

Virtualization: A Growing Reality in the Data Center

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A major bank moves its data center out of “hurricane alley” after Hurricane Katrina, improves business continuity and disaster recovery capabilities, consolidates from 200 servers with direct attached storage to a storage area network (SAN) with 25 servers, and completes the primary move over six weekends—all with no application downtime.

A health-care organization serving more than 70 U.S. cities upgrades and standardizes its IT infrastructure, reduces its number of physical servers by a ratio of fourteen to one, improves availability of its distributed services, and increases ease of administration and cost-effectiveness—enabling it to provide better service to its patients and reduce power consumption by 20kVA (kilovolt amperes).

Success stories like these were made possible through server virtualization, a technology that is bringing change to the data center on the scale of a technical revolution.

Over the past few years, the decreasing cost of microprocessors made servers so affordable that it became easy to toss a new “box” at an application, business unit, or user group, rather than take on the political battles of sharing physical server resources.

That strategy led to server-sprawl, the bane of the data center. By now, huge numbers of servers, cables, and power cords consume expensive floor space and electricity. IT staff struggle to maintain software patches, security updates, storage, network connectivity, and disaster recovery planning for hundreds (or thousands) of separate machines. They also need to ensure that all that hardware, software, and data is protected in a way that complies with regulatory and business requirements. To complicate matters, these servers often run a disparate assortment of legacy applications and operating systems. And, adding insult to injury, most of the servers are vastly under-utilized, typically running at single-digit percentages of their total processing capacity.

To the rescue has come x86 server virtualization, a technology that consolidates and optimizes data center resources, streamlines data center operations, and provides a range of business benefits to the enterprise.

At Once Retro and Revolutionary

Server virtualization, or the partitioning of a server to function as many virtual servers, is not a new or cutting edge concept in information technology. After all, partitioning has been around on the mainframe for decades. What is new is that this concept has been applied to the x86 family of microprocessors—the engine of today’s servers—and, within the past few years, virtualization technology has become ready-for-prime-time in its robustness and scalability.

How It Works

Server virtualization turns one physical server into many virtual servers. Virtualization capabilities are currently controlled by *hypervisor* software, as described below, and will eventually be coupled with the virtualization capabilities of the processor itself.

Virtualization technology essentially places a supervisory layer between the server hardware and the requests made of it by the operating system and the software application. The supervisory layer is referred to as the hypervisor, (that is, the “hyper-supervisor”). The *hypervisor* pools and manages the server’s underlying resources—such as the memory, the processor, the network cards, and storage devices—to optimize utilization of the machine’s capacity and capabilities.

The *hypervisor* also allows the processor to be partitioned, i.e., to function as if it were several separate processors. This effectively creates many virtual servers within one physical server. Each virtual server can run a separate, independent operating system and application.

Capacity Planning: A Prerequisite for Virtualization

Virtualization is all about optimizing server capacity, which addresses a core issue highlighted by data center studies: underutilized CPUs are the norm, rather than the exception. Several recent industry studies put the average CPU utilization into single-digit percentages (that statistic doesn’t include memory, storage, or network-integration-card utilization, which are equally egregious).

The price tag on all that underutilized capacity is high—both in the cost of unnecessary hardware, and the cost of staff

needed to manage it. Virtualization allows you to optimize existing capacity rather than purchase unnecessary new CPU cycles.

The transition to a virtualized environment begins with a capacity—utilization analysis. This task was once arduous, but that is no longer the case. Capacity management tools have matured and have become a mainstream means for resource planning. These tools are part and parcel of robust virtualization technology. So, don't be afraid to look under the hood and get a clear picture of how the server resources in your data center are being used. There is no better way to make a case for virtualization than with solid capacity—utilization metrics.

It is worth noting that, although massive adoption of virtualization is impending, not all servers and applications are meant to be virtualized. The choice of when, where, and how an application can be virtualized would be based on an ample performance metric. There are cases where processing, memory, storage, and network requirements do dictate a solely dedicated server.

The Value of Virtualization

The implications of virtualization for the enterprise are monumental. By turning one server into many, it multiplies the capabilities of every machine many-fold, and reduces the number of machines in the data center. This yields immediate benefits for all enterprises, regardless of size or industry, and adds up to substantial cost savings and process improvements.

Capacity optimization. As described above, virtualization places capacity planning and optimization at the forefront of data center management. Properly implemented, it produces the maximum ROI per server dollar.

ITIL enhancement. Capacity management is a mainstay of the mature frameworks used to manage service delivery and support, such as ITIL, the Information Technology Infrastructure Library. So, as an added bonus, the capacity planning that is a prerequisite for implementing virtualization will also support corporate ITIL initiatives.

Rapid server provisioning. In a virtualized environment, virtual servers are created with as much ease as files and directories, using a server template that can be modified as needed. New server provisioning therefore takes minutes or seconds, rather than the days or weeks required to procure a new box and install an operating system and software. This ability to rapidly deploy servers for new applications and initiatives is important to any business that wants to be nimble and proactive, rather than reactive, in a demanding market.

Server portability. Virtual servers and the applications they support can be easily moved or copied to other hardware

independent of physical location or processor type. This feature alone provides unlimited flexibility for hosting servers and applications on any combination of physical hardware.

Streamlined data center operations and business continuity/disaster recovery planning. The consolidation of servers into fewer boxes means fewer burdens on the IT staff to operate and manage the data center. The virtualized server environment consolidates all related data center operations, such as storage, updates and patching, backup, security, and business continuity and disaster recovery planning.

Reduced hardware, facilities, and HR expenses. Fewer server boxes cost less, take up less floor space, require less electricity and air conditioning, and require less maintenance, thus reducing costs related to hardware procurement, real estate, utilities, and human resources.

Easier regulatory compliance. Because virtualization reduces the sheer size of the data center, it enhances your organization's ability to properly store, secure, protect, and recover data, and to ensure business continuity, in compliance with regulatory and business requirements.

Down the Road

As the virtualization market continues to mature, expect to see improvements in virtualization technology and resolution of software licensing issues. In addition, expect a return to centralized data processing and an expansion of thin-client desktops, reminiscent of the mainframe model.

Server-provisioning functionality. Improvements in virtual server provisioning can be expected in the future. IT staff will have the ability to change performance characteristics for each server, not only at implementation, but on the fly, as circumstances may require (for example, for heavy end-of-month processing).

Integration with various data center operations. Technological maturity will bring smoother integration of virtualization with related data-center management functions, such as resource allocation/balancing, storage, network, backup and recovery, security, and business continuity.

Resolution of software licensing issues. Software licensing issues currently add complexity to the virtualization space: "If I run an application on eight virtual servers which are all on one physical processor, should I be paying for eight software licenses or one, depending on the licensing scheme?" Most application vendors will eventually have to support the new virtual infrastructure and redesign their licensing approach to support such environments.

Return to a centralized data processing model. As virtualization evolves from a process run by software to a

capability integrated directly into the processor, every server coming off the assembly line will have the built-in capability to take advantage of hypervisor—or virtual—technology. The effects of this will be far reaching. The rationale for distributed computing power will fade as faster networking enables CPUs to return to a centralized data center, allowing for greater security and control of storage and processing power. The cost of each desktop will also potentially decrease, requiring only thin-clients consisting of a terminal and keyboard.

A “Must-Have”

With budget dollars and floor space at a premium, the C-level is recognizing that the benefits of virtualization make it a “must-have,” not a “let’s-think-about-it” strategy. Ongoing improvements in server virtualization technology, along with the eventual incorporation of virtualization capabilities directly into the hardware, point to virtualized environments as the upcoming new standard. Consequently, these are noteworthy times, as a major shift in enterprise server strategy is underway, touching every facet of the infrastructure.

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