

Changing the economics of the x86 server environment



The x86 server challenge

In 1992, it cost more than \$222 to produce a chip with 1 million transistors. By 2008, it cost 27 cents.¹ We can add computing power to nearly anything—from cell phones and cars to refrigerators and tiny radio frequency identification (RFID) chips—and we can connect all of these things via the Internet.

From the end user's perspective, this is great. Computing has become increasingly pervasive and abstract, an invisible layer that makes everything work with lightning speed. From the perspective of the people who provide the underlying infrastructure, this is not so great. The demands of these end users are anything but invisible. When infinite possibilities meet finite resources, there's a conflict.

To resolve this conflict, we need to think more rigorously about how we harness infrastructure resources more efficiently. With shrinking budgets and a mandate to keep costs down, IT departments are tasked with processing exponentially more transactions and managing massive amounts of data. At the same time, they're expected to buy less equipment, consume less energy and manage with less space and staff.

It's not surprising that cash-strapped IT departments are turning to the x86-based server. As a foundation for some of the most cost-effective platforms in the marketplace, x86 servers are no longer restricted to file, print and collaboration functions. They're running mission-critical workloads in businesses of practically all sizes—from high-volume transaction processing to memory-intensive business applications and analytics as well as Web and collaboration infrastructure. The ability of organizations to optimize these workloads—for speed, scalability, security, availability and manageability—will become the new definition of performance moving forward.

Rethinking what x86 servers can do

Larger servers, more sockets, more powerful processors and basic virtualization of x86 systems have certainly helped IT address this performance challenge. IT departments can make

better use of the servers they already have—saving on capital and operations costs. Yet in the ongoing quest to provide more computing power at a reduced cost, there's a need to run more and bigger virtual machines—while still delivering the performance and throughput that the business demands.

Working closely with clients, IBM has approached this performance challenge in the same way it always has—by designing systems, not simply exploiting a chip. No matter how powerful, a processor alone cannot provide computing speed, energy efficiency, ease of use, flexibility and availability. Only a well-engineered system can do so.

IBM engineers took a fresh look at the technology underlying the IBM System x® and IBM BladeCenter® systems. With the introduction of fifth-generation IBM Enterprise X-Architecture® technology (eX5), IBM is the first to decouple memory and input/output (I/O) from the processor—moving processing power from what's theoretically possible to what's actually possible.

Closing the gap between theoretical and actual performance

The new Intel® Xeon® processor 7500 series extends computing power far beyond its predecessors. But are organizations realizing its potential? Certain aspects of the overarching server design, such as memory and I/O, constrain real-world performance. In particular, multicore processors like the Intel Xeon processor require huge amounts of memory to achieve maximum utilization.

By decoupling memory from the processor, the IBM goal was to make it possible for organizations to “snap on” enough memory to leverage the full processing power of the powerful Intel Xeon processor and enable superior performance of the system overall. IBM's engineering accomplishment was to eliminate the system connection issues that would result from decoupling.

This IBM engineering breakthrough completely changes the economics of an enterprise x86 server environment. You are now able to dramatically increase utilization of the Intel Xeon processor 7500 series to ramp up the real-world performance of x86 servers—unleashing memory, providing flexible scalability and simplifying deployment for dramatic efficiency gains.



Redefining X. When an organization needs more computing power for today's memory-intensive workloads, the conventional wisdom is to buy more servers. This can lead to massive inefficiency and server sprawl. By letting you add memory independently of the processor, the fifth generation of IBM Enterprise X-Architecture technology has redefined the capabilities of the x86 platform.

Remove performance bottlenecks by unleashing memory

With the ability to add memory capacity independent of the processor, you gain exceptional configuration flexibility. You're better able to achieve the right balance between the processor and the memory to achieve superior performance. The number of processors no longer constrains the number of dual inline memory modules (DIMMs) available. You don't have to add another underutilized and expensive processor simply because you need more memory for your existing applications.

If your enterprise-level workloads or virtualization requirements require more memory than your System x or BladeCenter chassis can hold, you can simply add a MAX5 external memory enclosure. And memory technology from IBM boosts the memory performance of eX5 servers beyond that of other servers using the same processors and memory.

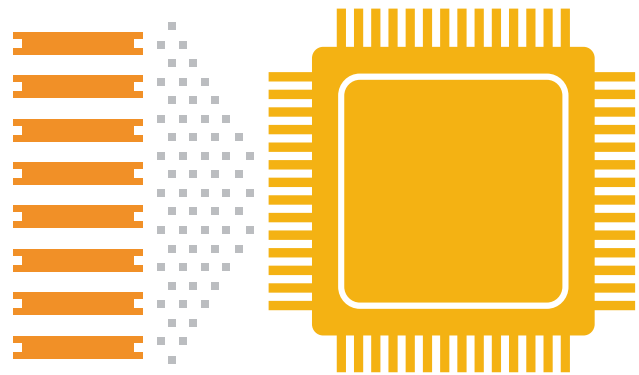
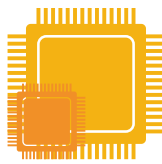


Figure 1: Because you can add memory capacity to eX5 servers independent of the processor, you gain exceptional configuration flexibility.



**Extend
memory
as needed.**

MAX5 technology allows eX5 systems to add more memory than standard Intel Xeon processor 7500 series implementations—helping to deliver higher performance for enterprise-level workloads:

- In two-socket rack systems, the Intel Xeon processor 7500 series supports 32 DIMMs, while the two-socket IBM System x3690 X5 system with MAX5 supports 64.
- In four-socket rack configurations, the Intel Xeon processor 7500 series supports 64 DIMMs, while the IBM System x3850 X5 with MAX5 supports up to 96 DIMMs, and the four-socket IBM System x3690 X5 system with MAX5 supports 128.
- Plus, the larger memory footprint of the eX5 systems helps reduce I/O requirements significantly.

You can extend memory as needed to address the performance demands of just about any given workload. Server utilization goes up. And infrastructure complexity goes down—along with operating costs.

2 sockets/
16 DIMMs



8 sockets/192 DIMMs



The IBM eX5 systems are available in configurations from 2 sockets and 16 DIMMs to 8 sockets and 192 DIMMs. You can scale up for more processing power or expand memory to increase system utilization for memory-hungry business applications, transactional computing and robust virtualization solutions.

Add capacity when and where you need it

If you invest in an expensive high-end server for a project that ends, you don't want to waste money by relegating it to e-mail serving. By the same token, it's simply not cost-effective to throw out an underpowered, inexpensive server and replace it with a more costly one or add a new server for each new workload. You need systems that can start out small and inexpensive and grow with the business yet be simple to administer and flexible enough to be repurposed as workloads change.

Such flexible scalability begins with memory. Because IBM decouples memory from the processor, you don't have to buy everything up front. You can decrease your hardware acquisition costs while increasing the processing power and extending the life of your existing servers. You purchase only the capacity you need at any given time. You're free to scale to accommodate greater capabilities as your workload and processing needs change.

More memory also means you can support more virtual machines per processor, increasing utilization, cutting down on physical servers and helping to lower your per-processor software licensing costs. IBM benchmarks show that you can:

- Run up to 82 percent more virtual machines on eX5-based systems for the same license fees
- Reduce enterprise application expense dramatically—for example, running a Microsoft® SQL Server database environment on an eX5 system for half the licensing cost of the same number of users
- Slash storage costs by up to 97 percent with the eX5 system eXFlash database capabilities.²

The more you can virtualize workloads, the more space and energy you save, particularly if the servers you have are highly energy efficient. IBM x86 servers have earned some of the highest efficiency ratings in the industry.

In addition, high-availability features that keep your systems up and running mean fewer expensive service calls. IBM is a long-time leader in reliability, and many of the IBM OnForever™ features pioneered by IBM engineers in earlier generations of Enterprise X-Architecture technology have now become industry standards, including Chipkill memory correction, Predictive Failure Analysis (PFA), redundant power and cooling, and memory mirroring. And the innovation continues. IBM now extends the protection of its servers to a whole new level. Instead of only having PFA for memory, hard drive disks and perhaps processors, IBM now provides PFA support for Peripheral Component Interconnect Express (PCIe) adapters, power supplies, fans and voltage regulator modules (VRMs). Instead of stopping at Chipkill protection memory mirroring, IBM has now added more layers of data integrity and availability, including patented IBM Memory ProteXion, memory scrubbing and memory rank sparing. If one of your eX5 nodes fails, automatic node failover is designed to allow the other node to take over, with no downtime. When you're dealing with enterprise workloads, you can't afford extended downtime. That's why you need IBM eX5 system reliability and availability.

Simplify deployment and ease system management

IBM provides its industry-leading eX5 technology in both rack and blade form factors built with “ready-to-go” building blocks already optimized for particular workloads and designed to be quickly and easily implemented. In addition, with consolidated single points of management and remote administration, you can rapidly qualify and deploy eX5 systems.

The embedded IBM Systems Director software provides a unified view of your data center to save your IT staff time while delivering savings for operational expenses associated with systems administration. It also helps streamline the process of repurposing System x and BladeCenter machines for almost any workload. For example, consider a large project that requires exclusive use of a large multinode system. When this project ends, IT staff can use logical node partitioning capabilities to break the system down into single nodes for redeployment to smaller projects—without ever touching the hardware. Or consider a retail operation that requires many smaller sales order systems running during business hours and a larger system to process the transactions at night. The ability to schedule redeployment remotely through a unified service management console can significantly increase IT productivity and responsiveness. Organizations are able to cost-effectively support unique business workloads as needed, even when requirements change suddenly.

Why IBM?

IBM has exhibited a long-term commitment to helping IT managers provide reliable services to their internal customers through our historic and continuing investment in hardware systems and storage technology. We've been the leading vendor in technology patents for 17 years running. And unlike many of our competitors, IBM does not presume that a single systems approach can be force fit to every need.

Superior technology and a visionary road map

IBM offers you a range of eX5 systems: scalable two- and four-socket System x3690 X5 and System x3850 X5 rack systems, database- and virtualization-optimized System x3950 X5 systems, and scalable BladeCenter System HX5 systems. Each offers a clear road map to help you minimize the risks of migration now and provide some peace of mind for the future. IBM systems integrate applications with the platform and storage. And matching the workload to the right platform is part of a larger IT dynamic infrastructure strategy. With IBM, you can establish a strategy and roadmap that is right for your business—and adapt quickly to new realities.

Optimization and implementation services

A successful solution is much more than buying boxes. IBM provides a suite of services—including implementation, migration, consolidation, virtualization and support offerings—that can help you quickly and efficiently leverage System x technology in your IT environments. These services help accelerate your return on investment; simplify day-to-day operations; and achieve the rapid system availability, security and efficiency demanded by the business. By using proven methods and skilled IBM specialists as well as the latest remote implementation services, you can reduce the need for training or hiring staff to get your new servers up and running cost-effectively and without business disruption.

Additionally, maintenance and technical support solutions from IBM can help you get the most out of your IT investment by helping to reduce support costs, increase availability and simplify management with integrated support for your multiproduct, multivendor hardware and software environment.

Financial support

IBM Global Financing helps you acquire the IT solutions that your business needs in a highly cost-effective way. You can choose from a variety of financing options to address your unique solution requirements and help optimize your cash flow and IT refresh strategy. You're able to stretch your IT budget and turn large up-front expenses into affordable monthly payments.

For more information

To learn more about System x and BladeCenter systems featuring eX5 technology, contact your IBM marketing representative or IBM Business Partner, or visit: ibm.com/systems/eX5



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¹ Deloitte Center for the Edge, Measuring the forces of long-term change: The 2009 Shift Index, John Hagel III, John Seely Brown, and Lang Davison, June 2009.

² This reduction in cost is based on equivalent input/output operations per second (IOPS), not equivalent storage capacity.



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