Highly-Scalable Virtualization: Optimizing your Infrastructure with IBM eX5 and VMware vSphere

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Scalability and high availability maximize the return on your virtualization investment

Organizations today face challenges that require a new approach to how IT is conceived and implemented. They need a dynamic infrastructure that reduces costs and generates more business value while managing risk to the company's information. Virtualization is an important part of this, unchaining logical resources from physical elements and redelivering them in a fluid fashion—whenever and wherever the organization requires them. Many high-value business benefits follow: higher hardware utilization, higher uptime, lower energy costs, and faster IT response to business units.

Companies of all sizes are employing VMware virtualization technology as a way to reduce costs and improve services to deliver a more dynamic infrastructure. Maximizing the cost savings—and the ROI—on larger virtualization deployments requires high consolidation ratios.

IBM eX5 architecture and portfolio: Designed for virtualization

The IBM® System x® eX5 enterprise server portfolio, running VMware® vSphere™, represents a best-of-breed set of virtualization platforms. VMware vSphere on IBM's highly-scalable eX5 server platforms allows the highest possible consolidation ratio onto x86 systems. This new portfolio of servers includes the System x3850 X5, x3690 X5, and BladeCenter HX5—based on the intelligent Intel® Xeon® processor 7500 series for the expandable server segments—along with the MAX5 memory expansion unit and the eXFlash solid-state drive unit for high data throughput. VMware selected the IBM System x3950 M2 as the reference platform for the scale-up capabilities of the VMware vSphere software suite. Now, IBM has evolved that industry leading eX4 platform to an eX5 portfolio that is able to scale to new levels. These platforms are ideal for consolidating large numbers of virtual machines onto a single server, and for virtualizing large databases and mission-critical workloads, providing companies with reduced costs, improved service, and reduced risk.

> ***"Ultimately the joint goal of VMware vSphere and the IBM eX5 is to squeeze the most out of the investment that our customers are making. The more applications that you can fit into your virtualized environment, the greater the reduction in cost and the reduction in downtime that you are able to achieve."***
>
> *- Steve Herrod, Chief Technical Officer, VMware*

A scalable virtualization environment is important for more reasons than just near-term benefits to business operations and the bottom line. The IT services industry is moving toward new service delivery models including cloud computing. Companies can take steps now toward managing their IT environment as an "internal cloud," so that in the future they can take advantage of external cloud computing resources from service providers if they choose to do so.

To fulfill all of these goals, the System x3850 X5, x3690 X5, and BladeCenter HX5—along with the MAX5 memory expansion unit, the eXFlash solid-state drive unit, and VMware vSphere—provide an optimized computing environment. With many compelling innovations and optimizations, eX5 platforms are exceptional for VMware virtualization, characterized by high performance, high availability, and flexibility for enterprise workloads. And for the highest possible levels of scalability, the IBM System x3850 X5 with VMware vSphere is well suited for even the most demanding virtualized applications and services.

Do more with less

For any organization looking for x86 platforms to drive virtualization strategies, IBM System x is a leading choice. The System x eX5 architecture boasts many unique features, unavailable on x86 platforms from other OEMs, that maximize both performance and availability while minimizing costs.

IBM System x3850 X5, x3690 X5, and BladeCenter HX5 are available as 4-, 6-, or 8-core systems. The x3850 supports up to 1TB of memory per chassis (plus an additional .5TB with the MAX5). The x3690 X5 supports up to .5TB of memory per chassis (plus an additional .5TB with the MAX5 and the HX5 supports up to 128MB of memory per blade server. The eX5 portfolio includes the largest snoop filter in its class, virtualization hardware assists, enterprise-class scalability, reliability, availability, flexibility, and record-setting performance.

IBM BladeCenter® HX5
IBM System x® x3690 X5
IBM System x® x3850 X5

More capacity = more performance

With eX5 systems, memory costs can be substantially lower than competing alternatives with large memory configurations. Each base system has ample memory slots with an option for more using the MAX5 option. With MAX5, an eX5 server can support up to 96 memory DIMMs allowing the use of less-expensive DIMMs to reach the capacity required. No longer are you forced to utilize the more-expensive 16GB DIMMs required by other platforms with fewer DIMM slots to reach the appropriate memory capacity required to support a large number of virtual machines, larger virtual machines, and maintain and improve application performance. When you multiply the costs per DIMM by the number of DIMMs needed the cost savings is substantial. eX5 architectures and VMware make virtualization affordable.

Another key factor to consider: I/O capacity. Just as a high-end virtual infrastructure has exceptional memory requirements, it also has exceptional I/O requirements. Here, the business case for the IBM offerings is clear. A four-socket system typically supports more I/O slots than a two-socket server, which better facilitates mapping of I/O ports on a one-to-one basis with virtual machines as required. The ability to map I/O ports to each virtual machine provides access control, the bandwidth required for that application, and security for that virtual machine. With greater memory capacity, greater I/O capacity, and greater system flexibility come more configuration options for each system, and better hardware utilization for every virtual machine hosted on the system. Thus, IBM System x hosts a virtual infrastructure that generates superior business value—particularly when you consider memory costs.

Simplify

Also key to the IBM value proposition is the fact that IBM's eX5 servers can be configured with up to eight processors. The IBM platform is easily scalable to suit the needs of the organization; customers can add more processors, memory, and disks to increase performance for demanding applications.

x3850 X5

The revolutionary "pay-as-you-grow" scalability of the

System x3850 X5 allows you to start simply and later expand— as your needs dictate—far beyond the limits of a conventional four-socket server. By connecting a second x3850 X5 chassis to the first, you can double the processors (8)/cores (64), memory (2TB), I/O slots (14), and drives (24). This provides you with tremendous flexibility and bandwidth. By adding the MAX5 option, this system will support up to 3TB of memory.

x3690 X5

The System x3690 X5 is a new addition to the enterprise server portfolio that also provides "pay-as-you-grow" scalability. This system supports two processors in the base server, .5 TB of memory, (4) I/O slots, and (16) drives. By adding the MAX5 option, this system will support up to 2TB of memory.

BladeCenter HX5

IBM BladeCenter® HX5 scalable performance blade server enables unprecedented compute, memory, and I/O capacity in a blade form factor for compute- and memory-intensive workloads. At its foundation, the HX5 is a 2 socket system, which can scale easily for customized performance and optimal utilization. Simply by connecting a second HX5, you can double the processors (4)/cores (32), memory (256GB), I/O ports (16), and drives (4).

These systems are ideal platforms for VMware vSphere. Why is this so? The answer is that the eX5 architecture allows the maximum processing power and memory to be assigned to any single instance of an application within a virtual machine on demand. VMware vSphere's new workload expansion capabilities now support up to 64 cores, one full terabyte of memory, and 320 virtual machines. The IBM System x3850 X5 can support those maximum limits in every respect. Meanwhile, offerings from other vendors leave vSphere expansion potential untapped.

Unique features maximize service, availability and performance

Central to the business case for the IBM System x3850 X5, x3690 X5, and the HX5 are key features included with the IBM eX5 architecture and not available on competing systems. Together, these features help to enable virtual machines hosted by the system to be highly available and deliver exceptional service levels.

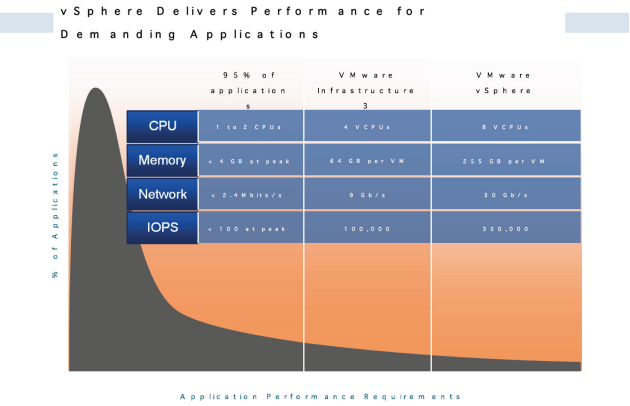
- IBM Memory ProteXion® ensures that memory-resident data is protected, better preserving system stability and application functionality.

- FlexNode failover increases availability in virtualized multi-node environments. For example, if one node of an 8-socket x3850 X5 experiences a failure, the system will reboot and the remaining node will automatically pick up where the system left off. If a monolithic eight-socket fails, the whole system will remain down until someone arrives to repair it.

- Another distinction of IBM System x eX5 servers is support for Predictive Failure Analysis on more critical components than on other server vendors' systems. This technology boosts availability and uptime of all virtual machines, and the services they support, by proactively detecting future hardware failure and notifying IT staff by generating an alert. Once notified, IT can then take prompt action to mitigate or even preclude any business impact of the anticipated failure. Virtually all physical elements of these systems are supported by Predictive Failure Analysis, including memory, processors, power supplies, fans, hard drives, voltage regulator modules, and L3 cache. IBM light path diagnostics then helps a technician save servicing time by lighting an LED next to the failing component, so the technician doesn't have to figure out which of 16 DIMMs needs to be replaced.

Lower cost per virtual machine

One particularly compelling benefit of processor-rich IBM System x hosts: lower cost per virtual machine. Because of their exceptional computational power, IBM System x servers allow for similarly exceptional consolidation ratios; quite literally, organizations can accomplish more, yet use far fewer systems. This consolidation, in turn, translates into less money required for each virtual server those systems support. The IBM System x3850 X5, x3690 X5, and the HX5 can be used to consolidate the workloads of many two-processor systems for typical virtualization deployments. As a result, the cost per virtual machine can drop significantly.



VMware vSphere: Optimized software foundation for virtualized infrastructures

Just as the IBM System x3850 X5, x3690 X5, and the HX5 represent a best-of-class hardware basis for virtualized infrastructures, so too does VMware vSphere represent a best-of-class software basis. VMware is the recognized world leader in virtualization, and vSphere is designed to spur virtual infrastructures to new heights, maximizing the business value they generate while driving down their associated costs.

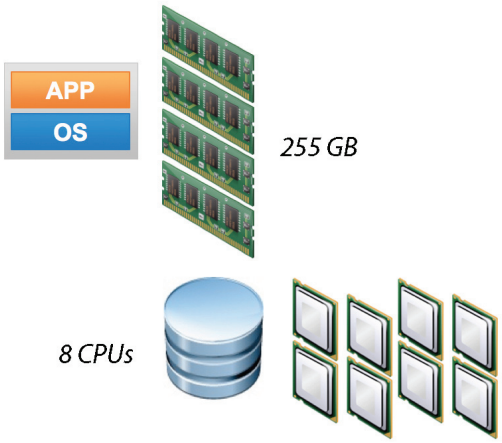
Scalability

For virtual infrastructures to capitalize fully on their potential, they must be able to scale to meet dynamic workloads on demand. vSphere represents a quantum leap in scalability as measured by several different metrics.

Virtual machine CPU count has doubled from four to eight with vSphere. Host CPU core maximum has similarly doubled from 32 to 64. Maximum host memory has quadrupled, from 256 GB to a full terabyte; the amount of memory that can be allocated to any single virtual machine has also quadrupled, from 64 GB to 255 GB. Perhaps most impressively, vSphere now supports up to 320 virtual machines and 512 vCPUs.

Are you interested in consolidating large workloads and mission-critical workloads to a single virtualized server, but have found that memory and processing limitations are impeding? The increased processing power of more cores and additional memory capacity allow a customer to virtualize larger business-critical workloads without impacting application performance. The more applications that can be supported in a virtualized environment, the greater the reduction in cost, risk, and downtime. The capabilities of the IBM System x3850 X5, x3690 X5, and the HX5 and VMware vSphere have made virtualizing more of your mission critical applications a reality.

In short, vSphere delivers more scalability for the virtualized environment than ever before—and therefore is exceptionally well suited to the resource-rich IBM System x3850 X5, x3690 X5, and the HX5, which similarly scale to extraordinary levels when required and can take full advantage of the new scalability features of VMware vSphere and subsequent releases. For these reasons, the System x3850 X5 and System x3690 X5, and the HX5 and vSphere combine for a very powerful virtualized solution.



CPU, memory, storage, and networking

Superior utilization of host CPUs is possible with the VMware ESX 4 scheduler. The scheduler boasts fine-tuned co-scheduling of virtual CPUs, finer-grained locking to reduce scheduling overheads, and an awareness of processor cache topology.

Storage capabilities with vSphere include a virtual storage adapter, Paravirtualized SCSI designed for exceptionally I/O intensive applications, and support improvements for iSCSI that significantly spur both performance and overall functionality.

Not to be forgotten in the list of vSphere optimizations is the networking subsystem, now updated with a third-generation virtual network interface card adapter, as well as many optimizations to the network stack. The upshot: even links of up to 10 Gb/s can now be saturated for both transmit and receive network I/O operations.

Resource management

VMware VMotion™— the capability to deliver transparent migration of live virtual machines across hosts—has been further enhanced. Virtual machines can now be migrated up to 75 percent faster.

Intel Xeon processors have a built-in virtualization capability called FlexMigration, which allows VMware VMotion to migrate workloads between multiple generations of Intel processors. Future and backward compatibility helps to assure that IT managers can pool IBM servers containing Intel processors of different generations together without breaking the data center architecture every time a new server is purchased. This increases IT financial protection.

Furthermore, Storage VMotion, previously an experimental technology, is now fully supported. Thanks to a new technology called Changed Block Tracking, Storage VMotion now minimizes both CPU and memory resource time on the ESX host.

Performance management

For organizations with large-scale virtualized infrastructures, new improvements in performance management of vSphere will be very welcome indeed. vCenter Server manages up to 300 hosts and 3000 virtual machines. Furthermore, through vCenter Server Linked Mode, many vCenter Servers can be integrated logically, allowing the management of as many as 10,000 virtual machines from a single pane of glass.

Thanks to charting and reporting features, keeping track of those virtual machines and the business impact of their services is easier than ever. Performance charts now provide a single view of all performance metrics, including CPU, memory, disk, and network. Aggregated charts reflect high-level status, and yet in the event of technical problems, administrators can drill down to any necessary level of detail to isolate and resolve those problems.

Seeding the clouds: How IBM and VMware enable cloud computing

The powerful combination of IBM System x® hosts and

VMware vSphere software implies a range of exciting opportunities for IT—a chance not just to accomplish current tasks more effectively and cost-effectively, but also to create new business value in new ways.

One particularly compelling possibility, given a virtual infrastructure powered by IBM and VMware, is cloud computing. An internal cloud architecture represents a new model (considered as both a management scheme and a technology platform) to create and deliver IT services with unprecedented speed and flexibility. In this sense, cloud computing can be seen as a means to achieve the dynamic infrastructure end; organizations looking for the most dynamic responsiveness from IT will find it appropriate to take steps now towards an internal cloud architecture that meets both their near-term and longer-term needs.

Cloud computing represents a dramatic acceleration of every stage of the service delivery process. Given an internal cloud infrastructure— typically a high-end computational platform in combination with virtual server management and system monitoring and provisioning tools—the time required to create new services can fall from multiple weeks to less than a single business day.

As compelling as an internal cloud architecture can be, however, it requires a best-of-breed virtual infrastructure for its potential to be fully realized. Here, too, IBM and VMware represent the ideal combination of hardware and software elements in the pursuit of such an infrastructure.

IBM eX5 servers deliver industry-leading uptime, availability, performance, and scalability—all mission critical metrics for virtualization and cloud computing, which by their nature will be required to support unpredictable workloads at unpredictable levels.

And VMware vSphere, the first operating system specifically designed for cloud deployments, helps enable virtual machines running in the cloud to obtain the best possible utilization of the IBM hardware through a comprehensive array of new features and enhancements addressing scalability, resource management, and performance management.

Summary

x86 virtualization has transformed enterprise-class IT. A VMware virtualized infrastructure can more efficiently and cost-effectively adapt to changing priorities in business requirements, strategies, and workloads.

For this reason, organizations today, confronted by a difficult economy and threatened revenues, will often find that virtualization can play a key role in helping them to obtain the best business outcome from IT. Virtualization helps by reducing costs, spurring service levels, and mitigating business risks of many types. Maximizing the consolidation of virtualized workloads onto highly-scalable platforms maximizes those benefits.

Virtualized infrastructures require best-in-class platforms to deliver on their full promise. IBM System x3850 X5, 3690 X5, and HX5 servers, based on Intel's Xeon 7500 processors, deployed with VMware vSphere, are ideal thanks to compelling innovations and unique optimizations on both hardware and software. These joint IBM-VMware offerings boast a compelling total value proposition for even the most demanding mission-critical tasks, such as enterprise resource planning, core database hosting, and more.

Organizations that deploy IBM-VMware solutions today will find themselves exceptionally well-positioned to capitalize on emerging technologies and architectures, such as cloud computing, to render IT services with exceptional speed and consistency.

By selecting the highly-scalable IBM System x3850 X5, x3690 X5, and HX5, and running VMware vSphere, organizations can create a more dynamic, resilient, and cost-effective virtualized infrastructure, serving IT and business needs today and tomorrow.

For more information:

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