Reviews of Books and Papers in the Computer Field

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A. COMPUTER SYSTEM DESIGN

R68-8 Language Directed Computer Design—W. M. McKeeman (*1967 Fall Joint Computer Conf.*, *AFIPS Proc.*, vol. 31. Washington, D. C.: Thompson Book Company, pp. 412–417).

It has been observed, perhaps facetiously, that "the world's best programmer is also the world's top computer engineer." For indeed, when designing computing systems one attempts to provide a mechanism which permits the convenient solution of many disparate problems. The design of such a system will necessarily encompass both programming and engineering considerations.

The computing system that a user sees is, in general, not the machine that the hardware craftsmen have assembled. The same hardware machine will be looked at in different ways by two users—one numeric analytic oriented, the other business data processing oriented. The difference stems from the fact that the two users have different computers: the one a computer assembled from the hardware machine and a FORTRAN compiler and its associated state of mind, the other from the same machine and a COBOL compiler and its associated state of mind. Parenthetically, the unfortunate thing is that the intersection (in the set sense) of these two states of mind is all too often zero.

The important thing is that users recast the basic hardware into that machine which seems to think the right thoughts about the problem area the user has in mind. The modeling material used to pad out the hardware is, of course, system software.

The great disparity between what hardware is immediately capable of doing and what users want to do has required the building of complex translators in software to bridge the gap. The size and cost of these software systems is almost never small.

This paper argues convincingly—and it seems to me that the examples are well chosen—that the gap between the user (more particularly, the facilities provided in a software system) and the machine can only be bridged effectively when the dialog between the software man and hardware man proceeds meaningfully from a common basis of understanding.

That the hardware engineer should be educated to the software world, via the experience of building a software system, as is here advocated, is perhaps a bit of a one sided view of the gap. What really is of concern is that the computing system be designed from its inception with a full realization of what language it is expected to be fluent in. This can only be achieved when all involved in the design are fully aware of all the implications of what may appear on the surface to be minor decisions.

It is interesting to note that by and large, as evidenced by the examples in this paper, the complications of translation and of fail-safe operation have to do with addressing: that is, with the referencing of pieces of data. Yet this one area has had, I suspect, fewer fundamental hardware changes than nearly any other facet of a computing machine. While index register, indirect addressing, character addressing, etc. features abound, the application of them is all too often bound up with the operation performed rather than with the operand involved. And it still is nontrivial, for example, to reference in a single step a multidimensional entity. Memories continue to be linearly addressed and copious translation is required to map multidimensional structures onto the linear array that is the hardware memory.

These points are some of many that could be cited to support the claim that the gap between fundamental use and basic hardware does exist and that its bridging is nontrivial. How best to bridge it is, in detail, probably not specifiable. Clearly, however, as this paper suggests, the hardware designer will have to be totally aware of and sensitive to the requirements of the users' needs as exemplified by the language structures he constructs. At the same time, however, the language designer will need to be aware of what hardware can reliably and economically be produced.

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B. MAGNETIC RECORDING

R68-9 A Computer Simulation of Electrical Loss and Loading Effect in Magnetic Recording—W. W. Chu (*IEEE Trans. Electronic Computers*, vol. EC-16, pp. 430–434, August 1967).

This paper is basically concerned with determining readback distortion in magnetic recording. This determination is obtained, not by closed-form analysis, but by simulation of the readback system, consisting of the head and load. The simulation environment allows the author to avoid two limiting assumptions of the past. In this case, he is able to treat a head of finite permeability and a nonzero load. The load considered is a rather standard and adequate parallel RC network. For the finite permeability head, an RL series equivalent circuit is used in which the resistance and inductance are frequency dependent and determined experimentally. The argument is made that the open-circuit readback voltage (zero load) is linear with the input (variation of flux in the storage medium). This fact allows superposition to be applied, and the actual readback voltage computed at the various harmonics of the input. Since R and L vary with frequency, a different equivalent circuit of the head applies for each harmonic. The analysis and superposition of the linear network responses for each network is performed digitally. Finally, some digital filtering is performed in an attempt to offset the effects of distortion, to no avail.

To the extent that the eye can compare two time domain waveforms, there seems to be good agreement between experiment and the simulation. In this writer's experience, such agreement constitutes the beginning of a simulation study, not its conclusion. If this contention can be accepted for the moment, we would conclude that the major contribution of this paper is to demonstrate that the techniques used here can provide a useful starting point for others in studying this phenomenon. That is to say, the author has established his model.