LETTERS TO THE EDITOR

Microprocessors defy classification

The designation of a computer as 8-bit, 16-bit, or 32-bit seems to be more a marketing decision by the manufacturer than anything else. Every definition I have heard results in an absurd designation for some computer. For example, that offered by James Isaak in the December 1983 issue of IEEE Micro (Letters, page 3) would designate the IBM System/370 as a 12-bit computer.

There is a consensus in the personal computer marketplace that the IBM PC is a 16-bit computer. Those writing about such systems have a difficult time explaining how the 8086 differs from the 8088.

Hubert Kirmann's rather complex classification (December 1983, Letters, page 4) does seem to capture the essence of current microprocessors. The designation is usually applied to the architecture of a processor rather than its implementation, however. In his definition, both numbers are implementation-dependent, though the first is usually determined by architecture. The introduction of on-chip caches—already announced by several manufacturers—will soon render even this definition inadequate.

James R. Goodman
Computer Sciences Dept.
University of Wisconsin—Madison
1210 West Dayton Street
Madison, WI 53706

Author's reply:

The most important parameter of a processor seems to me to be its address size. Therefore, I proposed to classify a microprocessor by both its address and its data size and thus designated a 68000 a 24+16 processor and an 8086 a 20/16 processor (the slash means that address and data are multiplexed, while the plus sign means that they are not). Goodman is right to observe that a cache makes this definition inadequate to describe performance.

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depreciating capital can take full, beneficial effect if our electronics companies do not have the trained personnel necessary to utilize opportunities in high-tech industries. There can be no doubt that the international technological revolution has caught the United States understaffed and surprisingly undereducated. You may have heard about the American Electronics Association report which concluded that America's educational system needs to triple its output of electrical and computer science engineers in the next five years if it is going to meet the needs of the electronics industry alone. Indeed, it is staggering to consider the small number of people on whom the United States depends for its technological expertise. For example, out of 200 million Americans, only 1000 are trained to design large-scale integrated circuits.

In recognition of such deficiencies, the United States House of Representatives has passed the Math and Science Education Act of 1983. This bill authorizes funds to improve and increase math and science education at all levels in America, to update facilities in our university laboratories, and to promote stronger ties between research in our universities and innovations in our private industries. That bill is currently being considered in the Senate, and I hope that we can also cooperate in an effort to get the Math and Science Education Act passed in Congress and signed into law.

Yet we must do more than offer seed money to improve our academic environment. The U.S. government will have to offer more than that to help update our educational systems and provide the crucial braintrust necessary for the success of your industries. I am now supporting measures in the House of Representatives to provide tax credits to companies donating computers and other scientific equipment to our nation's schools. That is probably only one of many bills which could get private companies to help improve the technological education provided by our schools. For example, I feel that the federal government could and should cooperate in some way with private firms in the effort to provide a sufficient supply of high-calibre educators. Concerned citizens in Silicon Valley have begun to worry about the "Brain Drain" developing as firms hire away vitally needed professors. I think we can all agree that Congress, private industry, and the educational community should work together to help preserve our nation's precious supply of teachers, so that we will have people who will train the next generation of scientists and technologists—and not, in effect, eat our own seed corn.

Trade. There is another point on which we can all agree—that is that without international trade, the electronics industries would suffer immensely. And if all the measures I have discussed are to bear their full and fair dividends, we must also address the state of world trade itself. The current administration has imposed severe and unnecessary restrictions on the export of many technological products, thousands of products which our military adversaries neither want nor need and which are readily available from other sources. As a result, business people have to wade through a sea of bureaucratic red tape. Again, I think we can agree on appropriate legislative redress. We should adjust the legislation which allows all of these unnecessary and detrimental restrictions, the Export Administration Act. In Congress, we have been working to amend that legislation so that only the trade restrictions which truly promote our national security will remain in place. Here again, we should remind those who hesitate that our national security depends upon vigorous trade as well as military might.

Involvement. All of these initiatives address specific concerns of the electronics industries. But I think it is important also to try to grapple with a wider array of public policy issues. As the high-technology lobby matures, there may be a great temptation to think only about devising a menu of tax credits or public incentives which affect your balance sheets. But it must be recognized that all decisions about high-technology issues in the public sector will have to be made within the context of larger decisions about our future.

Therefore, just as government provides essential factors of production for industry, concerned citizens must provide the essential factors of production for government. We must all involve ourselves in the broadest issues of our day, such as foreign affairs, the provision of health care, and the maintenance of our environment. All of these deserve your attention. Government needs your energy and your expertise.

Norman Y. Mineta (D) represents California's 13th Congressional District, located at the southern tip of San Francisco Bay. The district includes portions of San Jose and the Cities of Campbell, Los Gatos, and Santa Clara, as well as unincorporated parts of the County of Santa Clara.

Born in 1931, Mineta was one of 110,000 Americans of Japanese ancestry who were evacuated from the West Coast and placed in relocation camps during WWII. Attending schools in San Jose, he later graduated from UC Berkeley in 1953 with a BS in business, then served on active duty in the Army as an intelligence officer in Japan and Korea.

Commencing his political career in 1962, Mineta served in a variety of local offices including membership on the San Jose City Council and mayor of San Jose. He has held a seat in Congress since 1974, serving on several major committees ranging from the Public Works and Transportation Committee to the Select Committee on Intelligence—posts he continues to hold today. Currently he is also a member of the House Committee on Science and Technology, where he serves on the Subcommittee on Space Science and Applications and the Subcommittee on Science, Research, and Technology.

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It is difficult to describe a microprocessor with only a few symbols. To integrate more parameters, one should also indicate the size of the on-chip memory and the clock speed—one should call the Z80000 a "32/32 C256 K5" processor, for instance, since it has a multiplexed 32-bit address and data path, a 256-byte cache, and a 5-MHz bus clock (which is more meaningful than the CPU clock). The 8051 would be a "17/8 R4K + M128 K12," since it has two address spaces, 4K of ROM plus 128 bytes of RAM, and a 12-MHz bus clock. Such a method of description would be rather cumbersome, of course.

Hubert Kirmann
Brown, Boveri & Cie
Research Center
CH-5405 Baden, Switzerland