June 1985 Vol. III / No. 6

Jump STRIDE

Artificial Intelligence And The SuperMicro

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Hold 'Em

by Verlene Bonham

Maybe Kenny Rogers said it best, "You gotta know when to hold 'em; know when to fold 'em." From Rogers' fictitious gambler to real life legends such as Amarillo Slim, poker has always been a part of the action of the frontier West. So maybe it's not so unusual that the latest world class poker player was born and bred with good 'ol American high-tech.

While doing some intensive research into games for an upcoming issue, I came in contact with "The Mad Genius Of Poker", Mike Caro. Caro is in the process of converting his poker program, ORAC (Caro spelled backwards), to run on a Stride 440. (No, ORAC is not for sale yet.)

Previously, ORAC resided on an APPLE II. In our discussions, Caro kindly explained to me that ORAC is not a game but a highly statistical set of routines with elements of an artificial intelligence (AI) program. Since this issue's main article was on AI, and I had just done a little brushup on the subject, I was at first sceptical. Moreover, I found that some AI folks state that a program that plays poker on a world-class level can't be written for at least 20 years. Of course, statements like that cause programs like ORAC to get written.

The first time ORAC played publicly, it was matched against world champion Tom McEvoy. McEvoy ran a "semibluff" on the computer betting **all** of his chips on the first two cards. The outcome was then a matter of who drew the best cards, rather than skill. Lady Luck deserted ORAC and it lost.

Next, ORAC challenged two-time world champion Doyle Brunson. Brunson tried the same power play as McEvoy and again the human won. However, Brunson immediately offered a rematch and finally ORAC had a chance to show its skill. After an hour, the computer was ahead with 128 chips to Brunson's 72. The game was called due to time and declared a draw with the advantage to ORAC.

The last event was a head-to-head contest with Bob Stupak, world-class poker player and owner of the Vegas World Casino. ORAC played five hours of No-Limit Texas Hold 'Em for a half a million dollar pot. ORAC lost, not due to any flaw in program strategy, but because the APPLE II locked up in the second critical match. By prior arrangement, if this happened the match would be replayed.

ORAC can play several different card games. In states where it is legal, it plays No-Limit Texas Hold 'Em, a variation of seven card stud. Play starts with two "hole cards" dealt face down followed by a round of betting. Next three cards are dealt face up in front of the dealer. These cards are shared by the players and called the "flop". Again, everybody bets. One more shared card is dealt face up. Everybody bets again before the last shared card is dealt face up. Final bets are made. Each player creates the highest five card hand possible from his two hole cards and the flop. Best hand wins.

Note that the players have four rounds of betting! This is how poker differs from other computerized games such as chess. It is nondeterministic. There are no right plays and no wrong plays. The winning play in one situation would be fatal at another time. Poker has only percentage plays. In the long run, playing the percentage makes money. This is why Nevada casinos are still highly profitable even after paying daily "jackpots."

Unlike the single-hand poker slot machines that have become so popular here in Reno, ORAC plays its own hand against a human opponent. The action includes raising, calling, holding and bluffing. Bluffing? I don't know about you, but I'm willing to grant any program that can bluff a pretty high IQ.

One of the hundreds of factors that ORAC tracks in order to bluff is how aggressive the opponent is on different rounds of betting. As play progresses, ORAC "learns" how to predict his opponent's moves, just as any good human poker player does. When it wins, ORAC "giggles" by flashing its own encoded victory message. When it busts, Mike gives it a little consolation talk on how to handle the pain.

After a little more research (a couple of evenings actually playing No-Limit Texas Hold 'Em with family and friends), I've decided that ORAC really is an AI program. It is written in Pascal, not LISP (the AI language of choice), and uses no advanced AI tools. However, its author is an undisputed "expert" in the domain of poker. Some of the math also looks pretty tricky.

The new port to the Stride 440 is part of Caro's master plan for a new battle. The event is set for late 1985 at the world's largest poker club, the Bicycle Club in Los Angeles. Texas Hold 'Em is illegal in California, so the game will be No-Limit Heads-up Five Card Draw. Two world poker champions have already agreed to participate. Who knows? Someday the best Poker face in town may be a Stride terminal! □

Ed. Note: In addition to writing poker-playing programs, Mike Caro is the author of "New Poker Games," "Caro's Book of Tells" and "Poker for Women."

In Stride

Editor: Verlene Bonham
Advertising: Kate Harper

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Cary Millsap with his booty from Stride Faire '85.

Faire '85 Winner

Cary Millsap went to Stride Faire '85 at the MGM Grand Reno last February to meet some of the Modula-2 speakers and to learn about Stride and the Stride 400 Series. He left with a lot more.

Cary was the winner of the Faire door prize — a Stride 420, with 256K RAM, two floppy drives, and a terminal.

Millsap, who graduated in May from East Central University in Oklahoma, said he will be putting the machine to good use. "When we teach it to speak Modula-2, it will be in for a great many hours of work," he wrote in a recent letter to Stride.

Computers were not available to Millsap while growing up on a farm, so he has only been acquainted with them for about three years. During his second semester at East Central University, he took his first computer course and enjoyed it so much he added computer science to his mathematics major.

Cary has just finished an amazing university program, jam-packed with awards. These included the E.O. Box Memorial Scholarship Award, given to the ECU graduating student of mathematics with the highest grade point average (his was 4.0 —they don't get any higher!), the James O. Danley Memorial Scholarship, the B. Alice Francisco/M.P. Hatchett Scholarship Grant and the Presidential Leadership Grant.

His name appeared four years in a row on the ECU President's Honor Roll. In 1984, he was both the ECU and the Computer Science Department's Student of the Year. That year the U.S. Jaycees named him one of their Outstanding Young Men of America. He was listed in Who's Who Among Students in American Universities & Colleges in 1984 and 1985. Also in 1985, he received the ECU School Spirit Award.

Millsap held office in the ECU Student Chapter of Sigma Pi Sigma, the mathematics and physics club; the ECU Student Chapter of the Data Processing Management Association; and the ECU Presidential Leadership Class. He also was active in the ECU Student Honor Court, the Association for Computing Machinery and the Mathematical Association of America. He was president and co-founder of the ECU computer science club.

Millsap is under contract with John Wiley and Sons publishers as co-author with Jesse H. Ruder of a university-level computer science textbook. The proposed title for the text is ***Business Program Development with IBM PC BASIC.***

While school and computers take most of his time, Cary also enjoys bird hunting and volleyball. He earned a college letter in golf. He shoots in the high 70s with a six or seven handicap.

He will be visiting Richard Wiener and Richard Sincovec in Colorado Springs soon and will then formulate plans for seeking an advanced degree. □

UNIX System V CPU Benchmarks

The UNIX system has been under beta test for the last month and is now in its first release. It's time to talk about performance. Most of the following times were taken on the machines at a UNIX convention. The 400 Series benchmarks were taken here at Stride, in Reno. Note that most of the machines shown also have 68000 CPUs. The MHz column gives the clock rate of the 68000 if this is the case.

Andrew W. Tanenbaum (Vrije Universiteit, Amsterdam) and Teus Hagen (Mathematical Centre, Amsterdam) conducted the actual benchmarks listed below. Their comments provide useful background information:

"UNIX meetings give us a splendid opportunity to run test programs on the machines present at the exhibition. At the recent meetings in Leeds and San Diego, we have run two test programs on a wide variety of machines. The test program measures CPU/memory speed. The program #1 was tested six times, with the 'TYPE' declared in six different ways: short, register short, integer, register integer, long, and register long.

The program:

```
/* Test 1-CPU/memory*/
main()
{TYPE i,j,k;
for (i=0;i<1000;i++)
      for (i=0;i<1000;j++)
            k=i+j+1983;
}
```

"On the small machine, the tests were generally made in single user mode; on the large mainframes, we had to share the machine with other users. The optimizer switch was used in all cases.

"The times reflect a combination of several factors, among them the CPU type, the clock rate, the speed of the memory management unit, the speed of the memory itself, the width and speed of the bus, and last, but certainly not least, the quality of the C compiler used on the machine. Also, the times were obtained using the time (I) command. There is reason to believe that not all vendors understand that 50 Hz!=60 Hz, which makes some of the times slightly suspect."

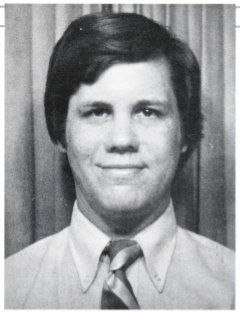
If you decide to run the benchmark on another machine, beware the optimizer switch. There can be cases where the optimizer will remove the code related to the last line of the program (k=i+j=1983) since the optimizer may detect that k is not referenced elsewhere. To check if this is the case, rerun at least one set with the last line left out and compare the results with and without the k terms.

Stride benchmarks were taken on a multiuser UNIX System V in one wait-state memory at Stride in Reno with the optimizer switch on. □

Times are for "usr" in seconds.

MACHINE	MHz	short	reg short	integer	reg integer	long	reg long
VAX780	--	8.8	8.6	6.7	4.7	6.7	4.7
VAX750	--	18.9	19.3	13.0	8.5	11.6	8.6
VAX730	--	37.4	37.5	23.9	14.4	24.1	14.6
AED511(/23)	--	34.5	14.9	34.6	14.9	72.2	72.2
MICR011(/23)	--	36.8	16.2	36.9	16.2	76.8	76.8
Stride**	10.0	9.7	4.4	13.1	6.7	13.1	6.7
WorkForce1250*	12.5	9.9	5.6	11.6	4.9	11.6	4.9
WorkForce1250**	12.5	11.3	6.4	13.0	5.7	13.0	5.7
PARALLEL	10.0	11.6	7.0	13.5	6.7	13.5	6.7
FORWARD	10.0	11.9	7.0	13.6	6.8	13.6	6.8
CADMUS 68030	10.0	12.0	5.8	12.1	5.8	17.2	8.2
SUN	10.0	12.0	6.9	13.8	6.5	13.8	6.5
SUN W/SMD	10.0	12.0	6.9	13.8	6.5	13.8	6.5
GOULD 3000	10.0	13.1	7.4	15.7	6.9	15.7	6.9
PIXEL 100/AP	8.0	13.2	8.3	14.9	8.0	14.9	8.1
ALTOS	8.0	13.9	13.9	13.9	13.9	17.8	17.8
MSC	12.5	13.9	7.9	13.6	6.9	16.1	6.9
CYB	8.0	15.3	9.0	15.3	8.2	17.5	8.2
CODATA	8.0	17.1	10.5	19.3	10.5	19.3	10.5
PACIFIC	10.0	18.1	10.7	20.7	9.7	20.8	9.7
NCR 1632	10.0	18.9	10.8	21.6	9.3	21.7	9.3
HAWK 32/E	8.0	19.0	11.3	21.5	10?3	21.5	10.3
CORVUS	8.0	19.8	11.6	22.5	10.1	22.6	10.1
POWER 520	8.0	21.1	9.2	20.7	9.2	31.4	12.5
FORTUNE	8.0	21.7	12.8	25.0	12.4	25.0	12.3
APPLE UNISOFT	5.0	22.6	13.7	25.9	12.1	25.9	12.1
APPLE XENIX	5.0	22.7	13.9	26.0	13.0	25.9	13.0
CADMUS 68000	10.0	24.5	11.9	24.5	11.9	33.0	15.1
WICAT WS150	8.0	24.8	14.4	28.1	13.1	28.1	13.1
TRS80	8.0	25.2	14.9	28.3	14.0	28.4	14.2
ALTOS 12	5.0	26.7	14.1	26.7	14.1	53.7	53.9
DUAL	8.0	26.9	15.6	30.7	13.3	30.7	13.3
CH RIVERS	8.0	28.2	15.8	31.7	15.8	31.7	15.8
UNISTAR 200	8.0	28.7	16.5	32.8	14.3	32.8	14.3
IBM PC XENIX	8.0	30.3	17.6	34.2	17.3	35.1	16.9
COSMOS ANT.	8.0	34.1	19.5	38.7	16.4	38.7	16.4
ULAB	8.0	37.2	21.0	44.1	18.9	44.1	19.0
IBM PC IDRIS	8.0	37.9	22.7	37.9	22.7	73.3	73.3

* zero wait-states ** one wait-state



Structured Analysis With BUBLED

by Tom Bartolac

In recent years, we have witnessed the growth of computer programs. Now they can be huge software systems, written by teams of programmers over many months and years. The cost of writing such a program can easily exceed the cost of the computer it will run on, and maintaining the software over its useful life can be several times more expensive than the original cost of writing it!

To manage such complex projects, it is necessary to adopt a methodology that imposes a structure on the programming process. One successful technique, popularized by Ed Yourdon and Tom DeMarco, develops the software in three phases. The analysis phase determines what the software will do. The design phase determines how the software will do it. And the programming phase produces the program that does it.

Each of these phases are conducted according to a particular methodology, or set of rules. Structured Analysis, as described in Tom DeMarco's book, ***Structured Analysis and System Specification*** (New York, Yourdon Press, 1978), has the analyst describe the software in terms of a set of Data Flow Diagrams, a set of Mini-Specs and a Data Dictionary.

A Data Flow Diagram (DFD) is a graphical depiction of the software represented as data flowing among processes, stores, sources and sinks. Figure 1 shows a typical DFD. The ovals, or "bubbles" (DFDs are often called "bubble diagrams"), are the processes; the "arcs" are the data flows; the "boxes" are the data sinks and sources; and the pairs of horizontal lines, or "files", are the data stores.

DFDs are related as in a tree hierarchy with each bubble in a DFD at one level represented as a complete DFD at the next-lower level. The top-level DFD, or context diagram, shows the overall function of the whole program. The bottom-level DFDs are comprised of primitive bubbles which cannot be decomposed further.

Each primitive bubble is described with a Mini-Spec. This defines in structured English what the primitive bubble does, and how its inputs and outputs are related.

Furthermore, each data flow, data sink, data source and data store is defined, also with structured English, in the Data Dictionary.

A properly analyzed software project will produce a set of DFDs, their Mini-Specs and a Data Dictionary that are self-consistent.

Generating and maintaining the DFDs, Mini-Specs and Data Dictionary, as well as making sure that they are self-consistent, is tedious if done manually. Fortunately, several computer-based tools recently have been developed to support Structured Analysis.

The simplest tool is a standard editor adequate for handling the text-based Mini-Specs and Data Dictionary. However, an editor will not provide any support specific to the Structured Analysis technique.

A Data Flow Diagram (DFD) is a graphical depiction of the software, represented as data flowing among processes, stores, sources and sinks.

A more powerful approach is to represent the information contained in the Mini-Specs and the Data Dictionary in the form of a database. Then the structure and capabilities provided by the database manager can be adapted to support consistency checks.

However, without an automated drawing tool, the analyst usually draws the DFDs manually using paper and pencil. In this form, the DFDs are cumbersome to maintain. Also, because the information they represent is not part of the database, global consistency checks that include the DFDs cannot be made.

To be effective, an automated drawing tool must provide the analyst with the ability to draw and maintain DFDs in their graphical form as easily as an editor manipulates text. And it must make the information contained in the DFDs subject to the database manager's consistency checks.

BUBLED (pronounced "bubble ed") from Sur Software is an automated drawing tool that does both. BUBLED is object-oriented; it works directly in terms of arcs, bubbles, boxes and files. Using a graphics terminal, the analyst can easily draw and manipulate

BUBLED is object-oriented; it works directly in terms of arcs, bubbles, boxes and files.

DFDs by interactively adding, changing and deleting the objects in the DFD. BUBLED frees the analyst from having to worry about the details of how the objects are drawn.

For example, to add a bubble, BUBLED prompts the analyst for the bubble's number, name and location on the screen. BUBLED automatically determines the size and shape of the bubble, and draws it centered on the specified location. Boxes and files are similarly added.

To add an arc, BUBLED prompts the analyst for the arc's source and destination objects, its optional name and the location of its "steering point". BUBLED automatically draws the arc as a smooth line between the boundaries of the source and destination objects passing through the (optional) name centered on the steering point.

The analyst can change an object by selecting it with the cross-hair cursor. BUBLED redraws the object with a dotted line to highlight it and then prompts for which of the object's characteristics to change. For example, to change a bubble's location, the analyst merely moves the cross-hair cursor to the new position; BUBLED automatically redraws the entire bubble at its new location as well as all arcs connected to it.

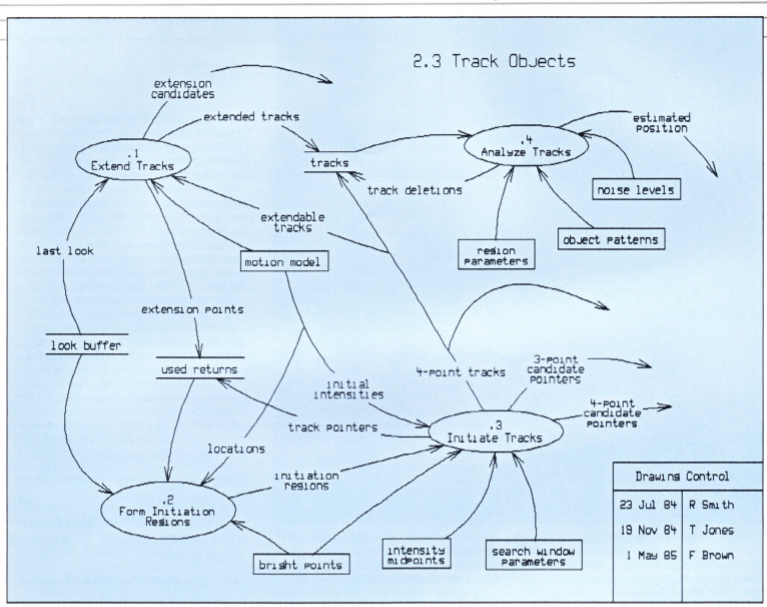


Figure 1: This is an actual output from BUBLED drawn in less than 35 seconds.

Objects are deleted by just selecting them with the cross-hair cursor. They are immediately erased from the screen.

For each DFD, BUBLED keeps in the analyst's directory a data file which defines the DFD in terms of its objects. A DFD being composed on the screen can be saved at any time, and at any time an old file can be called up for modifications.

In this form, BUBLED is an "independent" automated drawing tool. It is designed to understand the objects in a DFD, but it doesn't understand the relationships between DFDs. However, it is possible to merge BUBLED with the database manager being used to support the Mini-Specs and Data Dictionary making it part of an "integrated" Structured Analysis tool.

With a simple utility program, the information contained in the DFD data files produced by BUBLED can be extracted. Then, using the facilities of the database manager, the information can be merged into the associated Mini-Specs and Data Dictionary database. The database manager can then perform consistency checks across the entire set including the DFDs.

Sur Software can provide XTRACT, the first half of this utility program. Available in source form (FORTRAN), it will read the DFD data files, making accessible the information that defines the DFD. The analyst, knowing the specific details of the database manager being used, would write the second half of the utility program to merge the DFD information into the appropriate Mini-Specs and Data Dictionary database.

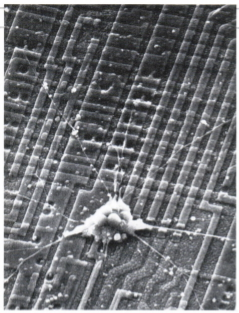
Both BUBLED and XTRACT run on the Stride/Sage computers under the UCSD p-System. BUBLED executes quickly with a minimum of disk swapping. The DFD shown in Figure 1 was read from a floppy in 15 seconds and drawn on the screen in 35 seconds.

BUBLED uses the Selanar HiRez-100 graphics terminal to represent DFDs. This terminal's outstanding resolution (1024 by 768) results in attractive, uncluttered DFDs. Identical in appearance to Qume terminals, the HiRez emulates the ANSI-standard VT-100 and the Tektronix 4014 graphics standard.

BUBLED can produce printed copies of DFDs by dumping the terminal's graphics screen to a locally connected printer. The terminal recognizes the DEC LA-100, the Epson FX-100, the HP-GL interface and a user-definable printer protocol. These hardcopies are suitable for program documentation or viewgraph presentation.

With BUBLED, an analyst can conveniently create and maintain Data Flow Diagrams. And with XTRACT, BUBLED can be combined with a database manager to provide an integrated set of tools that completely supports Structured Analysis. □

Ed. Note: Tom Bartolac is a co-owner of Sur Software. Those interested in BUBLED or XTRACT can contact Tom or his partner Marie Trisler at Sur Software, PO Box 772, Duarte, CA 91010. (818) 359-8782.



Pictured above is a micrograph of brain cells grown in tissue culture on a Motorola 68000.

Artificial Intelligence And The MicroComputer

by Bill Meakin and Carol Joynson

Artificial Intelligence (AI) is a field of computer science primarily concerned with research into symbolic non-algorithmic reasoning processes, that is, programming the computer to think like a human. As the hardware of a computer is quite different from that of the human nervous system, most AI programs can only mimic human abilities such as reasoning and sensing. However, recent developments in AI, specifically the technique of **expert systems** have very immediate and practical applications. AI is no longer solely the domain of Universities and government research; a large and growing interest is developing within the business community.

Market forecasters are prophesying an expansive market for AI-related products. From $70 million in 1984, the market is expected to reach $100 million in 1985, rising to $2.5 billion by 1990. The media are giving more and more coverage to AI-related subjects. For example, The *San Francisco Examiner's* Sunday Business section (Sept. 9, 1984) had a banner headline reading "High IQ computers hit hi-tech market." ***Fortune*** magazine proclaimed AI "The next revolution in computer programming" (Oct. 29, 1984).

EE Times (April 29,1985) indicated that governments alone are expected to pour more than $8 billion into such programs as the United States Strategic Computing Project, Japan's Fifth Generation Project and the European Common Market's Esprit effort.

A report that appeared in the Sept. 15, 1984 ***Datamation*** suggested that the largest business computer supplier, IBM, is not interested in this marketplace! IBM figures indicate only a paltry $5 billion turnover by 1990. However, IBM did attend the AAAI Show in Austin, Texas (August, 1984) and announced a version of LISP, at $6,550, and a prototype expert system designed to assist computer operators. It appears that IBM is not going to ignore AI entirely.

Why AI?

Traditional (algorithmic) programming languages limit the level of sophistication of the applications that programmers can actually write. A bottleneck in cost and time spent develops as the programmers struggle to do complex tasks with simplex tools. The tools and development methods provided by knowledge-based expert systems, or knowledge engineering, represent a qualitive leap forward which may circumvent this bottleneck.

Expert systems currently require a lot of memory and a lot of processor power. But memory and processor power are becoming cheap. Over the past twenty years, the industry has moved from expensive mainframes to smaller minis and now to affordable desktop micros.

The main effort in AI reasearch has been to construct intelligent, reasoning programs. An important observation that has come out of this effort is that the performance of an intelligent program is dependent on the knowledge it possesses rather than the particular type of inference mechanism or theory it uses.

An expert system is based on a data base of domain-specific knowledge. A "domain expert" is simply a person who is expert in the subject (domain) being studied. He is not generally the programmer. A "knowledge engineer" translates the domain expert's knowledge into computer code or into a definition for other computer specialists.

An expert system contains a set of inference rules or mechanisms. The system follows these rules using problem data and information from the knowledge base, to arrive at its final conclusions. It also uses a set of heuristics. These are rules of thumb derived from the human expert, to augment the inference rules. The rules of an expert system are not exact in the way rules of arithmetic are. Generally, a rule is given a "confidence factor". The most common use of such a factor is in weather reports, where the weatherman may predict "an 80% chance of rain." Expert systems are proving to be much more reliable than the weatherman, however.

In a period of only three months, our group at Metacomco built a prototype expert system to diagnose plant disease.

It is important but not essential to be able to add to the data or the heuristics, as well as to have the system justify its conclusions, so that the user or builder can correct the system's reasoning when necessary.

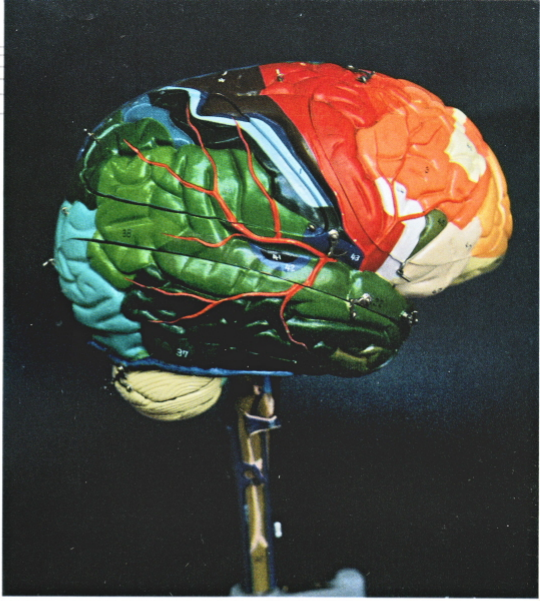
Knowledge based systems have been built that exhibit performance equivalent to human experts in certain domains of knowledge. **Prospector** (SRI International), which considers geological data and sug-

```
                    Building Expert Systems

              Knowledge = Facts + Beliefs + Heuristics

    Success = Finding a useful answer with the resources available
              Search efficiency directly affects success

Aids to efficiency:     a) Applicable, correct, discriminating knowledge
                        b) Rapid elimination of blind alleys
                        c) Elimination of redundant information
                        d) Computer power
                        e) Multiple, co-operative sources of knowledge
                        f) Reasoning at various levels of abstraction

Sources of difficulty:  a) Errorful knowledge
                        b) Dynamically changing data
                        c) The number of possibilities to evaluate
                        d) Complex procedures for ruling out possibilities
```

gests where to drill test bores, reportedly has discovered a molybdenum deposit of considerable value. **R1** configures VAX equipment for customers at DEC. **MYCIN** diagnoses and recommends treatments for infectious blood diseases.

The examples above are complex systems with large databases. Their knowledge representation to inference mechanisms (the rules the systems use to draw conclusions from their databases) are the results of several years of research. But as a result of the tools and methods spawned by these and similar efforts, today one does not need a major research effort to build a prototype or demonstration system for a small and clearly defined knowledge domain.

In a period of three months, our group at Metacomco built a prototype expert system to diagnose plant diseases. We demonstrated this here last year with excellent results. Those who tried it were interested enough to spend a lot of time playing with it. There were obvious omissions, such as a good plant finder. A plant finder is a dictionary to help identify the plants by their physical characteristics. The expert system did assume a certain amount of technical knowledge in the user. We subsequently added a plant finder and the program did exhibit useful diagnostic behavior.



This highly colored brain model was photographed at the University of Nevada Medical school. The human brain weighs about 3 lbs, a Stride 440 about 30 lbs. The number of nerve cells (neurons) in the brain is on the order of 100 billion. By contrast, the Motorola 68000 chip has only about 70,000 transistors and the MC68020 has about 200,000.

Your Own Route To AI

The best way to find out how to build an expert system is to build one. The first step is to identify your domain. The domain should be one that is easy to define and relatively small. Expert systems are only as good as their knowledge bases. If you don't have access to someone who knows a lot about the topic, pick another topic. In the United Kingdom, some manageable domains might be tax planning, agricultural land utilization or dairy herd management. The government of the UK has commissioned an expert system for installation in offices of the Department of Health and Social Security to help workers through the complex welfare claims procedures.

Next, you will need to obtain a suitable tool. Three basic classes of tools are available, the first class is general purpose programming languages such as LISP. LISP is a symbolic manipulation language that has been around for more than 20 years. It is commonly in use in the US academic community and is the language in which many higher-level tools have been implemented. A large body of public-domain software has been implemented in LISP in the United States, for which the codes can be obtained. Over the next six months, Metacomco plans to obtain and implement some of these programs on Cambridge LISP.

The next class of tools is the rule-based programming languages, such as OPS5. Designed for AI and cognitive psychology applications, OPS5 was the tool used to create R1, the VAX equipment configuration program. One of the benefits of OPS5 is that the rules to allow the programmer to represent symbolically the relationship between data items are already created, but none of the symbols are predefined. The recognize/act cycle is the simple loop on which OPS5 operates. An OPS5 program consists entirely of conditional statements called "productions." The productions operate on expressions stored in a global data base called "working memory." A production contains two parts: a set of conditions and a set of actions. If all the conditions are true simultaneously, then the actions are executed in sequence.

The third class of tools is the skeletal systems derived from earlier expert systems. EMYCIN, for example, was derived from MYCIN and can be used to build a diagnostic system. Essentially, the inference engine is provided, and only the knowledge base and heuristics particular to the new knowledge domain need to be added to create a new application.

One of the best ways to build your own expert system is to follow an example: obtain a source and examine it. Metacomco plans to obtain and catalogue public domain software implemented in LISP; we would be pleased to distribute this catalogue to interested parties. □

Ed. Note: Bill Meakin is the president of Tenchstar, Inc., a business that began about a year ago. He is also technical director of Tenchstar, Ltd. of England. Carol Joynson is a freelance writer. Copies of the above mentioned catalogue can be ordered from Metacomco, 201 Hoffman Ave., Suite 12, Monterey, CA 93940. (408) 375-5012.

The micrograph of brain cells grown in tissue culture is available as a museum-quality poster. For ordering information call (713) 526-9617.

Customer Service

Static

We've found an inexpensive way to treat carpets to prevent static buildup in the office. Spray the carpet about once a month with a mixture of one part Downy to one part water. This has been working well for several months so we thought we'd pass the tip along.

Multiuser on the 420

The 420 floppy based system can be configured to support two users. This is useful, especially when the second user is in background mode and is really just a second task for the operator. The documentation does not make it clear that a configuration file, CONFIG.420, has already been built for the 420 and is distributed on the UTILITY disk. Page 460 of the Owner's manual (Feb., 1985) describes more about 420 multiuser operation.

Idris

An EMACS message in Idris may say that you have the wrong terminal type or an unknown terminal type. This indicates that the environment variable TERM is not set correctly. Have your system manager change the **/etc/ttytype** file to identify your type of terminal for your port.

Timberline Spreadsheet

To run Timberline Spreadsheet on a Stride (Wyse WY-50) terminal, use only TV925 mode. The spreadsheet "spec" file for the WY-50 mode is not available yet.

DBMaster

The DBMaster demonstration program (part number SF0149A) currently works only on 400 series, not on the Sage. Stride hopes to have a Sage version soon.

Mix and Match

The number one mistake most users have been making lately has been to mix system files from different versions. Now, it may be fun to mix & match clothes, cars, recipes, furniture, etc., but this technique fails miserably with software. Please be especially careful when you next build a system.

Smart Cursor

The Stride terminal (Wyse Wy-50) does not always display the cursor at the new position for each character typed, depending on how fast the characters are coming in. This is why the cursor will appear to "hop" around the screen on some programs such as ASE. At higher baud rates, such as 38.4K, this is a definite advantage, allowing the terminal to keep up with massive data inputs.

International In Stride Subscription Policy

In Stride is now available to international users by direct subscription. Outside the United States of America, the magazine is handled by Stride's International Distributors. Some of the distributors reprint the magazine in the language of their country and add or delete material to meet the needs of their special markets. Those overseas users who wish to receive the original domestic version can now get a subscription directly from Stride Micro.

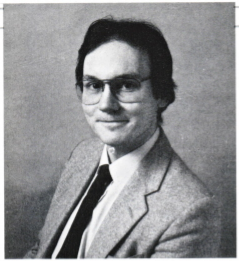
An international subscription (12 issues) is $36 USD. Domestic (USA) subscriptions are $24. If you include the serial number of your machine, the price is reduced: the International cost is $12 and there is no charge for domestic subscriptions with the serial number.

Send check or money order with your name, address and phone number to:

Editor, In Stride, Stride Micro
4905 Energy Way
P.O. Box 30016
Reno, NV, 89520-0016 USA

Our English version of In Stride is translated by some of our international distributors into other languages.

The serial number of Sage II's and IV's is found on the bottom of the machine. On the 400 series, look at the back panel. □



The Multiuser Mirage Operating System

by David Eastwood

Mirage, a multi-user operating system for the 68000 family of processors, was written by a United Kingdom software house — Swifte Computers — and is marketed exclusively by Sahara Software Ltd. of London.

Since most Sahara clients use their computers as business tools rather than as tools for software development, certain considerations were important to Sahara when they looked for an operating system.

Performance

On a given machine, the operating system must provide the best performance possible. Typical Sahara business sites have four users or more per system and possibly some background jobs. Under those circumstances, multiuser throughput and response of the system is paramount. Sahara Software evaluated several multi-user operating systems, specifically UNIX, and while single user speed was adequate, severe performance degradation occurred with even a small number of users. Unlike most UNIX systems, Mirage and its utilities are written in assembly code which minimizes overhead and increases each user's performance.

Portability

The software portability question was also a key factor in their selection. The "supermicro" market appears dominated by the 68000 processor — some 60% or more of such systems sold last year used the 68000 (the nearest competitor was Intel with 17%). Given this, one might assume that portability at the 68000 machine code level would be all most people need. However, "C" is usually proposed as the mechanism for arriving at truly portable code, although in this context portability means "90% of the code is compatible at the source code level." Sahara decided "C" was not the answer and chose two other ways to provide a measure of portability.

First, where a recognized standard for a language exists, the company tried to ensure that the Mirage version of that language adheres as closely as possible to that standard. Source code from other machines, for example mainframes, is then easily compiled again under Mirage. This approach has worked well with Sahara's FORTRAN and APL.

Second, once compiled, Sahara felt that applications should be portable at the object code level between all systems running Mirage. This was done successfully. User programs can move between all Mirage systems even accommodating hardware floating point units (if appropriate) without recompilation.

Mirage Overview

Mirage is written in 68000 assembler, resulting in a fast, compact system. Mirage will typically require some 40K of RAM.

Hardware independence is achieved via a system of "device drivers" through which all environment-specific calls are made.

A memory-management unit is not necessary, although these devices are supported.

A networking capability is built into the operating system at the lowest level, allowing genuine networking support.

The support programs available for Mirage offer a full range of facilities such as a full screen editor/word processor, macro assembler, diagnostics aids, print spooler and more. In total, these utilities require under 1M byte of disk space. It is feasible to run a multiuser Mirage system on a 128K, floppy disk based micro!

A networking capability is built into the Mirage operating system at the lowest level, allowing genuine networking support.

Applications programs which run under Mirage are portable at the object code level across all systems which run Mirage. In most cases, Sahara insured that the same floppy disk format is used to allow easy transfer of data.

Mirage is a reasonably mature product, the first installations having taken place in 1981.

Those familiar with other operating systems will find that Mirage is closest in style and features to the Alpha Micro Operating System (AMOS) and to the DEC RT11 operating system.

Device Drivers

All hardware related calls made by Mirage or by Mirage programs are routed through one of five types of driver:

Clock Driver
Device (or Disk) Driver
Terminal Driver
I/O Board Driver
Node (or Network) Driver

These drivers ensure that Mirage programs can be written so that they are easily portable from one system to another. Porting Mirage to a new computer is a matter of rewriting these drivers for the new machine.

When first started, a Mirage system has information about a System Disk and a System Console. Further disks, terminals and jobs can be easily declared by a series of Mirage commands or by running a text Configuration File which has been stored on disk.

Two of the drivers are worth studying in more detail:

Terminal Drivers

All terminal I/O is passed first through an I/O Board Driver and then through a Terminal Driver. The Terminal Driver will take care of all screen handling, if required. The user makes a series of Terminal calls to perform such activities as cursor addressing, setting screen attributes and color selection. The photograph shows a short program will run in BASIC which carries out some screen control. This program will run on ***any*** terminal attached to a Mirage system without any rewriting or recompilation. If a terminal cannot support any call, it will ignore it.

Color support is already built into the drivers. Sahara felt the use of color terminals will become more and more prevalent in the near future and most Mirage utilities are being recoded now to provide full color output.

The photo shows an example of a Mirage color screen. Written in Swifte BASIC, only 10 or so lines of code are needed to display

Only about 10 lines of Swifte BASIC were needed to create this example of a MIRAGE color screen.

the screen. By using a single BASIC keyword CRT, the user can address a number of terminal functions such as color selection. For example, **CRT-2** followed by another number selects one of 8 foreground colors, or when followed by two positive numbers positions the cursor at the xy co-ordinate specified by those two numbers.

Networking

The machines which run Mirage are usually in an office environment, where a number of similar systems are active in the same building. Networking is easy for the user as it is supported at the lowest level of the operating system. All files have a specification which includes a NODE Name as well as the usual Disk, Directory, Name and Type information. With suitable networking hardware, such as Omninet or Ethernet, the user can access files on any system in the network without restriction. Mirage offers a true networking capability — with each user on each machine being able to access all files on any machine in the network.

File protection and locking are maintained in the network. Given machines also can restrict network access if desired. A Mirage network can function with different protocols in use at the same time. For example, a network can be run with both IEEE488 and Ethernet networking in use. So long as at least one machine has an interface to both protocols, any file requests can be automatically routed from the IEEE488 network to the Ethernet network.

Languages

The compilers available under Mirage are: BASIC, Pascal, and FORTRAN. There is a very popular APL Interpreter, one of the mainstays of Mirage.

All the compilers generate 68000 Assembly code and can use the full address range of the 68000. With the exception of BASIC for which no generally agreed standard exists, all languages are designed to adhere as closely as possible to some relevant standard. For example, the FORTRAN has been tested and certified by the British National Computer Centre as being a true FORTRAN 77 implementation. The validation suite run by NCC is done in cooperation with the Federal Software Testing Center in Washington, D.C. The APL is a superset of the current IBM APLSV specification.

Applications

Mirage systems have been in service since late 1981 and there are now several hundred systems running Mirage. Most sites are in Europe, although there are a number of North American installations.

Users have tended to be large multinational companies using systems for management information systems and research work, with a large number of users operating in the financial markets. The spread of applications software has meant that many smaller companies are now using Mirage systems for their general accounting work. □

Ed. Note: David Eastwood is the Managing Director of Sahara Software. For more information contact Sahara Software Ltd., Unit 1F, Tideway Industrial Estate, 87 Kirtling St., London, SW8 5BP, England. 627-1733. Telex 541 896885, Ansbk IOTA G. Or the main USA outlet is Integrated Electronic Technology, PO Box 135 Penndel, PA 19047. (215) 752-4100.

Q&A

Can I have multiple configuration files on my multiuser?

Yes, if you don't name them MU.CONFIG, the system will ask you for the name of the configuration to use. Your hard disk partition sizes cannot change, however.

Will the graphics work under the Stride Multiuser?

Multiple graphics boards are not supported. One user can access a single graphics board, but there is no mechanism to share a graphics board among users.

How many users can you effectively have under the BOS operating system on a Stride 400 machine?

16 terminals in business application environment is a real possibility.

How much RAM does each user need with the multiuser BOS operating system?

The operating system takes about 32K bytes and each user takes up to a maximum of 55K bytes.

How close is BOS/MicroCOBOL to ANSI-standard COBOL?

MircoCOBOL supports the normal verbs and commands of ANSI-standard COBOL but goes beyond so as to allow screen editing, do loops, internal sorts and other programmer aids which allow programs to be written quickly.

I turned the RAMDISK initialization flag on in multiuser, but the RAMDISK was not there when I booted. Why?

Put the file MU.BOOTEXT.CODE on your multiuser partition. That will zero the RAMDISK if the flag is ON. Also, make sure device 11 is mapped to 11 in each user channel map that will be using the RAMDISK. All the files you wish transferred to the RAMDISK must occur before ENDBOOT on the multiuser partition.

File USER.BOOT.CODE must be on the multiuser partition in order for a user to boot to it. For a user to boot to RAMDISK, file RAM.BOOT.CODE must be on the multiuser volume. For the p-System, these last two files are simply a copy of MU.PBOOT.CODE.

Why does my system lockup when I turn on Exclusive Control for a device in the multiuser BIOS?

Generally, don't use Exclusive control without "Hang and Wait" and a timeout greater than zero. For hard disk access, 1-5 seconds is typical. For the printer, try 15-20 seconds.

If you use Exclusive Control without a timeout greater than zero, your programs must send a special call to the BIOS to release control when they are done. Otherwise, the first user task to access the device gets control forever. The other users will get an error message if they try to use the device. The error message depends on the program being run.

"Hang and Wait" works this way. One user gets control of a device by reading or writing to it. The multiuser system starts a timeout from his last access. If this user again accesses the device before the timeout occurs, he retains control and the timeout is reset. Once the timeout occurs, control is given to the next user who requested access to the device. This means that if the device is already busy when a user needs it, that second user "hangs and waits" until the first user is done. No error messages are returned.

My multiuser system seems to take forever to boot up. What can I do?

The most common problem is having the second floppy drive enabled on a single floppy system. Use MU.UTIL to set it to "No drive equipped".

Another culprit is "Hang and Wait". On boot, all users check all the volumes. If a timeout of 5 seconds is set, then your boot time takes an extra 5 seconds for every user for that device. If you have several devices setup this way, it really stretches out. Try turning off Exclusive Control and Hang and Wait to devices that are easy to share with human courtesy such as the floppy disks and printers. This is dangerous! You will also find that a V(olumes listing will take less time.

Also check for user boot delay again with MU.UTIL. Boot delays are no longer needed in most applications. ☐

New Product Releases

FORTRAN and Pascal for UNIX

FORTRAN 77 and a UCSD compatible Pascal from Silicon Valley Software are now available for the 400 Series UNIX. Contact your Stride dealer.

Kermit

The Kermit communications program is now available in source as a non-supported product from Stride. Kermit is a widely used program for transmitting files between different computers and operating systems. This p-System version will talk to almost any other computer over an RS232 line or modem if the other computer also has a Kermit. The implementation was done by Steve Pacenka, based largely on work by Kate MacGregor of Cornell Computing Services.

Error Free Transmission

A new Hayes-compatible modem product line by Microcom provides MNP (Microcom Networking Protocol) for any RS-232 port. Shortly, a MNP gateway into the IBM PCNET will be available. This protocol is already supported by GTE Telenet, UNINET and GEISCO. Both 1200 and 2400 baud models are available from $499 to $999. These modems are V.22 bis, Bell 212A AND Bell 103 compatible. Contact Jim Schneringer, Flaire Data Systems, 5962 Royal Lane, Suite 156, Dallas, TX 75230. (214) 696-2650.

Windows for C

Windows for C™, from Vermont Creative Software, allows you to easily and quickly incorporate windows in your Stride software. Features include unlimited windows and files, popup menus and help files, word wrap, horizontal and vertical scrolling, read and write functions, plus complete building block subroutines. It may be configured for any terminal. The object code version required to work with Digital Research CPM-68K C compiler is $495. Source code is available. Vermont Creative Software, 21 Elm Ave., Richford, VT 05476. (802) 848-7738.

Modula Bugs

Modula Assured Quality Software will begin publication in August of QAN, the ***Quality Assurance Newsletter*** which will contain bug reports, bug fixes and new release notices dealing with Modula software. Subscription rates will be $25 per year for the quarterly edition only or $50 for the product-specific, monthly QAN as well. QAN will pay for any reports used. Modula Assured Quality Software, 6521 Raymond Street, Oakland, CA 94609. (415) 658-3797. Telemail RKarpinski.

EMACS Editor For UNIX

The popular EMACS editor has been released for Beta sales. Stride part numbers are:

DK0116A UNIX EMACS editor
DK0117A UNIX EMACS database

Longer Video Cable

In response to the many requests for this feature, a longer cable for the video board is now available. Stride part numbers are:

CC0170A 5 ft. graphics cable
CC0171A 10 ft. graphics cable

In order to get the longer cable to work, modifications had to be made to the video board. The longer cable cannot be used with boards before BD0016A.

ASE for IV.2x p-System

An updated version of the popular editor ASE is now available. Version 1.0 (previous release was 0.9q) runs under the new p-System version IV.20 and IV.21. Updates are available from Volition Systems, 490 Fanuel St., Suite #208, San Diego, CA 92109. (619) 270-6800.

Return the original diskette with your check for $25 and state which version of the p-System and which computer you need the ASE for. The update offer is available until the end of May 1985.

Jonelle Lewis

Ian Setterfield

Jonelle Lewis, the accounting manager here at Stride has a cheery smile and the patience of Job when it comes to explaining accounting procedures to those of us who aren't familiar with them. Jonelle is responsible for Accounts Payable, Data Entry and cash planning. Cash planning is a very critical area. It means that after consulting the right folks and determining what is going to be shipped, Jonelle formulates a plan on how that money should be spent.

Lewis has been with Stride for two years, having moved back to Reno from the Bay Area. There she was the Corporate Accounts Payable manager for Memorex. Immediately before coming to Stride, she was the business manager for Walt Collin, Inc., a restaurant firm. She has her associates degree in accounting from West Valley College.

Jonelle spends much of her free time involved in family related activities. Her two children, ages one and three, keep her busy. She and her family travel to the Bay Area three or four times a year to visit grandparents.

Ian Setterfield is another ex-Bay Area resident now at Stride. Ian is an electronic technician in Stride's factory. His main responsibility is repairing Controller and CPU Boards that have been through initial testing.

Setterfield got his associates degree in Electronic Engineering Technology from the Heald Institute in San Francisco while he was a restaurant manager at Pier 29 in Oakland. Two months before his graduation from Heald, his wife was offered a good career opportunity in Reno. So after graduation, he followed her here. He worked at Nevada Novelty before coming to Stride.

Ian calls himself one of the most optimistic people at Stride. He wants to see the company gain a place as a major competitor in the market.

A family man, he takes great pride in his son who was born in January. Ian likes to spend time working and improving his home which sits on a half-acre lot at the base of Peavine Mountain. □

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