



The IBM X6 Family — Taking Infrastructure to the Next Level

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Management Summary

As we move from the Winter Olympics, and ready for a new season of baseball, “America’s Pastime” (or to cricket in the northern hemisphere), let’s reflect upon what contributes to a successful sports team. Besides the obvious – superior athletic ability – every great athlete has a keen sense of *anticipation*. World-class hockey player Wayne Gretzky often has been quoted that he does not pass the puck to where his teammate is, but rather to where he is going to be. In baseball (or cricket), any successful batter (batsman) must swing not only at *where* the pitched ball is going to be when it reaches the batter, but exactly *when* it will be there, as well. If anticipation is mistimed, the batter will swing and miss.

In order for any enterprise to be successful in today’s highly interactive society, it requires the same keen level of anticipation that is exhibited by the great athlete. The enterprise is not concerned with a ball or a puck, but it is concerned about being ready to engage the customer when s/he wants to be engaged and without very much delay. Any amount of analytics will significantly decrease in business value if the customer is no longer waiting (i.e., “in the batter’s box”) and ready to respond (i.e., to act when the ball crosses the plate) but the information isn’t there for the customer to make timely decisions. **Thus, for analytics and other critical business calculations to deliver a high degree of business value, enterprise IT delivery mechanisms need to respond within a very short anticipation period.** The level of performance (the ability to anticipate quickly enough) that is delivered by your IT infrastructure can make the difference between success and failure in the marketplace. **Therefore, your IT infrastructure is crucial in attaining your business objectives.**

When we talk about “infrastructure”, what are we actually talking about? The *Free Dictionary* defines it as “an underlying base or foundation, especially for an organization or system”.¹ When we talk about infrastructure in the data center, we mean a complex system with many interactions between servers, I/O devices, I/O channels, and networks that interconnect them. **Optimizing and simplifying that infrastructure has become of paramount importance to enterprise data center managers working to achieve enterprise goals (SLAs) without breaking the constrained budget.** More systems automation with less administrative oversight makes this more cost efficient. **Thus, the necessary infrastructure must satisfy the requirements for performance with less administrative involvement.**

When the data center manager is tasked with the requirement to provision for a new application, such as transforming the enterprise through Big Data and analytics or cloud, this may require integrating a new, high-performance system into the existing infrastructure, or the deployment of a new infrastructure requiring interaction with the old. S/he is faced with two options, *build it* or *buy it*, while being constrained by a limited budget and an inability to deal with too much infrastructure complexity. One method, buying individual

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¹ See <http://www.freedictionary.org/?Query=infrastructure&button=Search>.

components and integrating them yourself, adds even more complexity to the solution. The other method, acquiring systems that are pre-integrated for the targeted application set, removes that complexity, enabling faster deployment of new applications for the enterprise.

Usually, the primary objective for the data center is to deploy an efficient infrastructure that optimizes application workloads and assigns resources in a manner that reduces the total cost of ownership (TCO) of that infrastructure. One way to do that is to leverage the newest technologies that are based upon open standards for modular growth. One company that has made a habit of doing just that is IBM. With a long and storied history in consolidating, simplifying, and integrating solutions for the enterprise data center, IBM has announced the newest members of its *System x* product line, based upon the sixth generation of its x86 server architecture, known as *Enterprise X-Architecture* or *EXA*.² With EXA, IBM does not force the enterprise to make a choice of performance *or* features. IBM is providing a platform that provides both performance *and* features that can be used wherever you need it (whether for analytics, business applications, or cloud hosting). If your enterprise has an unlimited budget with unlimited resources, buy as much as you need without worrying about the TCO. However, if you want to have your cake and eat it too (i.e., get performance and features while focusing on the TCO), please read on to learn about the latest System x models and the Enterprise X Architecture upon which they are built.

Enterprise Data Center Environment

The data center staff requires an IT infrastructure that is up to the task in terms of performance and reliability, and also is able to respond rapidly to changing business opportunities, all with a minimum of hands-on integration and administration, and all with an eye on the bottom line and also towards the future. Thus, there is a five-pronged set of objectives.

- Enable enough performance for rapid response times;
- Maintain high reliability and low administrator involvement with systems;

- Reduce, or at least maintain, the administrative burden on the data center staff (i.e., automate);
- Respect the IT budget; and
- Consider future requirements.

These all are interrelated.

Being Highly Performant

Enterprises of all sizes rapidly are adopting analytics for greater business insight, both within the data center and in the private cloud. The speed with which the enterprise can analyze the data and “get to where they need to be”, often can spell the difference between a successful application and failure. The need for speedy answers only will accelerate, especially when considering the increasing social, mobile and Big Data workloads. This is putting great strain on data centers, because the time available for getting an answer (or reaching a conclusion) almost always is extremely short. Thus, for the in-house or in-the-cloud data centers, the challenge is having sufficient, high-performing IT assets exactly when they are needed. Not only is this a technical challenge, but also, an economic challenge, in order to increase efficiency and lower the TCO of the IT environment.

Being Highly Reliable

Improving resiliency is closely tied to keeping the infrastructure operational at all times, i.e., maximizing uptime through improved availability. This means that the data center staff must have tools to proactively identify potential failures and take corrective action *before* a failure can occur. Enterprise features that facilitate this capability must include ongoing failure analysis on components that are easy to replace.

Being Efficient to Manage

To lighten the administrative load, the data center must use products that inherently are less complex (to install and manage) and which rely on automation and virtualization tools to increase simplicity (without adding cost). This includes integrating components, such as flash memory, and creating a modular design for a longer IT asset life-cycle.

Being Cost Efficient

As discussed above, being highly performant is a requirement. However, this needs to be accomplished without breaking the budget. Usually, improved performance requires increased power consumption, cooling, and floor space, all of which will increase the TCO. That usually is unacceptable as most, if not all, enterprises are faced with the issue of lowering the

² Last month, IBM announced that its System x business would be acquired by Lenovo. Until this transfer happens, probably in the third quarter, it is business as usual for IBM Systems x business, including the new sale and delivery of the products discussed in this report.

power and cooling requirements of its IT infrastructure and not growing its need for more space in the data center. Thus, the chosen high-performing and highly-resilient infrastructure also needs to be highly efficient.

Being Future Focused

In addition, the data center staff must also keep one eye on the future. They must deploy systems today that can be upgraded tomorrow while protecting today's infrastructure investments. More and more enterprises are turning to open systems, i.e. x86 servers, to accomplish this. However, each generation of x86 CPU from Intel often requires a forklift upgrade to the server architecture. The enterprise must ensure that future generations of technology can be accommodated within the deployed infrastructure, whenever possible.

With many servers from which to choose, this presents an interesting dilemma to the data center staff: *Which Windows or Linux server platform is right?* Traditionally, an x86 server from one vendor may be very similar to the x86 platform from other vendors. The data center staff must try to identify which x86 platform has the most features that add needed value to running the planned applications and services. These features include, but are not limited to higher efficiency, improved performance, and increased reliability.

One company that has been, and continues to be, dedicated to the principle of adding unique innovation to an otherwise comparable environment, is IBM. Its X6 portfolio of *System x* servers uses the same Intel *Xeon* processors as everyone else, but IBM has invested heavily to add unique capabilities and features (beyond the industry standards) that will make a difference, especially with respect to the five objectives discussed above.

IBM X6 Architecture

IBM's *System x* portfolio is built upon the sixth generation of *IBM's EXA³ architecture*, called X6, continuing IBM's x86 innovation on top of industry standards for the open systems community. This architecture started more than a decade ago with the availability of the original *EXA* architecture. X6 enables *System x* with the ability to deliver increased application performance, starting with an accelerated deployment of the largest mission- and business-critical workloads.

³ *Enterprise X-Architecture.*

X6 is enhanced by a new and unique flash technology that delivers lower latencies for workloads that require faster access to data, thus providing faster response times plus smarter data management with real-time tiering to get products and services to market more quickly. This is accomplished by putting flash memory into the server via IBM's *eXFlash memory-channel storage* (discussed in detail below), by offering 52% more flash storage capacity (than on X5), and by providing larger virtual machines with a three-times larger cache to reduce latency for more consistent performance.

X6 Cloud Benefits

X6 extends the scalability advantages of virtualization and cloud deployment by providing a better foundation for the virtualization of enterprise applications and thus enables the data center staff to manage infrastructure at scale. X6 can integrate both public and private clouds with back-end systems for greater workload optimization and, thus, can consolidate more users onto a single application image, potentially lowering software licensing charges for both systems and applications.

X6 Application Performance Benefits

Today's data center has to be fast, agile, and resilient. X6 provides exactly that with extremely fast performance for large analytics and ERP workloads as a result of IBM's innovative flash technology. X6 extends the capability of the standard x86 server with optimized performance, enterprise-level availability, and investment protection to enable IBM to continue to deliver simple, proven data center solutions.

A *System x* platform with an X6 architecture leveraging the *eXFlash* memory channel storage⁴ and *IBM Flash Caching and Storage Accelerator* software will be able to deliver the agility required by today's mission-critical applications. According to IBM, It also can deliver up to 43% lower solution cost by consolidating hardware and reducing software licensing.

Reliability Benefits

Even with three times more memory, X6 provides the higher resiliency and availability that the modern data center requires to meet the growing demands of enterprise workloads via IBM's *Predictive Failure Analysis* on a variety of components⁵, diverse RAID support, and self-

⁴ More on *eXFlash* on page 4.

⁵ This includes fans, power supplies, SAS/SATA HDDs and SDDs, memory, and processors.

healing fault tolerance features, such as memory page retire and automatic processor recovery. All of these improve the virtualization, analytics, and cloud-based enterprise workloads.

TCO Benefits

With a modular design, X6 enables the data center to reduce the TCO of the IT infrastructure by reducing deployment costs, lowering application costs through better virtualization with more memory and lower licensing costs, and decreasing support costs through easier maintenance. Based upon industry standards, System x platforms built on X6 also will provide longer life-cycles for data center stability by allowing Intel Xeon processors to be upgraded to the next generation, without affecting system storage, networking, or management. (More on the new, modular approach in the next column.)

IBM System x Family Additions (X6)

Because of the demands being placed upon server functionality by critical new workloads, the features and capabilities needed by business- and mission-critical applications continue to increase. In fact, the scope of mission-critical applications has changed, dramatically. Today, these applications are extending out to mobile devices and reaching into the cloud. Because this increases demand for processing capacity, requiring even more scalability for additional users, there is a strong need for increased reliability and 7x24x365 availability.

The requirement to have the right information at the right place in something approaching real-time could determine whether or not your enterprise is ready to compete. Thus, it is a prime requirement for your “best” enterprise servers in your data center to be able to support high-volume analytics – in order to ascertain and act on what is happening right now, while also working on what could happen tomorrow.

The newest X6 members of the IBM System x family optimize the speed of decision making in real-time by using embedded intelligence to accelerate operational processes (such as I/O). This capability is unique to IBM X6 advanced servers and enables the enterprise to get closer to their customers in a shorter time frame. This is done with some clever technology that manages secured access to the data whether it is stored on the *eXFlash* cache (described in detail in the next column) or on a disk beyond the cache. It does this while still lowering TCO (for the amount of work being done).

IBM now can deliver X6 architecture capabilities in two new server platforms, configured to suit diverse business needs by delivering more efficient results: the *IBM System x3850 X6* and the *IBM System x3950 X6*. Both of these server platforms deliver twice the performance of their previous models. Both increase virtualization density while reducing infrastructure costs and complexity. This enables the data center staff to design faster analytics, thus delivering valuable information with high reliability. These X6 servers provide the data center with the speed, agility, and resilience required to perform in these new arenas.

With the Latest Intel Xeon Technology

IBM has designed its X6 infrastructure to optimize overall solutions performance through an innovative modular, scalable design, and new storage technology. Based upon the latest Intel Xeon architecture, the *E7-8800 v2* and the *E7-4800 v2*, IBM is empowering the data center to host essential, critical applications with large virtual machines or to run large in-memory databases without decreasing performance, capacity, or scalability.

New Modular Approach

IBM's X6 offers a new modular construction that is made up by a unique “book” design (i.e., a server holds modular compute, I/O, and storage components in the form of “books”, which fit into the server chassis, which is akin to a bookshelf). The data center staff can use these books to create configurations that meet their needs. There is no need to pull the chassis in or out of the rack because all chassis components can be accessed either from the front or from the rear of the server. Book functionalities are described below.

eXFlash Accelerates Performance

X6 servers are the first systems designed and optimized for IBM's new eXFlash memory-channel storage, with an on-memory bus design (physically resembling DIMMs) to alleviate potential I/O contention caused by waiting for disk I/O. With this capability, IBM can deliver up to 12.8TB of ultra-low-latency flash storage with consistent performance, differentiating System x from competitive x86 servers. With eXFlash, these System x servers can deliver exceptional performance and value to the data center. With a write latency of less than 5µs, eXFlash provides lower write latency than other flash offerings to enable higher performance. As additional flash DIMMs are added, IOPS will

Exhibit 1 — Front and Rear Views of IBM x3850 X6



**Front View Showing Compute Book
Partially Extended**



**Rear View Showing I/O Book
Partially Extended**

Source: IBM

increase, but not the latency. This enables the data center staff to add several times more virtual machines per X6 server without impeding service for large databases and highly virtualized systems. IBM offers exclusive features called *WriteNow* to deliver the best performance in the industry on memory-channel storage. The IBM eXFlash DIMMs also feature an exclusive capability to have higher data protection with RAID-1 capability – which is critical when customers will leverage 12.8TB of this storage to host enterprise databases or virtual machines.

In addition to improving performance, eXFlash also lowers the TCO of the IT infrastructure by reducing outboard storage costs⁶ and often also lowering outboard storage software licensing.⁷ IBM also has developed an innovative *FlashCache Storage Accelerator*, which is advanced, intelligent caching software that enables eXFlash storage to work transparently with onboard hard disk drives (HDDs) to further maximize performance and minimize cost.⁸

IBM System x3950 X6

The x3950 X6 is designed in book form to facilitate scalability and maintenance. It is configured as an 8U, eight-socket system that can support up to 120 cores of Xeon power. Each

Intel E7-4800/8800 CPU operates at up to 3.2 GHz, with up to 37.5MB of cache and up to 1600 MHz memory access. The x3950 can support up to 12TB of memory using 64GB LRDIMMS and has support for up to 22 PCIe controllers in the I/O book.

The x3950 also can support up to 16 2.5” SAS HDDs or SSDs, or up to 32 1.8” eXFlash SSDs. This equates to up to 19.2TB of HDDs, 25.6TB of SSDs, or 12.8TB of eXFlash. Again, RAID-0 and RAID-1 are standard, with RAID-5 and RAID-6 being optional.

IBM System x3850 X6

The IBM x3850 X6 also is designed in book form to facilitate scalability and maintenance. (See Exhibit 1, above.) Each compute book has one processor and can support up to 1.5TB of memory, for a total of 6TB and up to 60 cores of processing power in a 4U, four-socket system. Each *Intel E7-4800/8800* CPU operates at up to 3.2 GHz, with up to 37.5MB of cache and up to 1800 MHz memory access. The x3850 can support up to 6TB of memory using 64GB LRDIMMS, while the I/O books have support for up to 11 PCIe controllers.

The primary I/O book hosts the integrated management module, two PCIe slots, and the new dedicated Mezz-LOM⁹ slot that supports both 1GbE copper and 10GbE fiber or copper I/O controllers. The optional I/O books deliver an additional three PCIe slots – allowing up to nine additional PCIe slots in the rear of the server. Optional I/O books are available in two formats, a half-length I/O book that supports three half-length, full-height PCIe cards, and a

⁶ Because high-performance (higher cost) disks most likely will not be required and because wasteful provisioning practices used to improve performance can be avoided.

⁷ Using internal eXFlash, in many cases, reduces the requirement for external SAN/NAS storage (and also SSDs or other flash technology therein), and usually reduces the number of software licenses needed.

⁸ By automatically managing the tiering and movement of data between the flash cache and the hard disks.

⁹ Mezzanine slot for LAN on motherboard.

Exhibit 2 — FlashSystem Enterprise Performance Solution Features

- **Real-time Compression** – to enable the data center to store up to five times more data in the same physical space;
- **Thin Provisioning** – in order to allocate storage “just in time”;
- **External Storage Virtualization** – to provide effective and efficient cloud deployment;
- **IBM Easy Tier** – in order to enable intelligent data placement;
- **Consolidation** – to enable existing storage systems to become part of the IBM storage system;
- **Data Migration** – to allow the data center staff to move data without disrupting active applications;
- **Mirroring and Copy Services** – to enable data replication and protection;
- **FlashCopy** – to enable multiple point-in-time copies; and
- **Remote Mirroring** – to enable business continuity.

Source: IBM

full-length I/O book that supports three full-length, full-height PCIe cards. The full-length I/O book supports specialty graphics or accelerator cards that may require additional power.

The x3850 X6 storage book can support up to eight 2.5” SAS HDDs or SSDs (solid-state drives), or up to 16 1.8” eXFlash SSDs. This equates to up to 9.6TB of HDDs, 12.8TB of SSDs, or 6.4TB of eXFlash. RAID-0 and RAID-1 are standard, with RAID-5 and RAID-6 being optional.

IBM System x Solutions

To assist the data center staff that is adopting analytics and wants to move enterprise applications to the cloud, IBM has announced a series of integrated solutions for its System x server family to enable the enterprise to gain access to the right information in order to gain real insights from that data. These are solutions that can be deployed faster (with a predefined configuration), more confidently (with pre-architected and tested solutions), and enable the data center to conserve resources. Solutions that deliver business critical reliability for analytics, database, and cloud deployment, include the following.

- **IBM System x Solution for DB2 with BLU acceleration for faster analytics** – to provide an optimized infrastructure solution for Big Data and analytics workloads.
- **IBM System x Solution for SAP HANA** – to drive deeper business insights on unstructured data, leveraging IBM’s X6 technology advantages; and
- **IBM System x Solution for VMware vCloud Suite** – to enhance Infrastructure as a Service capabilities.

Conclusion

To respond more quickly to the changing demands of an expanding enterprise, the data

center staff must re-imagine the enterprise IT infrastructure. To enable business transformation, the enterprise has to take advantage of the information available through Big Data and analytics. In order to be able to react to new business opportunities within a short window for anticipation, the IT infrastructure must have higher performance while lowering the cost of that infrastructure. Thus, the enterprise has to build more efficient and simplified infrastructures that improve reliability, optimize workloads and provide the scalability to support multiple generations of Xeon technology in one chassis.

IBM’s System x provides these benefits, and more. With three times more memory than the previous generation to facilitate improved virtualization and contain large data bases in memory, System x can greatly improve the overall performance of your mission-critical applications. With more simplicity, ease-of-use, and availability, the data center staff can devote more time toward deploying new applications rather than simply supporting the old ones. System x can provide integrated solutions for worry-free deployment of your critical systems. With multiple X6 platforms to choose from, the data center staff can right-size the installation to workload requirements.

IBM does not force the enterprise to make a choice of performance *or* features. It is providing a platform that provides performance *and* features, and enables the data center to live within the IT budget. If you have made a commitment to an open systems data center and want to avoid a mistimed “swing” and the resulting “miss”, then take a look at IBM X6 and related offerings.



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