Guest Editors’ Introduction

Operating Systems

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As we approach the 21st century and enter the Information Age, we see the uniquely qualified electronics industry playing a vital role in realizing the new era by providing state-of-the-art technology through microelectronics, telecommunications, computer networks, and software. The advent of 32-bit microprocessors that offer the processing power of minis at a fraction of the cost opens up new applications for the ubiquitous microchips in some areas previously thought impossible for computing. This is especially so in the automation of services and business industries.

Concurrent with these microtechnological advances are applications in the office, factory, and home, in entertainment and business, that have spawned new areas of opportunities. Office automation, factory automation, and home and business computers (PCs, desktops) make “computing for the masses” a reality. No longer is computing confined to big mainframes with traditional centralized processing and software and operating systems geared toward enhancing the performance of number-crunching operations.

With microelectronics we use microprocessors in workstations and file servers—be it in business, office, or scientific endeavors—which enhance the productivity and information management of the end user. In more-automated environments such as industrial automation, we find microprocessors embedded in controllers and monitors—very often controlling real-time, multitasking operations. Process control in factories, security and alarm operations in nuclear reactors, and patient monitoring in hospitals are some vivid instances of such applications.

Many of these controllers link hierarchically at interfaces to a central processing unit, or a network of processors, which provides for the management of more information or for more information-processing capabilities. The support of these complex multiple-node architectures requires advancement and innovation in the operating systems. Operating system architectures have evolved over the last decade to fully exploit multiple-processor distributed systems. Operating systems, in all flavors, are being pursued to provide effective end-user interfaces, while complying with constraints of code compatibility, portability, and hardware transparency.

In planning for this special issue, we focused on operating system architectures and analysis that exploit the rapid advances of microelectronics technologies. We examine a real-time operating system that is designed and implemented specifically for microprocessors embedded in the industrial environment; the architecture of a distributed operating system, the V-system; and finally an implementation and analysis of a network file server.

The first article by James Ready, of Hunter & Ready, Inc., discusses the Versatile Real-Time Executive (VRTX) family of software components. Designed specifically for embedded microprocessor applications in industrial environments, VRTX provides necessary real-time and concurrency control for software that must meet the response-time requirements of industrial systems.

Implementation of distributed file servers seems to be a current topic in the advances of operating systems technology today. Therefore, it is timely that the next article addresses this issue. Bill Jackson of EDS discusses implementation issues in the architecture of a file server having the major requirements of availability and reliability.

In the next article Eric Berglund of Stanford University describes the V-System architecture. It is a distributed hardware configuration that is available to client/server systems. The primarily message-based system supports a functionally partitioned operating system architecture wherein different processors assume responsibility for different tasks. The heart of the system is the distributed kernel (V-kernel), which provides inexpensive processes and fast interprocess communications. Servers use concurrency and message passing to run at the user level but also provide operating system functions. Berglund describes the design of the servers, along with their use of the V-kernel primitives and the interactions between them.

We feel these articles address issues that provide some insights into the advances made in operating systems and their environments and thus should contribute to the overall advancement of technology in this information age.

We acknowledge the many reviewers for their timely comments and appreciate the time they took in the review process. We also fervently hope that this exciting field of operating systems technology returns as a special theme to IEEE Micro soon.
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