

Medical Electronics

LynuxWorks fills the software requirements of medical-device manufacturers



Medical-device developers benefit from open software standards and software virtualization

LynuxWorks™ Inc. provides the most complete collection of open-standards-based operating systems for meeting the growing software requirements of medical-device manufacturers.

LynuxWorks provides a set of compatible software platforms for building a wide range of medical applications. Our family of operating systems includes the LynxOS® family of POSIX®-based hard real-time operating systems with an aviation safety pedigree, and the military-grade LynxSecure separation kernel and embedded hypervisor.

Developers recognize the complexity of embedded software in today's medical devices. The increasing need to communicate securely with external medical networks requires a full-featured real-time operating system. LynuxWorks operating systems are designed to meet the real-time, safety and security demands of these medical devices with open-standards-based APIs for truly portable application development.

For medical devices requiring hard real-time response, determinism, and



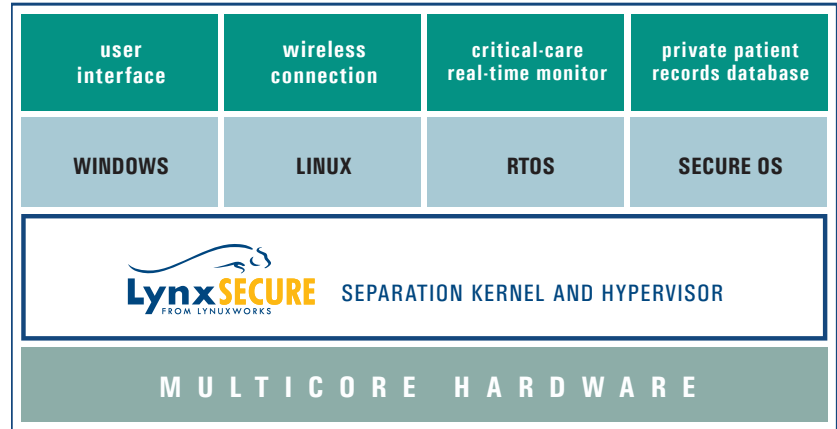
International medical technology group Elekta is basing its new generations of equipment on LynuxWorks' LynxOS-SE real-time operating system (RTOS) to get to market quickly with systems that deliver high levels of functionality, fault tolerance and safety.

Elekta chose the LynxOS-SE RTOS with hard partitioning so that multiple applications could run concurrently without interfering with each other. LynxOS-SE is available as a stand-alone OS, as used by Elekta, or as a para-virtualized guest operating system running on top of the LynxSecure virtualization platform.

safety-critical reliability such as surgical or control instrumentation, the LynxOS RTOS family offers the POSIX open-standard interface for reuse of software applications between Linux-based systems and hard real-time.

With the introduction of the LynxSecure separation kernel and embedded hypervisor, medical devices can now have the best of both worlds, with hard real-time applications running alongside commercial desktop operating systems on the same industry-standard Intel® processors. The separation kernel offers both safety and security partitioning for applications. The embedded hypervisor functionality allows “guest” operating systems and their applications to run in their own partitions.

SAMPLE MULTI-OS MEDICAL SYSTEM



Medical devices can now incorporate multiple systems, securely segregating the desktop operating systems from the real-time systems. Traditional desktop systems running on a

device are allowed to communicate with security-sensitive data such as patient records, while the real-time functions such as diagnostics and patient monitoring take place elsewhere on the device, simultaneously.

Securely reuse legacy Windows® and Linux medical applications inside new high-assurance real-time systems

LynxSecure’s virtualization technology provides an ideal foundation for securely reusing legacy Windows and Linux medical applications.

These Windows and Linux applications can be brought together as components of new applications controlled by LynxSecure, with real-time functionality added if required. LynxSecure manages each application in its

own dedicated partition with no compromise of performance or security.

The LynxSecure hypervisor creates a virtualization layer that maps physical system resources—such as memory, CPU time and I/O peripherals—to each guest operating system.

Medical professionals require instruments that handle functions with total stability, but also need to be connected to the medical IT infrastructure. Achieving these two objectives within a realistic SWAP-C (size, weight, power, cost) envelope entails having both run on the same hardware platform. The LynxSecure separation kernel and embedded hypervisor allows the LynxOS hard real-time RTOS family to securely coexist with desktop connectivity and other applications running under Windows® or Linux®.

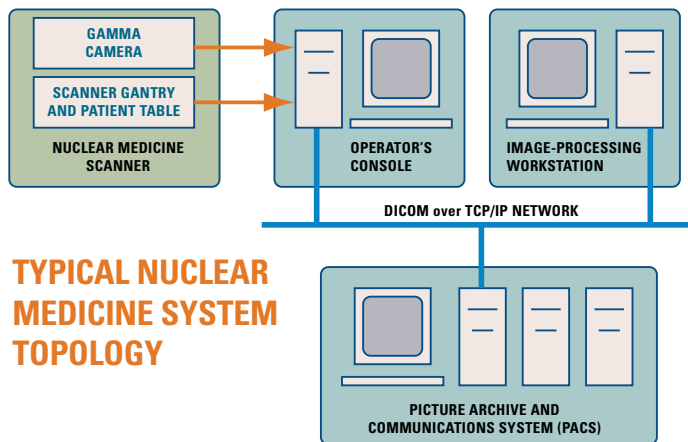
The medical-device market also has a large amount of legacy applications that are currently running on a Windows or Linux system. The Lynx-



Tactiq (www.tactiq.co.uk) plays a leading role in developing and supporting GE Healthcare's most successful nuclear

medicine imaging system—the GENIE Acquisition system, with LynuxWorks' LynxOS real-time operating system inside.

Tactiq is proud to have GE Healthcare as a major client for over ten years. Tactiq has been developing complex embedded software since 1996 and has earned an outstanding track record in the medical-systems industry.



TYPICAL NUCLEAR MEDICINE SYSTEM TOPOLOGY

The GENIE Acquisition Operators Console controls the NM scanner system and provides a graphical user interface for operator interaction, including scan set up, image review and network image transfer.



GE Healthcare's "MG" Nuclear Medicine Imaging System is a very popular variable-geometry, dual-gamma-camera imaging system with approximately 1300 systems installed worldwide.

Secure embedded hypervisor allows for those applications to be reused and joined with applications having real-time requirements without compromising either the performance or security of the individual systems.

The LynuxWorks family of operating systems is available across a wide variety of hardware platforms.

Evaluation platforms from the processor vendors are a good way to pro-

totype new medical designs before moving to either a proprietary hardware solution, or to a commercial-off-the-shelf (COTS) board. Many of the common COTS boards are supported by the LynuxWorks operating sys-

tems, including boards from American Portwell, Curtiss Wright, Emerson, GE Fanuc and Kontron.

LynuxWorks has been involved in many safety and security designs at the most rigorous levels. LynuxWorks has consistently met the ISO 9001 standard for engineering and compa-

ny practices, and the LynxOS product line has been subjected to safety audits to the highest level of aviation standards.

LynuxWorks operating systems have been used in devices for medical imaging, nuclear medicine, medical diagnostics and now in proof-of-con-

cepts for the latest of safe and secure medical devices.

Visit www.lynuxworks.com/solutions/medical for more information.

Secure virtualization and wireless body area networks

A recent advance in medical electronics has been the application of Bluetooth technology to wireless medical systems. A patient can wear wireless sensors which monitor the patient's condition in real time and which stream the collected data to a doctor, a database or other medical equipment.

The LynxSecure separation kernel and hypervisor has been used on a Portwell Mini-ITX board with Intel® Virtualization Technology to create a proof-of-concept platform that achieves multiple biomedical monitoring, display and communication functions.

The design securely connects more than 25 wireless biometric sensors to the network, with secure virtualization from LynxSecure keeping system components separate from each other. The Bluetooth networking stack resides in its



own secure partition, isolated from other system software.

For more information, visit the Intel Embedded Community web site at <http://www.lynuxworks.com/solutions/medical/intel.php>.



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