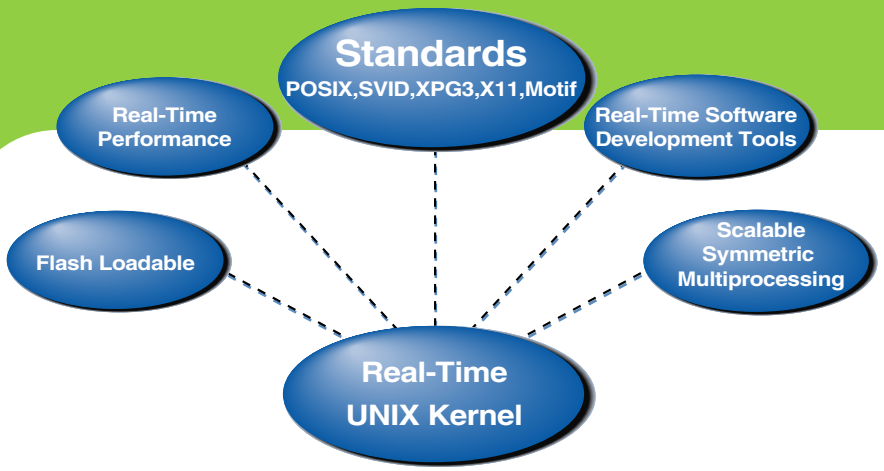
PowerMAX OS™
Real-Time Operating System

Features

- Real-Time UNIX® operating system, supporting the following Concurrent PowerPC SMP platforms:
  - Power Hawk™ 6U VME
  - PowerStack™ PCI
  - TurboHawk™ and Night Hawk® 9U VME
  - PowerMAXION™ 6U VME
- Industry-standard System V Release 4
- Open Systems Standards
  - POSIX® 1003.1-1990
  - POSIX 1003.1b-1993
  - POSIX 1003.1c-1995
  - SVID Release 4
  - XPG4
- Preemptive, multithreaded re-entrant kernel
- Multiprocessing support
  - Tightly-coupled symmetric multiprocessors
  - Closely-coupled PowerPC CPU modules
- Less than 8 microsecond interrupt response time
- Minimal process dispatch latencies
- Dynamic and static load balancing
- CPU shielding for maximizing deterministic performance
- Diskless operation with Flash ROM boot, VME boot, and network boot
- Single-vendor support for operating system, compilers and software development tools



Overview

Concurrent Computer Corporation's PowerMAX OS™ is an industry-standard, POSIX-compliant, real-time UNIX operating system for PowerPC computers. PowerMAX OS features high I/O throughput, fast response to external events, and efficient interprocess communication. The kernel is multithreaded and preemptive. It supports symmetric multiprocessing with load balancing and CPU biasing to maximize the determinism and real-time performance of the user's application.

Open Systems and Standards

Compliance with the System V Interface Definition (SVID), XPG4, POSIX 1003.1-1990 and POSIX 1003.1b-1993 (real-time extensions), and POSIX 1003.c (threads) standards ensures easy porting of standards-compliant application software.

The Concurrent suite of compilers, which includes C/C++, Ada, and Fortran, complies with applicable ANSI, federal, and industry standards.

Real-Time Features

PowerMAX OS includes the following real-time features:

- Static Priority Scheduling
- Shared Data and Synchronization
- Processor Shielding
- Physical Address Mapping
- User Interrupt Routines
- Memory Locking
- Asynchronous I/O
- High Resolution Clocks and Timers
- Direct Disk I/O
- Threads

Processor Shielding

In a tightly-coupled symmetric multiprocessing implementation, PowerMAX OS allows a processor to be shielded from the processing of interrupts, UNIX daemons, and networking protocol overhead. This provides a highly deterministic environment for real-time program execution.

Multithreading and Preemption

A multithreaded kernel allows multiple processes to execute in the kernel simultaneously. The kernel protects key data structures and critical sections of code with semaphores and spin locks to preserve the integrity of system data structures. With this implementation, processes contend with each other only when requesting an identical resource.

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Real-Time... Real Benefits

Otherwise, all kernel features and capabilities are available to all processes. This feature supports true linear performance in a multiprocessor system.

A significant benefit of a multithreaded kernel is that a process executing in the kernel can be forced to relinquish a CPU involuntarily — that is, to be preempted. The kernel can transfer control of the CPU from a lower-priority process to a higher-priority process. This allows a high-priority process waiting for an external event to respond immediately when the event occurs — even if the CPU is currently in use.

Process Dispatch Latency

Process dispatch latency is the time from the occurrence of an external interrupt until the process awaiting that interrupt is able to run. Dispatch latency includes the time spent in recognizing an external interrupt, executing the interrupt handler, waking the process that is waiting for the interrupt, performing a context switch to that process, and exiting the kernel so the process can begin executing application code. Such features as distributed interrupts, rapid context switches, an efficient preemption mechanism and low interrupt latencies combine to provide for typical dispatch latencies of 50 microseconds and worst-case dispatch latencies of 150 microseconds.

Load Balancing

Load balancing is the process that PowerMAX OS uses to distribute the workload effectively across multiple processors. A separate run queue for each processor provides faster context switch times.

Closely-coupled Multiprocessing

PowerMAX OS supports configurations of multiple single-board computers in a single VME chassis connected by a high-performance VME bus or PO-PCI link. A disk drive is required only on one of the boards in the rack – which acts as a file server for other boards. A range of communication interfaces between tasks on separate SBCs is available including shared memory, TCP/IP protocol on PO-PCI or VME, POSIX interprocesses communication, and DMA transfers between SBCs. This range of communication options allows the user to select whether the application should be highly portable to other distributed or tightly-coupled environments or tailored to be highly efficient at inter-board communication in a single VME chassis environment.

PowerMAX OS can be booted without a disk drive attached to the system by booting across a VME backplane, across Ethernet™, or from Flash ROM.

Interconnectivity

In addition to the standard communications components of the UNIX operating system (e.g., uucp, ftp), a full range of networking capabilities is available. These include Ethernet, TCP/IP, NFS™ and the X Window System™ with OSF/Motif®. PowerMAX OS supports multiple interfaces and networks simultaneously.

Concurrent also offers a wide range of integrated VME and PMC cards for connecting with industry-standard buses and vendor-specific devices and systems.

Complete Software Environment from a Single Vendor

In addition to PowerMAX OS, users can obtain a complete development and runtime environment directly from Concurrent which includes high-performance, optimized compilers, the NighStar™ real-time software development tool set, and NightGraphicsTM software.

Development Tool Set

NightStar™ is an integrated, development tool set that includes the NightView™ source-level debugger, the NightTrace™ run-time analyzer, the NightSim™ frequency-based scheduler, the NightProbe™ data monitor, and the NightTune™ performance tuner. NightStar tools provide for non-intrusive debugging and monitoring of real-time applications.

Languages

Compilers for high-level languages include C/C++, Ada 95 and Fortran 77, and are based on a highly-optimized Common Code Generator. Concurrent's MAXAda™ Programming Support Environment and NightStar software development tool set are designed to support development throughout the entire life cycle of an application.

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