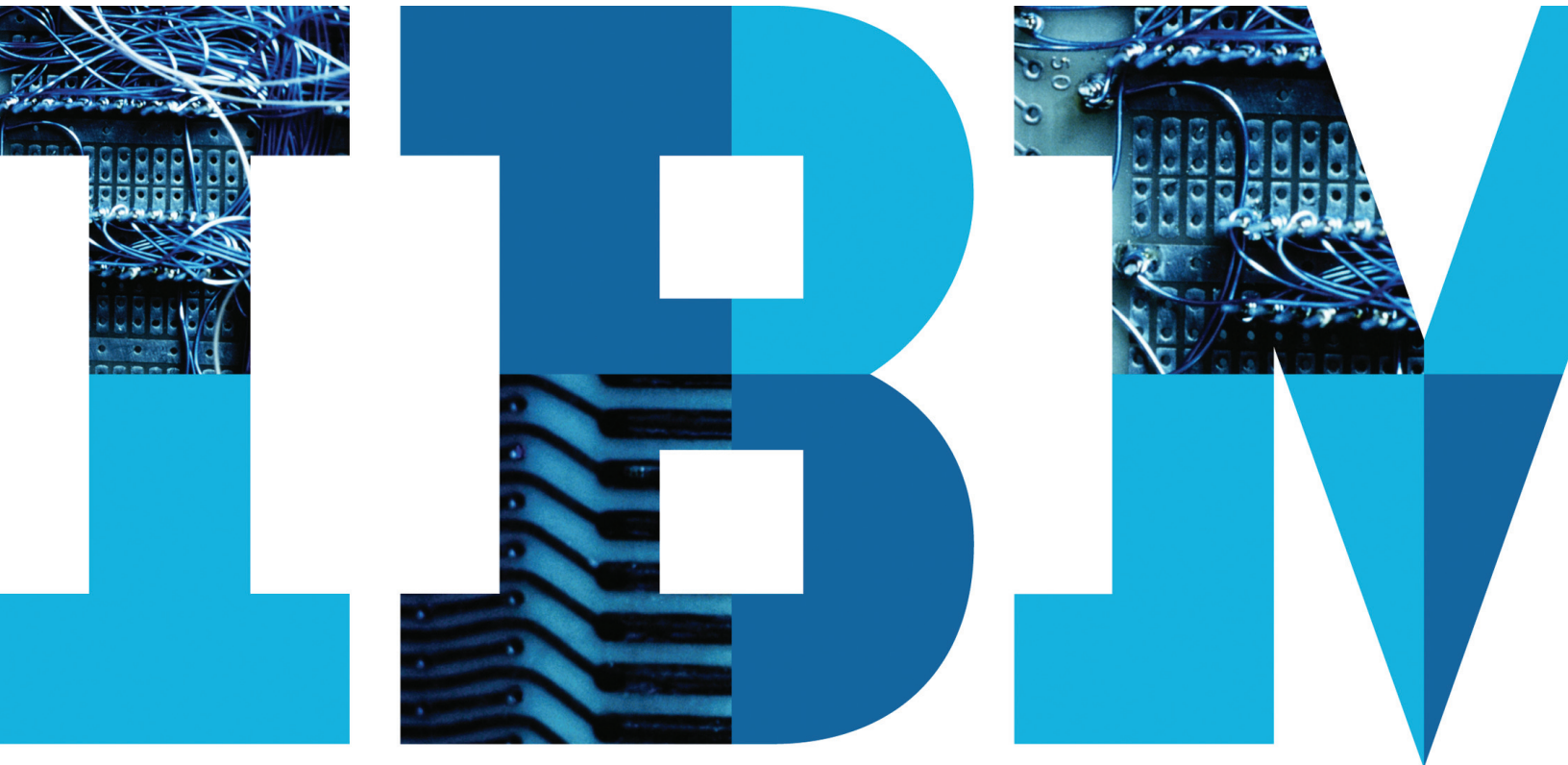


Virtualization reduces costs and complexity for mid-sized businesses

IBM, Intel and VMware virtualization benefits for mid-sized businesses



Virtualization is a catalyst for creating an enterprise-wide dynamic infrastructure, enabling integrated management of IT resources, improved resiliency, flexibility and faster service delivery. Many IT professionals think of virtualization specifically in terms of servers. IBM, however, has a broader perspective, in which virtualization is seen as a general approach to decouple logical resources from physical elements, so that those resources can be allocated faster, more cost effectively, more dynamically, wherever the business requires them in real time to ideally meet changing demand levels or business requirements. This paper explains virtualization, its benefits for mid-sized business and how IBM's virtualization strategy can help mid-sized companies reduce costs, improve services and simplify management.



What is virtualization for mid-sized businesses?

Virtualization is technology that allows application workloads to be managed independent of host hardware. Multiple applications can share a single physical server. Workloads can be moved from one host to another without downtime. IT infrastructure can be managed as a pool of resources, rather than a collection of physical devices.

Virtualization is not just for large enterprises. It is a well-established technology that reduces hardware requirements, increases utilization of hardware resources, streamlines management and reduces energy consumption.

Virtualization is most often implemented on x86 servers as either operating system (OS) virtualization or hypervisor-based virtual machines. OS virtualization uses a single instance of an operating system (such as Microsoft® Windows® or Linux®) with the help of virtualization software to host a large number of individual workloads.

The hypervisor approach is completely different. A hypervisor is code shared by guest operating systems and hardware. Guest operating systems can be various versions of Windows and Linux and can be mixed and matched on the same system. (For example, Windows 2000, Windows Vista, SLES 9 with Xen, and RHEL 5 without Xen can all operate simultaneously, including standard and enterprise varieties of each, as well as both 32-bit and 64-bit implementations.)

The hypervisor ensures that each operating system instance receives its proper share of hardware resources and also that activity in one virtual machine (VM), or partition, does not impact any other partition or the overall system.



Economics of virtualization for the mid-market

With organizations of all sizes watching costs more closely than ever, what are the economics in support of virtualization?

The initial (that is, entry) hardware cost is not the most expensive part of the investment. The majority of the expense is the *long-term cost of operating and powering* that hardware.

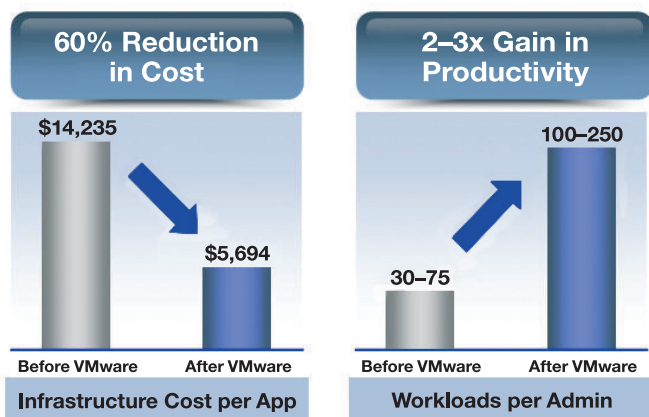


Figure 1. VMware Effect. According to VMware studies, the average cost per application is reduced by 60%. The number of workloads each administrator can manage increases by 200% to 300%.

If two servers support the same number of virtual machines, the one with better performance will be doing more aggregate work. To maximize virtualization performance, servers must have three features:

- Processing performance
- Maximum throughput
- Sufficient memory

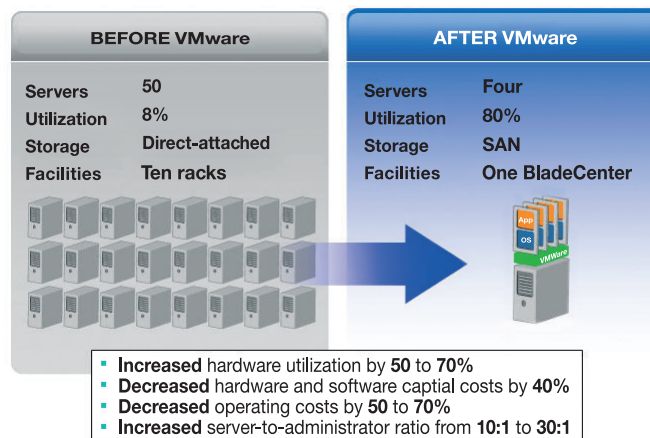


Figure 2. Customer example. A company had 50 servers running a variety of applications, directly attached storage and numerous cables, racks and power cords to support the servers. By implementing a VMware Infrastructure, they dramatically simplified their IT infrastructure.

97% of small and mid-sized businesses surveyed felt their VMware project met or beat expectations.

Small and mid-sized businesses that have implemented a virtualization strategy can realize a return on their investment (ROI) and, in some cases, in less than one year.¹ IBM System x3650 M3 and the x3550 M3 have a 11:1 consolidation rate and expanded memory capability supporting 18 RDIMM, up to 144 GB of memory and 12 2.5" HDD. These servers continue to offer outstanding energy savings and systems management, helping businesses save money and administrative costs.

Additional benefits include a new warranty, lower total cost of ownership and a server that takes up less space, uses less energy and makes less noise.

Benefits of virtualization for mid-sized businesses

Today, multi-core processors from Intel® and large memory capacities allow dual-processor servers running VMware virtualization software to host application workloads that, just a few years ago, would have required four-socket servers or larger. This intelligent sharing of computing, storage and information resources by different disciplines and departments in an organization unlocks the value of multi-core processors.

In a virtualized environment, system resources are gathered into a virtualized resource pool—and can be allocated dynamically—allowing servers and storage resources to be used more efficiently. From the IT side, costs will fall; this commonly occurs because of reduced complexity, enhanced resource utilization, recaptured floor space in space-limited data centers and improved energy efficiency. Service levels will climb; the performance and scalability of existing services will be boosted and new services can be developed and rolled out much more quickly. Risks, too, will be mitigated, because the uptime and availability of key, mission-critical and revenue-generating systems, applications and services will generally climb with virtualization.

From the business side, virtualization can help to create a foundation for growth. When new strategies are suggested by changing market conditions, those strategies will be easier to create and deploy via a virtualized, dynamic infrastructure.

Reduce cost and save energy

Mid-sized businesses need to improve service, manage risk and reduce costs. IBM System x® and BladeCenter® servers based on the new Intel Xeon® 5600 series processors are designed to help you do that. With new IBM System x and BladeCenter servers, you get an exceptional combination of performance and value that can provide your business the IT performance you need while offering extraordinary value.

The IBM BladeCenter HS22V has been designed specifically for use in virtualized environments. With 18 DIMM slots supporting up to 144 GB of DDR3 memory, the HS22V allows businesses to fit more and larger virtual machines per blade, which leads to enhanced resource utilization and reduction in cost. Durable solid-state drives and hardware RAID-0 and RAID-1 provide outstanding reliability when virtualizing multiple workloads on a single blade. Combine the HS22V with Virtual Fabric for IBM BladeCenter for a flexible, easy, fast and reliable I/O solution that helps reduce cost and complexity.

Further, IBM Systems Director Active Energy Manager™ helps these servers deliver major advances in power instrumentation, automated energy efficiency and management flexibility for IT infrastructure, contributing to significantly lower energy costs.

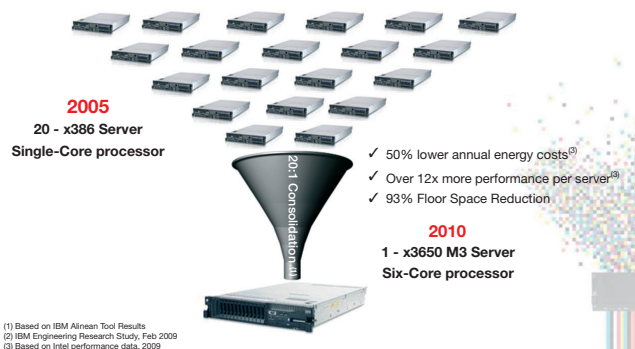
Get more performance and reduce TCO with the new two-socket IBM System x3550 M3 and x3650 M3 rack servers and the new two-socket HS22V blade server, all equipped with new Intel 6-core Xeon 5600 series processors. By consolidating and virtualizing on fewer IBM x3650 M3 servers, mid-sized companies can lower their energy costs by \$100 per server annually while still maintaining their workload levels.²

Smarter systems for a Smarter Planet.

Reduce TCO With Increased Performance

20:1 Consolidation Ratio⁽¹⁾ with Energy Efficient Design

Customers can **lower energy costs \$100 per server annually** and maintain workload levels with significantly fewer of the new IBM x3650 M3 servers⁽²⁾



VMware vConsolidate benchmark data shows the new generation servers providing nearly double the number of virtual machines per watt versus the previous generation.

Add value

The new generation of IBM servers delivers innovation throughout the systems management stack of hardware, firmware and software. The new Integrated Management Module (IMM) includes features that help manage, monitor, troubleshoot and repair—remotely. And with support for the next generation of BIOS, called Unified Extensible Firmware Interface (UEFI), the new servers are even simpler to update and maintain compatibility with peripherals and system components. UEFI provides a more intuitive user interface, understandable event logs and better management.

“UEFI is the next generation BIOS, based on industry standards. It is a foundation for delivering many innovative features to improve manageability, security, and the installation process,” said Doug Fisher, a vice president and general manager at Intel. **“Intel applauds IBM’s decision to adopt UEFI in the newest Intel processor-based IBM System x and BladeCenter products.”**

IBM Systems Director 6.1, a platform management solution, allows IBM clients to manage their entire data center—physical and virtual—efficiently, from one place and with one user interface. Systems Director can automate virtual machine relocation by using event action plans that integrate hardware monitoring with VMware VCenter.

Intel Hyper-Threading Technology and Intel QuickPath Architecture are additional features found in the latest generation of IBM System x servers. In processors implementing

Intel Hyper-Threading Technology, each core has two threads capable of running an independent process. Thus, a 6-core processor can run 12 threads concurrently. Intel Hyper-Threading Technology increases performance of both multi-threaded and single threaded workloads. The processors are connected by serial coherency links called QuickPath Interconnect (QPI). QPI is capable of 6.4, 5.6 or 4.8 GT/s (gigabit transfers per second), depending on the processor model.

In virtualized environments, Intel Hyper-Threading Technology and Intel QuickPath Architecture are key ingredients to achieve superior virtualized performance.

Intel Turbo Boost Technology is built into the new Intel Xeon processor 5600 series. It enables flexible performance for virtualized servers by automatically allowing processor cores to run faster than the base operating frequency and thus increases performance. For example, a 3.33 GHz six-core X5680 processor with 4-6 cores active can run the cores at 3.46 GHz. With only one or two cores active, the same processor can run those cores at 3.6 GHz.

Improve IT services

With VMware virtualization on Intel and IBM, IT services can be implemented in a much more efficient manner. Application workloads can be moved from host to host for maintenance. That means no downtime for employees, or customers using those applications. Unplanned downtime can be greatly reduced or even eliminated.

Flexibility

System x and BladeCenter servers can be configured with a variety of processors, memory, storage and I/O options. Intel provides a platform approach to virtualization with technology in the processor, chipset and Intel networking devices that boost performance, enhance I/O and enable flexibility.

You can mix and match the HS22 and HS22V with other blades in existing BladeCenter S, E, H or HT chassis for greater investment protection, incredible flexibility and deployment choice. Highly popular x3400 and x3500 tower servers offer increased storage capacity with support for 24 x 2.5" hot-swap HDDs in x3500 M3 and 16 in 3400 M3.

With Intel VT FlexMigration and VMware Enhanced VMotion, flexibility and investment protection is built in—IT managers have the ability to conduct live VM migration for multiple generations of Intel Xeon servers—providing tremendous flexibility for failover, load-balancing, disaster recovery and real-time server maintenance.

IT managers can also upgrade to future generations of Intel Xeon servers in the VM resource pool.

System management

The new generation of IBM servers features innovations throughout the systems management stack. Replacement of legacy BIOS with UEFI provides new capabilities important for virtualization.

For example, Systems Director 6.1 allows IBM clients to manage their entire data center—physical and virtual—efficiently, from one place with one interface at the click of a button, and to interoperate with VMware vCenter, including the linkage of event action plans.

“... the cost savings and business-level benefits are so straightforward that it’s really a no-brainer.”

—Sam Stravato, Chief Technology Officer, AIC Ltd.

Risk management

Virtualization can allow small and mid-sized businesses to implement a cost-effective disaster recovery plan. Not only does virtualization ease the process of planning for continuity and recovery, it also enables effective testing of those plans—with no downtime to the applications.

In short, IBM’s virtualization strategy can help mid-sized businesses by providing the capability to virtualize more—using fewer systems; consolidating servers with exceptional system reliability features and providing end-to-end management—from platform through services—to align IT with business goals.

With more workloads on each physical server, companies need the most reliable and resilient systems for their virtualized infrastructure. IBM System x and BladeCenter servers feature:

- Holistic monitoring with IBM Predictive Failure Analysis alerts, to warn of component failures—even before they happen
- IBM Memory ProteXion that automatically re-routes data around failed DIMMs
- Operating system-independent memory mirroring
- Hot-swappable components

System x and BladeCenter servers are the right platform for mid-market business

IBM System x servers are ideal platforms for virtualization. Large memory footprints and the capability to scale efficiently from 4 to 16 sockets (8 to 96 cores) provide an industry-leading virtualization foundation. System x servers are built with the IBM X-Architecture® blueprint, which melds both industry standards and innovative IBM technology to produce extremely fast, flexible and available x86 servers in the industry. Some models even include VMware embedded in hardware to minimize deployment time and improve performance.

VMware Infrastructure, when deployed on IBM System x and BladeCenter platforms, provides mid-sized businesses with the industry's leading virtualization software, proven in more than ten thousand joint IBM-VMware customer solutions. VMware's industry-leading virtualization and management suite provides a flexible and cost-effective development platform and an application environment with high availability.

VMware VMotion provides the ability to move running virtual machines between physical hosts. This capability is the foundation for benefits such as business continuity, disaster recovery, workload balancing and even energy-savings by enabling live applications to be moved between physical servers with no service disruption. When deployed on highly resilient server platforms from IBM and Intel, clients get the most reliable infrastructure possible.

Virtualization can help you maximize the value of your IT dollars with:

- Business agility in changing markets
- Computing resources to meet both current and future needs within the existing power envelope
- An IT infrastructure that is flexible and can scale with business growth
- Performance that can handle the most demanding applications
- An industry-standard platform architecture
- Intelligent management tools
- Servers with enterprise attributes—regardless of their size or form factor

Virtualization can help you improve IT services:

- Rapidly provision new application workloads—cut setup time from days or weeks to minutes.
- Improve IT responsiveness to business needs.
- Eliminate planned downtime by moving workloads before hardware is serviced.
- Greatly reduce—even eliminate—unplanned downtime.

In the past, clients had to choose blades based on optimizing processor performance or storage capabilities or memory capacity. Now, with IBM BladeCenter HS22V, clients have a balanced choice—the processing power, storage and memory required for virtualization—without compromise.

IBM System x3650 M3 and x3550 M3 are also optimized for virtualization. Both blade and rack options provide IBM resiliency and VMware ESXi embedded hypervisor for rapid setup of a virtual environment.

Conclusion: Small and mid-sized businesses can implement a virtualization strategy—now.

Virtualization is the key element of the IT strategy for businesses of all sizes, with a variety of benefits for small and mid-sized businesses. It helps them to build an IT infrastructure with enterprise-class capabilities and it does so with a form factor—and an ROI—that fits any business.

For more information

To learn more about IBM next-generation servers, please contact your IBM marketing representative or IBM Business Partner, or visit the following Web sites:

- ibm.com/systems/x/newgeneration
- ibm.com/virtualization/vmware
- www.vmware.com/go/ibm
- <http://www.intel.com/business/xeon/virtualization.htm>



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¹ IBM actual, public results on HS22 & Intel internal analysis.
1U rack server configuration: 2S 1C Xeon (3.8 GHz 2 MB cache) with 8x 1 GB memory and 1 HDD – total power: 382 W under load, SPECjbb2005 = 50,970 bops. Replace 1U rack server with HS22 blade server configuration: 2S 4C Xeon X5570 (2.93 GHz 8 MB cache) with 6x 2 GB memory and 1 HDD – total power with chassis burden = 317 W under load, SPECjbb2005 = 604,417 bops. Power cost estimate used is US\$0.10 kW-Hr. New hardware cost estimate based on projected US list pricing for the HS22 and chassis infrastructure, including 14 blades, BladeCenter E chassis with redundant power and redundant advanced management module. Software license cost for operating system & application estimate used is \$1,000 per server. Datacenter floor space cost estimate used is \$500 per square foot, average 8 square feet per standard enterprise 42U rack. ROI calculation solved for power cost savings + license cost savings + floor space cost savings = new hardware acquisition cost.

² IBM Engineering Research Study, Feb 2009



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