Volume 4 Number 1

Summer 1989

microware®

PIPELINES

Covering the Full Spectrum of OS-9 News and Applications

MICROWARE IS GROWING!

ALSO IN THIS ISSUE:

PIPELINES

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A NOTE TO OUR READERS

As with every issue of **PIPELINES**, we would like to solicit for publication any interesting OS-9 application articles or useful utility programs. Please address all correspondence to the Editor of **PIPELINES**, c/o Microware Systems Corporation or call Steve Simpson at 515-224-1929.

NOTICE

In past company publications and software documentation, Microware has referred to a facility that eliminates the necessity of reloading a terminated program module as a "ghost module". It has recently been brought to Microware's attention that the term "GHOST" is a trademark of GIMIX, Inc. of Chicago, Illinois. In all future references to this facility, Microware will now use the term "sticky module" and will no longer use the wording "ghost module". Microware regrets any inconvenience this may have caused to any and all concerned parties.

MICROWARE IS POISED

Perhaps the best, single-word description of what 1989 will mean to Microware is "growth." Of course, growth just for growth's sake is not necessarily good, but I think the kind of growth we will experience this year is very good indeed.

Our product line has expanded in the past with new tools like the C Source Debugger, OS-9/68030, UniBridge, and PCBridge giving OS-9 users an even wider selection of powerful solutions. Now, we are again poised to continue our leadership in the real-time marketplace with RAVE—a revolutionary new graphics and user interface tool.

Our staff has grown steadily by over 25 percent. Most of these new faces are working in areas that provide direct services to OS-9 users.

Our company is growing with the formation of Microware (U.K.) Ltd., which is already making a big difference for our large user community in England. And the formation of OptImage as a joint venture between Microware and Philips promises only bigger and better opportunities for the future.

Announcing an Exciting New

RAVE

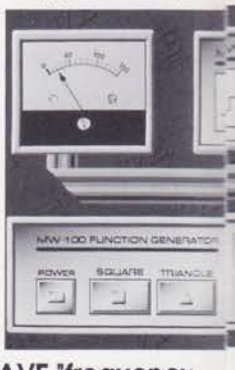
RAVE (Real-Time Audio/Video Environment) is a multimedia development tool and user interface that greatly simplifies the design of realistic man/machine interfaces for real-time process control systems. As an extension of OS-9, RAVE enables designers to combine high-quality audio and video, computer-generated graphics and customizeable menus in the same user interface.

With RAVE, designers can quickly configure realistic user interfaces and control panels using real-world sounds and images. Because the resulting user interface better represents the actual control environment, it can be manipulated and understood by non-technical users.

RAVE consists of three packages:

- **The Graphics File Manager**
- **Graphics Support Library**
- **The Presentation Editor**

The **Graphics File Manager (GFM)** provides the audio, video and input drivers needed to support the run-time user interface. The input drivers support a keyboard, as well as pointing devices. The keyboard driver supports any keyboard, from an IBM PC compatible keyboard, to a custom keyboard designed specifically for an application. The pointing device may be a mouse, touch pad, touch screen or any device that returns X:Y coordinate information.



A RAVE "frequency

The **Graphics Support Library (GSL)** builds upon the GFM to create the more complex concepts required for an application. These include controls, indicators, and menus. Controls are objects on the display that mimic the behavior of switches. Indicators are objects on the display that mimic the behavior of output devices.

FOR THE 1990'S

And finally, OS-9 itself grew tremendously. Almost every manufacturer of 680X0 board level products now offers OS-9 off-the-shelf, and many major companies and organizations have adopted OS-9 as a standard. And late last year, the first limited production runs of CD-I players were shipped, which just may be the very beginning of the first mass distribution of OS-9/68000-based systems.

All in all, 1989 has been an exciting year. But all of us here at Microware feel that it will pale in comparison to what we've got in store for the next 6 months (and into 1990). So stay tuned for details!

—Ken Kaplan
President,
Microware

Graphics and Interface Tool!

Both controls and indicators may be implemented as computer generated objects, or by digitizing an actual image of the device.

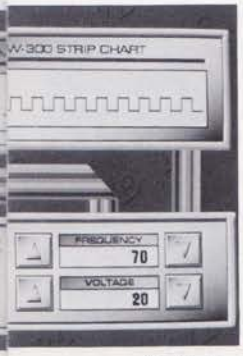
RAVE's third package, known as the **Presentation Editor**, draws upon the GSL and GFM to provide an interactive, menu-driven development environment for building applications. With the Presentation Editor, designers create the controls, indicators and menus supported by the Graphics Support Library.

Designers interact with the Presentation Editor via a keyboard and mouse. Audio can be input directly through a microphone, or loaded from disk. Video can either be captured via a camera, or built from scratch using graphics primitives. A Paintbox can be used to modify both computer-generated or real-world video images.

To use RAVE on new hardware, designers need only to port the low-level graphics, audio and input drivers.

And RAVE was implemented as an extension to Microware's OS-9 Real-Time Operating System. RAVE provides users with complete access to the real-time functionality of OS-9, which is vital for many process control applications. Exceptionally fast interrupt response, preemptive task switching and a ROMable modular architecture make OS-9 the operating system of choice for real-time factory floor applications.

To find out more about putting RAVE to work for you, contact Microware or an Authorized Microware Distributor today. ◆



generator" demo

SMARTWARE AVAILABLE FOR OS-9

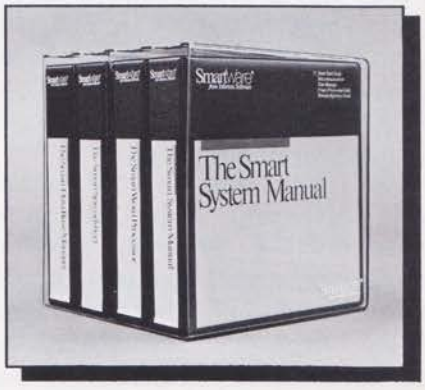
Microware announces the immediate availability of SmartWare--a powerful, integrated spreadsheet, data base and word processor package for OS-9. Licensed from Informix, a leader in SQL and office automation technology, SmartWare has been adapted to the OS-9 environment and works with any VT-100-compatible terminal. An electronic time manager, communications package and spelling checker are also included to enhance user productivity.

SmartWare consists of five software modules:

- **Data Base**
- **Spread Sheet**
- **Word Processor**
- **Communications**
- **Time Manager**

All five of the SmartWare integrated software modules are capable of outperforming virtually any stand-alone program in its category. However the real advantage of SmartWare lies in its ability to easily move data from one software module to another. All SmartWare packages feature common commands and screen designs to maximize ease of use. A menu umbrella provides a cohesive user interface which ties all modules together into a seamless, integrated package.

SmartWare provides the productivity tools engineers need to write proposals, model new systems, manage information and communicate with others. To find out more about OS-9 SmartWare, call Microware or an Authorized Representative today. ◆



OS-9 SmartWare

Strengthening Our Commitment in the United Kingdom

Pictured (l-r): Tony Mountifield, Sue Dawes, Mike Quelch, Kristin Doane, Alwyn Davies and Amanda Forrest

Last summer, Microware opened Microware Systems (U.K.) Ltd., a full-service sales and support office. This office provides direct representation of Microware's products and services throughout the United Kingdom.

Microware has drawn on a number of resources to assemble our U.K. staff. Microware (U.K.), located in Southampton, England, includes the following people:

Mike Quelch, general manager of Microware (U.K.), comes to us with eight years of experience in the OS-9 environment. Before becoming general manager, Mike helped develop the sales and marketing activities of Microware (U.K.). Mike formerly was a sales manager with Vivaway Ltd., and general manager with Dragon Data. Mike received his BSc (Hons) in Electronic Engineering and he studied for a Ph.D. at Loughborough University.

Kristin Doane is on temporary assignment to Microware (U.K.) from our corporate headquarters. Kristin provides guidance to the U.K. staff, as well as providing communication between the U.K. and corporate offices.

Last September, **Tony Mountifield** joined the U.K. office as a technical support engineer. In this role, Tony provides support to OS-9 users through the United Kingdom and is responsible for expanding the capabilities of the technical department. Tony has developed software for various real-time systems and achieved Chartered Engineering status in 1987. He became interested in programming will studying applied physics and electronics at Durham University.

Sue Dawes joined Microware (U.K.) in July as an account administrator. In this role, she helps process orders from customers in the U.K. Sue comes to Microware with extensive experience with computer companies, including her previous administrative position with a customer support organization.

As P.A./Administrator, **Amanda Forrest** is responsible for general secretarial duties, sales and marketing assistance. Amanda comes to Microware from a recruiting firm and has a strong background in secretarial and administrative duties.

Alwyn Davies came out of early retirement to join Microware (U.K.) as the accountant/company secretary. Previously, Alwyn was the financial director and company secretary to an engineering company in Southampton. He is a Fellow of the Chartered Institute of Management Accountants and is a member of the Chartered Institute of Secretaries and Administrators.

To contact Microware (U.K.), write 1626 Parkway, Solent Business Park, Whiteley, Fareham, Hampshire, England PO15 7AH. Phone: (44) 489 886699. Fax: (44) 4895 6290. ◆

Microware & Schweber Offer Turn Key Solution

Microware has entered into a national distribution agreement with Schweber Electronics, Westbury, New York. This agreement enables Schweber to bundle OS-9 with Motorola's CPU boards, marking the first availability of a turn key solution for Motorola CPU's.

Schweber's one-stop Motorola/OS-9 solution will include popular CPU boards such as the 68030-based MVME147 and other complete OS-9 packages.

Schweber is the third-largest broadline distributor of commercial and military system products in the U.S. ◆

Force Licenses OS-9

Force Computers has licensed OS-9 for their CPU-6, CPU-29, CPU-30, CPU-33 and CPU-37 board-level computers.

Both Industrial and Professional versions of OS-9 are available. For networking, FORCE customers can link OS-9 based systems using FORCE's ILANCE-1 Ethernet controller in concert with OS-9/ESP.

The power and flexibility of OS-9, coupled with Force's high performance hardware, greatly expands the options available to software developers. ◆

The March of Progress

Microware released the first version of OS-9/6809 in 1980. Over time, the 6809 became the 8-bit leader, and then slowly faded in front of more powerful 16- and 32-bit devices.

Recognizing this trend, Microware is discontinuing direct sales of end-user 6809 software products. Many OS-9 programs will continue to be available through Tandy/Radio Shack; manufacturer of the popular Color Computer.

Microware will continue support for existing customers, and OEM licenses will remain available. Customers should place orders for OS-9/6809 end-user products within the next 30 days. ◆

OptImage:
Tools For Compact Disc-Interactive

OptImage Interactive Services Company L.P. was formed by five leading high-technology companies to meet an unprecedented demand for the skills and technologies required to develop Compact Disc-Interactive (CD-I) applications for consumer and professional markets.

The OptImage Team
Standing (l-r): Steve Adams and Steve McClellan
Sitting: Bob Sorensen and Pam Wilber

Resources from Microware Systems and N.V. Philips, of the Netherlands, form the nucleus of OptImage. Microware and Philips also contributed a management team and software engineering staff who have pioneered CD-I technology since its early stages.

Three other firms lend specialized skills, technologies and products to the consortium and include: Sun Microsystems of Cupertino, California, Datalink from Minneapolis, and National Computer Systems (NCS), also based in Minneapolis.

CD-I is a new multi-media technology invented by Philips, Microware and Sony Corporations that allows audio, video and computer data to be stored and integrated on a single compact disc. "The integration of these various media creates some exciting possibilities for both consumer and professional applications," says Bob Sorensen, president of OptImage. Sorensen, previously vice president of Research and Development at Microware, adds, "CD-I programs offer the user a seemingly infinite number of options for interaction. CD-I lets you explore and discover a particular subject at the touch of a button."

OptImage was formed early this year with offices located in Microware's Des Moines headquarters and in Chicago. The company will begin offering CD-I tools and services during the third quarter of this year.

The tools and services OptImage will offer fall into four major categories. First are production and authoring tools that comprise the building blocks of CD-I development. These tools perform audio capture and encoding, video capture and encoding, plus emulation and simulation.

The second area is run-time software that is resident on the CD-I player. This software allows a user to view and interact with a CD-I title, particularly through the use of a remote control selection device.

The Chicago office will be responsible for the third category—studio services. OptImage will have complete facilities for authoring CD-I titles. This includes CD-I title design and layout, graphics, video and audio capture, and software engineering.

"Any or all of the studio services can be used to develop a CD-I title from conception to production," says Salvatore Locasio, vice president and general manager in Chicago. Before joining Microware, Sal worked for Electronistore Services, Inc. where he developed interactive video disc applications.

Finally, OptImage will offer basic CD-I systems. These systems will offer various levels of integrated hardware and software for the development of CD-I titles. (See box for related article on the OptImage Starter System.)

OptImage's address is 1900 N.W. 114th Street, Des Moines, Iowa 50322. Phone: (515) 225-7000. Fax: (515) 225-0252. ◆

Investigate CD-I Technology with Starter System From OptImage

OptImage now offers a CD-I Starter System to help organizations evaluate CD-I technology without making a large investment in complete systems. The Starter System also provides an economical gateway to the CD-I arena.

The Starter System consists of the basic hardware and software needed to perform demonstrations of CD-I technology. Hardware includes a CD-I player, monitor, keyboard and hard disk drive. Software includes paint, screen layout and demonstration tools, plus a clip art disk.

The CD-I Starter System is an affordable way for organizations to investigate the latest CD-I technology, or lay a foundation for building a CD-I production system. For more information, contact OptImage at (515) 225-7000. ◆

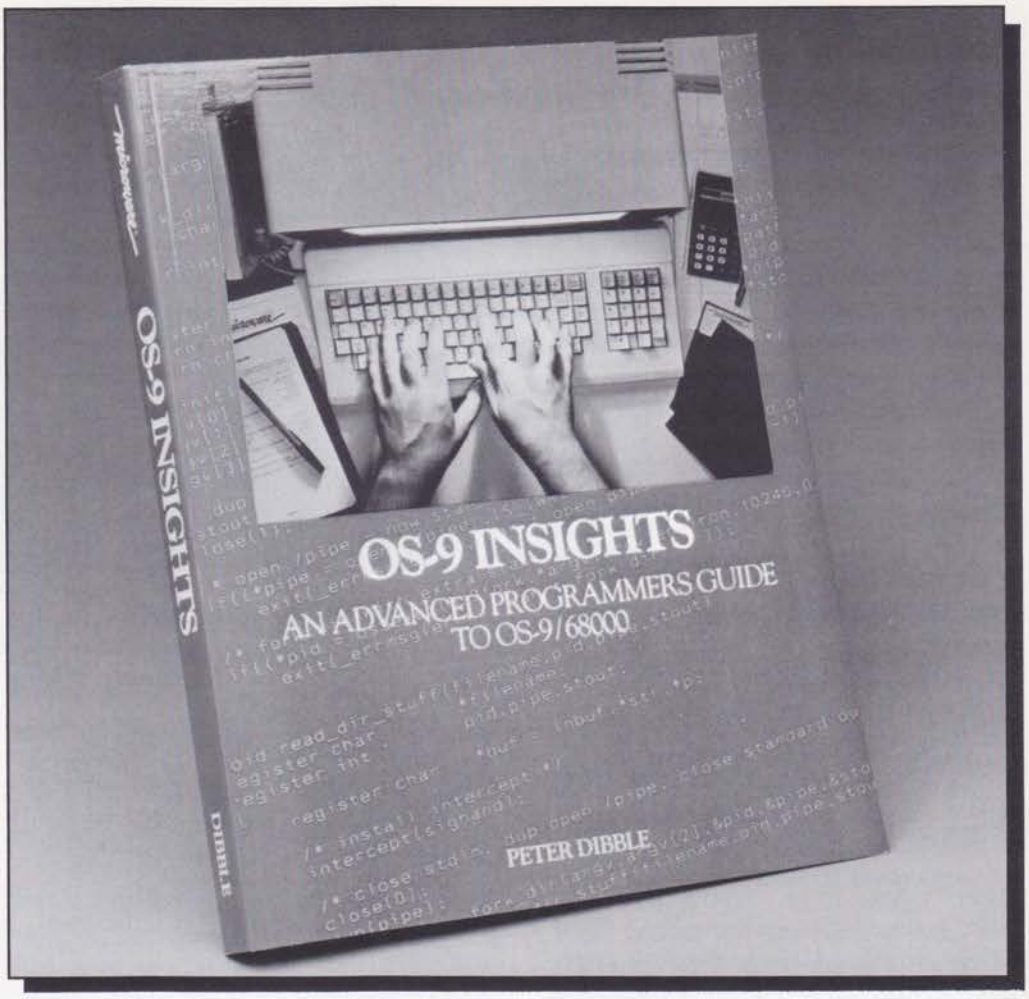
OS-9 Insights Into Second Printing

OS-9 Insights, by Peter Dibble, covers many advanced features available with OS-9. The book is now in its second printing due to its popularity among OS-9 programmers.

Serious OS-9 programmers will find valuable information in OS-9 Insights, including:

- **An in-depth examination of the OS-9 design philosophy, kernel operation and real-time features**
- **Sample file managers and driver source listings**
- **Information on customizing your OS-9 system**

Peter Dibble is a consultant for Microware and a Ph.D. candidate in the Computer Science department at the University of Rochester. Peter has also written OS-9 User Notes, as well as The Complete Rainbow Guide to OS-9 and The Complete Rainbow Guide to OS-9 Level Two with Dale Puckett. ◆



The new Microware addition connects the Marketing, Administration and R & D Departments

New Addition Connects Two Buildings

As Microware continues to grow, so do our facilities. Early this year, we completed a major addition that physically and aesthetically connects what use to be two separate buildings.

The highlight of the addition is the Compact Disc-Interactive (CD-I) and graphics environment laboratory. The addition is equipped with the latest in graphics technology, including development facilities and a production studio.

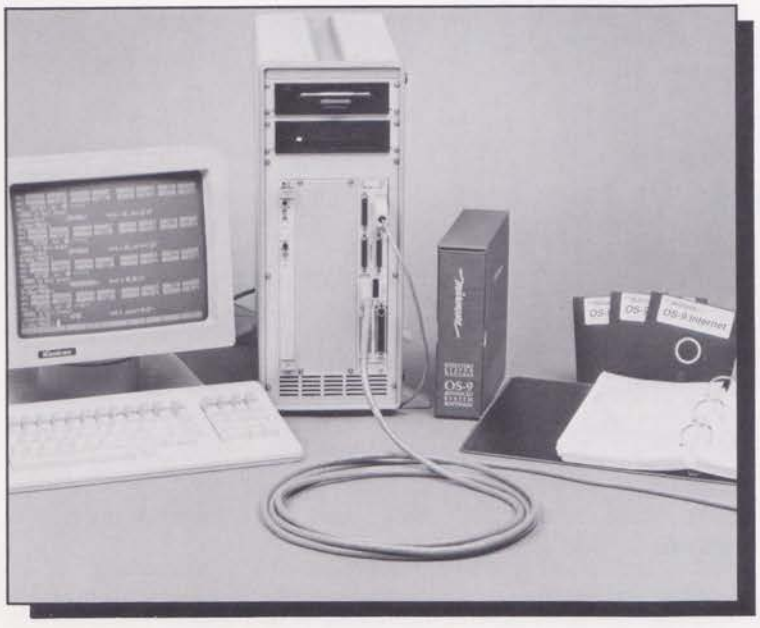
The addition is also home to the Technical Support and Technical Documentation departments. ◆

OS-9 INTERNET SUPPORT PACKAGE
A Technical Overview

OS-9/ISP (Internet Support Package) is a network communications software package that allows communication between OS-9 and other systems using the DARPA Transmission Control Protocol/Internet Protocol (TCP/IP). OS-9 Internet C library functions provide a programming interface nearly identical to the BSD4.3 UNIX socket interprocess communication facilities. Any application software written to operate with the OS-9/ESP (Ethernet Support Package) will work with OS-9/ISP without change.

FEATURES

- **DARPA Internet Support for OS-9/680x0 Systems**
- **Supports TCP/IP Protocols**
- **FTP Support for File Transfer**
- **TELNET Support for Remote Login**
- **Gateway and IP Packet Routing**
- **Device-Independent Interface Layer Allows Configuration to Most Any Network Transport Hardware**
- **Includes General-Purpose Socket Interface for Application Program Access to Internet**
- **Supplied with Drivers for on-CPU LANCE (Am7990) Chip Set**
- **Fully ROMable for Dedicated Applications**



OS-9 Internet Support Package

SOCKET FILE MANAGER

The Socket File Manager **(sockman)** provides BSD4.3 UNIX socket-style interface to the TCP/IP protocols. **Sockman** encourages easy portability of UNIX applications to OS-9. **Sockman** is a superset of the **Enpman** socket manager in OS-9/ESP, thus providing application object code compatibility between the two products. The address family protocols (Internet, etc.) are implemented by **sockman** as subroutine modules which allows dynamic loading of only active protocols as well as facilitating the addition of future protocols.

INTERFACE MANAGER

The Interface Manager **(ifman)** provides the socket protocol modules for a hardware-independent layer to configure and manage the network communication interfaces. The ifman allows interfaces to come up and go down without affecting the operation of other interfaces. The upper-level protocols can adapt to the changing status of the various interfaces and maximize system configuration flexibility. The additional software layer allows a single system to support a number of different types of network interfaces (Ethernet, ARCNEt, SLDC, point-to-point serial, etc.).

TCP/IP

Microware's TCP/IP implementation conforms to the United States DoD ArpaNet Standards with the latest BSD4.3 enhancements. The IP layer supports static routing of packets between interfaces on the same computer as well as default and gateway routing. The DARPA Internet standards also specify FTP (file transfer protocol) and TELNET (virtual network terminal) facilities. The OS-9/ISP package provides both TELNET and FTP utility programs for accessing other nodes on the network. FTP and TELNET server programs are included to allow other nodes to access the OS-9/ISP system as a server.

DISTRIBUTION

OS-9/ISP is distributed in object code form on diskette for Microware-supported Development Paks. Included in this package are file managers (sockman, ifman and pkman), the Internet protocol handler modules, network device drivers and descriptors, configuration modules, utility programs and socket-programming interface libraries. The OS-9/ISP Port-Pak configuration is distributed on diskette or tape and provides, in addition to the object code modules, the source code and documentation to allow adaptation and development of drivers for link-level network interfaces.

For more information about OS-9/ISP, contact Microware or an Authorized Distributor today. ◆

ON THE C SIDE

"time"

When developing code for a real-time OS, it is often times desirable to know statistics about how much time your process takes and what it spent time doing. The program below monitors a child process and prints information after it terminates. The information can be examined to determine a number of items:

1. **Ticks in system state - the number of ticks that occurred while the child process was in system state (kernel, file managers and drivers).**
2. **Ticks in user state - the number of ticks that occurred while the process was in user state.**
3. **Total time - the sum of 1. and 2. in terms of seconds**
4. **Clock time - the amount of time that elapsed from the time the child started and when it terminated.**
5. **% of time consumed - the percentage of time the child process was able to use the CPU. The difference between this percentage and 100% is the percent of time used by other processes and interrupts.**
6. **F$ and I$ Calls - the number of system calls performed by the process. The F$ calls are system service calls, whereas I$ calls are used to perform I/O.**
7. **Bytes written/read - the number of bytes transferred via the I$calls.**

NOTE: "time" does its output to the device in the user's PORT environment variable to allow for redirection on the child process. If you do not use the -r option, be sure to have PORT set before invoking "time."

```
@_sysedit: equ 2
#include <stdio.h>
#include <time.h>
#include <procid.h>
#include <signal.h>
#include <errno.h>

#define PARTPD 724                  /* size of process descriptor to copy */
#define FALSE (1==0)
#define TRUE !FALSE

extern char *getenv( );             /* the environment is character strings */
extern int os9fork( );              /* define fork call */

static procid Child_process;        /* buffer for the process descriptor */

static char *Stars = "**********************************\n";
static char *Darow = "vvvvvvvvvvvvvvvvvvvvvvvvvvvvvvv\n";
static char *Uarow = "^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^\n";

void argwrong( )
{
    /* never returns to the caller!!! */
    puts("");
    puts("Usage: time [-r] <program name> [arg1 arg2...argn]");
    puts("      -r will allow full redirection of output.");
    puts("      Normally, time outputs statistics on PORT ( from environment ).");
    puts("");
    exit(0);
}

main( argc,argv,envp )
int argc;
char *argv[ ],*envp[ ];
{
    int procn;                      /* process ID of child */
    int start,end;                  /* start and end time */
    char *ioport;                   /* I/O port string */
    int fullredirect = FALSE;       /* flag indicating use redirect path */
    double totalticks;              /* double value contains total proc. ticks */
    FILE *outpath;                  /* I/O port for use in printing */

    if (argc == 1)
        argwrong( );
```

ON THE C SIDE

"time"

(Continued)

```
    if( (argv[1][0] == '-') ) {
        if( (argv[1][1] | 0x60) == 'r' ) {
            fullredirect = TRUE;
            argv++;
        }
        else
            argwrong( ); /* the user doesn't know how to use it */
    }

    if( !fullredirect ) {
        ioport = getenv("PORT");
        if ( ioport == (char *)0x0 ) /* no PORT environment variable */
            exit(_errmsg(1,"'PORT' environment variable not defined\n"));
        if( (outpath = fopen( ioport, "w" )) == (FILE *)-1 )
            outpath = stdout;                    /* use stdout anyway */
    }
    else
        outpath = stdout;
    fprintf(outpath,"\n%s\t\tProgram: %s\n%s",Stars,argv[1],Darow);
    fflush(outpath);

    start = _getsys(D_Ticks,sizeof(int));                /* time at start */

    /* start up the child of his dreams */
    if( (procn = os9exec(os9fork,argv[1],&argv[1],envp,0,0)) == -1 ) {
        fprintf(outpath,"unable to fork %s!\n",argv[1]);
        exit(0);
    }

    do {
        /* hang out until child dies */
        tsleep( 1 );                /* give up time slice */

        if( _get_process_desc(procn,PARTPD,&Child_process) == -1 )
            _exit(_errmsg(errno,"Could not get process descriptor for %s!\n",
                                                                argv[1]));
        /* if has died, this will be close to the end */
        end = _getsys(D_Ticks,sizeof(int));
    } while( (Child_process._state & 0x100 ) == 0 );

    while( wait(0) != procn );              /* allow already dead child to
                                               report back */

    /* now print out the goodies about the program */
    fprintf(outpath,"%sProgram Statistics:\n CPU Ticks: ",Uarow);
    fprintf(outpath," user = %d system = %d\n",Child_process._uticks,
                                                Child_process._sticks);
    totalticks = (double)(Child_process._uticks + Child_process._sticks);
    fprintf(outpath," Total CPU Time (seconds): %lg\n",
                                            totalticks /(double)CLK_TCK);
    fprintf(outpath," Clock Time (seconds): %lg\n",
                            (double)(end - start)/(double)CLK_TCK);
    fprintf(outpath," %% of time used by %s: %lg\n",argv[1],
                            (totalticks /(double)(end-start))*100);
    fprintf(outpath," F$ calls: %d      I$ calls: %d\n", Child_process._fcalls,
                                            Child_process._icalls);
    fprintf(outpath," Bytes written: %d      Bytes read: %d\n%s\n",
                    Child_process._wbytes,Child_process._rbytes,Stars);
}
```

NEW EMPLOYEES AT MICROWARE

Back (l-r): Ryan Babic, Kevin Erwin, Mark de Angelo and Richard Rebouche
Front: Mike Ahrens, Polly Steele, Steve Simpson, Bill Gaffney and Ellen Grant

Microware continues to grow. Since our last **Pipelines**, a number of people have joined the Microware family. We'd like you to get to know our new employees.

Bill Gaffney, account manager, has been marketing VMEbus products since 1983. He worked at Mizar Inc. as a Program Manager before joining the Marketing Department at Microware. Bill has a Bachelor of Science in Electronics Technology from Langston University in Oklahoma. Bill's other activities include volleyball and basketball.

Ryan Babic, technical support engineer, has four years of experience working with OS-9 and is proficient in C and Assembly Language. Ryan holds an A.A. Degree in Electronics Technology and worked as a systems programmer at TRACOR Northern before coming to Microware. In addition to working at Microware, Ryan enjoys astronomy, lapidary, reading and strategy/simulation games.

Ellen Grant is a technical writer with Microware. She comes to us from Michigan Technological University, where she earned a Bachelor of Science in Scientific and Technical Communication.

Richard Rebouche, software support trainee, worked as a C programmer for Iowa Computer Resources before joining Microware. He graduated from the University of Northern Iowa with a degree in Computer Science and experience in Pascal, Assembly, and Basic languages. In his spare time, Richard enjoys computers, cats and reading.

Polly Steele joins the advertising department as a graphic artist. Polly recently completed her Associate Degree in Applied Arts at Des Moines Area Community College. Polly enjoys photography and attending dirt-track sprint car races around the Midwest.

Kevin Erwin joins Microware's Western Regional Office as a software engineer. While in school at California State University-Sacramento, Kevin worked as a programmer/analyst for SFL, Incorporated where he worked on a statewide data base application for a public utility. Kevin received his Bachelor of Science in Computer Science from California State with a specialization in systems software. Kevin enjoys sports, including golf, tennis and softball.

Steve Simpson joins Microware as an advertising copywriter. Previously, Steve held similar positions with a state trade association and an advertising firm. He received his Bachelor of Science in Marketing/Advertising from the University of Nebraska. Steve's interests include traveling, alpine skiing and tennis.

Mark de Angelo comes to Microware as a technical support engineer from NCR Corporation in Wichita, Kansas. While at NCR, Mark designed firmware for SCSI to VME host bus adapters. He has a Bachelor of Science in Electrical Engineering from the University of Iowa. Mark enjoys playing basketball and softball, and he umpires semi-professional baseball in the summertime.

Mike Ahrens, technical support engineer, comes to Microware after graduating from Buena Vista College with a Computer Science/Math degree and a minor in Chinese. He learned C and UNIX while attending the Iowa State University graduate program, and has a strong background in Pascal and Lisp. Mike enjoys travelling, particularly in Asia, where he spent a total of two years.

NEW VENDOR PRODUCTS FOR OS-9

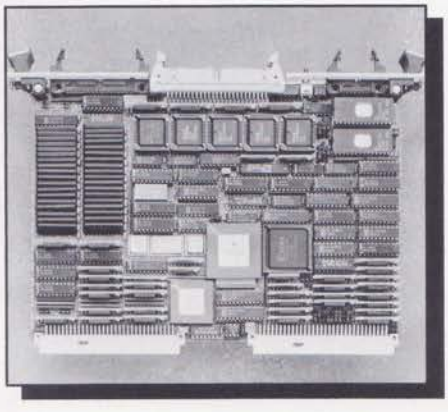
Heurikon Announces 68030-based VME SBC, Two 68030 CPU Boards

Heurikon Corporation announces the **HK68/V3E** single-board computer for applications requiring the power of the 68030 processor and the high-speed memory expansion of the VSB bus.

The HK68/V3E offers up to 33 MHz 68030 CPU, 1-16M on-board DRAM, up to 2M of EPROM, four serial ports, ANSI-compatible SCSI interface and a single Centronics-compatible parallel port.

Heurikon also introduces two 68030 CPU boards, the **HK68/V30XE** VMEbus CPU board and the **HK68/M230** Multibus II CPU board. Both boards offer speeds as high as 33 MHz on the 68030 processor. Key features include a buffered Ethernet controller, SCSI interface, two buffered 32-bit DMA controllers and MC68881/68882 FPCP.

For more information, call Heurikon Corporation at 1-800-356-9602 or (608) 271-8700.



Heurikon's HK68/V3E

Introl Offers Full Line of OS-9 SCSI Disk, Tape and Optical Subsystems

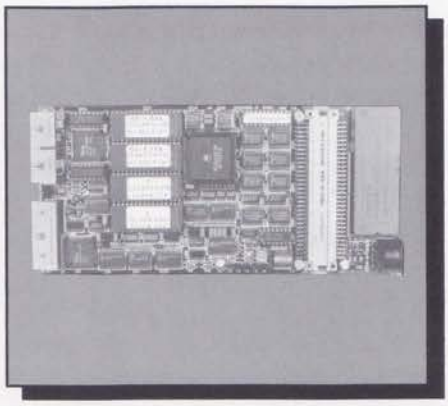
Introl Corporation now offers OS-9 users a full range of complete "plug-and-play" disk, tape and optical subsystems.

The **Model 700D** is a 700M (unformatted), 16 ms average access time Winchester disk subsystem that includes the drive packaged in a desktop enclosure. Introl's **Model 2300T** is a 2300M tape subsystem using 8mm helical scan drives. Introl's 650M erasable optical drive, **Model 650E**, looks like a standard Winchester to the user. Optical cartridges are removable, making the 650E good for security applications or where large data storage is required.

All three subsystems use the Introl 300 adapter. For more information, call Introl Corporation at (612) 631-7600.

GESPAC Offers SBC with 512K ROMed OS-9 Software

GESPAC introduces its **GESBDS-6**, a single board computer with nearly 512K of ROMed OS-9 software. The system is totally self-contained and provides the user with an on-board, 128K battery-maintained non-volatile



Gespac's GESBDS-6

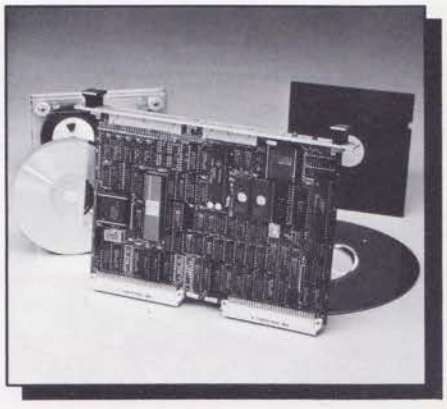
CMOS RAMdisk for storing source and object files. It can easily expand to include a flexible disk, hard disk, two additional users, a parallel printer, and up to 8M of additional external memory.

For more information, call GESPAC, Inc., at (602) 962-5559.

High Performance VMEbus Mass Storage Support from Ciprico

Ciprico Incorporated's VMEbus family now includes the **Rimfire 3510** Series of SCSI host bus adapters. The Rimfire 3510 Series capabilities include 2M/s asynchronous and 5M/s synchronous transfer rates. The board's command-ueuing software interface supports pass-through commands, providing the host flexibility in the choice of SCSI operations. Other SCSI features supported include disconnect/reconnect and the choice of single-ended or differential bus options.

For more information, call Ciprico at (612) 559-2034.



The Ciprico Rimfire 3510

Microware welcomes new-product announcements for consideration for publication in **PIPELINES**. All announcements should be addressed to "New Products Editor" c/o **PIPELINES**, and include company name, phone number and contact name. ◆

Join Us At Buscon/East-89

(See story on back cover)

MICROWARE TO ATTEND BUSCON/EAST-89

Microware will be attending BUSCON/East—89 in Marlborough, Massachusetts with demonstrations of RAVE and OS-9 Version 2.3. Demonstrations of our Internet Support Package (ISP) and SmartWare integrated productivity tools will also be featured. BUSCON/East—89 will be held September 12-14 at the Royal Plaza Trade Center.

On Wednesday, September 13th, Microware will participate in a discussion of graphic interfaces for real-time process control.

This is your opportunity to find out the latest information about Microware's OS-9 and related productivity tools.

Stop by and visit Microware at Booth 513. For more information about Microware's involvement at BUSCON/East—89, call us at (515) 224-1929, or contact us by Fax at (515) 224-1352. ◆

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