LynxOS-SE

Time- and space-partitioned RTOS with open-standards APIs

The LynxOS®-SE RTOS is the first and only time- and space-partitioned, hard real-time operating system with the ability to run POSIX®, ARINC 653 and Linux® applications simultaneously in a single partition.

LynxOS-SE is based on open standards and is designed specifically to fulfill the stringent needs of multithreaded and multiprocess applications in high-performance systems.

It offers the interoperability benefits of the latest POSIX 1003.13:2003 (PSE53) standard as well as the ARINC 653 APplication EXecutive (APEX).

Time and space partitioning for fault containment

LynxOS-SE runs standalone on x86 processors and as a guest OS with LynxSecure on x86.

Safety and reliability are achieved through Virtual Machine (VM) brick-wall partitions, which make it impossible for system events in one partition to interfere with events in another. Each partition runs as a virtual machine with dedicated resources.

Memory and resources are never shared between the partitions in a LynxOS-SE system, and an ARINC 653-based fixed-cyclic scheduling algorithm ensures that the system is deterministic and safe by providing each partition with fixed cycles of execution time.

Further, system partitioning allows real-time applications of various domains to be executed concurrently in different partitions on the same processor, according to the needs of each individual project. For additional containment, file systems in DRAM, Flash, and USB devices can be mounted read-write or read-only.

Medium-robustness security

LynxOS-SE is the only RTOS with general-purpose operating-system security features sufficiently complete for evaluation at "medium robustness" as defined by the US Government.

LynxOS-SE conforms to the Draft US Government Protection Profile for General-Purpose Operating Systems in a Networked Environment, Version 0.5, and security assurance requirements conformant to EAL 4 augmented (EAL 4+).

"Medium robustness" requires resistance to compromise through strength of security functions and augmented security assurance per Common Criteria Evaluation Assurance Level 4 (EAL 4+). Security features in LynxOS-SE include discretionary access control, roles, privileges, auditing, identification and authentication, quotas and trusted paths.

Open standards open the market

At the core of the LynxOS-SE operating system is LynxOS, a mature UNIX®-style operating system (born 1988) that was designed from the start for hard real-time determinism. LynxOS and its variants have been deployed in millions of safety-critical applications worldwide, including multiple military and aerospace systems certified to DO-178B, up to level A.

With the release of LynxOS-SE, LynuxWorks™ reaffirms its longstanding support of open standards by offering a powerful combination of POSIX and ARINC 653 compliance. Open standards promote application portability, software reuse and system interoperability, and this translates into time-to-market and investment-protection benefits for developers.

Linux Application Binary Interface (ABI) support

LynxOS-SE allows Linux applications to run unmodified in a partition along with native POSIX and ARINC applications. This allows customers to avail of the ever-expanding universe of Linux third-party COTS applications and run them in a time-space partitioned, hard real-time environment.

QoS networking

LynxOS-SE supports state-of-the-art networking capabilities for seamless interoperability with other systems. It supports over 300 RFCs with IPv4 and IPSec, and supports IP quality-of-service features for differentiating high-priority network traffic.

The key networking services provided by LynxOS-SE include:

Features & Advantages

- POSIX 1003.1-2003 PSE53 conformance
- Linux 2.6 (glibc 2.3.3) ABI support
- ELF file format
- Up to 2 GB RAM
- TCP/IP networking stack with IPv4, IPSEC and QoS
- NFS v4 support
- C++, Ada and Java support
- X-windows, Lestif, OpenGL
- GCC 3.4.3 compiler and GDB 6.x debugger
- USB 2.0, Serial ATA

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- FreeBSD 4.11-based TCP/IP stack with IPv4, IPSec and Quality of Service (QoS)
- SNMPv3
- NFSv4
- OpenSSL

ARINC 653 space and time partitioning

Conformance to ARINC 653 partitioning and scheduling is increasingly required in safety-critical systems.

Each ARINC 653 partition in a LynxOS-SE system supports full-fledged multithread, multiprocess applications. The application executive manages system execution by alloting a dedicated time slice to each partition.

LynxOS-SE conforms to the ARINC 653-1 APEX interface and provides the following mandated system service groups:

- Partition management
- Process management
- Time management
- Interpartition communications (sampling ports and queueing ports)
- Intrapartition communications (buffers, blackboards, semaphores and events)
- Health monitoring

Full POSIX conformance

The POSIX standard was developed by the Institute of Electrical and Electronics Engineers (IEEE) and is maintained by The Open Group. POSIX is recognized by the International Organization for Standardization (ISO) and American National Standards Institute (ANSI).

POSIX conformance assures code portability between systems and is increasingly mandated for commercial applications and government contracts. POSIX is the native LynxOS-SE interface, and POSIX calls are not an optional add-on library for the operating system, ensuring maximum performance. LynxOS-SE offers full compliance to the POSIX 1003.13:2003 (PSE53 profile).

POSIX processes are supported within partitions, allowing users the flexibility to *fork()* or *exec()* new POSIX programs within ARINC 653 partitions.

LynxOS-SE cross development tools

The LynxOS-SE cross development kit contains state-of-the-art tools for developing code targeted to the LynxOS-SE platform. LynuxWorks has over ten years experience maintaining ports of the GNU Tools for its operating systems.

Currently, the LynxOS-SE RTOS utilizes a GNU 3.4.3 based set of tools which includes gcc, g++, gnat, ld, gdb and all related tools. LynuxWorks has enhanced these tools to take advantage of various features of the operating system such as multithread safety and partition awareness.

In addition, LynuxWorks provides a set of proprietary tools to facilitate embedded programming. Tools such as mkimage can be used to combine an application with a LynxOS-SE kernel to produce a downloadable and bootable image for the target.

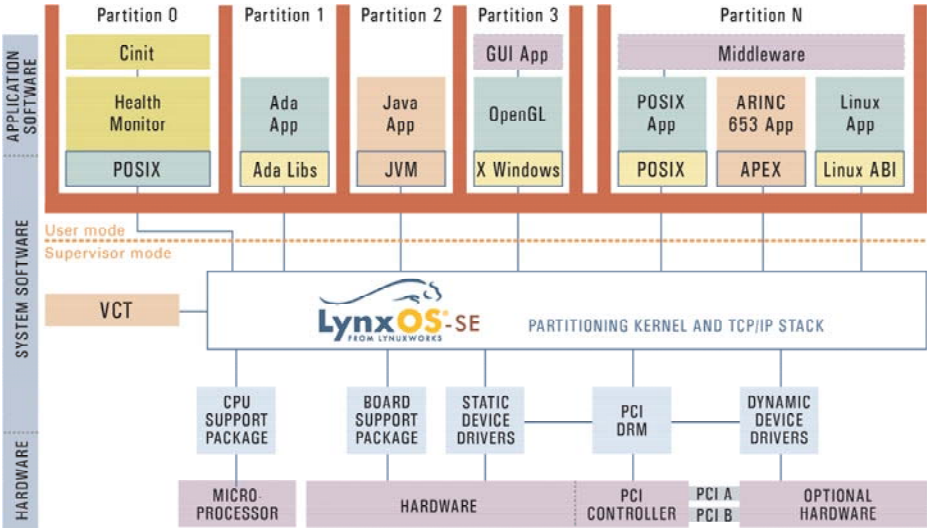
SpyKer, for system profiling

SpyKer is a dynamically instrumented system trace analyzer which allows you to monitor all the events in your system environment when your application is running.

X11 and Open GL Support

LynuxWorks offers an X11/OpenGL solution for LynxOS-SE based on the popular open-source XFree86/Mesa software.

Users can run the supplied X11 servers and client applications as well as build their own X11 applications using the supplied libraries.



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