definition. All station must support the same medium access rules. i.e. energy detection may solve problem, but length fields break it (everyone must read length). If in the same band and code space "We are all on the same wire"

Ad-Hoc networks: Same as Multicast/Broadcast (Bootstrap may be harder -- initialization)

Time-Bounded services (interaction with reservation system) Definition: The one doing the reservation must know the data rate of each station associated with it. The coordination of any speed change and the coordination of TB reservation need to be one and the same. Only applies AFTER reservation for a connection has been set.

Power Management (receive time stamps) Definition: Same as Multicast/Broadcast - must be sure all can hear time reference. There are some synchronization implications. Negotiated rondivous [??] are similar to TB situation.

Worry of inefficiency of backward compatibility method. (The cost of NOT providing the hooks) Complexity of feature in MAC. (all of the above) Definition: Identify the hook and the cost.

Worry about minimal amount of information that needs to be at common speed. Every frame / "n" frames.

Roaming: reaquisition of channel -- reassociation.

Assumptions:
MAC tells PHY which data rate to transmit MSDU
PHY will tell MAC what speeds it capable of
PHY will tell MAC what speed latest frame was received.

Matrix of orthogonal axis:
Channelized and Non-channelized PHY: DSSS, FHSS and IR PHY - All 11 MAC proposals.

Message to MAC Authors: MAC Authors should address above issues. Assess throughput gain to 2x PHY rate difference.

Group (Issue study group) agrees that some mechanism for accommodating increased speed migration must be provided in the MAC (PHY also!). Consequences of failing to do it are undesirable ad-hoc solutions.

Pro:

1.1) - For the purpose of increasing rates and only for significant throughput gains.

Con:

1.1) - The MAC will work in other frequency band (i.e 1.9 GHZ) which provides a better throughput.

Related Issue Identification:

1) - 18.2 (Data Rates)
2) - 18.5 (Data Rates)

Issue Originator: Dave Bagby
- History: September 1993: Date first opened - Alternative #1, Argument-general #1.0 & 2.0, Argument-pro #1.1 and Argument-con #1.1.

Issue History:

September 1993: Date first opened - Alternative #1, Argument_general #1.0 & 2.0, Argument_pro #1.1 and Argument_con #1.1.

Issue Status: Open

TOPIC: RELIABILITY

19

Issue Identification: 19.1 (Topic: Reliability).

Shall the 802.11 standard depend on the layers above the MAC for recovery from failed transmits ? If so to what extent ?

Alternatives:
1) - Partially

References:
1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.
2) - P802.11-94/16 - Review of MAC Issues List

Arguments:

Pro:

1.1) - A retry mechanism should be implemented in the MAC as required to bring the MSDU loss rate up to the equivalent of wired LANs. (See Issue 19.5)

1.2) - "partially" through the use of a MAC-Level ACK on directed transmissions. However, this mechanism only improves the delivery reliability and does not guarantee delivery.

Con:

Related Issue Identification:
1) - 19.5 - Reliability

Issue Originator:

Issue History:
May 1992: First opened
May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1
January 1994: Reference #2, Argument_pro #1.2 and closing of the Issue by endorsing the Alternative - MAC Yes-36, No-1, Abstain-0.

Issue Status: CLOSE January 1994

Issue Identification: 19.2 (Topic: Reliability).

Will the IEEE 802.11 MAC look like all other IEEE 802 MACs regarding delivery reliability?

How does Multicast affect this decision ?

Alternatives:

References:

Arguments:

General:

1.0) - Spliting of the Issue into 2 related Issues:

19.2A - Will the IEEE 802.11 MAC look like all other IEEE 802 MACs regarding delivery reliability?

19.2B - How does Multicast affect the decision made in Issue 19.2A?

Pro:

Con:

Related Issue Identification:

1) - 19.2A - Reliability
2) - 19.2B - Reliability

Issue Originator:

Issue History:

May 1992: Date first opened
March 1993: Spliting the current Issue into 2 related Issues: 19.2A and 19.2B

Issue Status: Open

Issue Identification: 19.2A (Topic: Reliability).

Will the IEEE 802.11 MAC look like all other IEEE 802 MACs regarding delivery reliability?

Alternatives:
1) - Yes
2) - No

References:
1) - P802.11-93/40 - The Wireless Hybrid Asynchronous Time-bounded MAC Protocol
2) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.
3) - P802.11-94/16 - Review of MAC Issues List

Arguments:

General:

19.2A:

1.0) - Bit Error Rate (BER) explicitly defined in the PAR.

2.0) - BER is not delivery reliability.

3.0) - Undetected BER must be low; detected BER could be higher that other 802 MACs.

Pro:

19.2A:

1.1) - It must provide comparable level of service to client software.

1.2) - Related to 1.1 above - must be good enough to not 'upset' the upper layer clients.

1.3) - See Argument_pro #1.2 in Issue 19.5

2.1) - Multicasts may be less reliable than directed transmissions.

Con:

Related Issue Identification:
1) - 19.2A - Reliability
2) - 19.5 - Reliability

Issue Originator:

Issue History:
March 1993: Date first opened - Alternative # 1 and #2 - Reference #1 - Argument_general #1.0 to #3.0 - Argument_pro #1.1 and #1.2.
May 1993: Reference #2 - Argument_pro #1.3
January 1994: Reference #3, Argument_pro #2.1 and closing of the Issue by endorsing Alternative #2 - MAC Yes-20, No-0, Abstain-7.

Issue Status: CLOSE January 1994

Issue Identification: 19.2B (Topic: Reliability).

How does Multicast affect the decision made in Issue 19.2A?

Alternatives:

1) - Broadcast and Multicast will not be as reliable

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.
2) - P802.11-94/16 - Review of MAC Issues List

Arguments:

General:

Pro:

1.1) - See Argument_pro #1.1 in Issue 17.2

Con:

Related Issue Identification:

1) - 19.2A - Reliability
2) - 17.2 - Addressing

Issue Originator:

Issue History:

March 1993: Date first opened
May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1
January 1994: Reference #2, and closing of the Issue by endorsing the Alternative - MAC: Yes-29, No-0, Abstain-5.

Issue Status: CLOSE January 1994

Issue Identification: 19.3 (Topic: Reliability).

- How much overhead is acceptable to get reliable frames (error checking and correction) ?

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:
1) - 20.3 (Data Unit Structure)

Issue Originator:

Issue History:

May 1992: Date first open
January 1994: Decision to leave this Issue open at this time.

Issue Status: Open

Issue Identification: 19.4 (Topic: Reliability).

Can some minimum Bit Error Rate (BER) be assumed for a PHY ?
If so:
- What is it ?
- Is it constant or variable ?

Alternatives:
1) - Bit error rate: 10**5 - See Reference #1

References:
1) - P802.11-93/45 - Joint MAC/PHY Subgroup Minutes (March 1993)

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: First opened
May 1993: Alternative #1 - Reference #1

Issue Status: Open

Issue Identification: 19.5 (Topic: Reliability).

What kind of error recovery mechanisms are to be incorporated into the MAC ?

Alternatives:

1) - Positive ACK with low retries.
2) - Segmentation and Reassembly procedures

References:

1) - P802.11-93/40 - The Wireless Hybrid Asynchronous Time-bounded MAC Protocol

2) - P802.11-93/70 - A distributed Access Protocol Proposal Supporting Time Bounded Services

3) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.

4) - P802.11-93/61 - Wireless LAN MAC Protocol: MAC-to-MAC Interface

Arguments:

Pro:

1.1) - The 802.11 MAC should include a positive acknowledgement protocol with low level retries. This mechanism helps the MAC present approximately the same level of MSDU delivery reliability as other IEEE 802 protocols.

1.2) - Since the wireless medium is interference limited rather than noise limited, MAC level recovery is needed to restore the delivery reliability level to that defined by 802. This can not be accomplished by PHY level recovery.
Note that MAC level recovery is not particular to Broadcast/Multicast frames, which will result in a lower delivery reliability than the one specified in 802.

2.1) - The segmentation of Mac Service Data Unit (MSDU), among other reasons (see Reference #4), increase the probability of successful data transmission. Detailed error rate figure are specified in Reference #4.

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened
March 1993: Alternative #1 - Reference #1 - Argument_pro #1.1.
May 1993: References #2 and #3 - Argument_pro #1.2.
July 1993: Alternative #2, Reference #4 and Argument_pro #2.1

Issue Status: Open

Issue Identification: 19.6 (Topic: Reliability).

What is the strategy for capacity control ?

Alternatives:

1) - See the CODIAC Protocol proposal (Reference #1)

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.

Arguments:

Pro:

1.1) - The CODIAC protocol (Reference #1) is in itself a strategy for capacity control. The purpose of the two operating modes is to allow efficient media use under different capacities, and in centralized mode each implementation's strategy for management of request periods and data periods in centralized mode is its strategy for capacity control.

Con:

Related Issue Identification:

Issue Originator: Wim Diepstraten

Issue History:

May 1992: Date first opened
May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1.

Issue Status: Open

Issue Identification: 19.7 (Topic: Reliability).

Is a maximum number of stations to be specified ? if so how many ?

Alternatives:

1) - No - the number should not be specified.

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.

Arguments:

Pro:

1.1) - That should be up to the implementation. In distributed mode the protocol will begin to break down at a certain number of stations, and the implementer should decide what action to take about that - whether to switch operating modes, or to make the degradation limit a parameter of the network.
In centralized mode, it is a function of the intended application. An application with huge numbers of stations with small payload and/or tolerance for large transfer delays can be supported, as can an application with smaller population with need of shorter transfer delays. The CODIAC protocol (Reference #1) can be set up to accommodate either, without loosing compatibility.

1.2) - The number should be left open.

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: Date first opened
May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1.
January 1994: Argument_pro #1.2.

Issue Status: Open

Issue Identification: 19.8 (Topic: Reliability).

How will the standard address the MAC robustness in the presence of co-site dissimilar networks ?

Alternatives:

1) - Nothing different from handling any other kind of interference.

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.

Arguments:

Pro:

1.1) - On the assumption that "dissimilar" means not so different that they don't see each other (e.g. IR and SS), and not so similar as to be able to recognize each other's MSDUs - Co-site dissimilar networks interfere with each other. There is nothing the MAC can do about this that is different from handling interference of any other kind.

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: Date first opened
May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1.
January 1994: Decision to close this Issue by endorsing the Alternative - MAC: Yes-28, No-1, Abstain-5.

Issue Status: CLOSE January 1994

Issue Identification: 19.9 (Topic: Reliability).

How will the standard address the 'range' related to Data Density ?

Alternatives:

References:
1) - P802.11-92/40 - Functional Requirement Draft.

Arguments:
General:
1.0) - Clarification of the Issue: - There is a section in Document 92/40 "Functional Requirements Draft" (Reference #1), called Other Functional Issues. A category in that section is Data Density, and a bullet item in that category is Range. It is suggested that this issue was intended to mean: " Will the standard specify a minimum or maximum coverage area per station? and If so, what are the values?

2.0) - Need to split this Issue into two related Issues:
19.9A - Will the standard specify a minimum or maximum coverage area per station?

19.9B - If the standard specifies a minimum or maximum coverage area per station, what are the values?

Pro:

Con:

Related Issue Identification:
1) - 19.9A - Reliability
2) - 19.9B - Reliability

Issue Originator:

Issue History:
May 1992: Date first opened
May 1993: Reference #1 - Argument_general #1.0 (clarification of the Issue) and #2.0 (splitting of the Issue into 2 related Issues: 19.9A and 19.9B).

Issue Status: Open

Issue Identification: 19.9A (Topic: Reliability).

Will the standard specify a minimum or maximum coverage area per station?

Alternatives:

References:

Arguments:

General:

Pro:

Con:

Related Issue Identification:

1) - 19.9 - Reliability

Issue Originator: C. Heide

Issue History:

May 1993: Date first opened

Issue Status: Open

Issue Identification: 19.9B (Topic: Reliability).

If the standard specifies a minimum or maximum coverage area per station, what are the values?

Alternatives:

References:

Arguments:
General:

Pro:

Con:

Related Issue Identification:
1) - 19.9 - Reliability
2) - 19.9A - Reliability

Issue Originator: C. Heide

Issue History:
May 1993: Date first opened

Issue Status: Open

Issue Identification: 19.10 (Topic: Reliability).

How will stability under heavy load be addressed ?

Alternatives:

1) - See the CODIAC Protocol proposal (Reference #1)
2) - See the CSMA/CA Protocol proposal (Reference # and #3)

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.
2) - P802.11-93/70 - A distributed Access Protocol Proposal Supporting Time Bounded Services.
3) P802.11-92/51 - A Wireless MAC Protocol Comparison.
4) - P802.11-9X/YY - Performance of the CODIAC protocol
5) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

General:

1.0) - This Issue is made obsolete by the MAC Foundation decision (Reference #5).

Pro:

1.1) - The centralized mode of the CODIAC protocol (Reference #1) remains stable under heavy load by increasing transfer delay. This is further explored in document "Performance of the CODIAC protocol" (Reference #4).

2.1) - The CSMA/CA protocol (Reference #2) is demonstrated to be stable under high load. Reference to document IEEE P802.11-92/51 (Reference #3) for simulation results.

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: Date first opened
May 1993: Alternative #1 and #2 - References #1 to #4 - Argument_pro #1.1 and #2.1.
January 1994: Argument_general #1.0. Issue closed as obsolete MAC: Unanimous

Issue Status: CLOSED January 1994.

Issue Identification: 19.11 (Topic: Reliability).

How will the transmission lost be addressed ?

Alternatives:

1) - Positive ACK and Retransmission (see Related Issues #1 and #2).

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.
2) - P802.11-94/16 - Review of MAC Issues List

Arguments:

Pro:

1.1) - Issues 19.1 and 19.5 cover this issue. - The CODIAC protocol (reference #1) proposes positive ACK and retransmission to bring the transmission loss rate to approximately the same level of MSDU delivery reliability as other IEEE 802 protocols.

1.2) - Propose to accept the Alternative for Directed Asynchronous transmission - Multicast or Time-bounded transmissions do not incorporate positive acknowledgments.

Con:

Related Issue Identification:

1) - 19.1 - Reliability
2) - 19.5 - Reliability

Issue Originator:

Issue History:

May 1992: Date first opened
May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1
January 1994: Reference #2, Argument_pro #1.2 and closing of the Issue by endorsing the Alternative - MAC Yes-28, No-0, Abstain-3.

Issue Status: CLOSE January 1994

TOPIC: DATA UNIT STRUCTURE

20

Issue Identification: 20.1 (Topic: Data Unit Structure).

- How does the preamble length affects the MAC performance ?
- What is the length requirement ?

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

Date first opened: May 1992

Issue Status: Open

Editor's note: Ref: 1 (92/58R1).

Issue Identification: 20.2 (Topic: Data Unit Structure).

Can the MAC handle different preamble lengths from different PHYs ?

Alternatives:

1) - No
2) - Yes

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.
2) - P802.11-93/146 - The Need for MAC Data Delimiters in the PHY.
3) - P802.11-94/16 - Review of MAC Issues List
4) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

Pro:

1.1) - If different PHYs must generate different preamble lengths then preamble should be handled by the Medium Independent Layer, which is on the PHY side of the MAC/PHY interface. The preamble would be stripped off by the time the frame is seen by the MAC.
To facilitate MAC independence from preamble length, perhaps the preamble should not be considered part of the MAC frame.

2.1) - (Reference #2) - The PHY should be responsible for generating the preamble, upon a MAC command. The PHY should indicate the end of the preamble to the MAC, so that the MAC can start generating the MSDU data.

2.2) - The MAC Foundation (Reference #4) does not need a specific preamble length.

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: Date first opened
May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1.
September 1993: Alternative #2, Reference #2 and Argument_pro #2.1
January 1994: Reference #3 & 4, Argument_pro #2.2 and closing of the Issue by endorsing Alternative #2 - MAC Yes-28, No-0, Abstain-3.

Issue Status: CLOSE January 1994

Issue Identification: 20.3 (Topic: Data Unit Structure).

What is the MAC frame structure ?

Alternatives:

1) - The use of ATM as a sub-mac frame structure for wireless LAN. Contentions:
- Time Bounded services must have a guaranteed bandwidth mechanism.
- ATM is one such wired (fiber) LAN structure meeting this.
- WLAN must be able to work with ATM backbones.

2) - All frames of the CODIAC protocol proposal (Reference #1) have the following format:

a) - Preamble: 8n bits where n is to be determined
b) - Start delimiter (SD): 8 bits
c) - Destination Identifier (DID): 16 bits
d) - Frame Type (Type): 8 bits
e) - Control flags (Control): Access Point (AP), Sequence, Out-of-sequence, Retry, Hierarchical - 8 bits
f) - Information (Info): optional - 8m where 0 < = m < = to be determined.
g) - Frame Check Sequence (FCS): CRC 32 - 32 bits
h) - End Delimiter (ED): 8 bits

Notes:
i) - Minimum frame length (12 + n) octets
ii) - CRC coverage: Fields c) to f) included.
iii) - For details refer to Reference #1, section 4. - Frame Format

3) - The framing of the Wireless LAN MAC protocol (IBM Proposal) (Reference #2) has the following format:
- a) Start frame delimiter (SFD) -- Size: 8 bits - Value: X'7E'
- b) Destination Address (DA) -- Size: 8 bits - Value: variable
- c) Source Address (SA) -- Size: 8 bits - Value: variable
- d) Control Field (C) -- Size: 32 bits - Value: variable
- e) Data Length Field (L) -- Size: 8 bits - Value: variable
- f) Information Data (Data) -- Size: Variable - Value: Variable
- g) Frame Check Sequence (FCS) -- Size: 16 bits - Value: variable
- h) End Frame Delimiter (EFD) -- Size: 16 bits - Value: X'7E7F'

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.

2) - P802.11-93/61 - Wireless LAN MAC Protocol: MAC-to-MAC Interface

Arguments:

Pro:

1.1) - Bandwidth on demand - more efficient for MPEG for instance which as a reliable bit/sec. rate.

1.2) - Maps easily for future WANs (B-ISDN based).

1.3) - It is "modern & new".

2.1) - The frame structure is designed with the following goals:
(1) - to minimize the frame size while keeping a consistent frame structure;
(2) - to have a minimum size destination identifier at the start of the frame to allow destination determination of frames as quickly as possible;
(3) - to provide a level of error detection suitable to the high bit error rate of the wireless media.

3.1) - The advantage of having unique packet framing delimiters is twofold:
a) - The start frame and end frame delimiters can be used to automatically trigger in an RF/IR transceiver the start of transmission and the end of transmission.
b) - the uniqueness of packet frame delimiters allows to avoid false packet detection.

Con:

1.1) - ATM designs are based on two assumptions which are not true for WLAN:
- The bandwidth is plentiful (i.e. some efficiency can be sacrificed for self routing characteristics).
- The channel is reliable

1.2) - Use of specific ATM-MAC is an inefficient and unnecessary constraining structure for WLAN.

1.3) - Present frame based (fixed length) MAC proposal meets Time Bounded service needs.

Related Issue Identification:

Issue Originator: Jim Schuessler

Issue History:

May 1992: First opened
November 1992: Alternative #1, Argument-pro #1-1 to 1-3, Argument-con #1-1 to 1-3.
May 1993: Alternative #2 - Reference #1 - Argument_pro #2.1.
July 1993: Alternative #3, Reference #2 and Argument_pro #3.1.

Issue Status: Open

Issue Identification: 20.4 (Topic: Data Unit Structure).

How is the MAC time preservation ordering of SDU to end systems (LLC requirement) will be addressed by the standard ?

Alternatives:

1) - No change in the order of MSDUs - See CODIAC Protocol proposal (Reference #1).

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.
2) - P802.11-94/16 - Review of MAC Issues List
3) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

Pro:

1.1) - The CODIAC protocol (Reference #1) is a stop-and-wait ARQ, it does not change the order of MSDUs.

1.2) - The standard should ensures that duplicates are not generated and that ordering is preserved (e.g. via a duplicate detection scheme as in the MAC Foundation (Reference #3).

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: Date first opened
May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1.
January 1994: Reference #2 & 3, Argument_pro #1.2 and closing of the Issue by endorsing the Alternative - MAC Yes-32, No-0, Abstain-0.

Issue Status: CLOSE January 1994

Issue Identification: 20.5 (Topic: Data Unit Structure).

Should the 802.11 MAC or PHY be responsible for MAC data delimiter generation and detection?

Alternatives:

1) - MAC=No, PHY=Yes

References:

1) - P802.11-93/146 - The Need for MAC Data Delimiters in the PHY

Arguments:

Pro:

1.1) - (Reference #1) - Only the PHY can implement proper means for end delimiter detection. It can start delimiter detection in various ways, including bit-stream detection.

- Start delimiter detection on the PHY allows for the implementation of a PHY-to-PHY signalling field. This is desirable for migration flexibility to future standards. It is further needed to allow mixed bit rate implementations where the PHY is to adapt automatically to the proper speed.

Con:

1.1) - The MAC can only do bit-stream delimiting detection. This is acceptable for a start delimiter, but not for an end delimiter, because it violates the hamming distance requirements of 802.

Related Issue Identification:

1) - 12.1 (Interfaces)

Issue Originator: W. Diepstraten

Issue History:

September 1993: Date first opened - Alternative #1, Reference #1, Argument_pro #1.1 and Argument_con #1.1.

Issue Status: Open

Issue Identification: 20.6 (Topic: Data Unit Structure).

- Is there a need for fragmentation/re-assembly function at the MAC layer?

Alternatives:

References:
1) - P802.11-93/208 - A Complete Description of Frame Prioritization in a CSMA/CA MAC Protocol.

Arguments:
Pro:

Con:

Related Issue Identification:

Issue Originator: MAC Group

Issue History:
January 1994: Date first open and Reference #1.

Issue Status: Open

Issue Identification: 20.7 (Topic: Data Unit Structure).

- Will the MAC support windowing (allowing multi-packets with single acknowledge (ACK)?

Alternatives:

References:
1) - P802.11-93/208 - A Complete Description of Frame Prioritization in a CSMA/CA MAC Protocol.

Arguments:
Pro:

Con:

Related Issue Identification:
1) - 20.6 (Data Structure)

Issue Originator: MAC Group

Issue History:
January 1994: Date first open and Reference #1.

Issue Status: Open

TOPIC: MEDIA

21

Issue Identification: 21.1 (Topic: Media).

- Will the standard define or limit the maximum number of stations in a Basic Service Set (BSS) due to media characteristics ?

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator: Nat Silberman

Issue History:

Date first opened: May 1992

Issue Status: Open

Editor's note: Ref: 96 (92/58R1).

Issue Identification: 21.2 (Topic: Media).

How does the MAC robustness in the presence of non-reciprocal wireless medium will be addressed by the standard ?

Alternatives:

References:
1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.

Arguments:
General:
1.0) - If this means stations may have different receive and transmit coverage area:
In CODIAC protocol centralized mode (Reference #1) , if the relationship between the controller and a station is asymmetric the station will not be able to register. Minimal bandwidth will be lost as it repeatedly tries to do so. In distributed mode the RTS/CTS exchange will fail, avoiding the wasted bandwidth of attempting to send the data itself.
If this means non-reciprocal traffic load:
The CODIAC protocol is flexible in the assignment and duration of the data periods in centralized mode, both at run-time and per implementation, creating no problems handling non-reciprocal traffic loads. This is a moot point for distributed mode as it has no directionality.

2.0) - Refer to Issue 19.8.

Pro:

Con:

Related Issue Identification:
1) - 19.8 (Reliability)

Issue Originator:

Issue History:
May 1992: Date first opened
May 1993: Reference #1 - Argument_general #1.0.
January 1994: Argument_general #2.0 and closing of the Issue - MAC: unanimous

Issue Status: CLOSE January 1994

Issue Identification: 21.3 (Topic: Media).

- What does the statement 'Resolve media use conflict' mean ?

Alternatives:
1) - Obsolete

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: First opened
January 1994: Alternative #1 and closing of the Issue by endorsing the Alternative - MAC: unanimous

Issue Status: CLOSE January 1994

Issue Identification: 21.4 (Topic: Media).

- Can the frequency reuse be resolved in the MAC? If so:
  - Should it ?
  - How ?

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

Date first opened: May 1992

Issue Status: Open

Editor's note: Ref: 30 (92/58R1).

TOPIC: DELAY

22

Issue Identification: 22.1 (Topic: Delay).

- What are the limits on latency and delay ?
  - Access delay
  - Transfer delay
- What are the delay characteristics ?
  - a) MAC to MAC delay:
    - Access delay (latency)
    - Any ACK in the MAC
  - b) Propagation delay
  - c) Transfer delay for datagram traffic
    - 1) Nominal load
    - 2) High load
  - d) Stability at overload
  - e) MAC Setup delay (connection oriented services or streams).

Editor's note: This issue may need to be broken down !!

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

Date first opened: May 1992

Issue Status: Open

Editor's note: Ref: 10 (92/58R1), 4 (91/138) - Re-phrase of 'Delay Characteristics' statement and 92/40 -'Other Functional Requirements Issues' - 'Worst Case Access Delay & Worst Case Transfer Delay' statements and 'Latency' statement.

TOPIC: CONFORMANCE

23

Issue Identification: 23.1 (Topic: Conformance).

- What are the conformance requirements ?
- Does IEEE 802.11 follows the ISO 9646 conformance standard ?

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator: Francois Simon

Issue History:

Date first opened: May 1992

Issue Status: Open

Editor's note: Ref: 24 (92/58R1).

Issue Identification: 23.2 (Topic: Conformance).

- Is there a requirement for different conformance levels ?

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

Date first opened: May 1992

Issue Status: Open

Editor's note: Ref: 25 (92/58R1).

Issue Identification: 24.3 (Topic: PHY Types).

How multiple PHY support for the MAC be specified ?

Alternatives:

1) - In the MAC Layer
2) - In the PHY adaptation layer at the bottom of MAC (see Reference #2).
3) - In a PHY dependent MAC sublayer (see Reference #3)
4) - In the Physical Medium Adaptation layer (see Reference #4)

References:

1) - P802.11-93/40 - The Wireless Hybrid Asynchronous Time-bounded MAC Protocol.
2) P802.11-93/115 - Protocol Layering Alternatives for Practical Implementation.
3) - P802.11-93/140 - MAC/PHY Functional Partitioning
4) - P802.11-93/204 - An Improved Reference Model for IEEE 802.11.

Arguments:

Pro:

1.1) - The intelligence should be in the MAC layer. There should be a PHY specific sub-layer in the MAC to accommodate different wireless PHYs. One way to provide parameters to the interface is to provide a field in the MAC header that is used to pass PHY specific information across the MAC/PHY interface, and from MAC to MAC. The WHAT protocol (see Reference #1) follows this approach.

2.1 - (Reference #2) - This adaptation layer processes PHY specific information, inserts and extracts such information to/from MAC headers being exchanged over the wireless media.

3.1) - (Reference #3) - A PHY dependent MAC sublayer will be defined that generates and processes PHY specific information in the MPDU header. There will also be a MAC management entity that implements certain PHY specific functions. The PHY layer will also include PHY specific and PHY independent sublayers.

4.1) - (Reference # 4) - The Physical Medium Adaptation layer within MAC processes PHY-specific information, and inserts / extracts such information to/from MPDUs being exchanged over the wireless media. The MAC and MAC Management functions are PHY-independent, while Physical Medium Adaptation layers are specific to a particular PHY.

Con:

Related Issue Identification:

1) - 12.1 (Topic: Interfaces)

Issue Originator:

Issue History:

May 1992: First opened
March 1993: Alternative #1 - Reference #1 - Argument_pro #1.1.
September 1993: Alternative # & #3, References #2 & #3 and Argument_pro #2.1 & #3.1.
November 1993: Alternative #4, Reference #4 and Argument_pro #4.1.

Issue Status: Open

TOPIC: PHY TYPES

24

Issue Identification: 24.1 (Topic: PHY Types).

- Will the standard support different PHY classes ?

Alternatives:
1) - YES

References:
1) - P802.11-94/16 - Review of MAC Issues List

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: First opened
January 1994: Alternative #1, Reference #1 and closing of the Issue by endorsing the Alternative - MAC: Yes-31, No-0, Abstain-1

Issue Status: CLOSE January 1994

Issue Identification: 24.2 (Topic: PHY Types).

- What type of PHYs need to be specified ?

Alternatives:
1) - Not relevant

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: First opened
January 1994: Alternative #1 and closing of the Issue by endorsing the Alternative - MAC: Unanimous

Issue Status: CLOSE January 1994

Issue Identification: 24.3 (Topic: PHY Types).

How multiple PHY support for the MAC be specified ?

Alternatives:

1) - In the MAC Layer
2) - In the PHY adaptation layer at the bottom of MAC (see Reference #2).
3) - In a PHY dependent MAC sublayer (see Reference #3)

References:

1) - P802.11-93/40 - The Wireless Hybrid Asynchronous Time-bounded MAC Protocol.
2) P802.11-93/115 - Protocol Layering Alternatives for Practical Implementation.
3) - P802.11-93/140 - MAC/PHY Functional Partitioning

Arguments:

Pro:

1.1) - The intelligence should be in the MAC layer. There should be a PHY specific sub-layer in the MAC to accommodate different wireless PHYs. One way to provide parameters to the interface is to provide a field in the MAC header that is used to pass PHY specific information across the MAC/PHY interface, and from MAC to MAC. The WHAT protocol (see Reference #1) follows this approach.

2.1 - (Reference #2) - This adaptation layer processes PHY specific information, inserts and extracts such information to/from MAC headers being exchanged over the wireless media.

3.1) - (Reference #3) - A PHY dependent MAC sublayer will be defined that generates and processes PHY specific information in the MPDU header. There will also be a MAC management entity that implements certain PHY specific functions. The PHY layer will also include PHY specific and PHY independent sublayers.

Con:

Related Issue Identification:

1) - 12.1 (Topic: Interfaces)

Issue Originator:

Issue History:

May 1992: First opened
March 1993: Alternative #1 - Reference #1 - Argument_pro #1.1.
September 1993: Alternative # & #3, References #2 & #3 and Argument_pro #2.1 & #3.1.

Issue Status: Open

Issue Identification: 24.4 (Topic: PHY Types).

- What characteristics of the PHY will be specified in the standard ?

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

Date first opened: May 1992

Issue Status: Open

Editor's note: Ref: 103 (92/58R1).

Issue Identification: 24.5 (Topic: PHY Types).

- What are the implications of the complexity of the PHY ?

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

Date first opened: May 1992

Issue Status: Open

Editor's note: Ref: 19 (91/138) - Re-phrase of the 'Implications on the complexity of the PHY' statement.

Issue Identification: 24.6 (Topic: PHY Types).

Does the PHY layer provide the PHY type to the MAC layer ?

Alternatives:
1) - Yes

References:
1) - P802.11-93/115 - Protocol Layering Alternatives for Practical Implementation.
2) - P802.11-93/140 - MAC/PHY Functional Partitioning
3) - P802.11-94/16 - Review of MAC Issues List

Arguments:
Pro:
1.1) - The MAC must be able to identify the type of PHY being used.

1.2) - The MAC needs to know what type of PHY it is using.

Con:

Related Issue Identification:
- 12.1 (Topic: Interfaces)

Issue Originator:

Issue History:
May 1992: First opened
September 1993: - Alternative #1, Reference #1 & #2 and Argument-pro #2.1.
January 1994: Reference #3, Argument_pro #1.2 and attempt to close the Issue by endorsing the Alternative - MAC Yes-18, No-11, Abstain-0. Full committee: Yes-19, No-20, Abstain-7; the Issue remains open.

Issue Status: Open

Issue Identification: 24.7 (Topic: PHY Types).

Will the MAC standard specify the support of multiple PHYs transparently ?

Alternatives:

1) - Yes
2) - No

References:

1) - P802.11-93/30 - Wireless LAN MAC Protocol: PHY Layer Transparency.
2) - P802.11-93/115 - Protocol Layering Alternatives for Practical Implementation.
3) - P802.11-93/140 - MAC/PHY Functional Partitioning
4) - P802.11-94/16 - Review of MAC Issues List

Arguments:

Pro:

1.1) - P802.11-93/30 describes how the MAC Protocol (described in P802.11-92/39) can be adapted in a straight forward manner to address several PHY layer types:

- Infra-red
- Spread Spectrum Direct Sequence
- Spread Spectrum Frequency Hopping
- Multi-channel Spectrum

1.2) - See Reference #2

1.3) - See Reference #3

2.1) - For the most part the MAC will support various PHYs in a PHY-independent fashion (i.e. transparently). However, there are certain PHY-specific functions which the MAC will handle in a PHY-dependent manner.

Con:

Related Issue Identification:

1) - 24.3 (Topic PHY Types)

Issue Originator:

Issue History:

May 1992: First opened
March 1993: Alternatives #1 and 2 - Reference #1 - Argument_pro #1.1.
September 1993: Reference #2 & #3 and Argument_pro #1.2 & #1.3.
January 1994: Reference #4, Argument_pro 2.1. Attempt to close this Issue by endorsing Alternative #2 fails - MAC Yes-3, No-24, Abstain-4.

Issue Status: Open

Issue Identification: 24.8 (Topic: PHY Types).

What functions are required in the Medium Independent PHY layer?

Alternatives:

1) - None
2) - The interface to the MAC that implements the core functions (Reference #2 - Section 4

References:

1) - P802.11-93/115 - Protocol Layering Alternatives for Practical Implementation.
2) - P802.11-93/140 - MAC/PHY Functional Partitioning

Arguments:

Pro:

1.1) - (Reference #1) - This layer is unnecessary. All medium-independent functions are able to be performed in MAC. The "adaptation" or "convergence" function is needed at the bottom of MAC - not at the top of PHY. The appropriate MAC/PHY interface is to the "medium dependent" portion of PHY.

Con:

Related Issue Identification:

Issue Originator: Jim Schuessler

Issue History:

November 1992: First opened
September 1993: Alternatives #1 & #2, References #1 & #2 and Argument_pro #1.1.

Issue Status: Open

Issue Identification: 24.9 (Topic: PHY Types).

Given a Frequency Hopping (FH) PHY, which protocol entity is responsible for the real time aspect of the PHY layer?

Alternatives:

1) - PHY adaptation layer within the MAC (see Reference #1)
2) - MAC

References:

1) - P802.11-93/115 - Protocol Layering Alternatives for Practical Implementation.
2) - P802.11-93/140 - MAC/PHY Functional Partitioning

Arguments:

General:

1.0) - The wording of the Issue is ambiguous.

Pro:

1.1) - (Reference #1) - This adaptation layer controls the timing of the hopping and the channel sequence. The PHY (medium dependent portion) controls the tuning changes necessary to execute the hops commanded from the PHY adaptation layer.

2.1) - (Reference #2) - The MAC must tell the PHY when to tune to a new frequency and therefore controls the timing of the frequency hopping. The PHY controls all other realtime aspects.

Con:

Related Issue Identification:

Issue Originator: Phil Langer

Issue History:

January 1993: Date first opened
September 1993: Alternatives #1 & #2, References #1 & #2, Argument_general #1.0 and Argument_pro #2.1.

Issue Status: Open

Issue Identification: 24.10 (Topic: PHY Types).

- What modulation scheme will be used for Slow Frequency Hopping (SFH) PHY?

Alternatives:
1) - GFSK

Arguments:
Pro:
1.1) - This is the simplest possible scheme consistent with 1 Mbit/s raw signalling rate and FCC Part 15.247.

Con:
1.1) - There may be schemes that offer higher raw signalling rates without.... (editor's note: The remaining of the text is missing from the document available to the editor)

Related Issue Identification:

Issue Originator: PHY Group

Issue History:
March 1993: Date first opened
July 1993: Alternative #1, Argument_pro #1.1, Argument_con #1.1 and decision to close the Issue by endorsing the Alternative (see Motion's text below) - Result: yes-30, no-4, abstain-7.

Motion:
All 802.11 2.4 - 2.5 GHz band Frequency Hopping PHYs shall be capable of operating using GFSK with BT = .5 and a minimum deviation of 160 Khz with a data rate of 1 Mbit/s.

Modulation techniques for higher data rates are for further study by 802.11 PHY committee.

A Means for negotiating a switch to higher data rates from the data rate defined above is also for further study.

Issue Status: CLOSE (07/93)

Issue Identification: 24.11 (Topic: PHY Types).

~~1) - How will Hopping synchronization, acquisition and tracking be accomplished in the Frequency Hopping (FH) and their terms defined?~~

2) - How will:
a) - synchronization, acquisition and tracking be accomplished when using Frequency Hopping (FH) PHY?; and
b) - their terms defined as they relate to FH?

Alternatives:
1) - The MAC makes decision related to PHY control when the appropriate information is only known by the MAC.
2) - See Reference #1

References:
1) - P802.11-93/148 - Preamble and MAC Header to Support Hop Acquisition for a Frequency Hopped PHY.

Arguments:
General:
1.0) - (Reference #1 - Abstract) - The requirements for the MAC header to support hop acquisition and timing are investigated. A preamble suitable for a frequency hopped radio is also presented. The preamble should support carrier detection/antenna diversity selection, baseband DC offset adjustment, and symbol timing recovery and unique word detection.

Pro:
1.1) - The MAC must make decisions regarding PHY control where information is used that only the MAC has.
The PHY will not interpret received information with the exception of any that is in the PHY header or any non-data symbols. All information received by the PHY will be passed to the MAC other than the PHY header and any non-data symbols.

The following synchronization and acquisition functions must be commanded by the MAC:
- some sort of timing reference,
- what pattern sequence is to be used,
- what state the PHY should be in (e.g. sync hunt, receiver on/off).

Con:
1.1) - The MAC should not directly control very time critical operations of the PHY or the MAC; implementation will be difficult.
Trying to control from the MAC all the FH parameters that some suggest, will make the MAC too complex and delay the standard too much. If the MAC must control these parameters, incorporate what is now the top PHY sub-layer into the MAC and don't worry that breaks with tradition.

Related Issue Identification:

Issue Originator: 802.11 PHY Group

Issue History:
May 1993: Date first opened
July 1993: New Issue text (#2), Alternative #1, Argument-pro #1.1 and Argument_con #1.1.
September 1993: Alternative #2, Reference #1 and Argument_general #1.0.

Issue Status: Open

Issue Identification: 24.12 (Topic: PHY Types).

What are the values in the Template defined in the current version of P802.11-93/83 (reference #1) related to Direct Sequence Spread Spectrum (DSSS) PHY?

Alternatives:

References:
1) - P802.11-93/83 - Draft Proposal for a Frequency Hopping and Direct Sequence Spread Spectrum PHY Standard.

Arguments:
Pro:

Con:

Related Issue Identification:

Issue Originator: 802.11 PHY Group

Issue History:
July 1993: Date first opened

Issue Status: Open

Issue Identification: 24.13 (Topic: PHY Types).

What are the values in the Template defined in the current version of P802.11-93/83 (reference #1) related to Frequency Hopping Spread Spectrum (FHSS) PHY?

Alternatives:

References:

1) - P802.11-93/83 - Draft Proposal for a Frequency Hopping and Direct Sequence Spread Spectrum PHY Standard.

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator: 802.11 PHY Group

Issue History:

July 1993: Date first opened

Issue Status: Open

Issue Identification: 24.14 (Topic: PHY Types).

What are the values in the Template defined in the current version of P802.11-93/83 (reference #1) related to Infra Red (IR) PHY?

Alternatives:

References:

1) - P802.11-93/83 - Draft Proposal for a Frequency Hopping and Direct Sequence Spread Spectrum PHY Standard.

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator: 802.11 PHY Group

Issue History:

September 1993: Date first opened - Reference #1.

Issue Status: Open

TOPIC: CHANNEL

25

Issue Identification: 25.1 (Topic: Channel).

Will the standard provide a procedure to reserve medium channel capacity ?

Alternatives:

1) - Yes
2) - No

References:

1) - P802.11-93/40 - The Wireless Hybrid Asynchronous Time-bounded MAC Protocol.
2) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.
3) - P802.11-94/16 - Review of MAC Issues List
4) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

Pro:

1.1) - The standard should provide the ability to reserve the medium. The WHAT protocol (see reference #1) uses this technique to allow Time-bounded MPDUs to have higher priority media access than asynchronous MPDUs.

1.2) - Not a lot of work has been done so far in this area, however this facility can easily be incorporated into the CODIAC protocol (Reference #2) by adding information to the request frame specifying a reservation of a particular length, or even making a "connection request" for a certain amount of bandwidth which could stand as a reservation of channel capacity until the connection is torn down, rather than having to issue a request every superframe.

1.3) - The time-bounded support in the MAC Foundation (Reference #4), in essence, reserves medium capacity so as to ensure that all time-bounded users receive guaranteed access to the medium.

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: First opened
March 1993: Alternatives #1 and 2 - Reference #1 - Argument_pro #1.1.
May 1993: Reference #2 - Argument_pro #2.1.
January 1994: Reference #3 & 4, Argument_pro #1.3 and closing of the Issue by endorsing Alternative #1 - MAC Yes-21, No-1, Abstain-11.

Issue Status: CLOSE January 1994

Issue Identification: 25.2 (Topic: Channel).

Must the MAC work on a single channel PHY ?
Will the standard support multiple channel PHYs ?

Alternatives:
1) Yes on Both

References:
1) - P802.11-94/16 - Review of MAC Issues List
2) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:
General:
1.0) - The Issue needs to be splitted into 2 related Issues:
- 25.2A - Must the MAC work on a single channel PHY ?
- 25.2B - Will the standard support multiple channel PHYs ?

Pro:
1.1) - The MAC Foundation (Reference #2) supports both single and multiple channel PHYs.

Con:

Related Issue Identification:
1) - 25.2A - Channel
2) - 25.2B - Channel

Issue Originator:

Issue History:
May 1992: Date first opened
May 1993: Argument_general #1.0: Splitting of the Issue into 2 related Issues: 25.2A and 25.2B.
January 1994: Reference #1 & 2, Argument_pro #1.1 and closing of the Issue by endorsing the Alternative - MAC Yes-27, No-1, Abstain-5.

Issue Status: CLOSE January 1994

Issue Identification: 25.2A (Topic: Channel).

Must the MAC work on a single channel PHY ?

Alternatives:
1) - Yes

References:
1) - P802.11-93/140 - MAC/PHY Functional Partitioning
2) - P802.11-94/16 - Review of MAC Issues List
3) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:
General:

Pro:
1.1) - See Reference #1
1.2) - See Issue 25.2
Con:

Related Issue Identification:
1) - 25.2 - Channel

Issue Originator: C. Heide

Issue History:
May 1993: Date first opened - Alternative #1
September 1993: Reference #1 and Argument_pro #1.1.
January 1994: Reference #2 & 3, Argument_pro #1.2 and closing of the Issue by endorsing the Alternative - MAC Yes-27, No-1, Abstain-5.

Issue Status: CLOSE January 1994

Issue Identification: 25.2B (Topic: Channel).

Will the standard support multiple channel PHYs ?

Alternatives:
1) - Yes

References:
1) - P802.11-93/140 - MAC/PHY Functional Partitioning
2) - P802.11-94/16 - Review of MAC Issues List

Arguments:
General:

Pro:
1.1) - See reference #1.

Con:

Related Issue Identification:
1) - 25.2 - Channel

Issue Originator: C. Heide

Issue History:
May 1993: Date first opened - Alternative #1
September 1993: Reference #1 and Argument_pro #1.1.
January 1994: Reference #2 (editor note: I have not the result of the vote on this Issue).

Issue Status: SEE editor's note ??????

Issue Identification: 25.3 (Topic: Channel).

What is the channel definition:
- PHY ?
- Logical ?

Alternatives:

1) - The channel definition is given in the referenced document (Reference #1) and is considered a logical definition.

References:

1) - P802.11-93/20 - Wireless LAN MAC & PHY Specifications (Draft)

Arguments:

Pro:

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: Date first opened
May 1993: Alternative #1 - Reference #1.

Issue Status: Open

Issue Identification: 25.4 (Topic: Channel).

- Channels
  - Same channel/Access Point (AP)
  - Different channel/Access Point (AP)
  - Both of 1 & 2

Editor's note: Need help with this issue

Editor's note: Ref: 73 (92/58R1).

Alternatives:

Arguments:

Pro:

Con:

Related Issue Identification:

- 16.6 (Topic: Mobility)

Issue Originator:

Issue History:

May 1992: First opened

Issue Status: Open

Issue Identification: 25.5 (Topic: Channel).

What is the definition of MAC fairness of access ?

Alternatives:

1) - The definition of fairness of access is all stations having an equal opportunity to access the media. Things about a MAC that can make access opportunity unfair are:

a) - sensitivity to the near/far bias (capture effects);

b) - allowing one station to hold the medium once it has it;

c) - bias to a particular data path - AP to station; AP from station; or station to station;

d) - bias to a traffic type, TBS or asynchronous.

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.

Arguments:

Pro:

1.1) - The CODIAC protocol (Reference #1) addresses these items:

a) - see Related Issue #1 (Issue 25.6).

b) - Maximum frame length controls this to in both modes. In distributed mode once a station has made a transaction, of up to maximum length, it must re-contend for the medium like all the other stations. In centralized mode the controller implementation controls this fairness. At the end of the request period it has the information required to divide up the data period bandwidth as it sees fit.

c) - In distributed mode there is no distinction between these data paths. In centralized mode the controller implementation controls this.

d) - In both modes the AP implementation controls this. An AP could deny a TBS request if it feels that the asynchronous traffic is being unfairly denied access by the amount of TBS traffic.

Con:

Related Issue Identification:

1) - 25.6 - Channel

Issue Originator:

Issue History:

May 1992: Date first opened

May 1993: Alternative #1 - Reference #1 - Argument_pro #1.1.

Issue Status: Open

Issue Identification: 25.6 (Topic: Channel).

How will the standard address the MAC facilitation of 'access fairness' (insensitivity to near/far bias) ?

Alternatives:

1) - See CODIAC Protocol proposal (Reference #1)

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.

Arguments:

Pro:

1.1) - In the CODIAC protocol (Reference #1) centralized mode sensitivity to the near/far bias will only come into play in the registration slots. If two stations attempt to register in the same slot and one of them has signal strength enough to obliterate the other, the winner will get registered and the loser will have to try again next superframe.
Summary - (1) the near/far bias can cause a minor delay in registration, but the protocol is insensitive to it for data transfer in centralized mode; (2) Distributed mode is sensitive to the near/far bias during the RTS/CTS exchange.

Con:

Related Issue Identification:

1) - 25.5 - Channel

Issue Originator:

Issue History:

May 1992: Date first opened
May 1993: Alternative #1 - Reference #1 - Argument_pro 1.1

Issue Status: Open

Issue Identification: 25.7 (Topic: Channel).

How to coordinate spectrum use between Extended Service Set (ESS)?

Alternatives:

References:

Arguments:
Pro:

Related Issue Identification:

Issue Originator: B. Crowder

Issue History:
July 1993: Date first opened

Issue Status: Open

Issue Identification: 25.8 (Topic: Channel).

What are the implications and associated details of Clear Channel Assesment?

Alternatives:

References:

Arguments:
Pro:

Related Issue Identification:

Issue Originator: PHY Group

Issue History:
Novemeber: Date first opened

Issue Status: Open

Issue Identification: 25.9 (Topic: Channel).

- What Clear Channel Assesment do we put in the MAC foundation?

Alternatives:

References:

Arguments:
Pro:

Related Issue Identification:

Issue Originator: MAC group

Issue History:
January 1994: Date first open.

Issue Status: Open

TOPIC: PRIORITY

26

Issue Identification: 26.1 (Topic: Priority).

- Does the concept of priority need to be addressed in the MAC ?
  - Different traffic priorities ?
- What is priority ?

Alternatives:

1) - See CSMA/CA Protocol proposal - Reference #1

References:

1) - P802.11-93/70 - A Distributed Access Protocol Proposal Supporting Time Bounded Services

Arguments:

General:

1.0) - There is a need to split the Issue into 3 related Issues:

26.1A - Does the concept of priority need to be addressed in the MAC?

26.1B - Does the concept of priority need to be addressed as different traffic priorities?

26.1C - What is priority?

Pro:

1.1) - Different access priority levels have been identified in the CSMA/CA+Ack proposal (Reference #1). The different priority levels are only used for inter-MAC operation, and is not available to the user/LLC. If needed, then different priority levels can be made available.

Con:

Related Issue Identification:

1) - 26.1A - Priority
2) - 26.1B - Priority
3) - 26.1C - Priority

Issue Originator:

Issue History:

May 1992: Date first opened

May 1993: Alternative #1 - Reference #1 - Argument_general 1.0 - Argument_pro #1.1

Issue Status: Open

Issue Identification: 26.1A (Topic: Priority).

Does the concept of priority need to be addressed in the MAC?

Alternatives:

1) - See CODIAC Protocol proposal - Reference #1
2) - Yes

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.
2) - P802.11-94/16 - Review of MAC Issues List
3) - P802.11-93/190 - Distributed Foundation Wireless Medium Access Control

Arguments:

General:

Pro:

1.1) - If the concept of priority is addressed in the MAC: The CODIAC protocol (Reference #1) lends itself very well to the implementation of priority in centralized mode. If priority is added to the RTS frame then the controller can service requests in prioritized sequence in the data period. The controller can also assign quantity of bandwidth to requesting stations in a prioritized fashion. Priority is not a concept which can be applied to the CODIAC protocol distributed mode.

2.1 - In the MAC Foundation (Reference #3), point-coordinated transmissions have access priority over distributed transmissions.

Con:

Related Issue Identification:

1) - 26.1 - Priority

Issue Originator: C. Heide

Issue History:

May 1993: Date first opened - Alternative #1 - Reference #1 - Argument_pro #1.1
January 1994: Reference #2 & 3, Argument_pro #2.1 and closing of the Issue by endorsing Alternative #2 - MAC Yes-33, No-0, Abstain-0.

Issue Status: CLOSE January 1994

Issue Identification: 26.1B (Topic: Priority).

Does the concept of priority need to be addressed as different traffic priorities?

Alternatives:

1) - Implementation dependant.

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.

Arguments:

General:

Pro:

1.1) - (Reference #1) - With respect to traffic types, in distributed mode TBS traffic is not supported so it is not relevant. In centralized mode the protocol does not give priority to either traffic type, but an implementation could do so, as TBS requests are marked.

Con:

Related Issue Identification:

1) - 26.1 - Priority

Issue Originator: C. Heide

Issue History:

May 1993: Date first opened - Alternative #1 - Reference #1 - Argument_pro #1.1

Issue Status: Open

Issue Identification: 26.1C (Topic: Priority).

What is priority?

Alternatives:

1) - Priority is a station having better access to the medium, in terms of access delay and/or time length of access, than other stations.

References:

1) - P802.11-93/54 - The CODIAC Protocol - Centralized or Distributed Integrated Access Control (CODIAC), A Wireless MAC Protocol.

Arguments:

General:

Pro:

Con:

Related Issue Identification:

1) - 26.1 - Priority

Issue Originator: C. Heide

Issue History:

May 1993: Date first opened - Alternative #1 - Reference #1

Issue Status: Open

TOPIC: CODE SIZE

27

Issue Identification: 27.1 (Topic: Code Size)

- Are there code size limits to be specified ?

Alternatives:
1) - No

References:
2) - P802.11-94/16 - Review of MAC Issues List

Arguments:
Pro:
1.1) - No 802 Standard specifies code size limits.

Con:

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: First opened
January 1994: Reference #2, Argument_pro #1.1 and closing of the Issue by endorsing the Alternative - MAC Yes-37, No-0, Abstain-0.

Issue Status: CLOSE January 1994

TOPIC: PHYSICAL SIZE

28

Issue Identification: 28.1 (Topic: Physical Size).

How important is the physical size ?

Alternatives:

1) - The physical size should not be considered as an 802.11 functional requirement.

Arguments:

Pro:

1.1) - Although extremely important to some implementations, should not be considered as any kind of functional requirement for 802.11.

Con:

Related Issue Identification:

Issue Originator:

Issue History:

May 1992: Date first opened
May 1993: Alternative #1 - Argument_pro #1.1
January 1994: Closing of the Issue by endorsing the Alternative - MAC Yes-33, No-0, Abstain-4.

Issue Status: CLOSE January 1994

TOPIC: SIMULATION

29

Issue Identification: 29.1 (Topic: Simulation).

- How does 802.11 addresses simulation:
  - Common simulator ?
  - MAC simulator ?
  - PHY simulator ?
  - How do we simulate ?
  - What do we simulate ?
  - What are the traffic models we drive simulations from?

Alternatives:

1) This issue is addressed by Document P802.11-92/123.
'A detail computational framework is established for the execution of performance simulations of MAC state machines operated over PHY entities'. 'This framework is to provide a common methodology for analyzing MAC/PHY performance that can be executed on a variety pf platforms'. 'This framework allows the experimenter to locate stations geographically and to assign attributes to those stations. Some of the attributes that can be defined are:
- Station location
- Transmit power
- State
- Message probability'

'The use of "Mathematica" as a software tool accomplishes this goal'.

2) This issue is also addressed in Document P802.11-92/26. The document describes a 'simulator that has been designed to analyze the CSMA/CA protocol used by Waveland product, and is being used to evaluate MAC protocols alternatives.
The simulator uses as input the actual locations of stations in two networks. The model uses individual signal path attenuation values between all stations, to evaluate interference conditions and capture effects at the receiver locations'.

3) - This Issue is addressed by Document P802.11-94/20 Reference #4). The RF MAC Simulator was developed to help wireless LAN designers evaluate the strenghts and weakness of four MAC protocols.

References:

1) - P802.11-92/123 - "Mathematica" Based Integrated MAC/PHY Performance Simulation Framework Including Capture Effect.
2) - P802.11-92/26 - Wireless Network Performance Modeling Approach
3) - P802.11-93/1 - Application of "Mathematica" Based Simulation Template to Demand Assigned MAC Described in IEEE P802.11-92/39 ("The IBM MAC Protocol")
4) - P802.11-94/20 - RF MAC Simulation

Arguments:

Pro:

1.1) 'The framework described (92/123) is flexible enough to handle many differing simulation needs and scenarios (Capture effects, Throughput efficiency)'.
1-B) 'This simulation method (92/123) can be 'executed on a variety of platforms and be within the budget of all IEEE 802.11 participants'.

2.1) The simulation tool described (92/26) as 'a powerful tool for MAC protocol evaluation in a radio environment'. 'The main characteristics of the PHY have been successfully modeled:
- Signal path attenuation as function of distance
- Effect of attenuation boundaries like walls and ceilings
- Fading / shadowing

- Capture effects
- Co-channel interference
- Adjacent channel interference
- Microwave oven interference (jammer)'

2.2) 'The model provides simulation at a high traffic load in a realistic Client-server, and in a peer-to-peer environment'.

2.3) 'The model allows efficient analysis of the causes of packet loss at individual stations'

3.1) - See Reference #4.

Con:

Related Issue Identification:

Issue Originator:

Issue History:
May 1992: First opened
November 1992: Alternative #1 and 2, References #1 and 2, Arguments #1 and 2.
January 1993: Reference #3
January 1994: Alternative #3, Reference #4 and Argument_pro #3.1.

Issue Status: Open

ANNEX A

ISSUES RELATED TO FUNCTIONAL REQUIREMENTS

1) **Physical network environment** - Issue ID: 2.1

2) **Ad-hoc network support** - Issue ID: 4.1

3) **Infrastructure support** - Issue ID: 4.2

4) **Distribution Systems** - Issue IDs: 5.1, 5.2, 5.3, 5.4, and 5.5

5) **Safety requirements** - Issue ID: 8.1

6) **Throughput requirements** - Issue ID: 9.1

7) **Attenuation** - Issue ID: 9.4

8) **Service area requirements** - Issue ID: 10.4

9) **Interworking with wired networks** - Issue ID: 11.2

10) **Network Management requirements** - Issue IDs: 13.1, 13,2, 13.3, 13.4, 13.5, 13.6, 13.7 and 13.8

11) **Connection Types** - Issue IDs: 14.1, 14.2, 14.3, and 14.4(?)

12) **Error handling related requirements** - Issue IDs: 19.1, 19.3, 19.4, 19.5, and 19.11

13) **Number of stations** - Issue IDs: 19.7, 19.9, and 21.1

14) **Robustness requirements** - Issue IDs 19.8 and 19.10

15) **Data unit lengths** - Issue IDs: 20.1 and 20.2

16) **Frequency re-use** - Issue ID: 21.4

17) **Delay requirement** - Issue ID: 22.1

18) **Conformance requirement** - Issue IDs: 23.1 and 23.2

19) **PHY types** - Issue IDs: 24.1, 24.2, 24.3, and 24.6

20) **Channel** - Issue IDs: 25.1, 25.2, 25.3, 25.4, and 25.5

21) **Priority** - Issue ID: 26.1

22) **Code size requirement** - Issue ID: 27.1

23) **Physical size requirement** - Issue ID: 28.1