The Open Channel is exactly what the name implies: a forum for the free exchange of technical ideas. Hold your contributions to one page maximum in the final magazine format (about 1000 words—less, if you want to include illustrations).

We'll accept anything (short of libel or obscenity) so long as it's submitted by a member of the Computer Society. If it's really bizarre we may require you to get another member to cosponsor your item.

Send everything to Jim Haynes, Applied Sciences, UC Santa Cruz, CA 94064.

Stack Overflow Dept.

Several months ago a man called me from SDC in New York wanting to know more about the articles we have run on interrupt-less systems. Not having anything readily at hand, I took his name and address for entry into the write-only memory on top of my desk and promised to send something later. The name and address are now gone forever; so, whoever you are I hope you read this.


Pat Skelley and I discussed the possibility of putting on a workshop on interrupt-less systems (he thought plenty of people would come, if only to denounce the concept). We couldn't think of anyone who would be gullible enough to do all the work of organizing the workshop, so that's where it sits.

Personals

B-1700!  
Brian Converse

WANTED: algorithms that run on pocket calculators. Would like to start a newsletter or something to circulate them in. Send to Ira Chayut, 3030 Brighton 12th Street, Brooklyn, NY 11235.

Exclusive! COMPUTER Magazine's Predictions for 1976!

In 1976 we predict that several companies will begin delivering systems made up of networks of microprocessors. These will allow each major element of a system to be more complex in function than has been typical in past systems. Functions which have been performed by software modules in operating systems will be distributed among the system elements, to be performed locally and concurrently.

These systems will work very well until 1978 (one of our consultants will only allow until 1977). Then, one by one, they will begin to collapse. Nobody will be able to fix them. The system manufacturer will say, "But microprocessors are so cheap that we can just pull out the bad one and throw it away!" The service technician will say, "Which one of these 19,572 microprocessors should I throw away?" The customer will reply, "All o' em."

Late in 1978 the company that brought us the 512 x 8 static RAM on one chip will introduce a 512 x 9 bit model. (Look who's discovered parity now!) Nine-bit-wide ROMs will soon follow; and within a year there will be a new microprocessor having a matrix of LED's on the cover that spell out, in appropriate red and green,

I AM

Another COMPUTER Magazine First! (and probably last)

PRODUCT TEST REPORTS

Microcomputer Associates Inc., who market the JOLT system, sent us one of their CPU kits. This consists of a double-sided PC board, a MOS Technology microprocessor chip (MCS6502), a peripheral interface chip (AM1 or Motorola 6820), 512 bytes of RAM (on four 2111 chips, each 256 by 4), a MOS Technology multifunction chip (MCS 6530, containing a 64 by 8 RAM, a 1024 by 8 ROM, a programmable counter, and some I/O port hardware), some ordinary IC's (two lines, and one each of TTL, CMOS, and low-power Schottky TTL), and a small handful of discrete components. Sockets are furnished for the three 40-pin chips and the 2111 RAMs. The ROM portion of the 6530 chip contains a (presumably proprietary) utility program which drives a serial ASCII terminal and allows the user to examine and modify the contents of registers or memory, begin execution of a program at any address, initialize certain RAM locations, handle interrupts, punch a memory dump tape, load memory from such a tape, punch a control tape for a ROM programmer, and use a high-
speed tape reader. A user program can call subroutines located in the ROM to get a character from the terminal, print a character to the terminal, print a space, print a carriage return and line feed with an arbitrary delay, type a byte in hexadecimal, or get a character from a high-speed reader. The user's serial terminal can have a current-loop (20 ma.), EIA (polar voltage), or TTL voltage interface and operate at a speed between 10 and 30 characters per second. (The program, using the programmable counter, measures the terminal's speed on the first input character and takes care of serializing and deserializing thereafter.)

Construction: I spent about half an hour reading the literature that came with the kit, and then an hour of actual assembly time. The assembly instructions will seem sparse to one who is expecting Heathkit-type hand-holding, but they should present no problem at all to anyone who is at all familiar with electronic parts and construction. Fully 10 minutes of the construction hour were spent in trying to coax the three 40-pin chips to bed down in their sockets without curling up their legs. We won't count another 10 minutes after I discovered that in spite of all the markings I had put these three chips in backwards. Some more lost time resulted from the chronic shortage of 25-pin EIA interface connectors around my place; but in this business we learn to be pretty resourceful with a cup-up paper clip. Since my household furniture includes an 8-level Teletype and assorted power supplies, I was ready for testing within 2 hours of opening the kit.

I turned power on, reset, and hit a carriage return per instructions. Instead of getting the register contents typed out I got a continuous typeout of mostly the same letter over and over. Brought the thing down to work the next morning and used the oscilloscope to find that the microprogram was at least going through the right addresses in the loop where it waits for the first character to come in so it can measure the speed. After the carriage return the program is a lot more complicated so I couldn't really tell what addresses were coming up on the bus. Noticed the logic voltage on the signal from the terminal was about 1.2 volts. It was necessary to reduce the value of R13 by about half to get the proper input voltage with a loop-current terminal. Looked at the signal going to the terminal and found much shorter pulses than are appropriate for the bit rate. Left the thing for the night.

Next morning there was some reasonable-looking print on the Teletype and a note from a student that if I would press on certain pins on one of the RAMs it would work as long as power was left on. Pulled the chip, looked at the dubious socket contacts, and scraped and bent the leads. After that it worked OK even if power was turned off and back on. (Student said he had already tried those things, but then everything this guy builds seems to have IC socket problems. Suspect he handles the chips while eating a jelly doughnut.) Has worked fine since then.

I haven't had time yet to try anything other than trivial programs; but the monitor utility seems to work as claimed and makes it reasonably easy to load and run small programs. The literature that comes with the kit is adequate for using the CPU board with a terminal as a stand-alone computer; but to do anything with other peripheral equipment you will need more hardware documentation. This has to be obtained from MOS Technology, or perhaps from Motorola in the case of the peripheral interface chip.

Comments: The two-page ad in the October Computer claims that JOLT is the "world's lowest-cost computer system." Today a claim like that is likely to be obsolete before it gets into print. JOLT is much more than a handful of IC's as they come from the manufacturer, but in its present state of evolution it is less of a system than some of the higher-priced competing products on the market that offer a variety of peripherals. (As advertised, the JOLT family is limited to the CPU board described above, a 4K RAM board, a power supply, a peripheral interface board, and a universal board for the user's own circuitry.) I wouldn't offer such a technically complicated product for home assembly by hobbyists even at three times the price. It's too easy to get eaten alive by the costs of servicing customers whose kits don't work after assembly.

There are quite a few "kits" on the market today, at a variety of prices, from various vendors: IC makers, independent suppliers to the industrial market, independent suppliers to the hobbyist market, and traditional parts distributors. Here are some of the things you can get depending on vendor.

a. Software: cross-assemblers, microprocessor simulators and run on batch computers or commercial time sharing services; assemblers, interpreters, compilers, utility routines that run on the microprocessor system, if suitably configured.

b. Loose parts: a collection of LSI chips and other parts needed to get a microprocessor going without endless shopping around.

c. Packaging hardware: perhaps a universal PC board where you do all the wiring, or a board that provides the wiring for a small processor-memory-peripheral configuration, or a system that could include console panels and cases as well as the means for building an arbitrarily-large system.

d. Engineering: ranging from a schematic showing how to hook up a few parts to make a minimum system to a complete system plan that provides for standard peripherals and software support.

e. Peripherals: ready plug in, in accordance with a set of packaging hardware and a system plan.

f. Complete microcomputer systems ready to plug in and use.

As noted earlier the JOLT system provides for a one-board minimum machine, a power supply, 4K byte memories, a universal PC board, and a utility monitor implemented in ROM. The suggested mechanical arrangement is to stack the several PC boards of a system with threaded metal spacers through holes in the corners of the boards. Inter-board connections are made with flat cable and connectors. There is presently no case, chassis, or front panel with lights and switches. The flat cable bus system and the PC cards save a lot of time in assembly, since it takes just one operation to put a connector on a piece of flat cable and you have 40 wires connected. I suppose
the roughly one-hour job of assembling the CPU board would have taken all day if I had been forced to use hand writing, either soldering or wrapping.

Whether the JOLT machine is the best for your own needs, and whether it is a good value for the price, is something you will have to decide for yourself. If you want to work with the MOS Technology chips and also develop some of your own hardware to use with it, then the JOLT will get you on the air quickly; and the time may be worth a lot of money to you. If you are more interested in a system with a box and front panel, the new Altair kit using the Motorola/AMI chip might be a better buy. But in this product you will have a lot less freedom to tinker with the hardware design and add things of your own choosing. (Also, for some reason, Altair seems to run the chip a lot slower than its advertised capability.) If you don't have a use for the JOLT memories, power supply, or universal PC card, then you might get along with the Motorola kit quite well. It now includes a PC card to build a minimum system and sells for only $149. The limitation here is that the packaging system consists of only one PC card. So far as I know you can't get any others; and while I haven't seen this one, previous experience with Murphy's Law leads me to speculate that it is probably an odd size that doesn't fit into any readily-available packaging system.

If you have or want to develop your own packaging, or if you want to use distributor off-the-shelf universal PC cards and are willing to do all the wiring, there are the Cramer kits. These give you a schematic to go by and save you the agony of having to contact a dozen different distributors to get all the necessary parts. It isn't clear to me, though, what else is in the kit to justify the $500 price tag.

These are intended only as examples; there are many, many things on the market these days in many different price ranges.

My personal reaction is that the JOLT is a nice product, easy to assemble, and pleasant to use. The packaging has some good points, but overall is too primitive for my tastes; and the prices of some items are a little hard to swallow. Like the ad says, I thought the price of $415 for the power supply was a misprint—but probably not in the way the ad writer had in mind. You can still buy a neat little 5-volt, 3-amp supply ready-made by Wanlass or several other firms for 25 or 30 bucks. (The CPU board needs only a single 5-volt supply if you can use TTL interfaces to the terminal; the other two voltages are needed for current-loop and EIA interfaces.) And the universal PC card at $25, plus $40 for a bag of things to connect it electrically and physically to its neighbors seems high-priced in comparison to what you can get from Vector or Vero or others. In any case, we can't complain of a lack of vigorous competition in this particular market (and in power supplies, too).

All this is simply one engineer's experience with one member of a new class of products that are relevant to many of our readers. We want to thank Microcomputer Associates, Inc. for making the hardware available. It is obviously beyond our capability to produce a comprehensive report on the whole field. But with microcomputers proliferating and starting to become household appliances maybe it won't be long before we can read about them in the publications of organizations such as Consumers Union. Meanwhile, visit your local supermarket and flip through the pages of some electronics-hobbyist magazines. You might be surprised.

Recently published books and new periodicals may be submitted for review to the Book Reviews Editor:
Dr. Francis P. Mathur, College of Engineering, Bioengineering and Advanced Automation Program,
University of Missouri-Columbia, Columbia, MO 65201.


Edited by C. Boon, this is one of the latest volumes in the Infotech series of State of the Art Reports. It examines the roles of microprogramming in systems architecture and how these roles are being affected by technological developments.

The organization follows the pattern well established in earlier reports: key extracts from invited papers, conference presentations, and discussions are linked in an editorial framework designed to bring out the essential points and arguments in a systematically readable and digestible analysis. It is followed by the full text of conference and invited papers, and an integrated bibliography.

The analysis section (155 pages) deals with the roles of microprogramming in systems architecture, approaches to microprogrammed control (horizontal and vertical, emulation, high-level language support, operating system support, system maintenance, microcode production, user microprogramming), and finally the influence of technology.

The report observes the since microprogrammed control was chosen by IBM for their System/360 range of machines, micro-