

TWO APPROACHES TO THE SEVENTIES

everyone wants to be "fourth"

by R. A. McLaughlin

As evidenced by their product announcements, most mainframe manufacturers seem to agree that the computer systems of the 1970's will be biased toward on-line information systems with highly developed man/machine interfaces, good I/O and communications capabilities, fast response times, high speed main storage and large capacity secondary storage. This is not to say that their product lines do, or will, necessarily look alike.

These two computer systems are a case in point. One is from a west coast manufacturer; one from an east coast firm. One from a vendor with a background in scientific instrumentation systems; one from a house most well known for emulators. The systems, the Standard Computer Corp. IC 7000 and the Systems Engineering Laboratories 86, show tremendous differences in execution if not intent.

standard ic 7000

Standard Computer Corp. originated as a manufacturer of emulators for second generation hardware and, in fact, its newest system is an outgrowth of a project which was initiated to develop an emulator for the GE 265. Emulation, as implemented by Standard Computer, consists of fashioning a "target" computer built to resemble, say, the 265 and having the language and hardware for translating the original cpu's programs into instructions understood by the equipment at hand, conceptually labeled the "inner" computer.

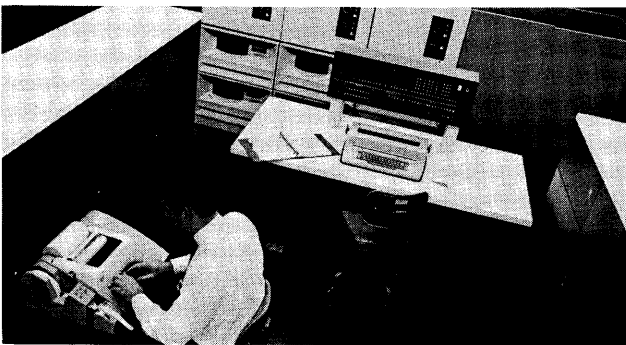
The language that all Standard's machines understand is called MINIFLOW, and consists of ministeps, a few hard-wired and most kept in fast control storage. MINIFLOW is assembled by a program called ICAP, Inner Computer Assembly Program.

Even the systems architects at Standard weren't too awfully quick to realize that by implementing microcode and "super instructions" in MINIFLOW that they could define, for the same machine, a supervisory language and a processing-oriented language that were different but executable on the same machine—rather than developing a compromise language to do both functions. Further, instead of developing just target computer languages, they could develop genuinely problem-adapted languages and execute first-, second-, or third-generation programs on the same machine, to boot. Given this realization, they came up with yet another language, a compiler called IMPLAN, Implementation Language, to write those problem-adapted languages. Super instructions like SAVE STATUS, SCAN, FIXED-TO-FLOAT and other complicated time-sharing functions normally performed in computers by machine language sub-routines have been microprogrammed into the instruction set of the IC 7000.

Of course, the hardware development program was moving along simultaneously. In fact, changes were made in the hardware which the software development made seem appropriate and, conversely, the hardware dictated the soft-

ware design. For example, given that the same hardware could understand an I/O machine language and a gp processing machine language, why not split the cpu into two sections to do these specialized tasks?

The project yielded a multiprocessor machine with a Supervisory Processor (composed of 2K of 18-bit one-usec control store, one to four channels, and a 500 nsec/ministep "inner" computer) and an Arithmetic and Language Processor (with another 2K x 18 bit 500 nsec control store, a 270 nsec cycle time parallel arithmetic unit, crossbar interfaces to main memory and the control console). Both processors pull double instructions from their control stores on each cycle. The ALP handles compiling and program execution and can perform a *mixed mode* add in 27 usec; the



SPU handles scheduling, resource allocation, swapping and I/O functions. They share from 32K-256K of 36-bit plus parity two-usec main memory. The SPU has 16 registers; the ALP has multiple accumulators, seven index registers, and working locations in control memory.

The 7000 uses sign-magnitude fixed point arithmetic and a binary sign-characteristic-fraction floating point system that allows for 27-bit accuracy in single precision and 54-bit in double.

Since four channels do not seem like much for a communications-oriented machine, one channel with a communications multiplexor can be expanded by the addition of up to four communications concentrators (presently in the form of Digital Equip. Corp. PDP 8's with attachments for 24 terminals each). One is a unit record channel, another an "IBM" channel for hooking up IBM controllers. The fourth channel is open and, since they are all programmable, can be used to duplicate any of the others.

The result is a time-sharing system billed as being able to handle up to 80 simultaneous users, providing them with BASIC, FORTRAN IV, and all of the GE 265 library. (COBOL will come later.) Features include dynamic time-slicing for adapting to changing job mixes, dynamic core compaction, swapping, a sophisticated security and memory protect system, and an associative file system that takes much of the work out of file generation, data retrieval, and report writing. Also, since the PDP 8's are programmable, terminal flexibility is almost unlimited.

The software represents the ultimate in unbundling. Standard didn't even write it—Call-A-Computer did. There-

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fore it is, by definition, user-oriented. A not-so-subtle effect of this cooperation is that a user, perhaps for the first time on a large system, has dictated, not just accepted, the programming, and hence very very strongly influenced the hardware design.

The cooperation has a big impact on other customers, too. Those who cannot afford an IC 7000 system for themselves can rent time on one—with no later software conversion problems—from CAC under a variety of contracts. Those who can afford their own system will find that a 32K version, with two IBM 2311 compatible disc units, an 800 cpm card reader, a 1250 lpm printer, and one 60KC tape drive, will cost them about \$599,200 or \$15,000 per month. For a 65K version with a five-drive IBM 2314 disc unit in place of the 2311-compatible gear and two tapes, the figures would be \$947,400 and \$22,450 per month. An expanded version, with two central processing units but only one SPU (the thing isn't really working very hard in a single-processor configuration) will be offered for big big t-s users.

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