ARTICLE SUMMARIES

Misleading Architecting Tradeoffs

pp. 20-26

Ton Kostelijk

Architects usually base key system architecture decisions on qualitative reasoning, which should be founded on concrete quantitative arguments and facts. Ill-founded qualitative reasoning can lead to a failed architecture.

Fortunately, such reasoning can be revealed and corrected, as occurred in the development of a real-time embedded product, a DVD hard-disk recorder. The evolution of this product reveals several pitfalls—from plain errors to overgeneralizations and, in particular, unsound tradeoff reasoning.

The Architecture of Virtual Machines

pp. 32-38

James E. Smith and Ravi Nair

Interjecting virtualizing software between abstraction layers near the hardware/software interface forms a virtual machine that lets otherwise incompatible subsystems work together. Further, replication by virtualization enables more flexible and efficient use of hardware resources.

Given developers' heavy reliance on standards and computer industry consolidation, any major innovation will likely be based on VM technology. In the future, VMs should be viewed as a unified discipline to the same degree that hardware, operating systems, and application software are today.

Virtual Machine Monitors: Current Technology and Future Trends

pp. 39-47

Mendel Rosenblum and Tal Garfinkel

The current VMM resurgence seems to be fundamentally altering how software and hardware designers view, manage, and structure complex software environments. Certain functionality, like trusted computing applications, appears to be better suited to benefit from a VMM-enabled environment. In addition, VMMs provide a backward-capability path for deploying innovative operating-system solutions that meet current needs and safely pull along the existing software base. This capability will be key to meeting future computing challenges.

Companies are increasingly abandoning the procuring of individual machines and tightly bundling complex software environments. VMMs are giving these fragile, difficult-to-manage systems new freedom, providing a fundamental building block for desktop mobility, security, and usability.

Intel Virtualization Technology

pp. 48-56

Rich Uhlig, Gil Neiger, Dion Rodgers, Amy L. Santoni, Fernando C.M. Martins, Andrew V. Anderson, Steven M. Bennett, Alain Kägi, Felix H. Leung, and Larry Smith

Once confined only to specialized, proprietary, high-end server and mainframe systems, virtualization is becoming more broadly available and is now supported in off-the-shelf systems based on Intel architecture hardware.

Intel Virtualization Technology provides hardware support for processor virtualization, enabling simplifications of virtual machine monitor software. This development, partly resulting from steady IA-based systems performance improvements, mitigates traditional virtualization performance overheads. Other factors include new creative software approaches addressing the difficulties inherent to IA virtualization and the emergence of novel applications for virtualization in both industry and academia.

Rethinking the Design of Virtual Machine Monitors

pp. 57-62

Andrew Whitaker, Richard S. Cox, Marianne Shaw, and Steven D. Gribble

Over the past several years, a University of Washington research group has developed the Denali VMM, working from the premise that it is both possible and useful to consider a virtual machine abstraction that differs from a physical machine. This effort has had two major results: paravirtualization and hardware interposition.

In *paravirtualization*, the virtual hardware architecture differs from the underlying physical architecture. The authors have leveraged this characteristic to construct a scalable VMM that supports hundreds of concurrently executing virtual machines. *Hardware interposition* lets programmers extend the VMM with new implementations of virtual hardware components such as virtual disks and Ethernet devices. These new hardware components can differ dramatically from native devices.

Virtual Distributed Environments in a Shared Infrastructure

pp. 63-69

Paul Ruth, Xuxian Jiang, Dongyan Xu, and Sebastien Goasguen

Advances in Grid computing technology have contributed to the formation of a wide-area shared infrastructure that provides opportunities for a broad spectrum of distributed and parallel computing applications. However, realizing the full potential of such a shared infrastructure presents significant research challenges.

The authors have developed a middleware system that integrates and extends virtual machine and virtual network technologies to support mutually isolated virtual distributed environments in shared infrastructures like the Grid and the PlanetLab overlay infrastructure.