IT optimization

White paper

Why virtualization matters to the enterprise today

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IBM offers a rich, diverse, and integrated array of virtualization solutions, spanning from x86 systems to System z™ mainframes to storage area network (SAN) volume controllers.

In IT today, the only constant is change. Achieving best business results from a complex enterprise-class IT infrastructure means more than simply deploying new solutions; it means redefining IT as a versatile instrument of business strategy, which can change in parallel with changing demands.

Toward that end, many businesses have pursued big-picture strategies such as *consolidation*—to reduce the number of servers required to support IT services—and *virtualization*—to unchain those services from specific implementations and redeliver them in a more dynamic, virtual form.

Through consolidation and virtualization, the enterprise can achieve a simpler, more scalable, more cost-efficient IT infrastructure that aligns more flexibly with emerging business goals.

Originating at IBM around 40 years ago in the specific context of separate logical partitions running in parallel on a shared mainframe, virtualization has taken on new life in a number of contexts: virtual servers to virtual storage, optimized networks, workstations in virtualized environments, and application virtualization. And like any major paradigm shift in business, virtualization has become a success because it delivers core practical benefits that drive business value by:

- Decreasing IT costs and business risks
- Increasing operational efficiency and flexibility
- Simplifying deployment and management
- Enhancing overall business resilience
- Enabling new forms of innovation.

As today's companies increasingly embrace virtualized technologies, it's important to understand what they mean, how they relate to one another, and how they are commonly implemented. In the pursuit of a big-picture virtualization strategy that incorporates varying virtualization-centric products, industry best practices and leading expertise to make your IT division more efficient, resilient, flexible and practical, IBM is one of the premier solution providers in today's business arena.

IBM offers a rich, diverse and integrated array of virtualization solutions, spanning from x86 systems to System z mainframes to storage virtualization and beyond. Furthermore, IBM can work effectively with you to develop key business strategies and processes to capitalize on those solutions' benefits—all while guided by established best practices.

IBM also has long experience in the concepts, theory and practice of virtualization, going as far back as the 1960s and the origin of virtualization itself. And while some competitors outsource the specifics of solutions and consulting to third parties once they've got a signed contract, IBM does not. What is the benefit to clients? Full accountability that the strategy will work as described, a single reference point to answer questions and resolve problems in the event they occur, and a tighter connection between new business processes and technological solutions.

With IBM's help, businesses today can leverage the many engaging opportunities virtualized technologies present in enhancing every aspect of how IT works in the overall organization.

Virtualization can help by shifting the functionality of many servers onto fewer servers (consolidation).

What is Virtualization?

While some forms of virtualization are more common than others, the general goal is the same in each case: to abstract a form of technology away from its original environment—a literal and physical form—and redeliver it in a virtual form. This virtual form, if implemented well, is capable of the same functionality as the original, yet is able to dramatically increase control and flexibility. The virtual version is, in short, significantly easier to change to suit changing goals because it has been freed from its physical constraints. This is a tremendous advantage in a business context, where IT services must continually be revised, adapted, or developed from scratch to meet emerging needs.

Server virtualization has received considerable attention in recent years due to its ability to consolidate many physical servers into multiple logical servers that can be deployed onto fewer physical servers.

Server consolidation: A necessity for today's enterprise

Many of today's largest organizations find that "server sprawl"—the rapid increase of servers in the IT infrastructure—constitutes a cumulative problem. In such cases, virtualization can help by shifting the functionality of many servers onto fewer servers (consolidation).

Since the mid-1980s and the rise of the microcomputer as an alternative to large mainframes, IT divisions have increasingly moved many services to smaller servers, deploying more and more services on inexpensive servers to meet specific business needs on a case-by-case basis.

IBM Systems Director platform management family can increase ease of use while helping to reduce complexity and cut costs.

This approach, however, turns out to have hidden costs and complexities. Consider the case of a large, enterprise-class business with multiple typical data centers, each of which has perhaps a thousand servers. Each server represents a potential fault point; if it should fail, it must be attended to, requiring precious time from the IT team, which is often already struggling both in terms of time and of budget, and causes disruptive downtime for end users.

Similarly, there is the question of logical management. Tracking literally hundreds of servers in varying contexts, such as which applications they have and which services they provide, is a tremendous challenge. The original concept of simply deploying more and more smaller, less expensive servers to create more and more IT functionality, in other words, is a strategy of diminishing returns. There comes a point where the management complexity and other costs translate into less and less business value for each deployed server.

By deploying multiple virtual servers on one physical server, enterprise-class IT can simplify management and cut costs.

Or consider the question of resource utilization. Getting the best return on investment means getting the highest business value from servers, yet many servers spend the majority of their available processing time sitting idle. Whether they are accomplishing business tasks or not, however, servers will still generate many types of costs, including management costs, electrical consumption and heat (which must be dissipated by cooling systems, requiring still more energy).

The solution to this problem is to consolidate the functionality of several servers onto one through virtualization. For instance, a single modern x86-based server, such as an IBM System x™ server, can easily host multiple virtual servers—each a logically separate entity partitioned from the others. As each virtual server is added to the host computer, its software will make demands on the underlying hardware, decreasing idle time and helping to ensure that the hardware is delivering as much business value as possible.

Nor are the benefits purely hardware/software-centric; they have a straightforward business slant as well. By deploying multiple virtual servers on one physical server, enterprise-class IT can simplify management, cut costs and increase server flexibility considerably, moving or modifying virtual servers as necessary to meet emerging business goals. Tracking, updating and maintaining one physical server is easier and less expensive than doing the same for several. Yet each virtual server is still, as far as the rest of the IT infrastructure is concerned, effectively delivering all the same services as it did in the old paradigm, in which that server required a dedicated computer of its own.

In this way, the metamorphosis from physical to virtual servers has brought with it a dramatic improvement in total business value.

Virtualized storage approaches treat storage as an abstract resource, which can be meted out (or reclaimed) in accordance with emerging business demands.

Virtualized storage: Abandon the static physical for the dynamic virtual

Storage represents another platform on which to explore virtualization concepts and demonstrate their business value. Today's large organizations need more storage to retain more data than ever before, and old-millennium strategies and solutions designed to support that data no longer suffice.

For instance, consider the question of deployment flexibility. A traditional approach to increasing storage would involve deploying new hard drives on business servers—a costly procedure in terms of hardware expenditure, time and energy. In this scenario, precious IT staff whose time is likely to be required for more mission-critical tasks will instead have to dedicate hours to migrating data from the current drives to the new drives—often involving an intermediate, temporary location—and then reconfiguring the servers to work with those new drives. And as the enterprise requires more storage, this process will have to be repeated.

Virtualized storage approaches, on the other hand, treat storage not as an element of a hard drive, but as an abstract resource, which can be meted out (or reclaimed) in accordance with emerging business demands. With the help of a solution such as IBM's SAN Volume Controller, virtualized server storage can be treated as an aggregated, logical pool regardless of where the physical storage exists in the IT infrastructure. When IT services require more storage for their functions, that storage can be allocated dynamically by optimized software and hardware solutions designed to perform that task. Should that task require more, it can receive more. When that storage is no longer required, it can automatically be returned to the common pool.

IBM Global Technology Services assist in the planning, design and implementation of leadership virtualization technology.

Not only is this approach significantly less expensive to the enterprise in the long term—particularly in terms of administrative resource—but it is also much faster and more flexible. It can be governed by configurable, logical policies, which relate to the services, or triggered by automated monitoring solutions that determine (as an example) that a storage problem may occur in short order on a given database server unless more storage is logically provisioned to it. In this way, in fact, virtualized storage can be seen as a tool to increase overall business resiliency by providing a mechanism through which problems can be foreseen and forestalled, instead of experienced and addressed. Surely, the fastest possible response to a storage problem is to prevent that problem from occurring in the first place. Monitoring and virtualized storage solutions make this ideal a very tangible reality.

Return on investment is also improved through virtualization in this context. Because storage is treated as a distributable resource, the concept of "future-proofing" servers or other IT assets that depend on storage by purchasing more storage than is required for the present is largely rendered unnecessary. Instead, servers can be equipped more moderately, and IT managers can be confident that storage will simply shrink or grow for them in any given context, for any given application or service that requires it at that time.

The overall business benefits of virtualization in the storage context, then, are similar to those for computation: reduced costs, increased resiliency and flexibility, simplified management and enhanced power through automation.

Numerous elements come into play in the area of network performance optimization; various forms of potential performance bottlenecks and technical redundancy must be minimized if an optimized outcome is to be the end product.

Virtualization and consolidation can help optimize networks

Network optimization is increasingly important for today's complex, enterprise-class IP networks. In many cases, that optimization will involve virtualization of some type, consolidation of services, or both.

Suppose that one business has acquired another. The two businesses will initially have completely different network infrastructures involving varying solutions, configurations and topologies. For the new, merged business to achieve target goals of IT performance and resiliency, numerous quality of service issues involving these two networks must be anticipated and addressed. Network elements need to be consolidated, and their IT services will be linked. For instance, both companies are likely to leverage virtual private networks (VPNs), which use high-grade encryption, to deliver secure network access between employees and the host organization across the public internet. Depending on how comprehensive the business merger will be, these two different implementations of virtual networking may require a ground up consolidation and integration.

Cases involving only a single company may still be comparably complex. Numerous elements come into play in the area of network performance optimization; various forms of potential performance bottlenecks and technical redundancy must be minimized if an optimized outcome is to be the end product. Without expert analysis and network tuning, such challenges could easily result in suboptimal IT service levels, availability and general business resiliency. Many businesses in such a situation will require expert consulting from a trusted partner to evaluate and resolve such complications. For them, one answer might come from

IBM's Network Strategy and Optimization Services—a broad-based solution model particularly applicable in this context, since it incorporates all elements of the service lifecycle and IT infrastructure and therefore represents an unusually holistic approach to network optimization.

Workstation functions are delivered from a centralized virtual host so they can easily be monitored, managed and backed up/restored on a centralized basis as well.

Virtual servers support more manageable, convenient workstations

Another form of virtualization increasingly used by businesses today comes in the form of virtual workstations that are deployed in a virtualized environment, which offer many compelling advantages in comparison to traditional workstation environments.

A traditional workstation environment contains a high-end desktop computer featuring local storage, local processing, local applications and local data. While it can be repurposed to serve new business functions on demand, that process will typically require new software and new configuration from IT staff. Similarly, giving someone else the use of that workstation will involve changing its location (or the user's). In these senses, it represents a classic example of a literal IT implementation in which an asset is tied to dedicated hardware and is, for this reason, relatively inflexible.

Workstations in a virtualized environment, by contrast, ameliorate these shortcomings through a completely different configuration. The entire workstation environment associated with that workstation is hosted remotely and accessed via software that delivers that environment over an IP network. The end user accesses a workstation in a window, with all the applications and data that would have been available on a literal workstation now delivered via virtual servers.

The business benefits of this virtualized approach are considerable to the end user. Because processing takes place remotely, the higher-level performance of the remote host can be leveraged by the local user, regardless of the performance of that user's local hardware. And because the workstations in a virtualized environment are delivered over a network, those workstations can, in theory, be accessed by any user, anywhere on the IT infrastructure; in fact, a single virtual workstation could be used by multiple personnel in completely different geographic environments.

From the standpoint of IT staff, the benefits are similarly clear. Workstations in a virtualized environment are more easily created, configured and deployed than in a traditional desktop environment. Furthermore, the fact that virtual workstation functions are delivered from a centralized virtual host means they can easily be monitored, managed and backed up/restored on a centralized basis as well.

Together, these benefits translate into substantially simplified management for IT staff, higher performance and greater convenience for users, and a more flexible, powerful solution for businesses.

IBM virtualization solutions and services: Solving business problems in the field

IBM has worked with hundreds of companies all over the world, delivering skilled consulting, specialized services, or best-in-class technologies to help them arrive at a holistic solution to varying business challenges through virtualization. Here are just two examples of many of how companies have successfully leveraged virtualization and consolidation to achieve business goals.

"With the p5 systems and DB2®, we have created an SAP application environment that can scale up, respond fast and deliver low license and operational costs." Francois van der Merwe, Pick 'n Pay

Pick 'n Pay

Pick 'n Pay is a South African—and increasingly, global—retail success story. The company's more than 40,000 staff operate over 500 hypermarkets, supermarkets and mini-markets under multiple brands such as Boxer, Franklins, Pick 'n Pay and Score, generating annual revenues of almost ZAR 32 billion (around US$5 billion).

Pick 'n Pay operated a self-developed retail system to track distribution, sales, stock and finances. Running on numerous vendor systems, the solution was becoming increasingly expensive to extend, often requiring new hardware to cope with increased workload. As Pick 'n Pay expanded both within South Africa and in Australia, this approach to providing information services was hampering growth.

Pick 'n Pay selected an all-IBM IT infrastructure, based on two IBM System p5™ 590 servers and a single p5-550 server, running IBM AIX 5L™ v5.3, with IBM System Storage™ DS8100 storage systems. "Growing by adding servers is a costly and disruptive way to expand," comments Francois van der Merwe, Technical Operations Manager. "In the past, as application workload grew, it would be shifted to a new server, which carries an unknown risk and time delay."

"The p5 solutions give Pick 'n Pay the ability to scale on demand by adding virtual servers and processor power without delay. When production workload is high, we allocate more power from the test and development environment to the production environment to ensure jobs are completed on time, without the need to add new servers to deal with temporary or seasonal demand."

Pick 'n Pay's two p5-590 servers operating SAP for Retail and SAP ERP software each have 32 processors installed, all of which are active. The p5-550 server runs SAP NetWeaver BI, with four active processors of a possible eight. Pick 'n Pay uses the On/Off Capacity on Demand feature to enable additional processors as required, paying only for the capacity it needs.

The IBM System Storage DS8100 manages data for all SAP applications. Pick 'n Pay will use IBM SAN Volume Controller to virtualize its storage volumes. By doing so, the company will be able to add to, subtract from, and upgrade its storage pools independently of the physical devices themselves—another step towards matching the IT infrastructure with the changing business needs.

"Of our three key IT words, 'speedy, small and simple,' I think we have now accomplished the simple part. … when it is necessary to make new arrangements for operations, if the supporting IT is simple, we expect to have a system in place in a short time at low cost."
Susum Hasegawa, Lawson Inc.

Lawson, Inc.

Lawson, Inc. convenience stores receive approximately 7 million customers a day. "The Hot Station in the Neighborhood" concept is aimed at providing services that are rooted in each store's location. The company is progressively building stores that cater to changes in the social climate with enterprises that depart from the normal business category such as the store formats NATURAL LAWSON and LAWSON STORE100. Says Susumu Hasegawa, the company's CIO and IT station director of the information systems administration, "to continue to grow amid changes in the social climate, [we] have to think about building stores that bring in shoppers outside [our] usual customer base. To do this, [we] must not only change our range of goods but also investigate services other than traditional retailing. In other words, if [we] don't change the way [we] do things, we cannot expect continued growth of the business."

Mr.Yamamoto, leader in IT station system engineering at the company, had this to say regarding the system supporting Lawson's business: "We had over 200 servers from a range of manufacturers spread across 4 centers. Operations were entrusted to several different contractors, and there was no uniformity in rules or levels. Since we provided servers to prepare in advance for peak periods for each work system, the system as a whole was wasteful. By simplifying this arrangement, we not only achieve a reduction in costs but also speed up system deployment when new systems are needed."

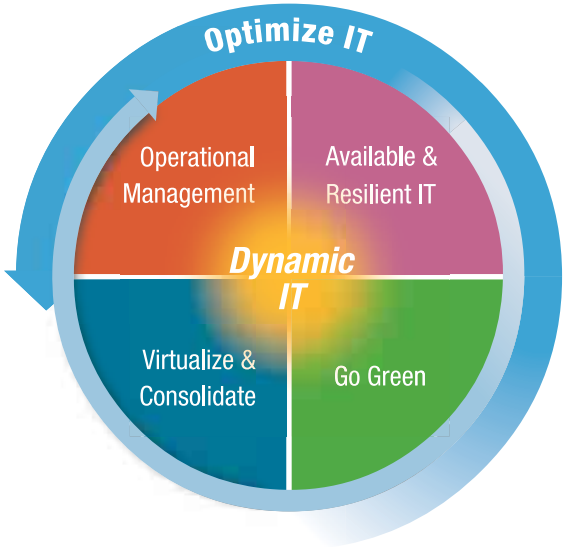
The system Lawson chose was IBM System z. Yamamoto explains the reasons for this choice. "We wanted an approach that allowed efficient migration of applications from an environment comprised of a range of different servers. Since we were focusing on a robust integrated infrastructure, it was of major importance to have robust and reliable physical hardware. In addition, by setting up virtual servers with VM on System z, the necessary applications could be developed on this in cell form, enabling shared utilization of CPU's added on demand to cover deficiencies in the system as a whole. This configuration is simple and reduces costs."

Mr. Kobatake, senior manager of IT station system engineering at Lawson, cites server integration as a benefit of introducing System z. "Mainframe applications previously distributed at 2 data centers were housed in a single System z cubicle. Furthermore, 8 work systems, including financial accounting, communication system with stores, data exchange system with dealers, etc., that were previously run on distributed servers, as well as a number of other systems, were migrated and integrated on System z. With System z, we can utilize the CPU vacant time of each system dynamically. So in addition to handling peak periods, there's an improvement in utilization efficiency during normal times, too. Batch processing time is also dramatically reduced, bringing financial processing time down to one fifth."

When migrating to System z, existing functions and responses of the system were maintained, and care was taken to facilitate a smooth transition. As a result of extensive testing and preparation, the migration proceeded with almost no detrimental effect on the users.

Says Yamamoto, “Host switching and other operations can be done ahead of schedule. This is extremely satisfactory in delivering cost-effectiveness, which is rare in a system migration like this.”

“We have almost completed the integration of one of the 4 centers and will proceed to integrate the other centers in sequence according our completion schedule. From now on, we plan to maximize the utilization of System z and will continue with an approach that reaps the benefits of integration, including lower total cost of ownership (TCO).”



Optimizing IT: How virtualization fits into the big picture

Optimizing IT is the process of creating a highly efficient and dynamic infrastructure to derive maximum business value from the IT investment. An optimized IT infrastructure can lead to a reduced cost structure that is aligned with business value,

an energy efficient and environmentally responsible green data center and a responsive, reliable, flexible infrastructure that supports meeting service commitments.

To create such a dynamic infrastructure, consolidating the existing infrastructure using virtualization technologies allows you to increase asset utilization and reduce the number of physical locations. Additional activities using virtualization can help standardize to reduce the number of disparate architectures and simplify to remove duplicated or underutilized infrastructure elements. Automating manual processes can also help reduce operational costs. By deploying and sustaining a highly availability infrastructure, planned or unplanned events do not interrupt critical business applications and data.

Virtualization can help diminish costs, improve IT asset utilization, enhance service consistency, and increase the overall return on IT investment, enabling an optimized IT infrastructure.

Why IBM?

For organizations looking for a trusted partner to leverage the full benefits of a consolidated, virtualized IT infrastructure, IBM offers a full complement of server, storage, application and workstation virtualization technologies and capabilities, and network optimization solutions—all surrounded by IBM Global Technology Services to assist in the planning, design and implementation of leadership virtualization technology.

In the category of enterprise-class virtualization solutions, IBM delivers a diverse suite spanning many different categories of business functionality.

IBM servers, for instance, combine best-in-class features, performance and integration to address virtualization strategies of all types.

- IBM System x servers add innovation to industry standards to deliver x86 servers with X-Architecture® technology that run faster and cooler, use less power and make ideal platforms for virtualization. IBM System x and IBM BladeCenter® solutions help reduce total costs so the data center can run as efficiently as possible. By teaming with VMware and other hypervisor vendors, System x and BladeCenter offerings can provide full-featured, enterprise-grade solutions.
- IBM System p™ UNIX®-based servers are driven by IBM's own POWER™ processor architecture and Advanced POWER Virtualization that can help lower the cost of existing infrastructure by up to 72%.[1] IBM System p virtualization technologies, such as Micro-Partitioning™, are opening the door to exciting new possibilities for server consolidation.
- IBM System i™ is tuned with virtualization capabilities that can manage multiple applications and processes with the subsystem workload manager, Micro-partitioning based on the POWER-hypervisor and automatic partition performance balancing.
- IBM System z mainframes deliver exceptionally high levels of performance and security for consolidated virtualized servers. They can concurrently run many separate iterations of operating systems or applications in wholly separate partitions for logically isolated, optimized virtualized environments.

IBM System Storage portfolio strength is lead by the IBM SAN Volume Controller (SVC), which allows the enterprise to position storage as an incremented resource that can be allocated and controlled on demand, ensuring maximum service flexibility, performance and robustness for almost any IT task. With SVC, today's organizations can also improve storage utilization, making the most of available hard drive space and optimizing the efficiency of IT tasks that pertain to storage.

IBM network optimization solutions include IBM servers such as the IBM BladeCenter, typically working in conjunction with a dedicated network telephony switch from a leading provider, to deliver network convergence. Telephone and data networks are logically and physically combined, simplifying management, reducing costs and leveraging IP architecture quality of service expertise that may already be present in the organization.

IBM virtual workstation solutions such as the Virtual Desktop Infrastructure and Virtual Infrastructure Access Service leverage the power of IBM x86 servers to recreate physical workstations as a hosted resource that can be accessed anywhere in the organization. In a virtualized environment workstations are delivered to any user on the network, even a user equipped with a thin client that has minimal local resources.

IBM software solutions are designed to make virtualized technologies as easily monitored, managed and optimized as possible. IBM's family of virtualization-centric platform management tools, collectively referred to as IBM Systems Director, empowers the enterprise with the comprehensive perspective and control required to coordinate all virtual and physical resources in a holistic manner, aligning business technologies with business goals to maximize flexibility and resilience. This modular, open-standards-based family integrates with and leverages other related products, such as IBM Director and IBM TotalStorage® Productivity Center and IBM Tivoli® Storage Manager, to provide organizations with a unified view of all relevant resources in both the server and storage resources, addressing key categories such as configuration, discovery, status monitoring and automated response.

But no matter what solutions are best suited to your particular business needs, the complexities and possible ramifications of virtualized technologies may require a comprehensive, overall strategy designed to maximize the value you get from them.

IBM Global Technology Services offer a broad array of technology services that specialize in different aspects of virtualization. IBM IT Transformation and Optimization Consulting Services, for instance, will work with your IT team to build a virtualization roadmap capable of connecting virtualization solutions to your overall business goals in the most straightforward and sensible manner. For distributed IT architectures, such as x86-based servers, IBM Virtual Infrastructure Access Services can help you move from the physical to the virtual by way of modular approaches based on open standards—without compromising security. And customers of IBM's POWER-based System p servers may want to consider IBM Implementation Services for System p to be sure that the unique strengths of the POWER architecture are leveraged to the fullest possible extent where virtualization is concerned.

IBM network optimization solutions work in conjunction with a dedicated network telephony switch from leading providers, to deliver network convergence. Telephone and data networks are logically and physically combined, simplifying management, reducing costs, and leveraging IP architecture quality of service expertise that may already be present in the organization.

In sum, IBM is among the best-positioned players in the enterprise-class virtualization space. IBM can serve as a single-source guide for today's organizations as they move toward a future that ideally incorporates and integrates virtualization-specific products, best practices and proven strategies to reduce cost and complexity and improve utilization of the IT infrastructure.

For more information

To learn more about the Consolidation and Virtualization please contact your IBM marketing representative or IBM Business Partner, or visit the following Web sites: **ibm.com**/systems/optimizeit/cost_efficiency/consolidation/

[1] "Impact of IBM System p Server Virtualization: Transforming the IT Value Equation with POWER6™ Architecture." International Technology Group, May 2007

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