

SELECTING AN EMBEDDED RTOS



FEATURED INTERVIEW:

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QNX SOFTWARE SYSTEMS — RTOS PRODUCTS & SERVICES, 2009

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Q. First of all, tell us a little bit about yourself and your responsibilities at QNX.

- A. I have more than 20 years of experience in the software industry, including embedded and realtime systems development, UML modeling, and object-oriented design. I currently work as a product-marketing manager at QNX, where I am responsible for operating systems and tools.

Prior to joining QNX, I held software development, consulting, and product management positions at IBM, Rational, Klocwork, and ObjecTime. I have a Bachelor's degree and a Master's degree in electrical engineering.

Q. If you would, please give us a very brief, bulleted outline of your products. What sorts of real-time operating systems (RTOSes), tools, and/or services does your company offer?

- A. Our product lineup includes:
- **QNX Neutrino RTOS** — A POSIX-certified, protected-mode, microkernel RTOS with support for symmetric multiprocessing (SMP), transparent distributed processing, CPU time partitioning, and a wide range of file systems, networking stacks, and advanced graphics technologies.
 - **QNX Momentics Tool Suite** — An Eclipse-based IDE with tools for application profiling, system profiling, memory analysis, code coverage, remote target debugging, and JTAG debugging. Our IDE supports the latest versions of the GNU toolchain and Eclipse CDT.
 - **QNX Aviage HMI suite** — A middleware solution for building sophisticated, hardware-accelerated HMIs in Adobe Flash Lite and OpenGL ES.
 - **QNX Aviage Multimedia Suite** — A middleware solution that allows media servers and in-car infotainment systems to seamlessly integrate content from multiple media sources, including iPods, Zunes, USB drives, cellphones, satellite radios, and hard disks.
 - **QNX Aviage Acoustic Processing Suite** — A modular framework that improves the quality and lowers the cost of automotive handsfree systems through noise suppression, echo cancellation, bandwidth extension, and other advanced algorithms.

- **Professional Services** — A full range of custom engineering services, training services, and technical support plans.

Q. What is QNX's "unique value proposition" for the embedded systems engineer or programmer who is considering an embedded RTOS? What do you and your products do to help him get his product to market faster, cheaper, better?

A. We offer three distinct advantages:

- **Componentized architecture for greater reliability, scalability, and security** — Unlike most operating systems, *QNX Neutrino* uses a true microkernel architecture. As a result, device drivers, networking stacks, and file systems (which traditionally run as part of the OS kernel) can all run outside of the kernel as memory-protected user-space processes. This model makes embedded systems far easier to debug, customize, and upgrade, and much more tolerant of faults. For instance, you can replace a device driver dynamically, without having to reboot — a phenomenal benefit for high availability systems.

QNX microkernel architecture is also highly scalable: it scales up for massively distributed multicore systems and scales down to small resource-constrained devices. It supports both symmetric multiprocessing (SMP), which allows developers to take advantage of multi-core processors, and transparent distributed processing (TDP), which allows embedded systems to share resources seamlessly in a peer-to-peer fashion.

QNX microkernel architecture also offers greater security by preventing local application exploits that could bring down the entire system. Because it separates the kernel from device drivers and the networking stack, microkernel architecture ensures that external attacks are localized. *QNX Neutrino* also provides time partitioning, which guarantees that applications, drivers, and network stacks don't exceed preset CPU limits. As a result, QNX-based systems can easily contain denial of service attacks that try to wipe out device availability by maxing out the CPU.

- **Middleware solutions** — QNX goes far beyond offering an OS and tools; it also provides complete middleware packages to significantly reduce development time. For example, our HMI software is built with Adobe Flash, allowing developers to create rich, dynamic user interfaces with a minimum of hassle and special coding. Our multimedia framework, meanwhile, eliminates tedious engineering details by automatically handling digital rights management and by presenting applications with a unified interface to iPods, USB drives, and other media sources. And our acoustic processing software provides best-in-class noise reduction and echo cancellation, but is extremely simple to configure, taking less than an hour to tune, whereas competitive products can literally take weeks.
- **Professional engineering services** — QNX has been serving embedded OEMs for almost 30 years in the automotive, industrial automation, networking, medical, and defense markets. This deep market experience has made us acutely sensitive to the regulatory and time-to-market requirements of our customers. Our automotive services team, for example, has a perfect track record in helping major auto suppliers meet their project milestones. We offer services that can help customers through

every stage of their project: evaluation, design, training, development, integration, and maintenance.

Q. How are you different as a company from competitors? What sets your products apart from those of other RTOS companies?

- A. The comprehensive nature of our products and services. With QNX, you don't have to buy your graphics solution from one vendor, your networking stack from another vendor, your flash file system from yet another vendor, and your code coverage tool from still another vendor. We work extremely hard on a pre-integrated approach that allows developers to hit the ground running.

That said, our products play nicely with others. For instance, our graphics framework allows customers to seamlessly combine our Adobe Flash-based technology with their existing graphics frameworks. Moreover, our graphics support isn't limited to Flash and OpenGL ES: we work with many different third-party vendors that also provide graphical toolkits for QNX. Also, we have long championed standards such as POSIX and Eclipse, which allow customers to leverage their existing code bases, skill sets, and development tools.

QNX technology also makes it much easier to migrate legacy code to multi-core processors. For example, we've supported symmetric multiprocessing (SMP) over a decade — it's a proven, mature implementation. Other RTOS vendors, meanwhile, have only started to support SMP. We also provide bound multiprocessing (BMP), an SMP variant that lets developers migrate to multi-core at their own pace, and multi-core visualization tools that help developers optimize their code for parallel execution.

Q. What embedded architectures do you support - e.g., Intel architecture, MIPS, ARM, PowerPC, etc.?

- A. We support a large number of ARM, MIPS, PowerPC, SH-4, XScale, and x86 processors, on a wide range of boards. For an up-to-date list of our board support packages (BSPs), developers can visit <http://community.qnx.com/sf/wiki/do/viewPage/projects.bsp/wiki/BSPAndDrivers/>.

Q. What additional software do you offer such as networking, file systems, TCP/IP, security, IDE, GUIs etc.? What about development tools? Are there particular partnerships with other software companies that are especially helpful?

- A. Unlike conventional RTOSs, *QNX Neutrino* comes with a rich set of networking stacks, file systems, and other services out of the box. For instance, *QNX Neutrino* includes:
- A high-performance NetBSD 4.0 TCP/IP stack and wireless networking
 - A power-safe file system for high-capacity hard drives, an embedded transaction file system (ETFS) for NAND flash, as well as EXT2, NFS, FAT, CD, UDF, and RAM file systems

- Adaptive partitioning, a flexible new form of CPU time partitioning that can contain denial-of-service (DoS) attacks, eliminate task starvation, and simplify software integration efforts
- Accelerated graphics support for Adobe Flash Lite 3.x and the OpenGL ES 3D API

We will also introduce a secure kernel (certified to EAL level 4) in early 2009.

As for partners, we have a large partner ecosystem that includes IBM, Intel, Freescale, Renesas, and Texas Instruments. Our close relationships with major silicon vendors help ensure that our customers can leverage the latest processors and reference boards.

Q. How are your products sold? What is a typical fee arrangement? Is it royalty free? Per unit royalty?

- A. When customers purchase a QNX development seat, they get the development rights to work with all of our operating system technologies; there's no need to negotiate royalty fees up front. (Note that middleware typically involves an incremental development cost and royalty fee).

We charge royalties for runtime deployments, but the actual royalty arrangements can depend on several factors. For instance, if a device manufacturer knows that their product will ship in large volumes, they will sometimes negotiate an "advanced" royalty payment with us before the product hits the streets. That way, the manufacturer can reduce total costs. Basically, we take a flexible approach that complements our customers' business models.

Q. Finally, what sort of "try before buy" experiences does your company offer? Are there free demo downloads, webinars, seminars? What web URLs can you point us to for more information?

- A. Developers can download an eval of our complete development platform, including the *QNX Momentics Tool Suite* and the *QNX Neutrino RTOS*. This isn't a crippled version of our product, but the real thing.

To download the QNX eval, visit <http://www.qnx.com/products/evaluation/>

Also, QNX is the only RTOS vendor to make its source code freely accessible on the web. Anyone can download it, run it, modify, or redistribute it, as long as they follow the licensing terms that apply to their intended use of the software. We've also made our development process transparent, for everyone to see. As a result, community members can participate in the product development process and access patches and experimental features in real time.

To view or download QNX source code, visit the Foundry27 community portal at <http://community.qnx.com/sf/sfmain/do/home>.

We hold webinars on a regular basis, on topics ranging from multicore to in-field debugging. To learn about upcoming webinars, or to access archived webinars, visit http://www.qnx.com/news/web_seminars/.

Q. Thank you for this interview.