“Any clot can have the facts, but having opinions is an art.”
Charles McCabe, San Francisco Chronicle

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TOM: The Only Methodology

The programmer cul-de-sac. It is a well-known fact that programmers (liveware) move from project to project in relatively short times, requiring frequent retraining and enhancement to suit the new environments.

A common axiom in project management circles states: If more than 20 percent of a programmer needs retraining, it is cheaper to replace him. (The percentage may be much lower after exposure to certain types of rogue software.) This axiom is an informal expression of the tenets of a new discipline, that of “disposable liveware.”

The overall result is that conventional software development is trapped in the programmer cul-de-sac. Unless a way out can be found, present trends—high inter-softwarehouse programmer mobility, lack of corporate identity, and of course, ever-increasing software life cycle (SLC) costs—will escalate.

Obviously, it would be desirable if programmers could be reused in many different projects without extensive retraining. It would then be possible to “plug in” a programmer to perform certain dynamic tasks in the SLC and remove him when his assignment is complete. This has been formalized in the development of the “liveware bus”—soon to be released as a marketable product, the Bus voor Systeem Designers or BSD™.

But the root cause of most SLC problems is that we are attempting to produce deterministic software using nondeterministic development tools—i.e., traditional liveware methods.

The way out. A current proposal advocates development of a “universal programmer” who, ideally, meets the following broad requirements:

- IQ > 150 or, perhaps, < 50,
- at ease with all programming languages,
- portable among all (rational) processors, and
- 100 percent utilizable—i.e., does not “busy wait” to eat, drink, etc.

Clearly, such a development in liveware is beyond the current capabilities of the relevant technologies—genetic engineering, cloning, etc. Indeed, the development time to attain a useful level could be as much as several decades. Furthermore, controlling the optimal usage of liveware (formerly an unstructured allocation process) will require an analogue of Hardware Development Methodology (HDM) and Software Development Methodology (SDM)—i.e., a Liveware Allocation Methodology (LAM).

As a sensible alternative, we propose development of a program to emulate the functions of the universal programmer outlined above. Although such a program would have to be created by a fallible, nondeterministic human programmer, this does not present a severe limitation, since the first task of the program would be to rewrite itself. This process would have to be the first step of an iteration—the bootstrapping being repeated until the level of principal consultant had been reached. The final result—the Deconceptualized Universal Programmer Emulator (DUPE)—could be cast in silicon, a commercially safe exercise since the program is known to be bug-free by axiom.

Research topics. In the above, we have only scratched the surface of the many problems involved in rational software production. One tool undoubtedly required by the DUPE will be the Program’s Worker Bench (PWB), used to test the reaction of imperfect users to perfect programs.

The field of real-time applications is too complex to discuss here in depth, but we mention three areas of current research activity:

1. Concurrent Pascal+. This extends the concept of MONITORS. A monitor can be a person dedicated to the task of ensuring that the liveware does not interfere with the delicate real-time processes.
2. Real-time executioner. This process, invoked by the monitor, can delete liveware which attempts to interfere with the real-time environment.
3. Multitasking. By assigning too many simultaneous tasks to the available liveware, the program can prevent their having free time for interfering with the real-time environment.

The message. The above findings can be summarized as follows:

No software at any stage of the SLC should be seen, touched, or modified by the system liveware.

This conclusion has a major impact on the traditional activities of software houses; unless rational steps are taken, a Software House Catastrophe (SHC) is inevitable.

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In the Limit

From what one reads about IC technology, the 64-bit-word microprocessor will eventually become a reality. If address space keeps pace, a 64-bit virtual address will also be possible.

If world population remains fairly constant (it certainly is not growing as fast as the IC business) and if eventually everyone has a microprocessor, then everyone could share the same address space: 2^33 people, 2^64 bytes (or words or bits if that is the addressable unit) gives 2^31 bytes per person.

In this situation digital communications would become nothing more than transfers from one area of virtual memory to another—assuming that each microprocessor had protection mechanisms guarding against destructive memory-to-memory transfers.

Now, if one packetizes these memory transfers, then each packet becomes nothing more than a memory read or write operation. (One would also want to allow interlocked read/modify/write operations to implement semaphores and critical regions.) Thus, the communications network can behave as a memory address/data busing system. (Packet protocol is simplest if both the to and from addresses are included in the packet. Shorter packets are possible but require overhead of one sort or another. Typically this would be replacing one or both addresses with microprocessor identification numbers and having the referenced microprocessor develop the required address.) Finally, with current fiber optic technology the packets could be serialized and transmitted at memory cycle rates (greater than one megaHz packet rates).

Thus, taken to the limit, distributed processing, digital communications, and shared virtual memory behave as a multiple memory bus, multiple microprocessor network.

It might be wise to consider this the ultimate evolution of packet systems and to design for it:

"Sir, what is your microprocessor ID?"
"AE00F501, why?"
"You are using too much address space!"
"But I traded a mountain cabin for 500M bytes of AE77312C's address space."
"Don't argue with the Authority!"

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