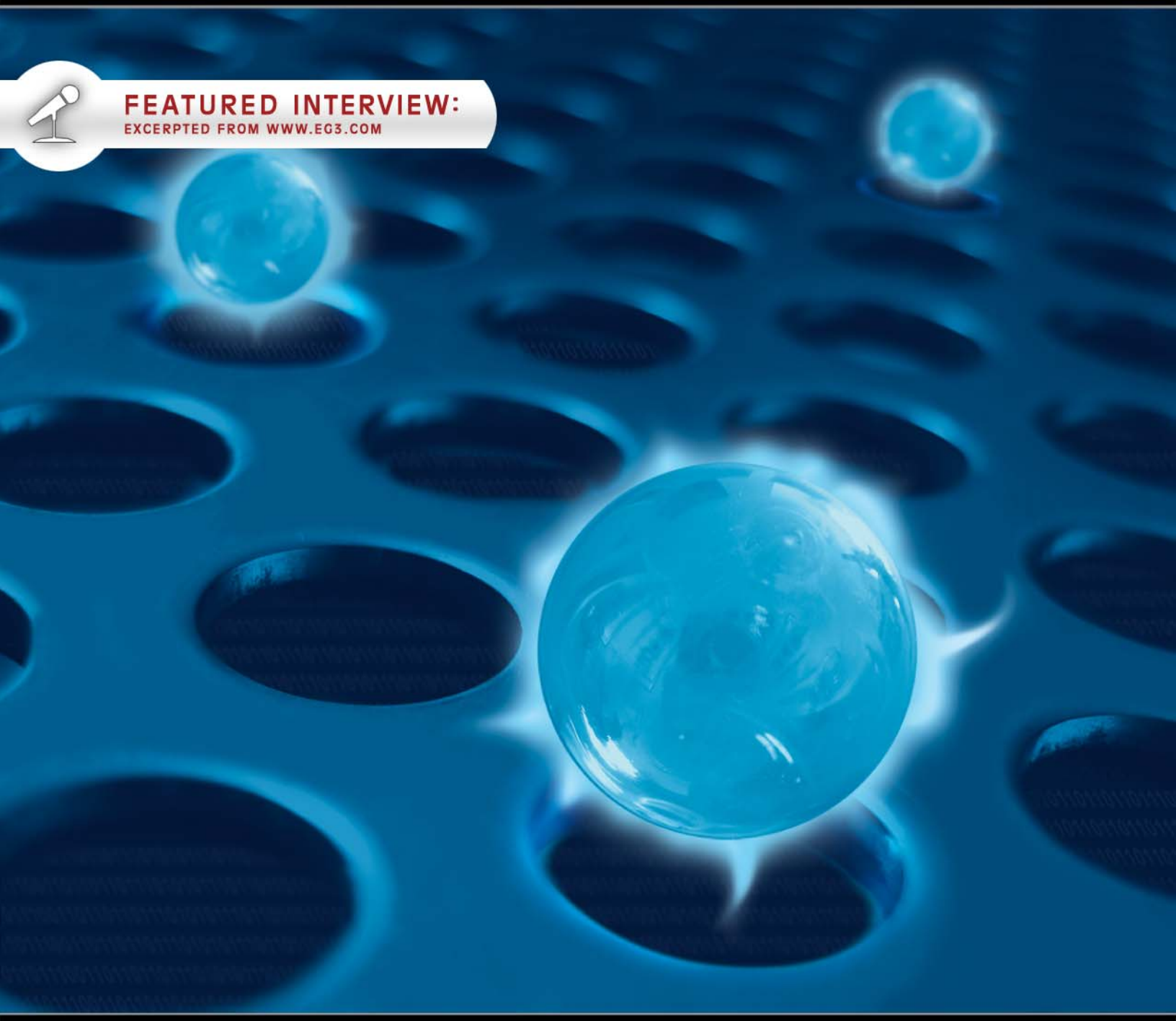
SELECTING AN EMBEDDED RTOS



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OPEN KERNEL LABS - VIRTUALIZATION PRODUCTS & SERVICES, 2009

Open Kernel Labs: Virtualization Products & Services, 2009

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Q. **First of all, tell us a little bit about yourself and your responsibilities at Open Kernel Labs.**

A. I have worked with embedded systems for over 20 years, including time spent as a developer. For the last 10 years I have worked in product management, translating customer and market needs into product requirements.

Currently, I am focusing on Open Kernel Labs embedded hypervisor, OKL4.

Q. **If you would, please give us a very brief, bulleted outline of your products. What sorts of virtualization, tools, and/or services does your company offer?**

- *OKL4* is an embedded hypervisor, providing a unique combination of virtualization and general-purpose microkernel capability in an implementation that is optimized for the embedded systems environment.
- *OKL4* provides a high-performance, low footprint virtualization capability for embedded systems
- In addition, *OKL4's* Secure HyperCell™ Technology, compliments the operating system by; providing a more trustworthy parallel environment for securing data and services, improving reliability through better fault isolation, increasing hardware and OS independence for middleware, and making legacy software re-use easier.
- These technical benefits result in a lower Bill of Materials cost, reduced development expense, shorter time-to-market, and more compelling end products.

Q. **What is Open Kernel Labs "unique value proposition" for the embedded systems engineer or programmer who is considering an embedded RTOS, especially as it relates to "virtualization." What do you and your products do to help him get his product to market faster, cheaper, better?**

A. There are many ways in which the use of *OKL4* results in lower development cost, shorter time to market, reduced BOM cost, higher reliability, and better security so I could easily provide pages of information here. Let me summarize the ways in which *OKL4* helps embedded developers and some of the most common examples:

OKL4 helps maximize the return on the investment in software development by reducing development cost and protecting the value of the resulting software. It protects the investment in legacy code by making it easier to reuse in new handsets. *OKL4* also makes it easier to integrate software from different sources. Additionally *OKL4* makes it easier to meet the real-time requirements of functions like audio processing in designs using rich operating systems with little or no real-time capability. Finally, the functionality provided by *OKL4* allows for the logical separation of software used under different license terms.

OKL4 makes it easier to address security requirements, whether those requirements are high, medium or low by providing a separate, trusted, software environment for data or functionality requiring a higher level of security.

OKL4 can enable lower bill of materials cost by consolidating the functions of multiple processors onto a single processor, while maintaining isolation between those functions. An example of this is running a Linux application environment and a mobile phone communication stack with real-time requirements on a single ARM processor.

OKL4 increases Hardware Platform Independence. It provides an abstraction of the *underlying* hardware, reducing the coupling between specific hardware and device software, which improves portability across different handsets.

OKL4 increases Application Environment Independence by offering a direct execution environment for services that need to be used in a variety of products incorporating different operating systems. Implementing such a service as an *OKL4* hypercell, utilizing our *OKL4* Secure HyperCell™ Technology, reduces the coupling between a specific operating system and that service.

OKL4 can enable new mobile device capability by providing multiple use contexts on a single device. For example a mobile worker context supported by a corporate IT department and a personal use context that is more open and less restricted. *OKL4* can also increase the reliability of the system through improved fault isolation and recovery.

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

A. Using *OKL4* allows the system designer to incorporate BOTH virtualization AND componentization into their system architecture. By componentization I mean creating an architecture in which a number of simpler software components are combined in well-defined and well-managed ways. The opposite of componentization is monolithic software architecture where well-defined separation and interfaces are few and far between. Many virtualization technologies for the embedded market only offevirtualization and not the additional benefits of componentization.

The way in which *OKL4* enables virtualization and componentization is better because of *OKL4's* Secure HyperCell Technology, which builds in security at the system level. Secure HyperCell Technology offers a very flexible and fine-grained ability to componentize

complex software into a number of separate hypercells. Hypercells can contain anything from a full VM to an individual device driver and everything in between. They can also be fully isolated or tightly integrated. is controlled by design. Our solution offers fundamental security benefits. In the system, only *OKL4*, the small-embedded hypervisor runs at the highest privilege level.

Keeping the privilege mode code small and simple equates to trustworthy management of resources and the isolation of cells per the chosen design. This also results in a smaller trusted computing based (TCB) for subsystems or services with higher security requirements. Secure HyperCell Technology is implemented in a way that overcomes common concerns over the performance of microkernel-based systems. We have optimized for fast context switching and high performance communication between hypercells.

Our technology is also adapted to and optimized for the performance and resource requirements of an embedded environment, including the requirement to meet real-time requirements. *OKL4* is available under both an open source and commercial licenses. The availability of *OKL4* under an open source license increases transparency and productivity through source code availability for all. This also allows for a no fuss, hands on evaluation of *OKL4* without the need to do anything more than download the software from ok-labs.com. In addition, this makes *OKL4* extremely user-friendly for research and educational uses

And finally, *OKL4* has been proven ready for use in commercial products, having already been shipped in approximately 250 million mobile devices

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

A. *OKL4* support is available for ARM, MIPS and Intel architecture processors. Support for the use of Linux, Symbian, Windows and a variety of RTOSes can be provided.

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. In addition to the *OKL4* embedded hypervisor we offer paravirtualization of operating systems as indicated in the lat question, and a powerful system configuration tool. *OKL4* is provided as an SDK so that development teams have flexibility in their choice of compatible core development tools such as compilers, debuggers, and build environments.

Support for TCP/IP, GUIs, and other similar functions is most typically provided in conjunction with a chosen guest operating system.

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

A. There are no fees associated with the use of *OKL4* under the open source license.

Use of *OKL4* under the commercial license requires a one-time project development license, annual support agreement, and production license.

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

A. Since we are open source, "try before you buy" is as easy as it can be. Anyone can download our source code and start working with *OKL4* immediately. In addition, anyone wishing to try out *OKL4* has the full support of our developer community. This includes training videos on GeekTV, How-tos and other documentation, a forum and an active developer mailing list.

Q. **Thank you for this product interview.**