IBM's System x eX5 servers attack customers' most challenging IT problems with efficiency and flexibility

When it came to determining the features and capabilities to include in its fifth generation of System x Enterprise X Architecture-based servers, dubbed System x eX5, IBM's System x server team did not merely pick from a list of nice-to-have features or defer to its technological bag of tricks. Instead, the team went directly to the source. Team members packed their suitcases and hit the road on a 22-city tour to talk to System x customers.

Background

For TBR to develop this whitepaper, it was essential to gain a clear understanding of IBM's goals in developing the System x System x eX5 server family, as well as the System x eX5's capabilities and the specific features and functions IBM devised to meet its objective of improving customers' business performance. To gain the required knowledge, we conducted a series of interviews with IBM's System x design and marketing managers.

The findings in this paper are also supported by a series of interviews conducted with IBM customers through TBR's Customer Satisfaction studies, as well as targeted research in the areas of IBM's System x server customer satisfaction.

IBM's System x eX5 Server Family

IBM's System x eX5 servers are available in two-socket and four-socket rack-mount and blade form factors

Source: IBM

Because business needs have changed so dramatically since the release of fourth-generation System x Enterprise X servers in early 2008 – and the System x team wanted to directly address current needs – the team sought to gather and incorporate direct customer feedback in its fifth-generation of Enterprise X machines, the System x eX5. Customers' priorities quickly became apparent: They desired a server family that was simpler to manage, more flexible and well balanced – and that provided a superior value.

"Customers said, 'We need more memory versus more sockets,'" Alex Yost, IBM Vice President and Business Line Executive for System X told TBR in an interview. "They said, 'We need more balanced systems.'" Based on this and other knowledge gained from the 22-city tour, the team set out to design a family of servers that would provide a great deal more flexibility, not only in terms of pricing and performance, but also in the ability to scale processor counts and memory capacities.

Responding to customers' needs, TBR believes IBM is providing business value through enhancements that provide a new level of performance, optimization and efficiency with its Svstem x eX5 servers

Providing more memory became one of the primary goals of the System x eX5 family. Larger memory allotments are vital to alleviating many of the most pressing pain points of x86 servers: lack of flexibility and scalability when implementing virtualization and databases. So, while it goes without saying that customers expect increased server reliability and performance from IBM's System x eX5 servers, the company sought to take it's newest fifth-generation Enterprise X Architecture one step further by significantly increasing memory – to add virtual machines and increase database performance – to tackle their top priorities while helping to save on server hardware, maintenance and software licensing costs. IBM also significantly broadened its System x eX5 server offerings. Its System x eX5 family includes both dual-socket and four-socket rack-mount servers along

IBM System x eX5 Server Capabilities

Performance/Scalability	Simplification	Cost Reduction

• Latest Intel processors
• More memory and more processor cores allow for:
  • More and bigger virtual machines
  • Larger-sized databases
  • Faster database performance
	• Flexibility to get the IT they need, the way they need it
	• Customers can buy what they need when they need it
	• Workload-optimized models address database and virtualization and shorten time from deployment to production
		• Lower management requirements = Lower Operating Expenses
		• Increased server utilization and lower software licensing fees; fit more processors into existing
		• Reduced energy costs

Source: IBM

with the company's first Enterprise X Architecture-based blade servers. By providing both dual-socket and four-socket offerings in both rack-mount and blade form factors, IBM delivered an increase in flexibility for customers, including adding support adding dual-socket servers on a pay-as-you-grow approach. The enhancements brought forth by IBM in its System x eX5 servers are directly related to their incorporation of the company's fifth-generation Enterprise X Architecture chipset, a version of the server equivalent of a nervous system created to work with Intel's next-generation server processors. The fifth-generation chipset doubles the amount of memory available in an IBM server when compared to competitors' Intel-chipset-based based servers. IBM System x eX5 servers provide an additional memory-boost feature, which allows customers to add a total of as much as four times the number of DIMMs (dual-inline memory modules) that can be found in standard dual-socket Intel-chipset-based servers.

IBM, through its Enterprise X chipset and resulting System x eX5 servers, is giving its customers something competitors cannot: Increased flexibility and cost savings made possible by a breadth of System x eX5 offerings and configurations, from two-socket to four-sockets, and from 32 DIMMs to 96 DIMMs, which provide increased performance and efficiency as well as lower software licensing costs. The result is a decrease in total expenditures – both up-front and over the servers' lifetimes – thanks to the System x eX5 server family's ability to lower software license fees, as well as administration, maintenance and electricity costs, while consolidating from large x86 server implementations to a smaller number of more highly-efficient System x eX5 machines. When replacing proprietary technology, IBM's System x eX5 family offers lower prices per machine, along with decreased management costs and software licensing fees, while still providing enterprise-level scalability, reliability and performance.

The System x eX5 family also provides additional value by delivering improved performance for specific mission- critical workloads, including databases. The family provides solutions-oriented servers, which are optimized (on a hardware and software level) for virtualization-driven server consolidations as well as large database implementations. The System x eX5 family provides a cost-effective solutions for businesses to consolidate large x86 server installations or move from proprietary platforms such as Sun SPARC or HP Itanium while improving performance and increasing manageability.

IBM has expanded its System x eX5 server family to best address customers' critical needs

IBM grew its System x eX5 server family to match broader spectrum of customers' business needs

IBM created the System x eX5 Server Family to meet customers' wide-ranging needs for performance and price. The addition of several new server form factors and configuration options within the System x eX5 family allows businesses customers more ways to access to the enterprise-level server performance, scalability and reliability of IBM's Enterprise X Architecture with greater flexibility than before.

The System x eX5 server family is IBM's first to include Enterprise X Architecture in both dual-socket rack- mount and blade-based server models. The availability of the x3690 X5, a new two-socket System x eX5 server, makes Enterprise X Architecture's features and capabilities available at a lower price points than before. Therefore, TBR believes the value proposition of IBM's System x eX5 servers is clear. Customers can expect to choose from an array of System x eX5 servers to find the machine that offers the right mix of features and pricing for their needs.

IBM's System x eX5 server capabilities focus on flexibility, expandability and cost management

Flexibility: The IBM System x eX5 family allows customers to dictate their own terms when it comes to deploying new servers. Customers who are looking for scalability at a relatively low entry price – or those who wish to pay as they go by adding servers based on escalating needs – can standardize on the two-socket, rack-mount System x 3690 X5. IBM designed the x3690 X5, which shares the same Enterprise X Architecture as all System x eX5 servers, for density and ease of implementation. Due to its performance, memory capacity and virtualization capabilities, the System x x3690 X5 can replace numerous older servers. Customers can start out by purchasing a small number of x3690 X5 machines. Then, as the need arises, customers can add additional x3690 X5 servers.

IBM System x eX5 Server Configurations

► **x3690 X5: All-new, dual-socket rack-mount server design that provides density for virtualization**

► **x3850 X5: Enhanced four-socket design delivers increased performance and memory capacity for databases**

► **x3950 X5: IBM's four-socket Workload-Optimized offering, delivers pre-configured and pre-tested**

► **HX5: IBM's first Enterprise X-Architecture-based blade server offering; offers two or four sockets**

Source: IBM

The x3690 X5's memory capacity of up to 32 DIMMs – nearly double that of competing servers – can be increased to 64 DIMMs using IBM's MAX5 feature. This allows the machine to significantly scale up the number and size of virtual machines – and therefore the number of applications – it can run simultaneously. The x3690 X5's large memory capacity also makes it well-suited for running smaller-sized databases.

IBM's first Enterprise X Architecture-based blade offering, the eX5 BladeCenter HX5, allows customers to combine the performance and memory capabilities of rack-mount System x eX5 servers and MAX5 memory expansion capabilities, with the density of BladeCenter blades. IBM's HX5 blades are available in either two- or four-socket configurations.

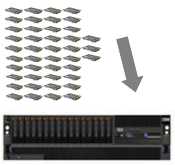
IBM's System x 3850 X5 provides a high-performance, four-socket system for customers

moving off of proprietary UNIX-based systems or seeking to consolidate large databases from multiple machines. The x3850 X5 provides up to four processors and 64 DIMMs, with the ability to increase memory capacity by an additional 50% to 96 DIMMs with MAX5, while also adding input/output performance with a new eX5 flash-based storage technology, which utilizes solid-state drives to increase database performance.

IBM's System x eX5 family also includes numerous Workload-Optimized options for customers who seek simplified deployment of pre-configured and pre-tested servers. IBM's System x 3950 X5, its Workload-Optimized option, pairs the four-socket capabilities of the x3850 X5 with a pre-tuned, pre-configured and pre-tested approach, provided by IBM experts, to deliver a range of drop-in-and-go options for customers who seek to utilize virtualization for consolidation or to run mission-critical databases.

IBM's System x eX5 family's memory expansion saves on costs and delivers increased performance

IBM eX5 eXFlash Database Performance



- **Leverages SSD (solid state drive) to accelerate IOPS performance by 50x to 200x vs. hard disk drives**
- **Up to 1.6 TB of capacity per eXFlash Pack and three eXFlash - packs per system**

Provides performance and cost-savings benefits for database implementations due to higher performance, greater reliability and lower energy consumption vs. hard disk drives

Source: IBM

With the ability to combine multiple server nodes that each incorporate next-generation Intel Xeon processors, IBM's System x MAX5 memory expansion and IBM's System x eXFlash SSD (solid-state disc drive)-based database performance accelerator, IBM's System x eX5 family allows customers to easily arrive at the levels of performance they need for their specific applications, while leaving some computing power in reserve and having the option to add additional servers should the need arise. Where the System x eX5 family's memory capacity enhances performance, it also meets a critical need for all customers by reducing costs.

IBM eX5 MAX 5 Memory Expansion

Increases server utilization and performance by upping Virtual Machine or database capacity

- **Delivers an additional 32 DIMM slots to x3690 X5 and x3850 X5 rack-mount servers, increasing memory capacity by 128 GB to 512 GB**
- **Delivers an additional 24 DIMM slots to HX5 blades, increasing memory capacity by 96 GB to 384 GB**

Source: IBM

IBM System x eX5 Memory

eX5 Model	Standard Memory	With MAX5
x3650 X5	512 GB	1 TB
x3850 X5	1 TB	1.5.TB
HX5	128 GB	320 GB

Source: IBM

Optimized memory performance: To provide high-levels of performance while maintaining flexibility, IBM delivered its System x eX5 servers with expansion capabilities, including MAX5 for memory and eXFlash for database performance. With MAX5, the System x 3690 X5 rack-mount server and BladeCenter HX5 blade, can deliver up to 64 DIMMs or 40 DIMMs, respectively.

Lower software licensing costs: Utilizing the System x eX5 family's memory expansion capabilities allows customers to reduce their software licensing fees for virtualization and database software. Software vendors typically charge licensing fees by the processor socket, but the large memory allotments found in IBM's System x eX5 servers' allow customers to run much larger databases or add many more virtual machines per processor. This reduces the need to add additional two-socket servers for virtualization and, in many cases, the need for additional processors in a four-socket machine – both of which lead to lower software licensing fees.

IBM System x eX5 Server Cost Savings

	IBM x3690 X5	Competing two-socket server
Hypervisor cost (per processor)	$7,000 USD for 2 processors	$7,000 USD for 2 processors
Memory capacity	32 DIMMs	16 DIMMs
Virtual machine capacity	200+ Virtual Machines	100+ Virtual Machines
Result	Due to its higher memory capacity, IBM's x3690 X5 with MAX 5 can support more VMs, leading to lower cost per VM, compared to leading competitors' dual-socket servers.	

Source: IBM

Because of its memory capacity, including the MAX5 upgrade, the x3690 X5 can run more than 200 virtual machines without increasing software licensing costs, as the number of processors (in this case two) stays the same. The addition of large numbers of virtual machines cuts down on hardware costs as a single IBM x3690 X6 server provides room to consolidate more virtual machines than competing servers, allowing the x3690 to accomplish what it would take multiple competing dual-socket machines or a much more expensive four-way server to do.

A dual-socket x3690 with IBM's MAX5 feature can sustain more than 200 virtual machines – the same number as a competing four-way server. The result is that the x3690 delivers more virtual machines for the same software license price, when measured against a competing dual-socket system, or the same number of virtual machines for half the price, when measured against a competing four-way machine.

The key to IBM's expanded memory capacity is reducing the number of servers deployed. This delivers a host of additional cost savings, including lowering operating expenses by reducing the number of personnel dedicated to server maintenance and support, reducing electricity and cooling costs and eliminating the need for datacenter expansion. Companies can accomplish their critical computing tasks without adding additional servers, which take up space in the datacenter and require IT personnel to administer. The benefits inherent in System x eX5 servers allow for lower costs by allowing businesses to do more work in the same space for less costs – customers can lower license fees, lower hardware costs and lower maintenance costs. The equation is similar for IBM's x3850 X5 and BladeCenter HX5 blades: The ability to increase the size of a database or the numbers of virtual machines running on one machine without increasing the processor counts leads to lower hardware and software costs. Customers can put more virtual machines or a larger database on each System x eX5 server than on competitors' servers. In many cases, a single IBM System x eX5 server can perform the same tasks as multiple competing servers.

IBM's System X eX5 family provides pre-tested and configured options

For customers who prefer a pre-configured and tested system, IBM's x3950 X5 provides an IBM-tuned and configured option for running large databases. IBM can also help customers avoid server optimization and deployment headaches with pre-configured workload-optimized models, specially designed and configured for databases or for virtualization applications. IBM's System x System x eX5 family includes a number of Workload Optimized Systems, which provide an option to deploy pre-configured and pre-tested

IBM System x eX5 Database Workload Optimized Solutions

Job type	Server	Deployment
Data Warehouse	x3850 X5	IBM provides x3850 X5 server with full pre-deployment hardware and integration testing
Database Engine	x3950 X5	IBM provides ready-to-deploy x3950 X5 server with fully tested and integrated database software and hardware
Integrated Solution	IBM Smart Analytics System 2050	IBM provides software, hardware and deployment of database server solution

Source: IBM

hardware; software and networking for customers who intend to use virtualization for server consolidation or those who are running mission-critical databases.

These Workload Optimized Systems allow customers to reduce their post-deployment optimization by ensuring that the right servers with the right configurations, networking and software are chosen from the start. IBM provides a number of application-specific System x eX5 server options under the System x Workload Optimized system. The range of choices allows customers to purchase an optimized server based on their specific needs and their specific application – virtualization or database – as well as their desired level of pre-configuration and testing.

IBM System x eX5 FlexNode Dynamic System Allocation

- **Allows one 4-socket server to switch between two and four socket operation**
- **Allows each 4-socket eX5 server to act like *two separate* dual-socket machines**
- **Provides automatic failover and node reboot**

Provides flexibility, cost savings and security by increasing the number of jobs running simultaneously on the same server

Source: IBM

Workload Engines come in the equivalent of small, medium and large. A small option includes an x3850 X5 server, whose hardware has been pre-configured and is ready to be deployed by the customer. A medium option, such as a Database Engine, includes database software fully tested and integrated on a preconfigured and tested x3950 X5 server.

IBM will also offer pre-configured hardware-only options and sizing assistance and support for applications from Oracle, SAP, IBM Software Group and RedHat. IBM provides IBM Lab Services for large System x eX5 deployments in addition. As part of this service, IBM engineers deliver an on-site assessment of a customer's needs. The assessment helps reduce future headaches for customers by fully qualifying their server configurations prior to deployment.

System x eX5 provides flexibility for pay as you go

IBM's System x eX5 family of servers combines increased headroom, thanks to increased processing power and memory capacity, with provides a number of built-in flexibility features which grant customers 'pay as you grow' capability. For instance, System x eX5 servers have multi-node capabilities, allowing the machines to pool memory and processing power to tackle larger jobs such as databases. The System x eX5 x3850 X5, for one, can scale natively to two nodes utilizing Intel's QPI (Quickpath Interconnect). The multiple node configuration capability allows a great deal of flexibility when taking advantage of IBM's System x eX5 FlexNode feature. FlexNode provides the ability to automatically reboot a node that experiences a failure. The ability to keep at least one node of a multi-node implementation up and running despite an adjacent failure ensures greater server uptime for customers. FlexNode also allows for the automatic re-deployment of systems on a project-by-project or day-to-night basis. The feature allows a four-socket server to run as a two-socket machine for certain jobs, while re-combining into a four-socket machine for other jobs.

Reliability: IBM System x servers have a reputation for reliability due to the company's design capability and its history in mainframes. IBM's System x team upheld that reputation when designing its System x eX5 servers, such as the x3690 X6 and x3850 X5, to provide reliability and high-availability. The company fitted System x eX5 servers with numerous redundant and hot swap components, including hard drives and power supplies, while including IBM-mainframe inspired technologies, such as memory error correction and mirroring as well as predictive failure analysis. IBM's decisions to incorporate IBM ChipKill and ECC (error correcting code) along with Memory ProteXion technology and memory mirroring all support the performance and reliability of in-memory databases for customers whose databases are mission-critical. Further, each System x eX5 server includes IBM proactive management technology with "call home"

features, which allow the company's built-in system health features, including the IBM Integrated Service Advisor, to address imminent hardware failures before they cause problems. The Integrated Service Advisor's call home feature allows it to alert IBM warranty service and support to begin a proactive replacement of a part that is approaching failure. The result of being proactive is preventing any server downtime.

Resiliency: IBM also built additional resiliency into its BladeCenter HX5 blades. The machines include redundant and hot swap components to eliminate the potential for problems arising from a single point of failure. The blades include redundant power supplies, dual I/O modules, as well as dual paths for I/O, Power and KVM connections. Should an HX5 blade experience a failure, the blades support automated failover between blades.

Management tools: IBM has also updated its System Director 6.1 server management console software for System x eX5 servers. IBM equipped Systems Director with features designed to improve deployment speed and remotely repurpose servers. One new feature includes the ability to pre-configure IBM XH5 blade systems identities when utilizing the machines with IBM Open Fabric Manager. Additional System x eX5-oriented features present in System Director 6.1 include remote node partitioning for System x eX5 servers and the ability to setup automatic system recovery parameters. Systems Director also includes the ability to leverage automated image deployment, remote software updates and, when utilized with Integrated Service Advisor, provides the automated call-home features, which automatically report problems to IBM Warranty Support.

Conclusion: IBM's System x eX5 family provides strong options for mission-critical applications

There are several notable firsts for IBM's System x eX5 servers. For the first time, IBM is providing its Enterprise X Architecture in a System x server that is not solely intended as a performance product for high-end applications such as databases. Instead, System x eX5 has branched out to provide a very broad range of servers that match with an equally diverse set of customer needs, particularly in the areas of increased density – with its BladeCenter HX5 blades – and improved virtualization performance and cost with its dual-socket x3690 X5. Despite starting at a lower price point than previous Enterprise X Architecture implementations, the System x eX5 family provides a host of reliability, scalability and performance improvements, including MAX5 memory expansion and FlexNode server failover and reassignment. These features are designed to meet customers' needs for increased flexibility and also cost-savings in these uncertain economic times. TBR believes that IBM's System x eX5 servers make the ideal candidates mission-critical applications, ranging from server consolidation and virtualization to high-end databases. The System x eX5 family provides not only the performance, but also the flexilbility necessary to address businesses most pressing needs: Performance and cost savings, all in one package. The bottom line is customers can turn to IBM's System x eX5 family to improve their business performance in 2010.