

OS-9 for PowerPC Background

Information on Microware's release of OS-9, FasTrak and DAVID for the PowerPC architecture

A WHITE PAPER

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OS-9/PowerPC is a modular, scalable real-time operating system. Featuring a ROMable real-time kernel, hierarchical file managers, and a variety of I/O and networking options, OS-9/PowerPC also comes equipped with a full suite of resident, UNIX and Windows cross development tools.

In OS-9, all functional components—including the kernel, hierarchical file managers, I/O systems, and development tools—are implemented as independent modules. By combining these modules, designers can realize a variety of configurations—from a lean, ROMable stand-alone kernel, to a full blown multiuser development system. In a typical scenario, development is handled using a full-featured configuration. Once the real-time code has been debugged, the development and I/O modules are stripped away and the kernel is deployed with the application code in the target system.

All of OS-9's modules are ROMable. They are also position independent (referred to by name rather than by absolute address). As such, modules may be dynamically added to or deleted from the system while the system is running without recompilation or relinking.

A compact, high-speed kernel

OS-9 includes one of the most robust kernels on the market, providing features such as:

- Mixed priority-based, preemptive real-time and time-shared scheduling modes.
- Task synchronization and process management constructs such as pipes, events, semaphores and signals.
- 18-microsecond worst-case interrupt latency.
- Hierarchical tree structured directories.
- Re-entrant code (code that doesn't modify itself), thereby enabling the sharing of modules among processes and a reduction in memory requirements.
- Memory protection through support for user and system state process permissions.
- Enhanced memory protection by taking advantage of standard hardware MMUs (Though OS-9 doesn't require an MMU to run efficiently).
- Standard C library interface for I/O operations (read and write calls) for improved I/O performance and application portability.

OS-9 File Managers

OS-9/PowerPC provides the broadest file manager selection of any real-time operating system, spanning such diverse applications as data communications, telecommunications and multimedia.

OS-9's core file managers facilitate interprocess communications and give OS-9 applications access to file systems, serial devices such as printers and terminals, and mass storage devices such as disks (hard, floppy, RAM and optical) and tape devices.

OS-9's network file managers give OS-9 systems easy access to a broad range of networked resources via TCP/IP and Microware's own OS-9/Net. The file managers also support a variety of high-level file transfer and network protocols, including FTP (File Transfer Protocol), NFS (Network File System) and RPC (Remote Procedure Call).

The OS-9 Developer's Pak includes the following file managers:

- **PIPE File Manager** — Named and unnamed FIFO buffers used for interprocess communications.
- **Sequential Character File (SCF) Manager** — Used to access sequential character oriented device such as terminals, modems, and printers, industrial I/O, A/D and D/A devices.
- **Random Block File (RBF) Manager** — Used to provide high-speed random access to devices such as SCSI hard disks, floppy disks, optical disks and RAM disks. RBF implements the OS-9 hierarchical multiuser file system.
- **Sequential Block File (SBF) Manager** — Used to access sequential block devices such as SCSI tape drives, digital audio tape (DAT) drives and intelligent I/O cards.
- **PC File (PCF) Manager** — A random block file manager that implements the DOS hierarchical file system. PCF enables OS-9 applications to read/write DOS floppies and hard disks, partition the hard disk, etc.
- **Internet Support Package (ISP) File Manager** — Enables OS-9 systems to communicate with any other system that uses the TCP/IP protocol, independent of the target system's underlying operating system. The ISP File Manager supports the TCP/IP, FTP and TELNET virtual network terminal protocols and works with both Ethernet and serial (SLIP and CSLIP). A bundled utility, known as BootP, enables diskless systems to boot OS-9 from a remote server via either a local area network or backplane.
- **NFS File Manager** — Featuring a full client-server implementation, the NFS File Manager provides a de facto standard for sharing file systems across any Internet network, regardless of the underlying hardware, operating system, network or transport protocol. Through NFS, any OS-9 system running TCP/IP and UDP/IP

(User Datagram Protocol/Internet Protocol) can access shared file systems that reside on any machine running Internet.

Extended File Managers

To support sophisticated man-machine interfaces and target vertical applications such as telecommunications, multimedia and video on demand, Microware offers optional extensions to OS-9's core file managers.

ISDN File Manager

Microware's latest addition to its portfolio of network and communications file managers is an Integrated Services Data Network (ISDN) File Manager. Targeting WAN telecommunications applications such as videoconferencing, high-speed fax and LAN/WAN bridges, this file manager enables OS-9 systems to access Basic Rate (BRI) ISDN channels.

The ISDN file manager is compatible with the AT&T 5ESS/5E6 and NTT INS Net64 central office switches, and supports the following protocols: LAP-B Bearer (B) channel link access protocol, CCITT Q.921 data link D channel link access protocol, and the Q.931 call control protocol, which provides call signaling and set up/tear down. Device drivers are available for the Siemens HD82525 and AMD 79C30 communications controllers.

MPEG Multimedia File Manager

OS-9's Motion Picture Experts Group (MPEG) File Manager (MPFM) targets a broad range of multimedia applications. These include professional broadcasting, digital interactive television, education, training and video on demand.

MPFM enables OS-9 systems to play back synchronized MPEG-encoded audio and video files from disk in real time. The MPEG File Manager supports full-screen, full-motion video at 24, 25 and 30 frames/second, with PAL and NTSC resolutions at data rates from 1.2 Mbit/second to 6 Mbit/second. Video control functions include play forward, pause, frame step/loop and scan forward/reverse. Audio control functions include volume control, muting, stereo mixing and looping. Device drivers are available for Motorola's MCD250 and C Cube's CL450 video decoders.

OS-9/X Window System

The OS-9/X Window System is a complete X Windows implementation. Available for resident OS-9 systems, UNIX cross and DOS cross development hosts, the OS-9/X Window System provides a powerful toolkit for building portable, distributed, architect-

ture-independent real-time graphics software. At the same time, it gives OS-9 users access to a broad range of X-based third-party software.

The OS-9/X Window System includes X Windows development libraries, run-time client programs, sample source client programs, and is available with both the TAB Window Manager and Motif user interface. The X Window Development Libraries include XLIB (X library), XT (X Toolkit Intrinsics), XAW (X Athena Widgets), and XMU (X Miscellaneous Utilities). The X Window run-time client programs (such as X Terminal) enable programmers to perform system level functions such as opening terminals, and initializing and starting up X Windows. OS-9/X Windows is compatible with a wide variety of networked X Windows servers.

OS-9 Resident Development and UNIX and Windows Cross Development Options

Microware offers development options for OS-9/PowerPC including OS-9 resident and UNIX or Windows cross development. Resident development enables designers to develop their code directly on their target PowerPC hardware using Microware's optimizing ANSI C compiler, symbolic and source-level debuggers, file managers and screen editor.

To support cross development, Microware offers FasTrak, an automated C language development and project management environment that can be hosted on PCs running Windows, as well as UNIX workstations from Sun, Silicon Graphics, Hewlett-Packard and IBM. Featuring a window-based user interface, FasTrak integrates personal and teamware productivity tools that automate the creation, debugging, analysis and management of complex real-time software development projects.

FasTrak addresses all aspects of the project development cycle, including source code creation and revision, code generation, source- and system-level debugging, system and application profiling, and software version control. To boost productivity for individual programmers, FasTrak provides automated facilities for editing and repairing C programs, an automated push-button utility for generating makefiles and context-sensitive on-line help. At the same time, FasTrak's integrated Source Code Control Systems and project-context files, which save working parameters on a per-project basis, help ensure consistency and coordination among multiple team members.

To facilitate the development of ultra-fast, ultra-efficient, production C code, Microware bundles its Ultra C optimizing compiler with its FasTrak development tools. Employing a unique multistage, I-Code architecture, the compiler features local, global and inter-procedural optimizations. Ultra C was the first C compiler for the real-time market to

pass the Plum Hall ANSI Validation Suite. It also complies fully with the 1989 ANSI and 1990 ISA/IEC C language specifications.

Turnkey Solution For Interactive TV Set-Top Boxes

The availability of OS-9/PowerPC facilitates the release of Microware's DAVID for PowerPC. DAVID (Digital Audio/Video Interactive Decoder) is a turnkey software solution for developing and producing digital set-top decoders that can be used in telephone, cable TV and wireless networks. The DAVID Package includes all of the software modules needed to design a real-time MPEG audio/video decoder for interactive digital television.

A total of 15 manufacturers have adopted DAVID for use in set-top boxes thus far including IBM, Philips, Adaptive MicroWare, Compression Labs Inc., GoldStar, Samsung, Kyocera, Mitsubishi, NEC, Fujitsu, Zenith, I2M, Divicom, ICTV and EURODEC.

The adoption of DAVID as a de facto standard for interactive TV represents a continuation of Microware's success in the multimedia arena that began with the selection of a version of Microware's OS-9 real-time operating system (CD-RTOS) as a standard for Compact Disc-Interactive (CD-i). CD-i was the first interactive multimedia platform mass-marketed for consumers world-wide, and today, CD-i players based on CD-RTOS are manufactured by a number of companies, including Philips N.V. and Sony Corporation. More recently, Microware was chosen by Bellcore as one of six corporate charter members to participate in Bellcore's Collaboratory on Information Infrastructure, an effort to develop technologies aimed at the emerging interactive "Information Superhighway." Since then, Bellcore has used DAVID set-top boxes in a number of interactive TV demonstrations. Earlier this year, Oracle used set-top boxes based on DAVID technology to demonstrate the capabilities of its new servers at a widely publicized event in Los Angeles. And a number of both domestic and international telcos, including Bell Atlantic and Hong Kong Telecom are conducting widespread trials using DAVID set-top boxes.

microware

Corporate Headquarters

1900 N.W. 114th Street

Des Moines, IA 50325-7077

Phone: (515) 224-1929

Fax: (515) 224-1352

Internet: info@microware.com

Microware Systems France

Phone: (33) 42.58.63.00

Microware Systems (U.K.) Limited

Phone: (44) 703 601990

Microware Systems K.K. (Japan)

Phone: (81) 3-3257-9000

