

Is Real-Time Linux for Real?

Microsoft's Windows NT and now Windows CE are typically at the forefront of discussions about real-time operating systems for manufacturing. Much has been said and demonstrated about their application in industrial settings, but many still look at these options with hesitation due to concerns about deterministic operation. Linux is the latest operating system to enter this discussion, particularly given the significant boost it enjoyed when Netscape recently announced its plans to support Linux. But is the industry ready for it? Better yet, is Linux ready for IA?

Unlike NT, Linux was not developed from scratch. It grew out of reused code and ideas from Minix, a more deterministic, UNIX-like operating system with a small footprint that was developed for 386 machines. Since then, its development has been driven by several thousand developers scattered throughout the world that are connected only by the Internet.

LINUX FACTS

The Linux user base has grown to about 5 million installations, rivaling that of Microsoft's Windows NT. The operating system's major strengths are its multi-user, multi-tasking capabilities and its ability to run on platforms ranging from Intel x86 and Motorola 68k, or PowerPCs to Sparc, Mips, and Digital Alpha. OpenLinux standard 1.1 outperformed Microsoft Windows NT version 4.0 in recent benchmark tests and the OpenLinux server exhibited excellent scalability and predictability with a near linear rise in performance. Implementing a superset of the POSIX standard, Linux can also interoperate with many other operating systems, including those from Microsoft, Apple, and Novell. Linux supports COM/DCOM as well as OMG's CORBA implementations. It also supports a wide range of interfaces, including X Windows, Emacs, and TCP/IP networking, and additionally benefits from nearly thirty years of API tuning in the UNIX community.

OPEN SOURCE

The fact that Linux is free, and its source code completely open, is a major contributor to its current popularity. Hundreds of thousands of developers from around the world, many of them hardware vendors, have developed a variety of device drivers without the burden of expensive source code licenses or restrictive non-disclosure agreements. This open sourcing has made it possible for manufacturing implementations that need a real-time operating system to incorporate a real-time kernel, similar to what companies like VenturCom are doing with NT and CE.

Bare bones Linux is natively well suited for soft real-time applications. Hard real-time support can be implemented with schedulers such as the New Mexico Institute of Technology's RT-Linux, where a small, real-time kernel coexists with the POSIX-like Linux kernel, permitting real-time functions to operate in a predictable and low-latency environment. RT-Linux utilizes a simple, real-time executive to run a non-real-time kernel as its lowest priority task, using a virtual

machine layer to make the standard kernel fully preemptable.

The potential for Linux to be adopted for factory floor applications is growing, but it is still early to predict how rapidly Linux will conquer IA. Linux enables IT to develop customized and effective IA solutions at a significantly lower cost relative to other operating systems. Most UNIX or Linux applications can be recompiled to run on the other system with minimum effort. Technical expertise is widely available, much more than any other operating system, since the source code has been available for anyone to learn and master. With Linux, you also have all the graphics capabilities of Windows, but without the disadvantages of MS-DOS.

Linux differs from fellow UNIX derivative QNX due to the fact that QNX remains proprietary. QNX has a very flexible architecture that can be scaled down for lean embedded systems or scaled out to create virtual multiprocessor supercomputers. QNX conforms to open systems standards like POSIX, plus it supports a range of standard options including TCP/IP, ANSI C/C++, and a variety of bus architectures. The source code is not open and available as it is with Linux, which in fact adopts some of the QNX scheduling techniques to increase its speed.

The open source model pioneered with Linux developers and now followed by Netscape will soon become an important factor to consider when deciding on a real-time operating system. Similar to past experience with hardware, software is now becoming a commodity that the industry increasingly requires to be open. Thus, open and non-proprietary real-time operating system source code will be the catalyst of a new business strategy, empowered by the users, that will promote close partnership between users and suppliers.

CONCLUSION

ARC believes that Linux will soon emerge as another real-time operating system option for manufacturing applications. Features not natively supported by Linux can be readily developed and easily incorporated in the operating system. Linux is Y2K compliant since it does not store data in a simplistic field by field fashion. Instead, it stores it as an incremental count of seconds. The current size of that counter is good until 2038. By then, Linux will be using 64 bit counters, which are good until the next "Big Bang." ■

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