IEEE P802.11
Wireless Access Method and Physical Layer Specification

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TITLE: **MAC EVALUATION CRITERIA**

AUTHOR: Chandos A. Rypinski,
Chief Technical Officer
LACE, Inc.
921 Transport Way
Petaluma, California 94954 USA
Telephone: 707 765 9627
Facsimile: 707 762 5328

SUMMARY AND COMMENTS

Attached and following is an edited, extended and revised version of the "MAC Comparison Criteria" the name of which has been changed to reflect an intent to understand the range and capability of all proposals and that the absolute requirements are already documented. Many of the remaining evaluation points are tradeoffs to which there is not an absolute and objective right or wrong. The wording of this criteria should encourage complete disclosure in a way as helpful as possible to the group as a whole.

The original comments are shown in square brackets [] and smaller type size. All of the comments have been reordered under subject area headings. Certain words have not been used (e.g. robustness) because they are difficult to quantify. I am sure that all proponents believe their plans to be robust. It is desirable to describe features which might make a system more robust in adversity.

Another special point is that the system capacity should be described at the highest level where all offered traffic is carried. In accordance with 802 tradition, the peak capacity is more important than averages over time. In the same vein, worst case delay (implying a deterministic system) is more important than typical. It is usually safe to assume that an underloaded system works better than when fully loaded.

It is possible that certain aspects of a proposal are advantageous taken alone. Features should be identified which are desirable and could be implemented within other MAC strategies

What is offered is more specific identification of the characteristics and merits of each of the various aspects of each proposal so that consolidation of the best aspects of each proposal can be integrated into an 802.11 plan.

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MAC EVALUATION CRITERIA

The following list of important MAC evaluation criteria as proposed by C. A. Rypinski) as an edit, extension and revision of the Comparison Criteria agreed to by the MAC subgroup at the November 1991 meeting.

1.0 Security, Integrity and Interference Criteria

[1. Unauthorized network access impact on throughput.]
[8. Robustness in the presence of co-site dissimilar networks.]
[14. Robustness in the presence of non-reciprocal wireless medium.]

1.1 Functions which reduce or limit normal and unintentional interference with communication in progress by authorized stations within a common system:
1.2 Functions which reduce or limit normal and unintentional interference with communication in progress by authorized stations in contiguous or overlapping separately managed systems:
1.3 Functions which reduce or limit intentional interference by users of authorized stations:
1.4 Functions which reduce or limit intentional interference using modified or non-system equipment:
1.5 Capacity reduction potential for categories 1a, 1b and 1c above:
1.6 Functions which reduce or limit interference from equipment malfunctions not deliberately induced:
1.7 Define method to minimize or avoid contention modes from interfering with data transfers in progress:

2.0 Peer-to-peer and Autonomous Functionality

[2. Ability to establish Peer-to-peer connectivity without prior connection, e.g. without "knowledge of the presence of your peers".

2.1 Provision for direct peer-to-peer traffic where possible with infrastructure present.
2.2 Provision for autonomous peer-to-peer operation without infrastructure.
2.3 As in 2b) but without a priori knowledge of addresses and status of stations within communication reach, and evaluation of changes in security level that may arise from the presence of this functionality:
2.4 Describe any "CQ" function (broadcast transmission inquiring what Stations within range are available to communicate) used in Stations including an evaluation of changes in security level that may arise from the presence of this functionality:

3.0 Spectrum Utilization and Frequency Re-Use Considerations

3.1 Does this plan provide for continuous coverage over large areas:
3.2 What frequency re-use strategy is provides:
3.3 If used, describe method of reducing coverage overlap by physical medium implementation (e.g., directive antennas):
3.4 What is the preferred possible spacing between simultaneously and independently usable co-channel stations:
3.5 What is the preferred possible spacing between nearby stations separated by time, frequency or code division:

4.0 Capacity and Performance Specifications for Connectionless MAC

(For stated performance--assumptions must be given for:
1) traffic model, 2) medium data transmission rate, 3) blocked traffic processing, 4) size of system, 5) delay dependence functions, 6) maximum average range, and 7) all other factors affecting understanding of basis for conclusions.)

[3. Issues of throughput.]
[4. Delay characteristics:
  a. MAC to MAC delay: includes Access Delay (latency) and any ACK in the MAC layers
  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)]
[5. Maximum number of stations.]

4.1 Extended area system peak packet LAN capacity where all offered traffic is carried within a defined maximum time allowance for payload sustainable for 100 seconds calculated:
  4.1.1 as fraction of medium signaling rate as a function of median medium access-delay for aggregate of Stations receiving and transmitting simultaneously in use (for a system where the number of served stations is several times the reciprocal of the average duty cycle of each station).
  4.1.2 as in 3.1.1 above but normalized to floor area covered.
  4.1.3 explanation of probability for exceptions taken.
4.2 Delay characteristics (as a function of offered traffic level if applicable):
  4.2.1 MAC to MAC delay including access delay and any ACK in the MAC layers:
  4.2.2 Propagation delay:
  4.2.3 Transfer delay for datagram traffic at nominal and peak load:
  4.2.4 Stability when offered load exceeds carryable load:
  4.2.5 MAC setup delay (connection-oriented services or streams):
4.3 Number of Stations servable
  4.3.1 apart from traffic limitation:
  4.3.2 with nominal traffic:
4.4 Area density of Stations servable with nominal traffic:

5. Mobility Functionality and Wide Area Service

[10. Area coverage implications of MAC timing constraints.]
[18. The ability to support handoff between service areas - a.k.a. ROAMING.]
[19. Implications on the complexity of the PHY.]
[20. Broadcast/multicast reliability.]

5.1 Identify and describe any registration or session start function which creates a "home" coverage area for a Station with/without infrastructure:
5.2 Describe Station MAC provision, if any, for recognizing and processing a change in service area resulting from movement:
5.3 When the infrastructure provides a large number of Access-points, describe any timing coordination and distribution that is required between Access-points within one system and between contiguous systems:
5.4 For autonomous operation, what timing coordination is required between participating Stations, what is the acquisition process and delay and how is it distributed:
5.5 Describe Station MAC functions and infrastructure requirements specifically necessary to deal with movement of Stations from one Access-point coverage to another:
5.6 Describe MAC provisions for network-wide or ESA scope broadcast messages:

6. Connection and Connectionless Service Integration

[6. Ability to service various traffic, including data/voice/video.]
[13. Support for different traffic priorities.]

6.1 Are any connection-type services supported, and are these extended to the Public Network:
6.2 Identify stack level for connection/connectionless multiplexing at Station:
6.3 Identify facility for dynamic/adaptive shift of capacity between connection/connectionless services:
6.4 For isochronous services, identification of infrastructure required:
6.5 Identify mechanism for partitioning and share-limiting of the two types of service:
6.6 Identification of principal types of isochronous services supported--
6.6.1 Intercom with compressed or 64 Kbs voice
6.6.2 Local and/or PSTN connection service at 64 Kbs:
6.6.3 POTS with integrated speech digitization and setup:
6.6.4 ISDN BRI, H0 (384 Kbs) or subset:
6.6.5 ISDN PRI (23B+D or T-1) or subset:
6.6.6 N*B up to CCITT PRI:
6.6.7 ATM (Asynchronous Transfer Mode) compatibility

6.7 MAC provisions for management functions (Q.921, Q.931) of isochronous services:
6.8 Identify and describe delay characteristics for setup and ongoing connection-type services:
6.9 Identify and describe means for assembling multiples of 64 Kbs into a common serial bit stream at the aggregate rate:
6.10 Describe MAC provision for marking, recognizing and prioritizing competing service demands including differing priorities of management, packet and circuit traffic:

7. Station Power Drain Factors Affected by MAC

[9. Power consumption.]

7.1 Description of repetitive or background Station transmitter functions including proportion ON time required for each apart from handling of data traffic:
7.2 Description of "sleep" mode provisions and extent including logic conditions for entry and exit:
7.3 Description of adaptive properties of a "sleep" mode which is a function of session status or system activity or other outside event:

8. PHY Layer Interface

[7. Support of multiple PHYs transparently.]

8.1 If used, description of channelization dependent on PHY properties (e.g. CDMA, FDMA):
8.2 Explicit statement of use of time allocated on a single channel:
8.3 Description of PHY layer functions apart from signaling data steam upon which the MAC is dependent (e.g. signal level, clock valid):
8.4 Description of measures for signal integrity which might be incorporated in the MAC or medium independent PHY sublayer functionality (e.g. scrambling, block coding):

9. Protocol Design Functionalities

[11. Fairness of access.]
[12. MAC facilitation of "access fairness" (insensitivity to near/far bias).]
[16. Same MAC must work in a minimum system and a maximum system (network size independence).]
[16.1. Interoperability of "low cost" and "reliable" MAC.]
[21. Preservation of time ordering of SDU to end systems (this is a requirement of LLC).

9.1 Describe MAC "access fairness" function for near/far Stations; and if biased define worst case consequences for the Station discriminated against:
9.2 Describe MAC "access fairness" function for blocked access Stations during traffic overload; and if biased define worst case consequences for the Station discriminated against:
9.3 Describe MAC "access fairness" function for queued traffic at Stations, Access-points or infrastructure concentrators.
9.4 Describe MAC access functions where contention may occur, and the measures provided to mitigate and recover from occurrence:
9.5 Identify MAC functions needed for core autonomous mode operation, identifying those which are identical for all more complex systems, and identify MAC functionalities needed for larger or more complex systems which must be added to the core functions:
9.6 Identify MAC functions which are only needed for high "reliability" and which may not be needed in conforming minimum cost equipment:
9.7 Describe MAC functions and frame fields which preserve time ordering of SDUs to end systems:
9.8 Describe and define functions which are necessary for system operation, which might be in the Station MAC but which are implemented in infrastructure:

10. Subjective Comments

[15. Time-to-market vis-a-vis implementation complexity.]

10.1 Factors known to affect time to market:
10.2 Factors known to affect Station cost, size or battery-drain:
10.3 Factors known to differentiate stations in large, small and autonomous networks:
10.4 Factors known to affect infrastructure cost or total system cost:

11. Access Method Independent Features

11.1 Security
11.2 Internal system interference:
11.3 Inter-system interference:
11.4 Deliberate interference:
11.5 Peer-to-peer function:
11.6 Sleep mode provision:
11.7 Fairness implementation algorithms:
11.8 Missed message recovery methods:
11.9 Message sequence assurance:

12. Compliance with PAR and 802 Functional Requirements

12.1 TEXT TO BE PROVIDED