

# Server Virtualization in the Scalable Enterprise

Server virtualization can help bring measurable benefits to enterprises, including simplified operations, improved resource utilization, and cost-effective scalability to meet business demands. As this important technology evolves, Dell intends to continue driving standards development and delivering standards-based products that offer choice and control for enterprise IT organizations.

BY JIMMY D. PIKE AND DREW ENGSTROM

*Related Categories:*

*Scalable enterprise*

*Virtualization*

Visit [www.dell.com/powersolutions](http://www.dell.com/powersolutions)  
for the complete category index.

Virtualization is among the most significant topics in computing today. It is also a technology in the midst of a multiyear evolution from its origins as a discrete layer of middleware to part of the base infrastructure of industry-standard servers and operating systems. This article explains the role of server virtualization within the broad context of enterprise computing and explores the important attributes server virtualization brings to the Dell scalable enterprise strategy.

## Dell scalable enterprise strategy

The Dell scalable enterprise strategy is a standards-based, multipurpose architecture that enables optimized use of resources, anticipates incremental growth, and supports extensive expansion. It focuses on standardizing core infrastructure elements, which can help reduce complexity and increase value. Systemic standardization, and the resulting interoperability, enables scaled-out solutions to be built from standard hardware building blocks and best-of-breed software components.

Why is standardization important? Mainstream, standardized technologies—whose development has

been fueled by market volume and competitive pressures—can help deliver optimized, sustainable technology innovation with increased value. A simple look at where the investments and innovations are taking place in the IT industry reinforces the power of standards, interoperability, and integration.

Dell is unlike many of the world's top IT providers in that its scalable enterprise strategy is built upon, and demands, industry standards. The strategy charts a phased, practical road map for building the IT infrastructure of the future based on standardized technologies. Thus, organizations can avoid closed architectures that rely on proprietary shortcuts, which can increase costs while limiting flexibility and control. Dell, in contrast, works with industry-leading partners to develop an approach in which enterprises do not sacrifice openness to gain the value-added benefits of an advanced architecture.

The net result of the Dell scalable enterprise strategy is that enterprises can gain organizational benefits through simplified operations, improved utilization, and the ability to cost-effectively scale their IT infrastructure to meet changing business demands.

## Basics of virtualization

Virtualization is a core enabling technology of the scalable enterprise strategy. Simply put, virtualization decouples software from hardware and presents a logical view of physical hardware to software, allowing a single server to act as multiple, independent servers.

Virtualization is a basic tenet of computing. It is used in various forms to abstract the interface of a resource from its physical implementation. Examples include storage (RAID or logical volumes), networking (virtual LAN), and Web-service application programming interfaces. Server virtualization applies the same concept to industry-standard servers.

Server virtualization is enabled primarily by software that sits between the server hardware and the OS. Often called the hypervisor, this software provides a container that presents a logical hardware interface to an OS. This logical interface enables hardware resources to be partitioned and shared among multiple guest operating systems, which can help improve server utilization. Additionally, each guest OS and its associated applications and data—known collectively as a virtual machine (VM)—are stored as a large file on the physical system. Administrators can easily transfer a VM from one physical system to another or save it on shared storage so that multiple systems can access it as needed.

## Virtualization's role in IT infrastructure

Server virtualization can help simplify operations, improve utilization and uptime, and enable cost-effective scaling.

### Simplifying operations

Server virtualization effectively hides hardware details from software, allowing the hardware to be truly interchangeable without affecting the software. Virtualization can help simplify operations by doing the following:

- Allowing workload portability across multiple servers, which includes the ability to “rehost” software (including legacy operating systems that are no longer supported)
- Streamlining application development and platform certification by certifying on a common virtual interface rather than multiple implementations of physical hardware
- Encapsulating complex configurations into a file that is easily replicated and provisioned

### Improving utilization and uptime

Server virtualization can help organizations make optimal use of existing resources. A single physical server with multiple VMs can host several workloads that, without virtualization, would require multiple physical servers. Additionally, because workloads can be relocated or replicated easily in a virtualized environment, administrators can

move them when performing maintenance without affecting service levels and can quickly provision new servers as needed.

Virtualization can help improve utilization and uptime by doing the following:

- Enabling safe resource sharing on industry-standard servers, so that if one VM fails, the other VMs on the physical server are not affected
- Providing the ability to migrate workloads dynamically from one physical server to another, so that workload service-level agreements can automatically match demand with capacity and system maintenance can be performed without disrupting enterprise services
- Empowering disaster recovery operations by restoring lost services regardless of the target physical platforms providing the services

## Enabling cost-effective scaling

The management and utilization benefits provided by server virtualization facilitate cost-effective, “pay-as-you-grow” scalability across a common, standards-based infrastructure. Virtualization enables cost-effective scaling by doing the following:

- Separating the OS and application workload from the physical server and enabling dynamic scaling through resource sharing and rapid provisioning
- Leveraging and optimizing industry-standard hardware, which can help deliver sustained, incremental performance improvements at consistent, competitive prices

## Efforts to standardize virtualization technology

Server virtualization is still in the early stages of a multiyear evolution that Dell believes will likely culminate with the technology being integrated as a standard component of the base IT infrastructure. However, virtualization technologies can be deployed effectively now to help deliver near-term benefits (see the “Usage scenarios” sidebar in this article for example cases).

## Influence for today

Dell is currently engaged in a number of activities to help provide effective deployment of virtualization technologies today:

- **Dell labs:** Several Dell labs are working on practical implementation details related to virtualization, helping enterprises adopt virtualization quickly and confidently. The Solutions Engineering lab works closely with Dell software partners to certify interoperability between Dell hardware and required drivers and virtualization software. The Scalable Enterprise Technology Center creates scalable enterprise reference

architectures, including virtualized environments, to show administrators how to build and maintain these implementations. And the Technology Showcase gives in-depth technical briefings to organizations that want to learn more about virtualization and how it should be implemented in their environment.

- **Practical publications:** Dell delivers a set of simple, pragmatic publications to help enterprises understand a variety of subjects associated with virtualization (see the supplemental online section of this article at [www.dell.com/powersolutions](http://www.dell.com/powersolutions)).
- **Platform management standards:** One of the key objectives influencing virtualization is management of the underlying platform. Dell supports platform management as defined by the Distributed Management Task Force (DMTF) and its Server Management Work Group. Specifically, Dell has been a key contributor to the development of Systems Management Architecture for Server Hardware (SMASH)—which defines architectural semantics, industry-standard protocols, and profiles to unify data center management—and the recently ratified SMASH Command-Line Protocol (SMASH CLP) specification.<sup>1</sup> SMASH CLP enables simple and intuitive management of heterogeneous servers independent of machine state, OS state, server system topology, or access method, thereby facilitating local and remote management of server hardware in out-of-service and out-of-band environments. Extensions supporting the management of VMs and their connection to physical resources are under development. Further work on VM and platform management and standardization is being conducted by the DMTF System Virtualization, Partitioning, and Clustering Work Group, which is charged with defining schema for managing VM resources and their dependencies.<sup>2</sup>

This focus on the management of virtualization, and integration into general systems management tools, is important to consider. Virtualization introduces capabilities requiring new management interfaces, but the use of and integration into standard tools and existing processes are key. For example, if an administrator uses

virtualization to enable a single server to accomplish what 10 servers used to do, that administrator has 9 fewer physical servers to manage—but still has 10 operating systems, 10 applications, and the virtualization layer to manage. Integrated, standardized systems management options can help address these issues.

### Impact for the future

Dell intends to focus on several key areas it deems essential to streamlining the evolution of virtualization:

- **Standard interfaces between the VM resource manager and VM operational interfaces:** Every managed element within a virtualized environment is associated with a resource manager. Typical functions consist of local operations within a VM or the management of multiple VMs. As such, the interface must be standardized and appropriate for multiple types of VMs.
- **VM monitor interoperability layer:** The VM monitor is the interface that links each VM to the underlying hardware resource. To date, successful virtualization schemes have either replaced or emulated instructions to enable virtualization. Some CPU and OS suppliers have begun adding virtualization support designed to eliminate this need. Although a single common hypervisor implementation is unlikely, development of a common interoperability mechanism that minimizes differences is important.
- **Virtual hard disk interoperability:** Today, there are at least two competing standards for the virtual hard disk format. One common standard must emerge for all virtualization schemes to support heterogeneous guest OS environments.

As these standards evolve, server virtualization as a technology may also affect the following:

- **Software distribution:** By creating a file-based distribution of server configurations, virtualization could dramatically simplify how servers are configured and provisioned.

<sup>1</sup> For more information about SMASH, visit [www.dmtf.org/standards/smash](http://www.dmtf.org/standards/smash).

<sup>2</sup> For more information about the DMTF System Virtualization, Partitioning, and Clustering Work Group, visit [www.dmtf.org/about/committees/SVPC\\_Charter.pdf](http://www.dmtf.org/about/committees/SVPC_Charter.pdf).

Reprinted from *Dell Power Solutions*, August 2006. Copyright © 2006 Dell Inc. All rights reserved.

Intel® PRO Network Connections



## Slot constrained?

Increase throughput by teaming embedded NICs with Intel® multi-port server adapters



## USAGE SCENARIOS

Although server virtualization is still an evolving technology, it can and should be incorporated into today's IT infrastructure to help increase effectiveness. The following usage cases describe how virtualization can be deployed effectively today.

**Legacy OS support.** Virtualization allows for continued support of guest operating systems and applications and can help provide long-term stability and support in a static environment. By decoupling hardware from the host OS, virtualization allows each to evolve without disrupting the other.

**Software development and testing.** Virtualization enables enterprises to create an environment for software development and testing without adding physical servers. It provides a private environment in which to develop software and a pristine environment in which to deploy it for testing. Multiple VMs can be used to create a multi-server environment for distributed testing on a single physical server. Additionally, IT departments can test patches and upgrades to exact copies of their environment without fear of corruption or end-user downtime. VMs, because they are stored in a flat file, can be set up in minutes and used multiple times. Certain software products also have an undo option to roll back changes to a VM.

**Workload consolidation.** Virtualization can accommodate many applications that do not coexist well in a conventional environment on a single platform, because the isolation between multiple

guest operating systems provides distinct execution environments that do not overlap. The resulting improved utilization can help increase return on assets.

**Software distribution.** Virtualization can provide a reliable and portable distribution mechanism for software that is supported on multiple hardware platforms. Virtualization software combines the image of an OS and application and creates a portable "wrapper"—allowing for application deployment on any server supporting the guest OS. The host and guest support helps to eliminate recertification of applications on multiple platforms, provided the guest OS is supported by the host.

**Load balancing.** Virtualization can help create a highly reliable mechanism for load balancing across a pool of cost-effective resources. Load balancing is achieved by allowing guests to be transported among multiple physical servers, helping provide a robust and cost-effective environment and helping minimize exposure to hardware failure.

**Disaster recovery.** Virtualization can help create a highly reliable mechanism for reprovisioning and restoring execution environments if disaster occurs. The encapsulation of VMs provides distinct execution environments that can be renewed as needed. Several products are available that support this cost-effective environment for disaster recovery.

- **Dynamic, policy-driven resource allocation:** Virtualization enables workload portability between servers. Because VMs can be migrated from one physical server to another without interrupting operations, resources can be rebalanced dynamically to meet computing needs.


Virtualization standards can help enterprises avoid vendor lock-in, retain choice and control over their IT environment, improve access to resources to deploy and maintain a virtualized environment, and ultimately increase value as market forces compete for customers' virtualization dollars.

### Virtualization: An essential data center technology

Server virtualization is a powerful technology that can significantly improve manageability and resource utilization. Although the technology is still maturing, current technologies can help deliver tangible benefits, particularly in supporting server consolidation, streamlining development and test environments, improving business continuity, and increasing IT responsiveness.

Dell believes that virtualization can become a standard feature of every industry-standard server system deployed, and that it is

one of the essential technologies enabling the scalable enterprise strategy. Organizations should begin actively evaluating and implementing current technologies to realize these benefits now and to lay the foundation for broad-scale implementation in the future.

Dell is taking an active role in bringing virtualization to the mainstream by working closely with industry leaders to enable current technologies and help develop interface and management standards. Dell delivers tested virtualization infrastructure solutions along with services designed to streamline implementation and support. Dell also provides pragmatic guidance and best practices to help enterprises with deployment. By focusing on standards and avoiding proprietary shortcuts, Dell enables organizations to achieve a dynamic, scalable IT infrastructure while retaining choice and control. 

**Jimmy D. Pike** is a director and distinguished engineer in the Dell Server Architecture and Technology Group, where he is responsible for the strategic system architecture of the enterprise product line.

**Drew Engstrom** manages the Scalable Enterprise Solutions team in the Dell Product Group, where he focuses on server virtualization and advanced data center architecture.