IEEE P802.11
Wireless Access Method and Physical Layer Specification

DATE: July 30, 1991 **REVISED:** July 30, 1991

TITLE: **IEEE 802.11 DESIGN GOALS QUESTIONNAIRE**

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IEEE 802.11 DESIGN GOALS QUESTIONNAIRE

INTRODUCTION, GENERAL INSTRUCTIONS AND ASSUMPTIONS

As part of our efforts to arrive at a set of design goals which can be used to develop and evaluate proposals for the IEEE 802.11 standard, the following questionnaire has been developed.

The intent of this questionnaire is to obtain information about a particular application that the responder is interested in implementing on an IEEE 802.11 LAN and to use those responses to develop a set of system design goals.

In recognition of the fact that individual responders may have a variety of applications in mind, we are asking that an individual questionnaire be filled out for each application.

We recognize that the answers to the questions which are posed in this questionnaire may not be readily available. We hope that the responders will make the investigative effort necessary to find the answers or where answers can only be postulated, to do their best job at presenting reasonable responses. Our objective is to be able to come up with one or more sets of numerical specifications which can serve as design goals for the development of a standard.

Many of the previous presentations, and much of the time which the committee has spent to date, has concentrated on market-oriented functional requirements. There seems to have been fairly broadbased support for one particular market-oriented requirement. In this questionnaire we will assume that the market-oriented requirement that an IEEE 802.11 can operate in some mode without requiring existence of a pre-installed infrastructure. With the exception of this assumption we have attempted to keep this questionnaire unbiased with respect to a particular implementation in an attempt to obtain technical specifications that are not tempered by the constraints of a perceived direction.

For the purposes of this questionnaire we propose the following definitions:

STATION - A device which uses or could benefit from a communication path to other devices.

DIRECTIONALITY FACTOR - $DF_{STATION}$ is a parameter describing the ratio (fraction or percentage) of channel time used by the station for transmitting to all active channel time processed at a station. $DF_{NETWORK}$ is the ratio for receiving channel time to all channel time used. The sum of the two ratios is 1 (or 100%).

HOST - A station that requires information to further enhance the functionality of an application. For example a data processing machine which produces management reports based on input from other machines on the network.

SERVER - A station whose sole purpose for communicating on a network is to provide a service to other stations on the network. For example a station that has as its sole function the sharing of a hard disk among stations on the network.

PRE-INSTALLED INFRASTRUCTURE - Equipment which is placed into a geographical area to be serviced by an IEEE 802.11 LAN in order to enable communication service in that area. This

equipment is typically not associated with a given station although it may contain station hardware which is intended to remain in place for the lifetime of the requirement to provide IEEE 802.11 service in the geography.

BASIC COVERAGE AREA - The geographic area that has communication service available at more than the minimum percentage of its area during more than the minimum percentage the time specified in the PAR for conformance to IEEE 802.11 without the support of pre-installed infrastructure for autonomous systems or within the range of one access-point when there is infrastructure.

LOCAL AREA NETWORK - A group of stations and associated interconnect hardware that has the capability to communicate over a bounded geographic area (typically no larger than a college campus) under administrative control of one entity.

TOTAL COVERAGE AREA - The geographic area served by a local area network. It has communication service available at more than the minimum percentage of its area during more than the minimum percentage the time specified in the PAR for conformance to IEEE 802.11 with the support of all equipment installed including (if it is present) pre-installed infrastructure.

APPLICATION DESCRIPTION

Please provide a brief description of the application for which you are providing data with this questionnaire. The breakup of applications and the determination of the scope that a given example of this questionnaire should address is left to the discretion of the responder.

It may be that the responder chooses to provide two instances of this questionnaire for a single application based on perceived differences in the requirements of the application in different environments.

For example, the communications needs of a network used only for word processing in a large aerospace-oriented firm with an engineering work floor the size of a football field, populated by engineers with desks and stations on a 10'x 10' foot grid, may be substantially different than the communication needs of a network used only for word processing in a law firm in which all of the lawyers (or their secretaries) have individual offices separated by fixed partitions.

If the responder finds that he is having difficulty providing one set of answers to the questions asked, perhaps it is necessary to breakdown the application into additional instances of this questionnaire.

TRAFFIC DESCRIPTION

The questions in 2.0 are intended to aid in determining the burst and average message traffic which will be generated by a typical station in a network running the current application.

Media Usage per Station

The answers to these questions will aid in determining the detail composition of various traffic parameters. It is our intention to calculate media usage per station for many different circumstances using the responses to this questionnaire as a data base for necessary assumptions.

In addition to the data transfer use of channel time, any IEEE 802.11 protocol which is established will introduce additional message traffic overhead. The impact of this traffic on media usage per station will be taken into account as

actual protocols are presented for consideration.

If these questions are not framed to yield a reasonable approximation of the media usage per station requirements for the application being described, please explain the reason within or outside of the questionnaire. The questions are divided into the following areas:

2.1 file size
2.2 file transfer frequency
2.3 file destination distribution
2.4 transaction frequency
2.5 transaction destination distribution
2.6 other, e.g. network management
2.7 broadcast messages

As a suggestion many operating systems provide the capability to list directories by size. Listing typical directories on your system by size should help in answering some of these questions.

The questions on destination distribution enable calculation of the Directionality Factor (DF) (defined above) for communications of each type listed.

Questions 2.6 and 2.7 deal with other factors not mentioned above. Please list any other known sources of message traffic on the network, such as higher level protocols which require periodic service and provide information regarding the nature of this traffic in the same terms as in 2.3.

It is preferred that broadcast traffic be dealt with as a per station use of channel time. The difference between station and medium occupancy is unimportant if broadcast is a small percentage of channel-time usage.

Traffic Timing Constraints

The set of questions in 2.8 is intended to quantify the amount of time a station can wait for communications to occur under a variety of conditions and what the tolerance of a station for variability in these parameters is. We expect that the immediate response of many responders may be that response time is not critical in their application.

We request that anyone planning to respond in this manner please make the effort to find out what the timeout and retry parameters are for any existing network they may have installed and to provide this information in response to the questions asked. If you feel that the existing numbers do not accurately reflect the actual requirements of the application please elaborate on why there is a difference.

Connection-type Services

One response to 2.9 is NO. If it is YES, the answers requested are a short menu of possibilities that is sufficient for a first look. The answers are for the average of only those stations using connection type services.

It should be noted that it is unlikely that a 1 Mb/s physical medium could serve more than one 64 Kb/s connection at a time. The higher rate services would only be possible in the context of a 10 or more Mb/s medium.

SYSTEM TOPOGRAPHY DESCRIPTION

The questions in this section are intended to provide information regarding the density of users in a particular network geography as dictated by needs of the application and the attenuation characteristics of the geography involved. These questions deal with both the question of topography of an individual network and of topography associated with the co-location of networks.

This section must be answered in terms of a projected wireless system,

however some care has been used to avoid a supposition about how many access-points might be needed for a given area. If the access possibilities for one station exceed just those stations in the same BCA, infrastructure is required.

Answers should be given assuming that the LAN requirement defined is the only LAN requirement within the BCA. Assembly of multiple requirements is another matter

Operating Environment

Within 3.1, the operating environment is classified three ways:

Interior areas
Exterior areas
Boundary areas

That environment may apply to one or more of the following contexts:

This application only
This BCA
This TCA
For a LAN across a boundary

It is expected that a typical application would only check off interior and boundary conditions for an BCA or TCA within one LAN. Most of the possibilities apply to less probable combinations.

It is the intention of this section to be blind as to how coverage is provided, but this is difficult when there is interference from across a service area boundary.

Nearby and Colocated LAN

This column in 3.1 is intended to quantify the degree of nearness and inter-penetration that needs to be supported in the IEEE 802.11 environment. Questions regarding partitioning apply to partitioning that exists between Total Coverage Areas of adjacent Local Area Networks.

A LAN is colocated if the intended coverage area duplicat3es one already present. A LAN with different intended coverage area is nearby regardless of overlap.

Quantities and Dimensions

The forms 3.2, 3.3 and 3.4 cover the cases of:

Combined wired and wireless.
Wireless only w/infrastructure
Autonomous wireless no infrastructure

When complete, these forms will give an average user density for one LAN and for a premise area. It is not required that all three be filled out.

3.2 should be used to report the status of an existing wired network for the selected application.

3.3 or 3.4 provide an opportunity to estimate usage differently for a wireless case.

Combined with the answers to the traffic questions, it is possible to derive offered traffic per unit area setting an order of magnitude for what is required of the wireless LAN in range and bandwidth.

Local Area Network Characteristics

The questions whose scope is per LAN apply to the total geographic area serviced by a network administration which may be made up of a number of basic coverage areas. The type of topography (i.e. type of partitioning, etc.) will be obtained from the answers 3.1

Mobility Considerations

The answers to questions in 4.1 should quantify the degree to which variations in the network topography are time-dependent. Some less common cases are shown as possibilities.

Numeric values may be shown under range/max and importance under motivating factor.

ABOUT QUESTIONS NOT ASKED

A deliberate effort has been made to avoid asking questions which give the respondent the opportunity to advocate a particular radio or access technology, or to presuppose the layout and arrangement of access-points if they are used. The questionnaire attempts to find needs rather than poll for preferred answers.

A number of questions have been omitted that relate to network environments generally operating above level 2, except that if those levels impose timeout restrictions or limit transit delay (latency), it is relevant. It is assumed that 802.11 is confined by 802 Functional Requirements and those of 802 LLC. This effort does not seek to find out if those constraints are unacceptable.

The questions on co-located LAN are not intended to explore the subject, but rather to detect the need for more consideration of this possibility.

CONCLUSION

Thank you for taking the time and effort to review this document and fill out the attached questionnaire. There has been a substantial effort to minimize the pain in completing it. As we are sure you are aware, wireless networking has many more parameters than wired networking and hence, the problem of generating design goals is complex.

With a handful of completed forms, the confidence in design direction of 802.11 could be greatly fortified.

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ATTACHMENT A
IEEE 802.11 DESIGN GOALS QUESTIONNAIRE

1.0 APPLICATION

What application are you addressing with this instance of this questionnaire?

2.0 TRAFFIC DESCRIPTION

Note: Enter NRQ, NA, UNK or TBD when appropriate in following forms.

2.1 File Size Distribution	Size of File in bytes				
	Under 1K	1K-10K	10K-100K	1K-1M	Over 1M
% of files in your system					
No. of files in your system:					

Note: If numbers are unavailable, % distribution only is useful.

2.2 Transfer Frequency Distribution	Size of File in bytes				
No. of files transferred	Under 1K	1K-10K	10K-100K	1K-1M	Over 1M
per hour -- typical:					
per hour -- max:					
per 5 minutes -- typical:					
per 5 minutes -- max:					

Note: If peak interval other than 5 minutes is more suitable, note peak interval here:_____

2.3 Destination Distribution and DF	Station-originated Traffic	Destination Distribution For File Transfer Traffic		
Station-Originate Traffic Proportion of all traffic		To Station	To Host	To Server
Within department;				
Within premises & dept:				
Off premises:				

Note: "Station-originated Traffic" is the proportional part of originated+terminated traffic to/from other stations+hosts+servers. If your station does not generate a given type of traffic, please enter NA.

2.4 Transaction Frequency Distribution	Size of message in bytes For transaction messages		
No. of transaction transmissions	Under 16	16-100	Over 100
per hour -- typical:			
per hour -- max:			
per 1 minute -- typical:			
per 1 minute -- max:			

Note: If peak interval other than 1 minute is more suitable, note peak interval here:_____

2.5 Destination Distribution and DF	Station-originated Traffic	Destination Distribution For Transaction Traffic		
Station-Originate Traffic Proportion of all traffic		To Station	To Host	To Server
Within department;				
Within premises & dept:				
Off premises:				

Note: "Station-originated Traffic" is the proportional part of originated+terminated traffic to/from other stations+hosts+servers. If your station does not generate a given type of traffic, please enter NA.

2.6 Special or Other Traffic Loading Loading from network functions not shown above:	

2.7 Loading from Broadcast Traffic		
Is loading from broadcast traffic accounted for in total traffic to Station in 2.3?	Yes	No
Is loading from broadcast traffic likely to use over 5% of channel time?	Yes	No

2.8 LAN Traffic Timing Constraints	Station wait/delay before timing out in milliseconds Number of station retrys before abandoning or timeout			
	Projected wireless station requirement		Known or existing network performance or requirement	
Station function	Wait/Delay	Retry/Remark	Wait/Delay	Retry/Remark
Initial registration upon entering system:				
Communication access-typical/worst case:				
Transit delay-typical/worst case:				
Transit delay variability-delay range-% of delay				
Acknowledgment of data if required:				

2.9 Connection-type Services Requirement No: If no, go to next question. Yes:					
Analog Modem	Coded voice 32 Kbs	64 Kbs clear channel	ISDN BRI 144 Kb/s	ISDN PRI 1536/2048	ISDN H01 384 Kbs
Give usage per wireless station estimate for E (circuit time hours used per hour), HT (average time each connection is held in seconds), N (number of stations per LAN having this average need).					
E	E	E	E	E	E
HT	HT	HT	HT	HT	HT
N	N	N	N	N	N

3.0 SYSTEM TOPOGRAPHY DESCRIPTION

For the application stated CHECK OFF those environmental conditions that apply in one single case or that are common to all of the cases considered. Do not check conditions that cannot occur simultaneously.

Nearby LANs are only those on the boundaries that might cause interference. If Nearby LAN is same-premises, only complete Boundary Section. Like-type LAN under separate management is a nearby LAN. Nearby LAN that is another part of one system is TCA.

Boundaries conditions will vary. Mark the situations which occur more than 25% of the time, or better enter estimate frequency of occurrence in steps of 10 or 20%.

3.1 Operating Environment	In This LAN		Nearby LAN
DESCRIPTION OF ENVIRONMENTAL CONDITIONS	This BCA	This TCA	
Interior service areas			
Open areas movable partitions			
Rooms hallways permanent partitions			
Meeting room, lecture hall			
High ceiling--heavy ind'l machinery			
High ceiling--cluttered interior			
Public area--transportation terminals, hotel lobby, convention center			
Single floor building			
Multi-story building			
Suspended acoustic ceiling			
Exterior service areas			
Campus between buildings			
Storage yards--high stacks			
Freight and package terminals			
Boundary			
Open--gap over 5 coverage radii			
Adjoining like-type area			
Boundary & attenuating wall coincide			
Adjoining area independently used			

Note: Other singularly different environments may be written in.

Note: One LAN may not serve more than two floors within a premise. Enclosed areas are bounded by walls within one premise and may fortuitously enclose one LAN. Multi-level shopping malls should be considered as one floor per level. (1□meter≈10□feet)

3.2 Quantities & Dimensions–All		For wired and wireless LAN with infrastructure			
Parameter Description	Scope	Units	Minimum	Maximum	Typical Example
No. stations per enclosed area	Per LAN	#			
Area per enclosed area	Per LAN	□meter			
No. stations	Per LAN	#			
Total area	Per LAN	□meter			
No. users	Per premise	#			
Total area	Per premise	□meter			
No. floors for area given	Per premise	#			
No. LANs	Per premise	#			

3.3 Quantities & Dimensions--Wireless Only		For wireless LAN only with infrastructure			
Parameter Description	Scope	Units	Minimum	Maximum	Typical Example
No. stations per enclosed area	Per LAN	#			
Area per enclosed area	Per LAN	□meter			
No. stations	Per LAN	#			
Total area	Per LAN	□meter			
No. users	Per premise	#			
Total area	Per premise	□meter			
No. LANs	Per premise	#			

3.4 Quantities & Dimensions--Wireless BCA		For wireless LAN only with NO infrastructure			
Parameter Description	Scope	Units	Minimum	Maximum	Typical Example
No. stations per area	Per BCA	#			
Area	Per BCA	□meter			
Area within which BCAs exist	Per premise	□meter			
No. BCAs	Per premise	#			

3.5 Co-located LANs

Will co-located LAN be improbable____, possible____, or likely____.
What is a common minimum distance between the centers of nearby LAN?_____meters

4.0 Motivation for Use of Wireless

The No. per LAN is the total of stations on one premise with interworking regardless of the number of BCAs required to provide the function. This information differs from that in 3.3 in providing a distribution by degree of mobility and motivation since one wireless LAN might serve both fixed and mobile needs.

4.1 Mobility Requirement	Quantity/Dimension		Motivating Factor	
	Range	Maximum	Major	Minor
For on-premises vehicles--speed ft/sec				
--#/LAN				
For roving job-function employees--#/LAN				
For visitors outside access--#/LAN				
Staff away from desk--paging/full function				
For on-premise machines--operating area				
--#/LAN				
For wiring inaccessible locations--reach				
--#/LAN				
For intrinsically safe control--reach				
--#/LAN				
For quick relocation--moves/mth-wk-day				
--#/LAN				
For hospital unwired monitoring--#/LAN				
For wiring cost avoidance--% difference				
--#/LAN				

Note: Comments or unrequested relevant items may be entered where appropriate

5.0 Source (optional)