

LynxOS RTOS

The world's most powerful, open-standards real-time OS



LynxOS® from LynuxWorks™ is the hard real-time operating system for original equipment manufacturers (OEMs) who want to construct sophisticated real-time systems that do more, perform better, and come to market faster than the competition.

The result of 20 years of real-time OS experience, only LynxOS combines hard real-time embedded technology with broad conformance to open and de facto standards like Linux®, POSIX® and UNIX®.

This means that you can confidently build products on top of LynxOS that meet the most stringent requirements for real-time mission-critical applications while enjoying the time-to-market and investment-protection advantages of open-standards-based development.

At the same time, LynxOS lets you leverage:

Enhanced Features

- Increased RAM support—up to 2 GB
- Symmetric MultiProcessing (SMP)
- New GNU toolchain—based on gcc 3.4.3 and GDB 6.5
- Eclipse-based Luminosity premium tool suite
- ELF file format
- Ada support
- New POSIX—POSIX 1003.1-2003 PSE 53/54
- Updated Linux Application Binary Interface (ABI) compatibility—Linux 2.6-based
- USB 2.0
- NFS v2 support
- Serial ATA support



- Mission-critical performance and reliability—absolute determinism and linear performance scalability
- Industry-leading openness—open APIs and Linux ABI compatibility, plus full POSIX conformance
- Latest technologies for Internet communications—advanced networking feature sets for rapid development of differentiated products

- The latest technologies and protocols for intelligent networked devices to rapidly create differentiating products
- The industry's broadest choice of open development environments and tools to speed your time-to-market and cut development costs
- A comprehensive range of professional services and long-term support programs to maximize the quality and value of your end-user solutions

Hard real-time performance

LynxOS is the superior foundation for sophisticated real-time systems that must:

- Perform complex series of tasks within set periods of time
- Support multiple applications with multiple interrupting devices
- Take full advantage of today's powerful high-end microprocessor and advanced networking architectures

All OS components within LynxOS are designed for absolute determinism (i.e.: hard real-time performance). This means that they absolutely must respond within a known period of time. This predictable response is ensured even in the presence of heavy I/O due to the kernel's unique threading model, enabling interrupt routines to be extremely short and fast.

LynxOS also exhibits true linear scalability, so that it stays unwaveringly deterministic even as the tasks it performs increase massively. And this determinism extends to networking applications, which can stay responsive even in the face of the most complex demands.

Unprecedented openness

LynxOS is the most open hard real-time operating system available today. Its native interfaces are those of Linux, UNIX and POSIX, it is ABI-compatible with Linux, and it is part of a family of open operating systems from LynuxWorks that also includes BlueCat® Linux, LynxOS-SE, and LynxOS-178.

...Open APIs

Because LynxOS is designed from the ground up for conformance to open system interfaces, OEMs are able to leverage existing Linux, UNIX and POSIX programming talent for embedded real-time projects.



Development time is saved and programmers are able to be more productive using familiar methodologies as opposed to learning proprietary methods.

...Full POSIX conformance

POSIX conformance means that OEMs can take advantage of existing POSIX-compliant applications—including open-source Linux and Solaris® applications—to speed up time-to-market.

Unlike real-time operating systems that comply with only parts of the POSIX specification, LynxOS is fully conformant with POSIX interfaces for core services, real-time extensions, and thread extensions—POSIX 1003.1-2003 PSE 53 conformance.

...True Linux compatibility

LynxOS not only conforms to open system standards, but it is also the only RTOS offering true Linux binary-compatibility.

ABI-compatibility with Linux means that applications written for Linux run on LynxOS with no loss of functionality and little time and effort involved.

This helps OEMs maximize the value of their code investments and enables Linux-based products to be quickly upgraded with new real-time features and performance by migrating them to LynxOS.

Linux ABI-compatibility has no impact on LynxOS kernel stability or maintainability, nor does it incur overhead as do usual compatibility layers. This is due to LynxOS' inherent compatibility with the interfaces of Linux, UNIX and POSIX.

Additionally, LynuxWorks development tools support LynxOS, LynxOS-178, LynxOS-SE, and BlueCat Linux. Hence there are no

new tools to purchase and no new learning curves to climb in order to extend code investments across both the open-source and hard real-time worlds.

Latest technologies for interconnecting devices

LynxOS gives developers access to state-of-the art networking technology. The new networking capabilities make it the most advanced of all the commercial RTOS offerings, with feature such as IPSec, IPv6 an integrated fire-wall, and Quality of Service (QoS).

The TCP/IP stack has been enhanced for reentrancy, determinism and performance, and includes the latest protocols and capabilities for networking, including Gigabit Ethernet, SNMP v1, 2 and 3, routing algorithms like RIPv2, OSPFv2, and BGP-4, and others. Consequently,

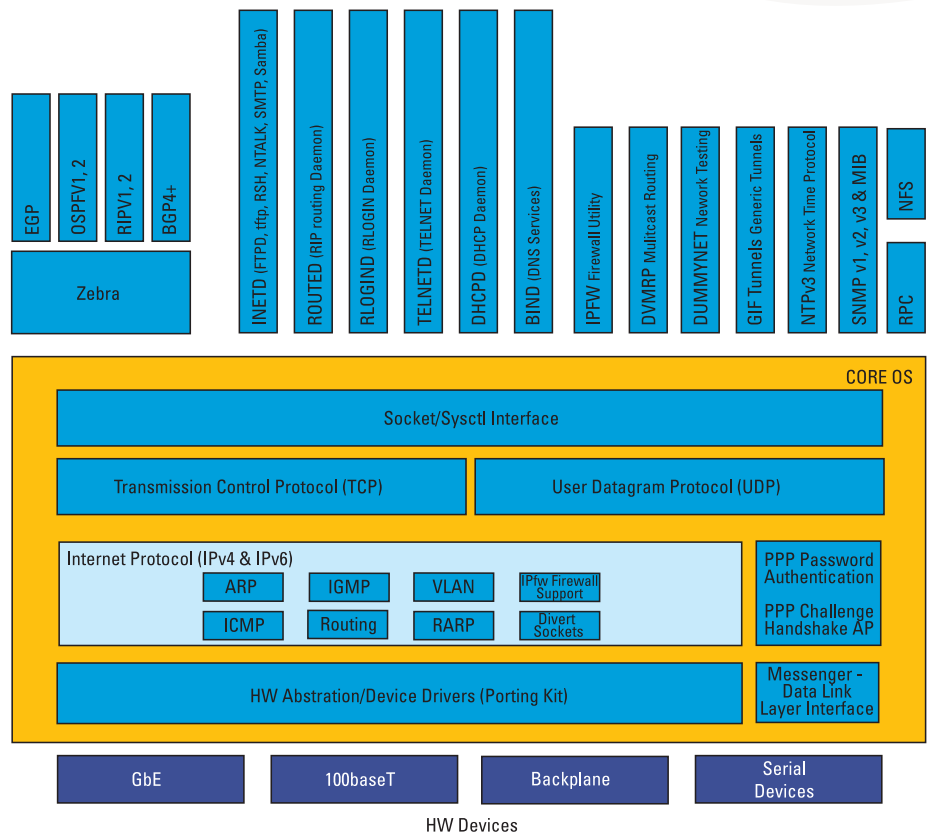
OEMs and TEMs can rapidly implement advanced features and functions to differentiate their products from the competition.

Reliable computing environment

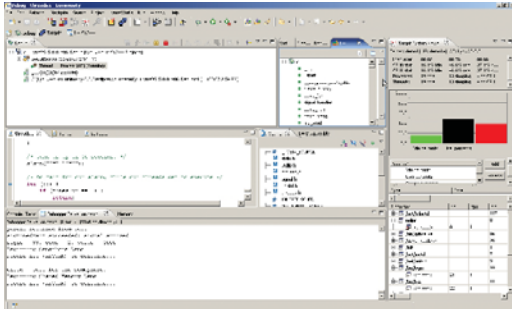
LynxOS couples its hard real-time performance with strict systems reliability so that it meets the needs of applications that must perform unfailingly in a range of demanding environments.

A key enabler of LynxOS reliability is its unique Memory Management Unit (MMU) support, residing at the lowest level of the LynxOS kernel.

Full MMU support, included in the kernel since 1989, provides the reliability advantages of protected memory and the performance advantages of virtual addresses.

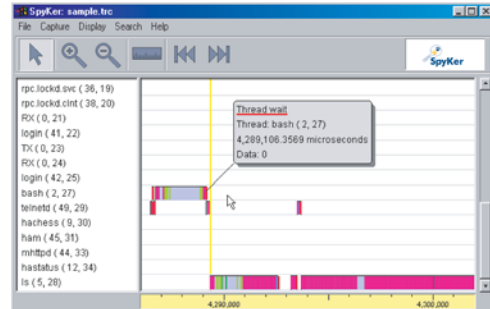


Choice of popular development environments



Luminosity Eclipse-based IDE

Create, edit, compile, manage, and debug C and C++ embedded and real-time applications with this full-featured Java™-based IDE for all LynuxWorks cross-development platforms.



SpyKer™ Pro

The first dynamically instrumented system trace tool, ideal for visualizing program execution and timing of events, identifying elusive application bugs, and fine-tuning system performance.

Hence, where other real-time operating systems rely on unprotected tasks running in a single flat address space, LynxOS enables each task to run protected in its own space for uncompromising reliability.

Long-term value

One of the few embedded software companies with an ISO 9001:2000-certified software development process, LynuxWorks backs up LynxOS with a comprehensive range of professional services and support programs that reflect our unparalleled expertise in embedded product development.

Examples include:

- Porting and compatibility verification services
- Full LynxOS consulting and training services on a global basis
- Long-term support options for development and deployment support of a LynxOS release for an unprecedented 15 years

The net result is that LynuxWorks customers not only come to market quickly with high-quality real-time solutions, but are able to more effectively provide value to their own customers over the long term.

Kernel features

- Hard real-time determinism
- Multitasking and multithreaded RTOS
- Unlimited number of tasks
- Extensive support for multi-threaded applications
- Complete MMU based protected address spaces for tasks
- Page level memory mapping for efficient memory management
- 256 priority levels
- Priority inheritance semaphore support
- Kernel threads and priority tracking support (LynuxWorks patented)
- Four scheduling policies (FIFO, Priority Quantum, Round-Robin, Non-preemptive)
- Deterministic context switching through real-time scheduling
- Low interrupt & task response times through efficient interrupt handling
- Demand paged virtual memory support
- Comprehensive inter-task communication facilities
- Message queues, semaphores, shared memory, sockets, signals, pipes, mutexes, condition variables (POSIX)
- Comprehensive POSIX API conformance: POSIX 1003.1-2003 PSE 53
- MMAP support for regular files & shared memory
- Extremely fast boot times
- Configurable tick timer resolution
- Configurable time quantum for priority levels
- Dynamic loading of device driver modules
- MIB style visibility into kernel variables
- Efficient floating point context management
- Support for static and dynamically linked libraries
- ELF file format
- SVR4-style ELF shared library support
- Modular design for flexible footprint management
- Kernel downloadable image (KDI) for diskless environments (LynuxWorks patented)
- POSIX real-time timer and clock support
- Kernel crash analysis
- Kernel level event logging of system events
- Up to 2GB of system-managed RAM
- Debug version of kernel for profiling and watchpoint support
- Dynamic device drivers

Networking Support

- Full state-of-the-art TCP/IP stack derived from FreeBSD 4.11 and enhanced for reentrancy, determinism and performance
- IPv4 and IPv6 support
- IPSec/IKE/VPN
- Quality of Service (QoS)
- Protocols: TCP, UDP, ICMP, IGMP, ARP, RARP, DHCP, NAT, RPC, NTPv3
- Divert Sockets, PF Packet, Raw Ethernet support

Routing Protocols (Zebra routing package)

- RIP, RIPv2
- Distance Multicast Routing Protocol (DVMRP)
- BGP4
- OSPF, OSPFv2

Network Booting

- PXE Netboot, TFTP boot

Network Security

- Secure DNS dynamic update
- IPSEC AH, IPSEC ESP
- PPP Password Authentication, PPP Challenge Handshake AP
- Firewall support: ipfw, ip6fw

Network Management

- SNMP v1, v2 and v3
- BIND: dns services, named

Network Device Support

- Gigabit Ethernet
- 100baseT interfaces

Network Daemons

- IPv4: inetd, routed, rlogind, telnetd, dhcpcd, tftpd, etc.
- IPv6: faithd, pim6sd, pim6dd, rtsold, route6d, etc.

Linux application support

- Linux application binary interface (ABI) personality
- Linux binaries run unchanged
- Compatible with Linux v2.6 and glibc v2.3.3
- Debugger support for Linux binaries

File system support

- Lynx Fast File system
- ISO 9660 file system
- Network File System (NFS)
- RAM disk file system

IO device support

- IDE and EIDE with DMA support
- SCSI support: Adaptec 19160, 29160, 29160N; Symbios 53c895/896
- Flash support: M-systems TrueFFS, Flash interface chips
- PCMCIA support
- UART, PTY (pseudo TTY support)
- DRM device abstraction layer for portability of drivers
- USB 2.0
- Serial ATA

Libraries and utilities

- Over 100 libraries and over 2500 utility routines

Development environment

- Multiple interactive shells: bash, csh, ash, dlsh
- Cross Development: Windows XP/Pro, Linux RH Enterprise 4
- GNU tool chain: GCC, G++ 3.4.3, and GDB 6.5
- Ada support
- Full support for multithreaded ANSI C development
- Full support for multithreaded C++ development
- Static, Dynamic, Multithreaded versions of system libraries
- ELF Dynamic linking loader
- C/C++ language Altivec support
- Symbolic debugging of multithreaded & Altivec applications
- Watchpoint support for application & kernel debuggers
- Configurable core file support
- Selective core file contents (Stack plus data, BSS, heap, and/or shared memory)
- Post-mortem debugging of configurable core files
- XFree86, LessTif
- Full suite of tools

Architecture Support

- Motorola/IBM PowerPC
- Freescale PowerQUICC II and III
- Intel® Architecture family
- AMCC 4xx PowerPC family

Please call for a complete list or check our web site for additions and updates.

Custom Board Support

- Modular architecture for rapid OS porting
- Improved Porting Guide documentation
- Boot loader support for firmware-less configurations
- Pre-configured "Demo" KDIs (Kernel Downloadable Image)
- Reference library of device drivers for porting ease



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