

Small in stature, but big at heart

# QNX, ANY SIZE YOU WANT

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The Hurd is unfortunately a long way from a finished product, and many Linux fans continue to mock the idea of microkernel architecture. Nevertheless one company has successfully shunned monolithic kernels for decades: QNX.



**Figure 1:**  
Fast, light and  
flexible.

Presented with an old laptop with no OS, no CD drive and no network card, I pulled out my QNX4 demo diskette and an old serial modem and five minutes later I was browsing *Project Gutenberg* with the Voyager Web Browser. The browser, GUI, TCP/IP and OS, along with a web server, dialer, word processor, Tower of Hanoi game and vector graphics demo fit on a single 1.44Mb floppy disk and made big news when QNX first did this a couple of years ago. It is still useful for getting online quickly today, when confronted with an old PC and no easy install method for a Linux distro.

Of course the demo disk is more than just a gimmick. It is a demonstration of how flexible a modular (unix-type) architecture, running on a

microkernel can be. As well as being a Real Time OS (see last month's column), QNX Neutrino - the latest version of the OS.

## Why QNX

The big advantage that QNX has over many embedded and RealTime rivals is self-hosting - the development platform and target platform are the same (see figure. 1). Combine this with an open and familiar API (Posix) and free (in every sense of the word) development tools, courtesy of GNU and the Free Software community and you have an easy to develop for and powerful platform. If the Real Time variants of Linux (see last month's column) are

### Microkernel architecture

*The microkernel includes only a small set of core services within the kernel, including thread services, message passing, condition variables, semaphores, signals, and scheduling. The kernel can be extended by dynamically plugging in service-providing processes, such as file systems, device drivers, POSIX message queues, and networking. These services run in user space and benefit from protected memory.*

*Throughout the 1980's microkernel architecture was taught as state-of-the-art in OS theory classes at universities across the world. The Hurd, the kernel for the Free Software Foundation's GNU OS was started in this period. However getting multi-threaded servers to pass messages to each other is particularly difficult to implement correctly, and although the underlying Mach microkernel was (eventually) available as a free, debugged base, Hurd development was (and still is) fairly slow. Ten years ago, when Linus Torvalds wanted to run Unix on his i386, the quickest solution seemed to be a monolithic kernel. Although the purists poured scorn on the idea at the time, readers of this publication have a fair idea of the subsequent success of the Linux kernel :-)* We will, nonetheless, return to microkernel architecture in greater depth in future columns. As QNX Neutrino shows, done correctly it has great potential for a GNU-based OS.

not yet powerful or stable enough for you, and your customer base will bear the licence cost (and they usually will in traditional embedded fields) then you may find yourself severely tempted.

QNX Neutrino has become the OS of choice for everything from fledgling Internet Appliances to what the *Guinness Book of Records* calls "the most intelligent robot" in the world, Cog, at MIT's Artificial Intelligence Lab. Designed to mimic the way humans react with and learn from their environment, Cog uses a QNX-based distributed control system to support its "realtime visual and auditory requirement" - camera "eyes" and microphone "ears" are placed in the same position as on a human face and Cog learns about its environment in a similar fashion to a baby. The distributed architecture and transparent networking enable the eight QNX nodes to be accessed and developed simultaneously by students and researchers in the lab, or from home. The performance has impressed the AI lab enough to move all of its robot research onto the platform.

## No X word

Another advantage is the embedded GUI, *Photon*. The X server/client architecture, common to all Unix systems, has many advantages but is far too big for most embedded systems. The modular approach to the GUI means that it has the smallest possible memory footprint, whatever the application, and can be used in many multimedia applications. Naturally it works over TCP/IP too.

The ability to distribute components across a networked environment is inherent in the system. With no user involvement QNX Neutrino can share disks, modems or even processors across your network. Whilst it scales up to huge distributed SMP systems, it is also an advantage in systems with limited resources. In the home entertainment sector this ability could speed the long-heralded "convergence" of comms, computer and audio-visual equipment into a low-cost distributed

### Microkernel on a mini disk

*QNX has a modular microkernel architecture which means that distributions can be custom made with only the services needed. Even the Photon Windowing system on the demo disk only occupies 45K with additional processes loaded as needed. As there is no room for the myriad of common drivers needed for compatibility with desktop PCs, a "flat" driver uses the frame-buffer memory of the graphics card, mapping it into the high-memory space of the processor. The largest application on the disk, at 400K, is the HTML3.2-compliant browser, Voyager. This understands frames, Javascript and animated GIFs. The full version in the Neutrino distribution has all the plug-ins (Real Player, Flash, et al.) that are needed. If you want to give it a go, visit the site and download the appropriate version. There is one for network connections and one for computers with a serial, ISA or pcmcia modem. Untar the download then copy the image to the floppy by simply running the makedemo shellscript included. It is as simple as that. Now stick the floppy in the drive of any PC - Minimum specification is a 386PC with 8Mb of RAM and a colour VGA display - and switch on. The OS boots and loads a compressed image to RAM from where processes are decompressed and loaded on-the-fly as needed. It will not overwrite your hard disk - you don't even need a hard disk to run it.*

environment where every multimedia service is available "on tap" around the house, and the system just works.

## QNX vs. Linux

With a proven track record in everything from life-critical medical instruments and emergency call centres to traffic control and supermarket POS (Point-of-Sale) QNX Neutrino is a tough competitor for the embedded Linux solutions providers. Although the licence is restrictive, it is a lot more open than most of the proprietary Unices, enabling one to dig into the code and construct just the system one needs. However the truly free Linux-based Real Time solutions, as well as Free alternatives such as ECOS, are strongly competitive with QNX Neutrino. The embedded space continues to be every bit as interesting as the Desktop market, and it will be an interesting test of the Free Software model to see how the Open-Source-but-not-free model of QNX holds up. ■

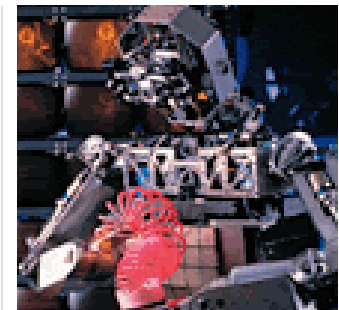


Figure 2:  
More than just  
a toy

### Licensed to what?

*It is with some trepidation that one approaches the maze of licences around QNX in all its forms. The QNX Community License and QNX Open Community License enable derivative works to be based upon QNX code, and royalties collected from customers for use of the code. Those who wish to probe the intricacies of the Custom License Certificate (CLC) Program should head over to <http://licensing.qnx.com>.*

*In addition to proprietary RTOS code QNX development is very much dependent upon GPL utilities such as awk, rcs, gmake, gzip, and sed. The company see their product - and their licensing model (with its "traditional" view of IP - Intellectual Property) as very much complementary to Linux. Indeed there is a great deal of sharing of applications and developers between the two platforms. However, for many, the licences will be the sticking point. Readers may be pleased to note that next month's posix compliant column will return to GPL'd OS's.*

### Info

QNX demo and ISOs of full system from <http://www.qnx.com/>  
(Register at <http://get.qnx.com/>)  
Hurd: <http://www.gnu.org/>  
Debian GNU/Hurd:  
<http://www.debian.org/>