

IEEE P802.11
Wireless Access Methods and Physical Layer Specifications

**Improving the Efficiency of Standards Creation:
INITIATE ONGOING STRATEGIC MANAGEMENT!**

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Author: Lawrence H. Zuckerman

Advanced Micro Devices, Inc.
I/O & Network Products Division
Mail Stop 70: PO Box 3453
Sunnyvale CA 94088-3453 USA
(408) 749-4934 E-Mail: larry.zuckerman@amd.com

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ABSTRACT

A major problem with Standards Creation is that the process takes too long. The purpose of this Submission is to make a plea for more professional and efficient Senior Strategic Management of our efforts, present several specific examples of what is retarding the process and what could be changed. Finally, a rough plan for completing the Subject standard in timely fashion is suggested.

BACKGROUND

The primary assumption made by all Equipment Standards Organizations is that if you remove a number of engineers from their diverse everyday distracting environments, feed them (too) well, and put them in a room together, (despite the fact that their agendas only partially coincide) they will create a standard. This assumption is deemed correct; as so many standards have been produced over the years by this method. Nevertheless, we are all aware of the major difference between doing something and doing it efficiently. We are also aware that good engineers are not always good managers. Even when they are sensitive to the need for efficient Project/Process management, if the management need is complicated or contains advanced concepts, they are rarely up to the task. All of us have participated in one excruciating meeting after another, witnessed endless floundering, and suspected that there must be a more efficient way to develop standards. Technology is moving ahead faster all the time, and with that comes the demand for less and less time between product concept ideas and deliverable goods. Our employers and society at large cannot afford to wait six years for a standard which could take two years under a correctly orchestrated process. Such inefficiency could not and would not be tolerated in any other aspect of our work. We must find ways keep pace with the rest of Technology or the Standards Activity will die.

The first part of this Submission describes several examples of how our efficiency has been undermined by inadequate attention to process concept and detail. There are undoubtedly many other examples which could come from other P802 members and professional managers.

THE VOTING FALLACY

We all expect--and IEEE P802 regulations stipulate--that the final provisions of the P802.11 Standard will reflect the wishes of the majority of its voting membership. Implicit in this expectation is the tacit assumption that the methods we use to vote will produce this result. Indeed, the voting practices we have been using here are so common in our society that almost nobody questions their validity; thus virtually anyone exposed to their refutation is surprised and even fascinated. The following paragraphs will attempt to:

1. Show that unless we are very careful with the selection of certain voting procedures, there is a good chance that the Standard will not reflect the wishes of the majority; no matter how intent each and every member is to the contrary;
2. Explain which voting procedures will make it most likely that the final standards do reflect the will of the majority.

This voting procedure problem involves pure logic and can occur in all situations for which three or more alternatives are under consideration. There are many provisions within the P802.11 Draft Standard which resulted from issues that fall within this category; a primary example is the "Foundation" MAC. It can be aggravated by the strategies (including manipulation) of participating voters but not mitigated by such practices, except by occasional very good luck.

To illustrate this voting fallacy, consider a not-so-hypothetical discussion concerning what should be the minimum allowable transmit power of an 802.11 compliant FH PHY. It is presumed that certain equipment manufacturers may decide to provide a "Deluxe" model which is capable of automatically (or even manually) reducing its power in accordance with various network conditions. This intended provision specifies that regardless of whether or not the "Deluxe" feature is incorporated, every compliant FH PHY must be capable of a minimum transmit output power.

The three candidates are +20 dBm, +10 dBm, and 0 dBm. The advocates for 20 dBm are interested in LANs having sparsely populated nodes at greater distances. They do not want to see Users purchasing very low power nodes advertised as 802.11 compliant which will not operate adequately in their systems. If a 10 dBm node were introduced into their systems, there could be considerable impairment in some situations; if a 0 dBm node were introduced, the probable result would be disastrous. The advocates for 0 dBm are interested in LANs having densely populated nodes located within a small region. They are also interested in maintaining a number of adjacent high density node groups which do not interfere with one another. These voters have at least two reasons for not being forced to use higher power. Frequency re-use will be impaired, and the node will cost more than necessary. If they were forced to use 10 dBm, they could probably accommodate it; if they were forced to use 20 dBm, their business plans would probably need wholesale modification. There would also be a few advocates for 10 dBm, who either plan LANs

needing an intermediate amount of power or who desire a compromise for one reason or another.

In the interest of simplicity (but not so much as to compromise the practicality of the examples), consider that there are 100 participants. Following an adequate discussion, which allows all voters to fully understand the issues, (in accordance with the above motivations) one probable distribution of voter classes is:

CLASS	PERCENT	FIRST CHOICE	SECOND CHOICE
A	45	20 dBm	10 dBm
B	40	0 dBm	10 dBm
C	10	10 dBm	20 dBm
D	5	10 dBm	0 dBm

DISTRIBUTION #1

If the balloting is done in the normal way, 20 dBm will come in first with a plurality (insufficient to elect for the standard) and 0 dBm will come in second. A runoff ballot will be needed to obtain a majority.

--	INITIAL					RUNOFF				
dBm	A	B	C	D	T	A	B	C	D	T
20	45				45	45		10		55
10			10	5	15	ELIMINATED				
0		40			40		40		5	45

DISTRIBUTION #1 RESULTS--NORMAL VOTING RULES

Notice, however, that 10 dBm--the only choice that would avoid disenfranchising about half the participants--was already eliminated in the initial ballot. In this particular example, the second ballot gave 20 dBm a simple majority. (In many other probable examples, 0 dBm would have won.) The point is that for a wide variety of distributions 10 dBm would be eliminated, even though it is the first choice of about 15% of the voters and second choice of about 85% of the voters.

Clearly, a different voting system is needed. The reasons vary according to the situation. In the case of voting for officers, a large percentage of the electorate will be disenfranchised. In the case of P802.11, a large percentage of the electorate will be totally dissatisfied and hold up the Standard for years while enough changes are painfully made to the "winning" choice to make it acceptable to the majority. One possible major example of this scenario was the voting process for the "Foundation MAC".

The new voting system needs two desirable properties.

1. A voter should not need to worry about wasting his vote on a candidate which probably will not win.
2. The popular compromise candidate will be chosen unless one of the other candidates is so popular that it would have won a majority on the first ballot of a normal voting system.

A chapter in a "pedestrian" mathematics book [1] describes a method, proposed by Brams, called "Approval Voting" [2, 3] which possesses the first property and part of the second.

As with normal voting, it allows each voter only one vote per candidate, but it *does* allow each voter to “approve” as many candidates as he wishes. The following chart shows the results of a modified form of “Approval Voting”, which adds a runoff election following the initial Approval vote.

--	INITIAL					RUNOFF				
dBm	A	B	C	D	T	A	B	C	D	T
20	45		10		55	45				45
10	45	40	10	5	100		40	10	5	55
0		40		5	45	ELIMINATED				

DISTRIBUTION #1 RESULTS--“MODIFIED APPROVAL” VOTING RULES

In the initial ballot each participant in Distribution #1 voted for (“approved”) his top two choices. Notice that this initial ballot not only did not eliminate the compromise candidate but produced more votes for it than for either of the extreme candidates. In the Runoff Election, all the votes from the eliminated category went to the compromise candidate, which was originally the second choice of these voters. The final result was that the compromise candidate was selected.

At this point, it may not be obvious why the Runoff Election is needed; inasmuch as it produced the same result as the Initial ballot. As will become clear with the illustration of other distributions, without the Runoff Election, the second of the above “desirable properties” is not completely satisfied.

Consider a distribution in which 55% (a simple majority) of the participants prefer 20 dBm as the first choice and only 35% prefer 0 dBm.

CLASS	PERCENT	FIRST CHOICE	SECOND CHOICE
A	55	20 dBm	10 dBm
B	35	0 dBm	10 dBm
C	5	10 dBm	20 dBm
D	5	10 dBm	0 dBm

DISTRIBUTION #2

As can be seen from the results, the initial ballot gives the compromise candidate a plurality; so “Approval” voting does not completely satisfy the second “desirable property”. The Runoff is needed to determine that a majority of the participants actually favor 20 dBm.

--	INITIAL					RUNOFF				
dBm	A	B	C	D	T	A	B	C	D	T
20	55		5		60	55				55
10	55	35	5	5	100		35	5	5	45
0		35		5	40	ELIMINATED				

DISTRIBUTION #2 RESULTS--“MODIFIED APPROVAL” VOTING RULES

The need for "Modified Approval" voting is even more obvious for the results of the following distribution (relevant to P802.11 balloting on technical issues):

CLASS	PERCENT	FIRST CHOICE	SECOND CHOICE
A	75	20 dBm	10 dBm
B	15	0 dBm	10 dBm
C	5	10 dBm	20 dBm
D	5	10 dBm	0 dBm

DISTRIBUTION #3

Although 75% of the participants desire 20 dBm as their first choice, the Runoff is needed to establish this fact.

--	INITIAL					RUNOFF				
dBm	A	B	C	D	T	A	B	C	D	T
20	75		5		80	75				75
10	75	15	5	5	100		15	5	5	25
0		15		5	20	ELIMINATED				

DISTRIBUTION #3 RESULTS--"MODIFIED APPROVAL" VOTING RULES

According to the Reference [1], which discusses several methods in considerable detail, no voting system other than "Approval" is free of anomalies. It claims its use in other professional societies and the United Nations Security Council.

ANOTHER EFFICIENCY IMPROVEMENT SUGGESTION

We must not allow the goals of the Committee-at-Large to be delayed by the education of new participants. How much time has been wasted over the years (and how much more time will be wasted in future sessions) rehashing previously discussed and supposedly resolved concepts brought up by newer participants? They are, in a sense, being given a free ride to begin with; they are permitted influence and voting rights (during the more influential later stages of the Standards creation Process) equal to those longer term participants who made a much larger investment. Each new participant should at least make two investments: He should purchase copies of all previous submissions and certify that prior to his participation in a discussion of, or preparing a submission on, any given topic, he will study all previous submissions dealing with that same topic.

The recent Draft Standard Letter-Ballot's low approval percentage was almost guaranteed by a combination of:

1. Inadequate voting procedures used all along;
2. Many of the participants voting now not being present when its provisions were originally discussed and voted in;
3. The new participants being required to study neither the submissions nor the minutes of the meetings they missed.

A more extreme measure should be considered. In the name of Democracy, each Voting Member has a single vote. This Committee rule does not reflect the realities of the actual overall scenario. It would be far more equitable to give each Voting Member one Letter-Ballot(?) vote for each session he has officially attended. One organization coming in at the end to "stack" the vote would be virtually impossible. If the idea of this practice seems extreme, just imagine a group of participants starting in May '95 having the same voting power as those who have worked on this standard for 30 sessions.

"HOW TO" EXPEDITE COMPLETION OF INITIAL P802.11 STANDARDS

The Author began writing this Submission during the first morning of the March Session, which was well after it had become clear that resolving the controversies registered in the Letter-Ballot will be an arduous task at best. In the FH PHY sessions, we started out by working on the more tractable issues from the Letter Ballot. Despite the clear understanding of urgency, most of the time was taken up with discussions about topics which had been explored in much detail years ago. These topics included various CCA items, such as even the desirability to defer to DS nodes! In addition to wasting time, this activity brought with it an especially cruel byproduct: Provisions which were decided on many Sessions ago based upon the meticulous thought invested in submissions and many hours of exhaustive discussion were changed for the worse by an aggregation of skilled engineers--some who forgot what they did and why they did it--and the remainder who had never witnessed those discussions, reviewed the minutes, nor studied those submissions.

At the end of the week came the announcement that another year will pass before any standards are final. This further delay is totally unacceptable. All around us, plans are being made to introduce high speed Wireless LAN products. It is entirely possible that the law for the Subject ISM Band will be changed to favor higher speed systems [4]. Should low priced higher speed equipment become available before 1 and 2 Mb/sec products, the latter will not be able to compete.

Earlier delays may have even turned out to be beneficial; as participants were learning from the product development processes within their organizations what is actually achievable and were translating this knowledge into a more prudent Standard. Now, as the pressure mounts to complete products and ready them for the marketplace, they have been designed using current information about the standard. Thus, the standards work has become more and more political and slow; as participants are told by their employers that design changes will be time consuming and expensive.

It is possible to present a final Draft Standard to the governing bodies by September at the *very* latest. In order to accomplish this goal, it will be necessary for the Group and its Membership to immediately increase its level of commitment and adopt modified operating rules. Shown here are a few ideas. Some of them may appear radical, but it is important to consider what will probably occur if they are not adopted. It is extremely critical that consensus be reached on a practical strategy *before* the May session. In order to facilitate discussions, the Reflector must be made operational forthwith.

1. Re-hashing issues which have been thoroughly discussed years ago, (sometimes resulting in ill-conceived changes) must cease immediately. In preparation for the next meetings, it will therefore be necessary for every participant to review all relevant Submissions and Minutes going back to the beginning of P802.11. As you know, these documents are available from IEEE. They may also be available from acquaintances.
2. Assuming participants are motivated enough to be prepared for and present at the meetings, there is no use for Letter-Ballots. All they do is cause further unnecessary delays. All final decisions should be made at the meetings. Provisions should be settled one by one by attending participants only--voted by subgroups & ratified by the P802.11 plenary.
3. Every provision should be settled by a motion, followed by one round of comments (5 non-transferable minutes maximum for each participant wishing to speak) followed by one rebuttal round (2 non-transferable minutes maximum per speaker), followed by a binding vote. In all cases involving more than two choices, the aforementioned Modified Approval system should be used.
4. Once a provision is settled, the only way it can be changed is if a voting member prepares a submission which shows a review of all previous submissions and minutes relating to the issue, explains what has been overlooked, and makes a motion. This motion will be made as early as the same session, with 24 hours notice after distribution. The same discussion and voting rules as shown above should apply.
5. Once the provisions have all been settled, the Standard is **complete**. The only allowable changes are to correct editing (intent, clarity, language art).
6. If the Standard is not complete and ready for final editing in July, a continuous meeting should be held in September, 7 days/week, until it is complete. Participants can come and go as they please, but binding ballots always continue with members who are present at the time.

FINAL REMARKS

The time has come for us to stop deluding ourselves into believing that we can manage the Standards Creation Process without professional help (which should be sought by IEEE and other standards-making organizations). If every P802 participant paid \$100 extra for each of six sessions per year, there would be sufficient funding to cover all the expenses of a high powered Senior Strategic Manager. Considering what it costs our employers for us to attend each session, an extra \$100 is minuscule, and if the Manager's expertise cuts even 20% off the time it takes to craft a standard, that \$600 annual incremental investment will pay off 10,000 fold.

Please don't merely declare that these ideas may be sound, but that it is too late in the process to implement them. If a person had been driving a vehicle for 10 hours a day across the USA at 5 m/h and were 75% of the way there, and someone told him how to increase his speed to 70 m/h by making a permanent modification that would consume a day or two with no progress, he would not hesitate to stop and do it. He would make this investment even though he could accurately predict the arrival date without the improvement. In our case, we cannot even make an accurate prediction of the arrival date.

Nothing appearing in this Submission should be construed as criticism of the various Chairmen of P802.11; they have given us only the best possible part time, volunteer performance possible--principally consisting of the tireless, meticulous, and tactful implementation of existing policy under difficult circumstances. The impetus for upgrading the standards formation process must come from high in the P802 Committee. A special task force should be set up to re-think the strategy of how to "work smart". Perhaps reputable management consultants could be brought in immediately to examine policy and audit session meetings. In order for any organization to stay/become healthy, it must critically re-assess its management practices on a continuous basis. Attention is needed without further delay.

REFERENCES

1. Paul Hoffman, *Archimedes' Revenge: The Joys and Perils of Mathematics*, BALLANTINE BOOKS, 1988, ISBN 0-449-21750-7, pp 215 to 248
2. Brams, Steven, *Paradoxes in Politics*, New York Free Press, 1976, 42
3. Fishburn and Brams, "Paradoxes in Preferential Voting", *Mathematics Magazine*, September 1983, 207-14
4. IEEE P802.11-95/40

Notes for Discussion