

NSF Center for Autonomic Computing

Opportunities and Challenges of System Virtualization: The "Managed Virtual Systems" Project

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Abstract:

Virtualization can provide degrees of freedom in resource access and use much beyond its known benefits for server consolidation in datacenters. Opportunities include (1) access to remote devices and runtime device migration without the need for expensive SAN hardware, (2) the provision of entirely new functionality via self-virtualized and logical devices, extending toward (3) the runtime composition of virtual computing platforms from physically distinct CPU/memory, disk, and device resources. The first part of this talk presents technical advances in system virtualization attained by our research, implemented for the Xen hypervisor and with experiments performed on server-class platforms. The second part of the talk addresses the 'management' challenges caused by the improvements in flexibility created by system virtualization. Using a few basic principles that underlie virtualized system management and associated based management mechanisms, we develop runtime methods for managing enterprise systems and applications with respect to the quality of service metrics desired by end user applications and with respect to the power/performance tradeoffs sought in datacenter environments. Runtime platform management for these applications results in substantive improvements in power/performance metrics, without violating application requirements and without extensive application or guest OS instrumentation. Next steps in this work focused on reliability promise similar improvements, by combining high level methods that automatically detect application behavior and characteristics with new platform-level techniques for adapting execution platforms to changes in application states and needs. Risk-based formulations of management goals further contribute to the viability of management automation.



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