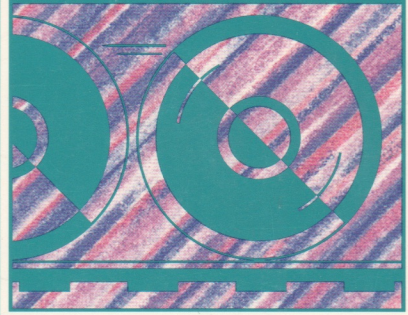


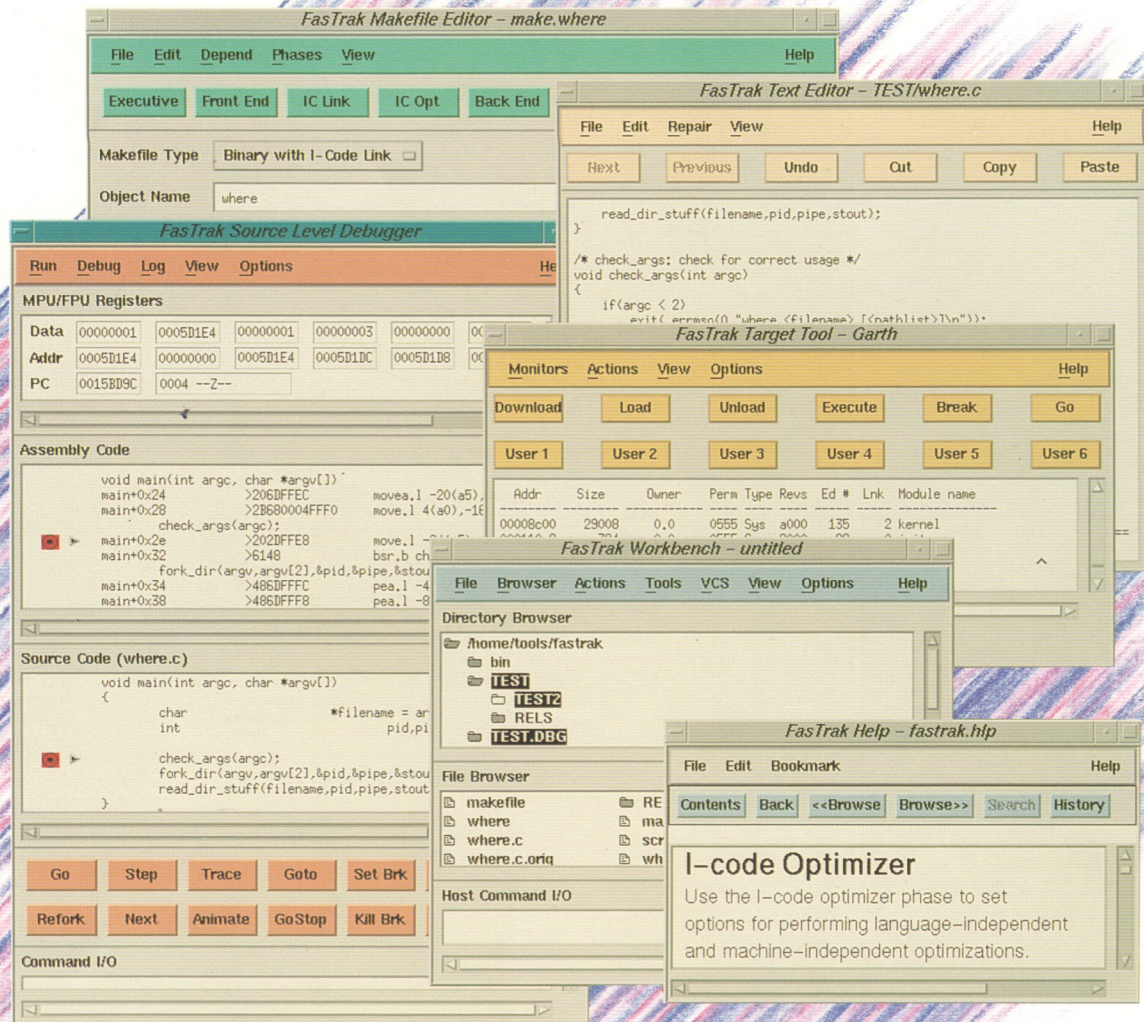
***FASTRAK***



Personal and  
Group  
Productivity  
Multipliers  
For  
Real-Time  
Engineering

*microware*<sup>®</sup>

Microware Systems Corporation



FasTrak's tools provide a total solution to real-time software engineering.

# FasTrak: The Software Productivity Multiplier For Real-Time Engineering

## The Increasing Need for Greater Programming Efficiency

Real-time software projects are rapidly growing in size and complexity. Increasing demands are being placed on individual programmers, as well as on software engineering managers. Delivering a software project on time requires increased individual productivity, greater group coordination and quality integration.

## Putting Powerful Tools in the Hands of the Individual Programmer

To increase individual productivity, programmers need tools within their reach that are easy to use and that simplify implementation phases of software development. By using intuitive tools that decrease the time required to edit, compile and debug their code, productivity soars. These individual gains in turn contribute to total team productivity increases.

## Managing Team Productivity

As the size and complexity of projects increase, so does the role of the software engineering manager. To maximize their effectiveness, managers need tools that automate the tracking and coordination of development activities. They need intelligent tools that help them coordinate the design team to ensure software quality and timely delivery.

## Targeting Real-Time Performance

Demanding real-time applications for Motorola 68XXX and Intel 386/486 systems need a powerful target environment. By working in integrated development and target environ-

ments, designers can focus on application development. They can spend their time developing and fine-tuning their application, rather than spending their time refitting their application for their target.

## FasTrak Provides a Total Solution to Real-Time Software Engineering

Microware has set the new standards for real-time development with FasTrak. Now, engineers have access to sophisticated tools specifically designed to target both OS-9/68XXX and OS-9000/386/486 real-time applications.

FasTrak assembles a powerful collection of tools that boost productivity and tracking during every implementation phase of development. Tools that simplify the process of creating, building, managing and profiling real-time applications. And all FasTrak tools are built with industry-standard graphics for interfaces that are intuitive and easy to use.

Plus, FasTrak includes Microware's Ultra C ANSI C compiler for OS-9 and OS-9000 targets. Ultra C provides state-of-the-art interprocedural and global optimizations. The result is final code of unequalled quality and performance.

FasTrak's approach goes beyond its rich set of development tools. It provides a total solution to real-time engineering including host communications for seamless networking, and a fully integrated interface targeting the OS-9/68XXX and OS-9000/386/486 Real-Time Operating Systems. This total solution approach speeds the time spent developing and managing your application code by offering perfectly matched development tools and real-time targets.



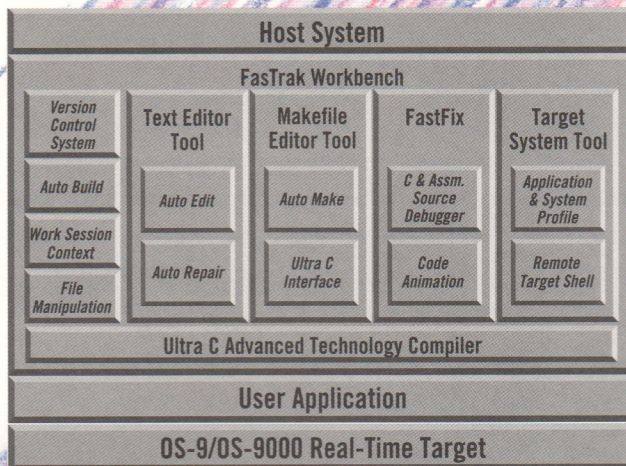
# E N V I R O N M E N T S

## Open Architecture for Today's Open Environments

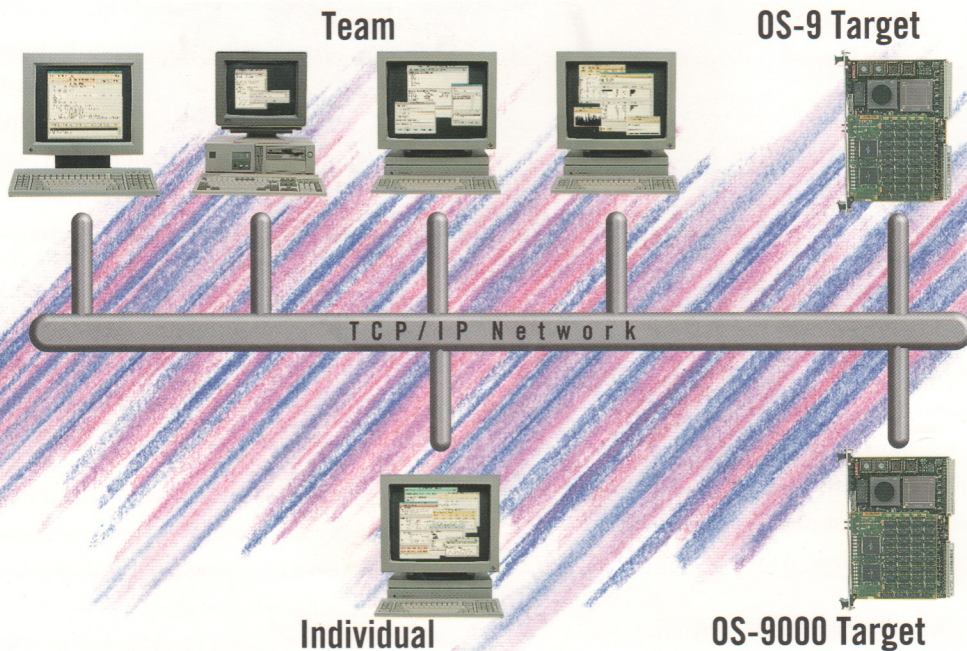
FasTrak provides solutions across a wide variety of development schemes and computing platforms. Whether working alone or in a group, individual engineers will benefit from productivity tools for editing, compiling and debugging their real-time applications.

And, if your job is to manage and coordinate larger development projects, you'll appreciate the integration with your version control system that automates the process of file access.

With the spectrum of computing platforms available today, you can look to FasTrak to provide a multi-platform solution for your software development.



Complete and seamless integration of the FasTrak development environment with OS-9 and OS-9000 target systems mean designers can focus on their application, not the development process.



FasTrak offers development solutions across a variety of computing platforms.

# W O R K B E N C H

## It All Starts Here

The Workbench provides the starting point for projects, as well as facilities for managing projects as they progress. An icon-based file and directory browser lets you drag-and-drop files in and out of FasTrak's tools. User preferences and target system parameters are also set using the Workbench.

## Managing Real-Time Development

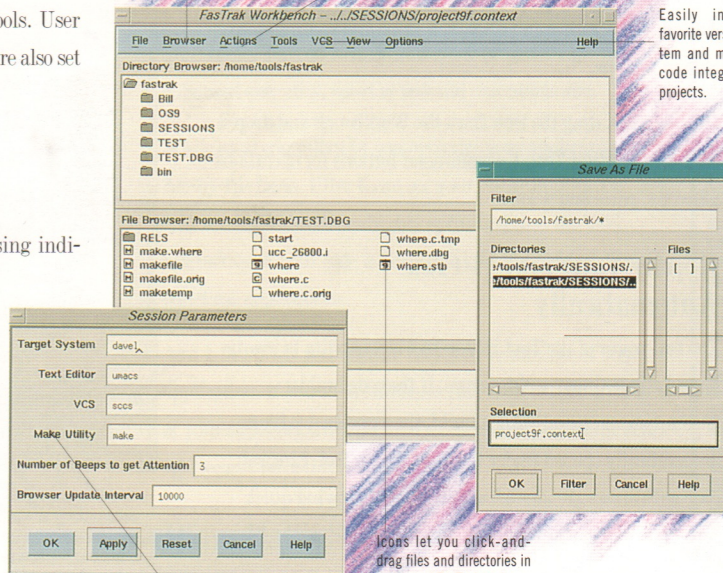
The Workbench includes tools for increasing individual productivity and monitoring the progress of a development project. Entire development sessions can be saved in "context" files. You can switch between projects at the click of a button and pick up right where you left off.

The Workbench's autobuild facility lets you build, run and debug your applications using just your mouse. The Workbench also lets you set up automatic use of your version control system so that it is activated every time source files are referenced.

The Browser uses a clipboard to manipulate working files and directories during a work session.

Automatically build, execute and debug real-time applications at the click of a button.

Easily integrate your favorite version control system and maintain source code integrity across all projects.



Icons let you click-and-drag files and directories in and out of FasTrak tools.

Customize your work environment. Set development host and real-time target options.

Save and restore workbench files that maintain the state of all FasTrak tools. Move project-to-project or work session-to-work session without missing a beat.

# H Y P E R H E L P

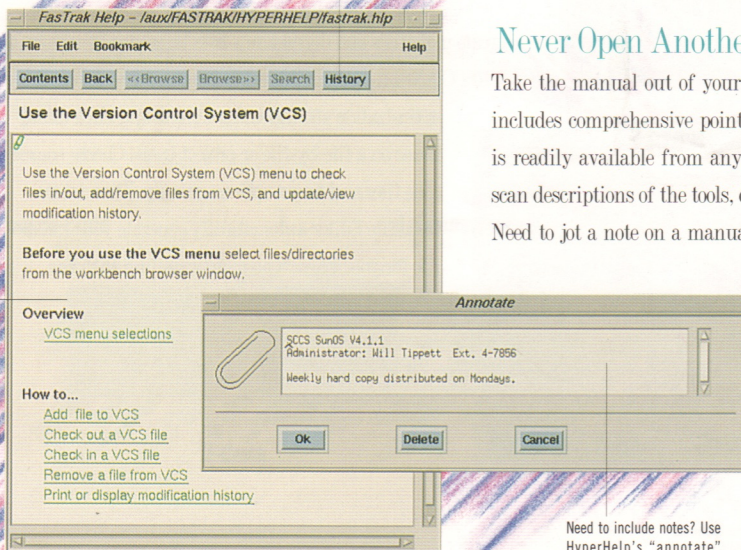
List the sections you've been through during this help session. Return to any of the sections by clicking on the title.

## Never Open Another Manual

Take the manual out of your lap and put it away. FasTrak includes comprehensive point-and-click documentation that is readily available from any of the FasTrak tools. Quickly scan descriptions of the tools, dialog boxes and function keys.

Need to jot a note on a manual page? HyperHelp lets you add notes that are "clipped" to the page. Or, set up bookmarks for sections that you reference often.

Pop open information on any facet of FasTrak at the click of a button.



Need to include notes? Use HyperHelp's "annotate" feature to clip personal notes to a manual page.

# T E X T E D I T O R

## Enhancing the Capabilities of Your Text Editor

The Text Editor Tool puts a graphical face on your favorite text editor. Common commands are mapped to buttons. And, since it works with your editor, you're up and writing source code in no time.

To open a file, drag the icon from the Workbench and drop it on the Text Editor Tool. Use command buttons for operations like copy, paste and delete.

## Repair Your Source Code Automatically

The real power of the Text Editor Tool is its ability to identify and repair C source code errors. If the code builder encounters an error during a build, the associated C file is automatically opened under the Text Editor Tool. Lines of code with errors are identified graphically allowing quick correction with just the click of a button.

Unique "repair" facility identifies errors found during a program build.

Put a mouse-drive interface on your favorite text editor. Easily cut, copy and paste characters, lines and blocks.

Drag-and-drop a text file from the Browser to automatically open it. Or open, close, save or switch between files from the "File" menu.

Errors found during building are displayed in the error window and the location is identified in the text.

```

FasTrak Text Editor - /home/tools/fastrak/TEST.DBG/where.c
File Edit Repair View Help
Next Previous Show Command Buttons Copy Paste
Show Errors
chr *buf = Inbuf,*str,*p; /* FE1.0 83 */
/* install intercept */
intercept(sighand);
/* close stdin, dup open /pipe, close standard out, dup old standard out */
close(0);
dup(pipe);
close(1);
dup((stout)); /* FE1.0 78 */
/* we will read the pipe (dir's output) */
while(gets(buf)) /* FE1.0 81 */
if(str = (char *)rindex(buf, '/')) /* FE1.0 82 */
*str = '\0'; /* FE1.0 83 */
p = str + 1; /* FE1.0 84 */
else p = buf; /* FE1.0 85 */
if(!strcmp(p, filename)) puts(buf); /* FE1.0 86 */
==== MicroMKS 3.11a (ASWE) == where.c == File: /home/tools/fastrak/TEST.DBG
Arg: 12
Next Previous Fixed Line Matching All
Expected
undeclared identifier
illegal type combination
    
```

Quickly scan text for source code errors and make your corrections. Then...

...FasTrak will automatically remove error markers. You tell FasTrak the scope of the corrections you've made.

# M A K E F I L E E D I T O R

Define names, l-code cache size and stack space for Ultra C front end phase.

Specify C, system and custom libraries for l-code linking.

Set up to 16 state-of-the-art optimizations to tailor your application for maximum performance.

Seven global levels of optimization. Choose emphasis on size or speed.

Develop applications to target OS-9 and OS-9000 Real-Time Operating Systems.

Select support for Motorola 68XXX family of 16-bit, 32-bit and CPU32 microprocessors and microcontrollers, and Intel 386/486 microprocessors.

```

FasTrak Makefile Editor - TEST.DBG/makefile
File Edit Depend Phases View Help
Executive Front End IC Link IC Opt Back End Asm Opt Asm OC Link
Makefile Type Binary with I-Code Link
Object Name where Execution Directory
Intermediate Directory RELS
where.c Executive Options
Optimization Level (0-7) 7 Default
Weight Given To Space 1 Default
Weight Given To Time 1 Default
Temporary File Directory /tmp Set
Target Operating System OS-9 Default
Target Processor Motorola M68300 Family Set
Generate Wari Code References Yes No Default
Generate Long Data References Yes No Default
Keep Source Debug Information Yes No Default
OK Apply Reset Cancel Help
    
```

## Automate the Creation of Makefiles for Ultra C

FasTrak's Makefile Editor Tool lets you point and click to create makefiles and dependency lists targeting Microware's Ultra C ANSI C compiler. Select interprocedural and global optimization strategies from point-and-click dialog boxes on a file-by-file or project basis. Choose source code files and target options quickly. Then let the Makefile Editor automatically generate your makefile for you. There's no more wrestling with the arcane syntax and rules of makefiles.

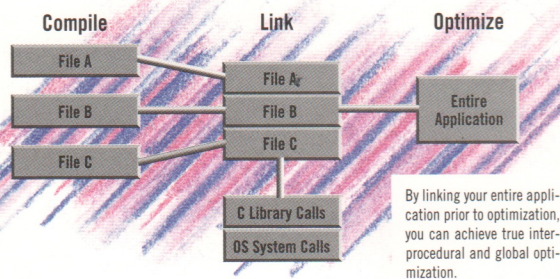
Link or suppress standard or shared libraries. Create standard OS-9 and OS-9000 executable memory modules.

# Ultra C: Microware's ANSI C Compiler

## A New Generation Architecture

Ultra C is a highly-optimizing, ANSI-compatible C compiler that produces code so fast it's like having a faster CPU. Ultra C is designed to meet your needs today, as well as accommodate new processors and programming languages in the future. This flexibility is due to Ultra C's unique architecture.

The Language Front End translates ANSI C source code into intermediate code, or I-code. The I-code Linker allows you to



link your entire application for optimization by the I-code Optimizer. The Processor Back End translates optimized I-code into the target processors' assembly language for processing by the assembler and machine-specific optimizations by the Assembly Optimizer. Finally, the Object Code Linker links program object code to library object code.

## Application-Wide Optimization

Ultra C is the real-time industry's first ANSI C compiler that allows you to link application, C library and target OS files prior to optimization. This unique feature accommodates true interprocedural and global optimizations across all functions.

Your code is the fastest possible for your real-time target.

Ultra C supports a complete set of state-of-the-art optimizations that allow you to maximize your program logic for enhanced execution speed or reduced executable size.

While most compilers let you optimize your application on a file-by-file basis, Ultra C can see your entire application. Not only are individual files highly optimized, but the total interaction of your code is fine tuned for the tightest, fastest real-time applications.

And Ultra C lets you balance the speed versus size of your application. If you need emphasis placed on reducing the size of your application during compiling, simply select the relative weight for Ultra C to apply.

## Plum Hall's Stamp of Approval

Ultra C has been fully validated by the Plum Hall ANSI Validation Suite. This validation ensures that Ultra C conforms to the ANSI X3.159-1989 and ISO/IEC 9899:1990 standards for the C language and helps ensure the quality of your final product. Code written to comply with these standards will compile under Ultra C and behave exactly as you expect it to.

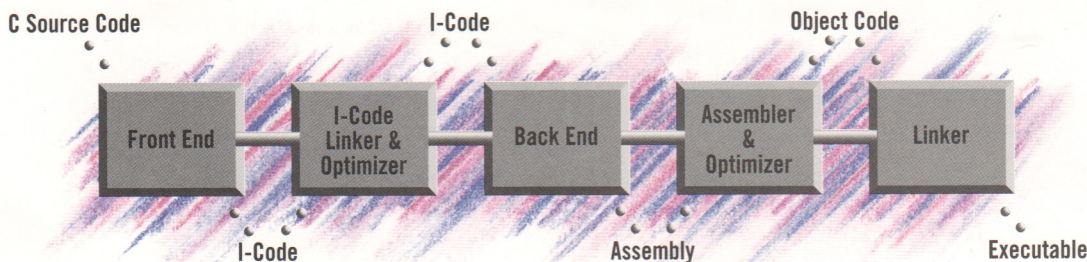
## Designed for Real Time

Ultra C goes beyond producing fast, tight real-time code.

Ultra C targets the OS-9 and OS-9000 Real-Time Operating Systems. And to take full advantage of these powerful operating systems, Ultra C provides complete C level bindings to the extensive system calls available under OS-9 and OS-9000.

## Ultra C Optimizations

- Address-mode shortening
- Address modes for computation
- Algebraic simplification and rearrangement
- Automatic inlining
- Branch shortening
- Branch-tail merging
- Code motion
- Common-subexpression elimination
- Constant collapsing
- Constant folding
- Constant propagation
- Copy propagation
- Cross-jump optimization
- Data area layout
- Dead code removal
- Global register allocation
- Instruction combining
- Instruction scheduling
- Jump-chain compression
- Loop-invariant code hoisting
- Loop-induction variable elimination
- Loop rotation
- Loop unrolling
- Peephole optimizations
- Redundant code elimination
- Redundant load/store elimination
- Register coalescing
- Register coloring
- Register tracking
- Switch statement optimization
- Variable lifetimes



Ultra C's unique architecture is designed to help you produce the the fastest code possible.

# F A S T F I X

## Put Your Code In Motion

FastFix gives you a total view of your application by providing a graphical front end to Ultra C's powerful source level debugger. Select views of MPU/FPU registers, C source and Assembly code. Open windows to view the stack frame, local variables and target system memory usage. Then select FastFix's "animate" feature and FastFix will automatically step through your application and put the views in motion.

FastFix also lets you set breakpoints graphically, while still permitting complex conditional breakpoints.

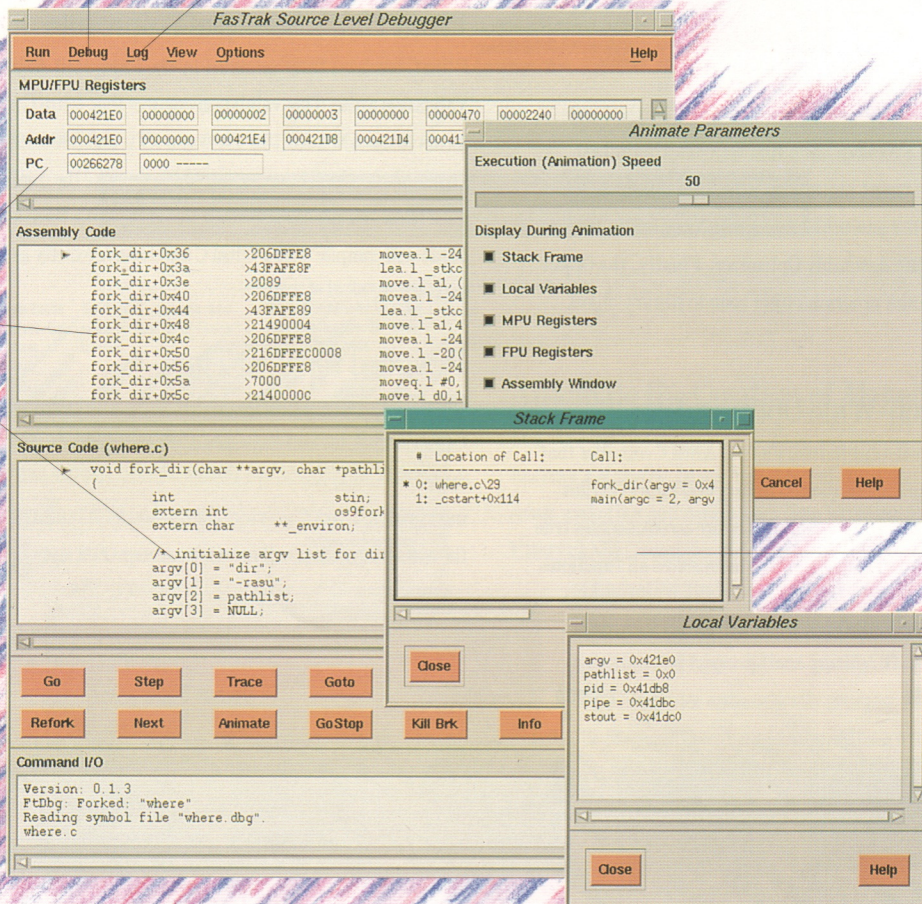
The ability to display multiple source files simultaneously makes it easy to refer to interrelated parts of your application.

FastFix puts these tools at your fingertips to allow you to easily debug multiple tasks and multiple targets simultaneously.

Add and delete breakpoints by pointing the mouse or clicking a function key.

Store and replay all commands used during a debugging session. Not sure you fixed a bug? Replay the session and verify it.

Watch C source and Assembly code, MPU/FPU registers as you step through an application.



Set the rate that you want FastFix to step through your code. Set up the views you want animated and ...

...watch as FastFix sets your code in motion and displays your stack frame and local variables on the fly.



# T A R G E T S Y S T E M

## A Window To Your Real-Time Target

FasTrak's Target System Tool gives you a direct window to your OS-9 or OS-9000 target. The Target System Tool provides a seamless method to download and execute newly developed applications on your real-time target. You can also open a remote terminal to your system and enter commands directly on the target.

The power of the Target System Tool lies in its features for monitoring and profiling the performance of your target system and application. The Target System Profiler is a sophisticated tool that builds a timing analysis of applications running on the target. You get visual representations that let you optimize the performance of your application.

Download executables to your OS-9 or OS-9000 system and run them from the Target System Tool.

Run utilities on your OS-9 or OS-9000 target system. If you're working with a diskless target, FasTrak will download the utility automatically from your host system and execute it.

Open a remote shell on your target system or connect directly to your target system's console.

The screenshot displays the FasTrak Target System Tool interface with several windows open:

- FasTrak Target Tool - Ted2**: The main window with a menu bar (Monitors, Actions, View, Options, Help) and buttons for Download, Load, Unload, Execute, Break, and Go. It also has User 1, User 2, and User 3 tabs.
- Target Profiler - Untitled**: A window showing performance data for application modules and functions.
 

Module Name	Tick Count	Percentage	Total tick count
1 kernel	6983	31.61	22094
2 IDLE	6606	29.90	
3 H2O_pressure	5226	23.65	
4 hydrolic	1549	6.99	
5 OTHER	1363	6.18	
6 gas_pressure	366	1.66	
7 scf	1	0.00	

Function Name	Tick Count	Percentage	Total tick count
1 OS9Svc	3107	44.49	6983
2 SetSys	1660	23.77	
3 CurrProc	1319	18.89	
4 SysRet	629	9.01	
5 UserRet	169	2.47	
6 ZZZProc	23	0.29	
7 Event	18	0.27	
8 NextProc	18	0.25	
9 Sleep	7	0.11	
10 ChkNam	6	0.09	
11 SClose	4	0.06	
12 ...	2	0.03	
- Target CPU Usage**: A window showing a histogram of CPU usage over time.
- Target Internet Status**: A window showing network status, currently displaying "100 packets/second".
- Terminal**: A window for entering commands on the target system.

Annotations include: "Download executables to your OS-9 or OS-9000 system and run them from the Target System Tool." (pointing to the Download button), "Run utilities on your OS-9 or OS-9000 target system. If you're working with a diskless target, FasTrak will download the utility automatically from your host system and execute it." (pointing to the User tabs), "Open a remote shell on your target system or connect directly to your target system's console." (pointing to the Terminal window), and "Monitor the performance of application modules on your target system. Choose a module and watch the performance of individual functions." (pointing to the Target Profiler window).

Histograms show CPU usage and Internet status on the target system.

# Targeting OS-9 and OS-9000

## High Performance and Real-Time Response

OS-9 and OS-9000 are modular operating systems that provide deterministic, high-performance operation for 68XXX- and 386/486-based applications. Their powerful features make OS-9 and OS-9000 optimum real-time targets for industrial, scientific, medical, telecommunication and consumer electronic applications. Real-time features include preemptive task switching, process execution control, flexible interrupt service routines and fast interprocess communications facilities. Plus, extensions to OS-9 and OS-9000 let you expand your system to include advanced graphics, networking and multimedia support.

## A Modular Architecture

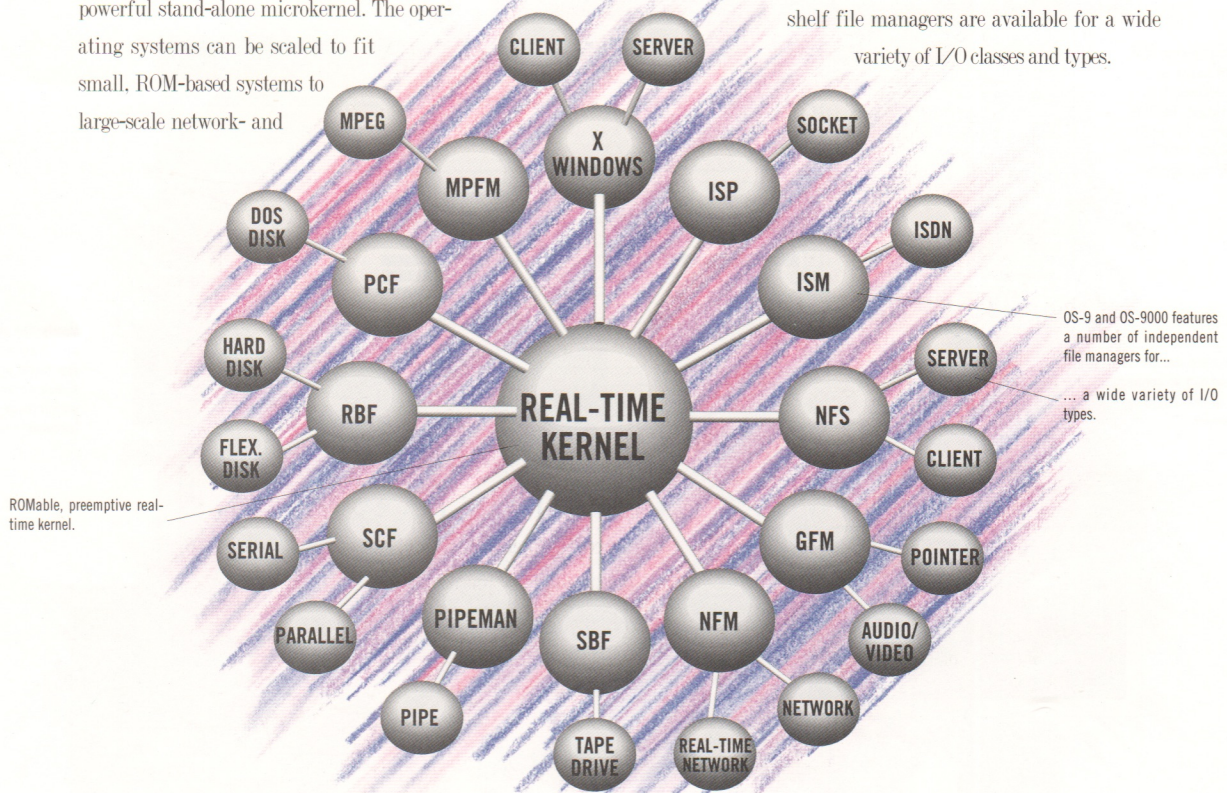
For the greatest flexibility in hard real-time applications, OS-9 and OS-9000 feature a scalable architecture built around a powerful stand-alone microkernel. The operating systems can be scaled to fit small, ROM-based systems to large-scale network- and

GUI-based systems by adding any of the wide variety of available system-level extensions. All extensions are ROMable, and can be dynamically loaded and linked to the system while the system is up and running.

The OS-9 and OS-9000 Kernels' multi-tasking services include priority-based, preemptive task scheduling, dynamic memory allocation, and complete interrupt, exception and task management facilities. Interprocess communications options include alarms, events, binary semaphores, data modules, signals, pipes and sockets.

## Off-The-Shelf I/O: Capabilities Beyond Limitation

OS-9 and OS-9000 feature unified I/O systems crafted for versatility, reliability and high performance. Hardware-independent file managers can be dynamically added to OS-9 and OS-9000 systems for quick and easy configuration. Off-the-shelf file managers are available for a wide variety of I/O classes and types.

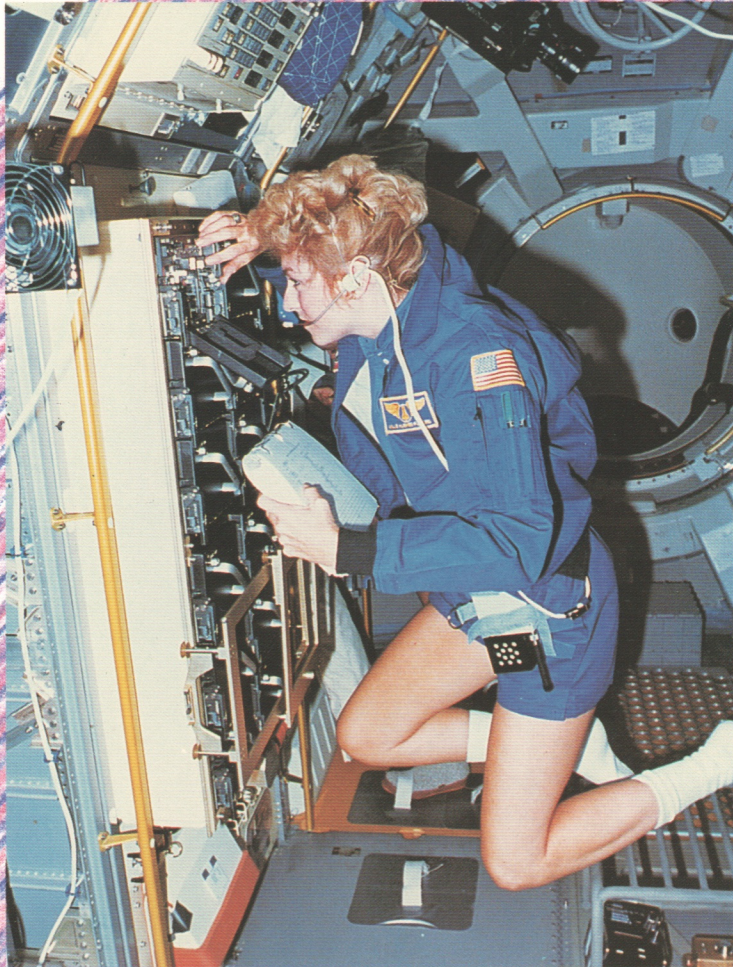


### Off-the-Shelf I/O Support

Serial, parallel, digital I/O  
 Industrial I/O: A/D, D/A, D/D, etc.  
 SCSI magnetic/optical disk and tape  
 RAM Disk  
 TCP/IP via Ethernet or serial (SLIP)

ISDN  
 Multiprocessor support  
 MIL-STD-1553B  
 GPIB  
 NFS client and server

X Window System client and server  
 Motif  
 MPEG  
 RAVE industrial GUI



## Put Your Next Project On The Fast Track

FasTrak is part of Microware's continuing commitment to providing a total solution for your real-time engineering needs. Microware's real-time operating systems, compilers, development tools, networking and graphics options represent a complete, state-of-the-art platform to launch your next real-time project.

Let FasTrak become a part of your design team.  
It's simply productive.



---

M I C R O W A R E   S Y S T E M S   C O R P O R A T I O N

---

Microware Systems Corporation • Corporate Headquarters • 1900 N.W. 114th Street • Des Moines, Iowa 50325-7077 • Phone: (515) 224-1929 • Fax: (515) 224-1352 • Internet: [info@microware.com](mailto:info@microware.com)

Western Regional Office

Phone: (408) 980-0201

Southeastern Regional Office

Phone: (407) 725-2840

Northeastern Regional Office

Phone: (603) 929-4107

Microware Systems K.K. (Japan)

Phone: (81) 3-3257-9000

Microware Systems (U.K.) Ltd.

Phone: (44) 703 601990

Microware Systems France

Phone: (33) 42.58.63.00

Microware, OS-9, OS-9000 and RAVE are registered trademarks of Microware Systems Corporation. FasTrak, FastFix and Ultra Care trademarks of Microware. HyperHelp is a trademark of Bristol Technology Incorporated. The X Window System is a trademark of MIT. All other brand or product names are trademarks or registered trademarks of their respective holders.

© 1993 Microware Systems Corporation. All Rights Reserved.

Printed in the U.S.A.