Letters to the Editor

Benchmark article stirs reader response

To the Editor:

With regard to benchmarks—yes, yes, YES. There are few benchmarks with any meaning that get published; that is, most of them are in somebody's advertising literature and are, shall I say, suspect. I found the article in the August issue of IEEE Micro very interesting.

One slight problem with that article was the final summary of results: the authors took an arithmetic mean when they should have taken a geometric mean. Their main conclusions are the same, but the advantage of the 68020 over the other processors is not quite as great as it appears from their numbers. I have enclosed the correct version of their Table 3, along with an article from the CACM showing why this is the correct method. (Editor's note: The CACM article is not reprinted here because of its length; see Comm. ACM, Vol. 29, No. 3, Mar. 1986, pp. 218-221.)

Bruce Walker
San Pedro, CA

Thayne Cooper replies

We wish to thank all of you who read our 32-bit microprocessor benchmark article. We hope the information was useful as well as interesting to many of you.

The letter by Bruce Walker addresses an issue which is always of interest in an article like ours: How should the information be presented? We read the article referenced by Walker with interest and suggest that others read it also.

We do note, however, that the article referenced by Walker treats the use of the geometric means on normalized numbers of individual tests. The summary we provided did not use normalized test numbers. Rather, it took the arithmetic means of the raw unnormalized numbers and then normalized those means.

We answered the question of information presentation by supplying the raw data of the tests along with a summary. This provides the opportunity for other kinds of summaries to be made. Walker has done that and arrived at essentially the same results.

To the Editor:

While we at National Semiconductor Corporation were pleased that one of the members of our Series 32000 microprocessor family was included in the article, "A Benchmark Comparison of 32-bit Microprocessors" (IEEE Micro, Aug. 1986, p. 53), we were disappointed to find that the microprocessor tested was the 10-MHz NS32032 and not the newest member of the family, the 15-MHz NS32332.

This MPU, which is both fully upward and downward software compatible with the other members of the Series 32000 family and has such speed-increasing features as an improved microinstruction set, larger instruction prefetch queue, and burst access mode, has been available as a 10-MHz part since October of 1985, with the 15-MHz version available since March of 1986.

Our own in-house executions of the EDN benchmarks, run on National Semiconductor’s NS32032-10-based DB32000 demonstration board, have produced slightly faster results than were shown in the article, due to our use of zero-wait-state RAM. Execution of the same benchmarks on our DB332 demonstration board, utilizing the 15-MHz NS32332 and zero-wait-state RAM, have shown an overall speed increase, as determined from the mean of the test times, of approximately 2.2 times.

National Semiconductor is working with the authors of the article to ensure that the NS32332-15 is included in their next round of benchmark tests and looks forward to results which will clearly show the architectural improvements of the NS32332.

David Raulino
Santa Clara, CA

Cooper’s response

Since our report in the August issue of IEEE Micro on 32-bit microprocessor performance, our evaluations have continued. The National 32332 (follow-on to the 32032) has been received and the same benchmarks run on it. The following are the numbers which can be added to the tables found in the August article:

Table 1.

<table>
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<tr>
<th></th>
<th>32332 (15)</th>
<th>32302 (15)</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>8.45 6.73 4.34 6.43 7.41</td>
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Table 2.

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<th>32302 (15)</th>
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<tbody>
<tr>
<td>2.</td>
<td>6.92 6.26 2.42 3.79 6.15</td>
<td>6.92 6.26 2.42 3.79 6.15</td>
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</tbody>
</table>

Table 3.

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<th>Static memory</th>
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<tbody>
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<td></td>
<td>Mean</td>
<td>Ratio</td>
</tr>
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<td>9.91</td>
<td>3.55</td>
</tr>
<tr>
<td>80386</td>
<td>4.91</td>
<td>1.76</td>
</tr>
<tr>
<td>68000</td>
<td>12.87</td>
<td>4.61</td>
</tr>
<tr>
<td>68020N</td>
<td>5.41</td>
<td>1.94</td>
</tr>
<tr>
<td>68020C</td>
<td>2.79</td>
<td>1.00</td>
</tr>
<tr>
<td>32032</td>
<td>10.26</td>
<td>3.68</td>
</tr>
<tr>
<td>32100N</td>
<td>9.00</td>
<td>3.23</td>
</tr>
<tr>
<td>32100C</td>
<td>4.18</td>
<td>1.50</td>
</tr>
</tbody>
</table>
To the Editor:

A word of thanks to Bob Stewart for his very kind reference to me in his article in the August IEEE Micro. Also, Mildred and I were very amused at Bob’s “. . . Bus Wars” cartoons—this is an accomplishment we’d never suspected.

We still have very pleasant memories of the Oregon expedition, and especially of that final Saturday we spent together. We hope all is well with Bob and that there’ll be another opportunity to get together before we’re too old and grey.

Matthew Taub

To the Editor:

The so-called “history” of microcomputer bus standards development presented in cartoon form in the August issue (IEEE Micro, “MicroStandards: Promises, promises, promises,” p. 66) grossly misrepresents at least those events with which I am personally familiar. This is particularly egregious in that I know author Stewart to be well aware of the facts and the correct information was readily available to your editors (see, e.g., the P896 PAR, IEEE Micro, Vol. 1, No. 1, p. 67; or Wesccon/81 Professional Program Session Record 27/5).

To cite a few specific examples:

Cash Olsen had absolutely nothing to do with the formation of the P896 working group. Olsen was the chairman of a subgroup (the Futurebus subcommittee) formed within the P696 project in mid-1978. This subgroup, of which I was a member, was established to identify future microprocessor bus requirements in general, and not at Olsen’s behest (panel 10). In June 1979, frustrated by the lack of progress within this subcommittee, I organized the study group on advanced microcomputer system buses that prepared the project authorization request resulting in P896. The P896 activity never met in Berkeley (panel 14). Note also that the misleading use of the term Futurebus for the P896 activity began at least three years after its inception.

The recognition of Taub’s development of the arbitration mechanism (panel 11) was, in fact, quite belated. Gustavson presented the concept to P896 without attribution and long before it became known that it had originated with Taub. It is my impression that it was the publicity surrounding its use in P896 that drew attention to the fact that it had actually originated with Taub.

The serial intermodule communication concept—one of the things most violently objected to by opponents of the early P896 drafts, but which has since been incorporated into both the VMEbus and Multibus II—originated with Rollie Linser, and the attribution to me in panel 15 is quite simply false, as is the one in panel 17. Stewart did not attend the Boulder meeting, but I specifically advised him of Linser’s contribution when he telephoned me early this year seeking background material for the original presentation of the material in question. There was, of course, ample opportunity to verify the other information at that time. Jean-Daniel Nicoud of EPFLausanne and the European participants whose activities he coordinated until 1982 also made many valuable contributions, including the low-cost, single-connector approach since adopted by Nubus.

The end of Nicoud’s and my active participation in the P896 effort (panel 19) is also misrepresented. In December 1981 (not 1980 as shown), the P896 working group voted—16 in favor and five (three of whom failed to meet the requirement to state the modifications necessary to cause them to change their vote) opposed—to take Draft 4.1.1 to the MSC with a request to approve distribution for public comment. Contrary to the impression given in Stewart’s comic strip, the rejection of this request by the other members of the MSC at its January 14, 1982, meeting was not unanimous, and Nicoud was not even present.

As was made clear by my statement at the time, a copy of which was provided to the then chairman of the MSC but misrepresented in the minutes of the meeting, my resignation was brought about not by the denial of the working group’s request, but by the committee’s general failure to prevent the holders of minority viewpoints from indefinitely delaying progress. The result, as I predicted then, has been a failure to achieve results commensurate with the enormous amount of effort that has been devoted by working groups over the past nine years. In the case of P896, for example, the MSC has manifestly failed in the objective stated in the PAR, namely to provide an alternative to the development of yet another generation of incompatible de facto bus standards, namely, those previously mentioned plus VAXBI.

Judging by the quality of the reporting of events with which I am familiar, the material in question may possibly belong in the funny pages, but clearly has no place in a publication of the IEEE. Kindly consider this a request for a public retraction.

Andrew Allison
Los Altos Hills, CA

Response from Robert G. Stewart

Ko Ko: Your Majesty, it’s like this: It is true that I stated that I had killed Nanki-Poo—

Mikado: Yes, with most affecting particulars.

Pooh Bah: Merely corroborative detail intended to give artistic verisimilitude to a bald and . . .

The Mikado,

W. S. Gilbert and Arthur Sullivan

Andrew Allison devoted hard and constructive efforts for years to the standardization activities of the IEEE Computer Society. He was the first MicroStandards editor of IEEE Micro. I sincerely apologize if he felt affronted by the material in my August column, “A Historical? View of IEEE Standards During the Great Bus Wars.”

His letter brings up several aspects of the 896 Futurebus project, some of which I agree with, and some which I don’t. Cash Olsen was dubious of the value of standardizing the S-100 MITS Altair bus (now IEEE 696). The talk of Tony Pietsch to the Microprocessor Standards Committee emphasized the need for more advanced buses. That led to the initiation of a study group with Cash as chair of the study group acting under the 696 PAR to look at other possible bus efforts. He looked at a “Home Bus” that never went very far.

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because of the adoption of power-line multiplexing as the predominant method for home device control, which has inadequate bandwidth for computer applications in general. Later the study group effort moved more to a higher performance backplane bus. That was the precursor to Andy's writing the PAR for the 896 project, which he then chaired. Andy preferred to use the more modest nomenclature, "Advanced Backplane Bus," rather than "Future Bus," which the rest of us had used for a long time previously. He is correct in his assertion that the name on the PAR was not Future Bus.

The contribution of Matthew Taub to the arbitration scheme used in Fastbus (IEEE 960), S-100 (IEEE 696), and Futurebus (IEEE P896) was known to us in the 696 working group very early after its suggestion by David Gustavson. Evidently Andy didn't happen to attend the working group meeting at which that information was stated.

The scene depicting the 896 meeting in Boulder was based on information Andy provided to me over the telephone. I'm glad that he points out that Rollie Linser was the inspiration for a serial bus that can substitute for the parallel bus for reliability. Apparently this was not in my notes, and so I tagged the balloon to Andy as chair expressing a general characteristic. That perhaps can be considered artistic verisimilitude—and possibly justifies the question mark in the title after "Historical." Many of the details contained in the presentation were my personal recollections going back as far as a decade and which had no written material anywhere for support. J. D. Nicoud spent a year's sabbatical in Palo Alto in the early eighties and attended MSC meetings while he was there. Andy is correct in saying that he came after the meeting at which Andy resigned.

The statement Andy gives regarding his resignation was because the MSC's "general failure to prevent the holders of minority viewpoints from indefinitely delaying progress." As one of the minority in the 896 working group I'd like to state that we had no intention of indefinitely delaying progress. Rather we felt that the parallel bus as it was then proposed was not a significant advance on the state of the art and had problems with driving the bus lines, problems which were not resolved. I personally was unhappy that Andy saw fit to resign rather than to resolve the differences within the working group.

Now let's see where Andy and I do agree. It is now 1986, eight years after the Futurebus effort started and no 896 draft has been approved by the MSC! I credit Paul Borriol with working extremely hard as chair, as had Andy, but Paul estimated that at most one year would be needed to finish the draft when he assumed the chair. It has taken at least three years more than that. When the realities of industrial competitiveness are taken into account, a company simply may not be able to wait for the IEEE standards development process to take its path, and time. The 802 efforts to develop LAN standards, however, constitutes a good counter example of the computer industry working constructively within the IEEE framework to develop badly needed standards in a reasonable time scale.

What has come out of those three extra years spent on the 896 effort?

- The new bus drives developed by R. Balakrishnan of National Semiconductor set a new level of performance in backplane buses.
- The Taub arbitration scheme has been enhanced to incorporate the suggestions of Keith Britton improving fairness among competitors.
- A new parallel-bus protocol containing fast two-edged handshakes from Fastbus was worked out by John Theus of Tektronix.
- The parallel-bus protocol was extended to provide services needed by caches.

Are these efforts worth it? Only time will really tell. Some of the other 32-bit buses now in existence have used features first hammered out in the 896 committee. Under Andy, P896 chose the Eurocard format, which VME and MB 2 and Nubus followed. MB 2 has also chosen the Taub arbitration scheme. Maybe in the future some of these other buses will see fit to retrofit to the higher performance possible with the 896 bus drivers.

I did not want to prepare another WOW (Write Only Writing) article, which only the writer would really read and so chose the cartoon format for the presentation. Perhaps Andy is right and professional society journals should not contain such a format. But the content was the best I could recall, and the effort needed to draw it was about three times that which a conventional written presentation would have required.

IEEE standards during the Great Bus Wars—another view

(Editor's note: When I approved the August cartoon-feature Micro Standards column for publication, it was intended to provide the reader with a depiction of the events of the past decade in a light, and I hoped, humorous manner. Any misrepresentation or offense given was not intentional and is regretted. Allison has responded to my request to submit his account of the events he has noted and that account follows.—J.F.)

The August issue of IEEE Micro presented one view of the work done within the Computer Society's Microprocessor Standards Committee. As someone who joined that body in November 1977, just three months after its inception, and was an active participant for over four years, I would like to offer a different one.

The genesis of the Microprocessor Standards Committee, originally established as a subcommittee of the Computer Society's Standards Committee, lay in the loss of control by its developer (MITS Inc.) over the specification of what came to be known as the S-100 bus. Although the subcommittee immediately began working on a number of other proposed standards, microcomputer system buses have remained a major part of its work—unfortunately, with very little practical result. After almost 10 years of effort, only two microcomputer bus standards, S-100 (696) and Multibus (796), have been adopted by the IEEE.

Much else of what was presented as history in the August issue is in conflict with my personal knowledge and the public record. For example, the origins of what became IEEE-STD-802 (Local Networks) and the P896 (originally the Advanced Microcomputer System Backplane Bus) are misrepresented. The following is the text of the first two paragraphs of a report on the status of the P896 activity in the February 1981 issue of Micro ("Status Report on the P896 Backplane Bus," Andrew A. Allison, p. 67):

"A subcommittee on microprocessor standards was set up by the IEEE Computer Society in August 1977. By the middle of 1978, the committee's efforts toward developing standard specifica-
tions for the S-100 (P696) and Multibus (P796) buses had made clear the need to consider future systems bus requirements before the emergence of yet another generation of de facto but incompletely specified and incompatible buses.

The working group set up to consider this need [This was the Future Bus (not Futurebus) subgroup chaired by Cash Olsen] concluded that the buses then being specified by the Microprocessor Standards Committee could not be extended to satisfy the requirements anticipated for future microprocessor-based systems. Three major categories of bus—backplane, local network, and residential—were identified. A backplane bus subcommittee was set up (by the present writer) in June 1979, and Project Authorization Request Number 896 was approved by the IEEE Standards Board in September of the same year. EDSIG—the European Distributed Intelligence Study Group—set up a subgroup in May 1980 to interact with the IEEE work. EDSIG is one of the working groups supported by the Commission of European Communities for promoting standardization in the field of data processing."

This makes it clear where the P896 and 802 activities originated. The fact that Marvin Graube quickly took the local network effort out from under the MSC's purview is no doubt the reason that it is now an IEEE standard.

The status report was based on the working document for the Boulder P896 workshop and included specification of the serial link feature allegedly introduced by me at the workshop. The position attributed to me in the August issue is quite simply, false. Credit for the development of this feature, part of P896 from its early days and since incorporated into several other buses, and probably the most useful outcome of the P896 effort, belongs (as I informed Stewart when he was researching his paper) to Rollie Linser.

The reference to Versabus in the August article is incorrect. Both Versabus and Nubus (then still in the hands of M.I.T.) were among the preexisting specifications presented to the P896 working group as candidates for standardization, but neither were felt to meet the processor-, manufacture-, and technology-independence objectives set for P896.

Similarly, the decision to present a proposed draft to the MSC for approval to distribute for public comment was the result of a vote of the working group. It is ironic that the MSC's January decision to deny that request on the basis of a minority viewpoint has resulted in Versabus's successor, the VMEbus, becoming the de facto standard 32-bit bus. The characterization of that vote in the article in question is, incidentally, not factual—among other things, Nicoud was not even present!

The fundamental reasons for the failure of the MSC to produce useful standards, in my opinion, were (and remain) lack of understanding of the difference between controlled and uncontrolled specifications, and of the needs of the user communities, and the insistence by certain members of the MSC that the proposed standards incorporate their opinions. Perhaps the most ludicrous example of the latter was the holding up of the Multibus draft for months until the working group chairman acceded to Stewart's nomenclature demands.

As noted above, in 1977 the S-100 bus specification was both popular and out of control, with as many implementations as suppliers and serious incompatibilities between them. All of the other preexisting buses taken up by the MSC since that time have been controlled by their proprietors. The failure to recognize this fundamental difference was the cause of the so-called "bus wars," which were (and are) primarily fought over efforts by the MSC to impose, frequently over the objections of the working groups actually drafting the standards, changes to proprietary, de facto standards. The outcome has been that the need which led to formation of the MSC, namely the interoperability of subsystems from different suppliers, has been met by the use of de facto rather than IEEE standards.

I submit that the MSC will continue to fail in its obligation to provide useful, timely standards until it recognizes that: (a) microprocessor and computer manufacturers have a (perfectly legitimate) commercial interest in establishing proprietary buses as de facto standards; (b) the MSC has no business ratifying such standards, with or without the cosmetic changes that are the only kind possible for this type of standard; (c) the plethora of overlapping bus specifications being "standardized" defeats the objective of standards development; and (d) the marketplace will continue to establish de facto standards if adequate (as opposed to wonderful) alternatives are not offered in timely fashion.

The foregoing is, unfortunately, probably irrelevant to microcomputer system bus standards development. The IBM PC and PC AT buses will clearly remain the de facto standards for 8- and 16-bit subsystems development for the foreseeable future. Absent something dramatic from IBM very soon, VMEbus's present domination of the 32-bit arena will also be secure. In other words, the war is over!

Andrew Allison

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