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IBM Improves System x Infrastructure — Simplifies, Lowers Cost and Improves Performance

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Management Summary

Every month, when the utility bills come in and you see what it costs you to heat, cool, and light your home, cook your food, power your electronics, and so much more, do you ever take a step back and look at the infrastructure of your home and ask yourself if there is anything that you can do to reduce the amount of energy you are consuming? *Can you replace an appliance with a more energy efficient-model? Do you have the proper amount of insulation in your walls and attic? Did you install weather-stripping around your doors? Did you install automatic set-back thermostats for your heating/cooling system to ensure that fuel consumption can go down when you are tucked into your bed or out to work?* Then there are potential improvements. *Did you install a smoke/fire detection system to prevent a future catastrophe? What can you do to control maintenance costs? Can you replace a roof before leaks appear ruining many of your treasures?* Yes, the acquisition cost of a new roof is significant, but what is the cost in dollars and memories to lose pictures and valued possessions, not to mention the ROI that might be received when you go to sell your house. **Replacing or improving the existing infrastructure is always less expensive than recovering from a disaster.**

Now, let's look around the data center of any enterprise, large, medium, or small; even yours. *Are you faced with server sprawl everywhere you look? Are those servers properly utilized at 75% or higher, or are they running at less than 50%? How about under 20%? Are you wasting valuable IT resources in terms of compute cycles, staff, and energy? Perhaps the opposite is true and you have more transactions than your infrastructure can handle? What about your storage? Do you have a wide (vast) assortment of disk arrays in your data center, DAS, NAS, or SAN, connected to those servers via Fibre Channel or Ethernet protocols? How many IT administrators do you need to deploy, administer, and maintain this complex environment?* In any case, whether your servers are being underwhelmed or overwhelmed, **now may be the time, the right time, to change the infrastructure paradigm of your data center in order to take advantage of the operational efficiencies that can be achieved by the latest, most-efficient IT infrastructure.** Newly announced servers present a wide variety of options to implement the kind of efficiencies that you need to improve utilization and to keep your expenses within budget. *Where do you look for the right infrastructure for your enterprise?*

One answer to that question is IBM. IBM has now announced a family of new server infrastructure, delivered as a new generation of *System x* offerings, all containing the latest CPU performance and efficiencies from Intel and value-added features from the IBM Labs. These will provide real benefits for your enterprise applications and enable your data center (and you) to become more valuable to your enterprise. This newest generation of System x enables the consolidation of your 3-5 year-old servers, enables the redeployment of current workloads on

new infrastructure with new features, and enables the deployment of new workloads. This new generation of open system servers from IBM enables an infrastructure that is easier to use, removing the complexity from your data center while enhancing application performance, and also should lower the total cost of ownership of your IT environment. To understand better what these new servers can mean to the enterprise and how they can contribute to data center and cloud infrastructure, please read on.[1]

The Two Legs of Requirements

It is very hard to walk using only one leg. However, with a pair of legs working together, so much is possible. The same is true for the data center in the modern enterprise. The first leg, belonging to the organizations and people "doing business" usually needs (is dependent upon) a second leg, the data center, which delivers the necessary levels of IT services to the "business doers". Working together, everyone benefits.

Often, each of these legs does not understand the requirements and pressures that the other is facing. While it would be nice if each could exist in a vacuum, that only adds to the challenge of moving the enterprise forward.

Understanding this is important when requirements are gathered for IT infrastructure. This is even more important when the next generation of technology, whatever it is, is being offered by competing vendors, especially when these vendors are building their solutions with some of the same componentry.

In this bulletin, the focus is on x86 server technology, in particular the latest generation of servers built on Intel's new chip generation (called *Sandy Bridge*, in general, and *Romley*, in particular, the latter of which is being offered in the latest generation of *Xeon*-based servers). Before we get to Intel's technology and IBM's latest offerings, let's first look at the requirements for each of the two legs.

Evolving Business and User Requirements

As we view the typical enterprise IT environment in 2012, we see a data center with a never-ending thirst for processing power, but, unfortunately, a finite budget and limited re-

sources. The IT staff is under constant pressure to provide more performance for mission-critical applications, such as online transaction processing, and to meet Service Level Agreements (SLAs) that may have been established in less trying times, when response time for applications running on dedicated servers was unencumbered by the complexity of today's applications, interrelated data, and virtualized data centers. What most data centers seek today is technology that can satisfy today's more challenging SLAs for better reliability, resilience, responsiveness, and performance, all while addressing some very real challenges caused by consolidation and virtualization,

Today's business units and end users have little or no tolerance for downtime. Every minute of downtime can equate to lost revenue (millions of dollars per hour, in many cases), as customers go elsewhere to do their business. If production comes to a stop because of a failure in the IT infrastructure, jobs might be lost – perhaps yours.

The business folks seek reliable services, whether coming from within the data center or from an external cloud. They want IT resources and services delivered when they need them and they don't want to pay for wasted headroom when demands are less than peak. What they want is the right amount of performance to meet changing requirements responsively and reliably. And, of course, they want to pay for it with last year's IT budget (or maybe less), even though application complexity, user demands, and data volumes are increasing!

The folks on this side do not care what hoops the data center or cloud provider has to jump through. In today's world of instant gratification, they want and expect everything now and for a pittance. That's a tall or even impossible order, but that where this leg's expectations begin.

Evolving Data Center Requirements

The other leg (belonging to the data center) knows it needs to keep pace with the first leg, or bad things will happen. However, it also has its own list of pressures and requirement to which it must respond.

Shrinking Budget and Limited Resources

Being able to deliver IT resources (usually in terms of running applications and data) reliably and responsively to business units and users is critical. The folks in the data center know this. Unfortunately, enterprise business units expect improved service levels even while the IT staff is faced with a shrinking budget, outmoded archi-

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[1] The discussion on IBM's new M4 offerings begins on page 5.

tectures and equipment, energy challenges, and much more.

As a result, all data centers are seeking a higher level of performance and resiliency than ever before and an environment that is easy-to-use (i.e., easy to deploy, easy to manage, and easy to maintain), has better (more efficient) access to data, and, of course, costs less, at least on a unit-of-work basis. They need solutions that deliver improved enterprise visibility to data, faster delivery of data, and better analytics for faster time to decision and profitability. The IT staff needs to improve overall application performance while also improving the energy efficiency of ever-more-powerful servers. With apologies to New Orleans, everyone in this leg is looking for *The Big Easy*. Let's decompose this a little.

Keeping Up with Requirements

Enterprises need more powerful infrastructure to keep up with user and business demands. At the same time, data center budgets tend to be tight or even shrinking. The only hope for achieving these apparently conflicting objectives is through technological advances.

Key to this is a continual stream of new processors, with more, faster cores and support for more memory, from companies like Intel and AMD. New, more capable technology enables enterprises around the globe to consolidate and virtualize applications and improve the utilization of other IT resources (e.g., via more widespread use of 10Gb networking). It is only through higher utilization at lower capital and operating costs that the data center can answer its many challenges.

Meeting these SLAs requires the consolidation and virtualization of an under-utilized infrastructure along with continual refreshing of the server environment within the data center. Server sprawl and aging, inefficient infrastructures have led to application and information complexity, especially as the data center tries to conform to evolving business processes. Server sprawl inhibits performance and raises the TCO of IT infrastructure through wasted (i.e., underutilized) resources – because of poor server utilization, ineffective networking, excessive energy consumption, and an IT staff overburdened by the administration of a complex and under-performing architecture. This complexity can delay the deployment of mission-critical applications, increasing the time to market and revenue.

Any loss of reliability and responsiveness can result in missed business opportunities, as the competitor that has refreshed its IT architecture first may become the "early bird" who wins the business. It is essential that the data center refresh its architecture so that more resources can be can be invested in business innovation and less needs to be consumed by operational inefficiencies.

Virtualization and consolidation are just two of the technologies that help the data center lower its costs (by doing more with fewer physical servers) and ease data center management (as it becomes increasingly complex). Unfortunately, consolidating through virtualization has not come easily, with the risk being that one set of inefficiencies has been replaced by other inefficiencies.

Making IT Simpler

What is needed to refresh <u>and</u> simplify data center operations? The answer to that is, well, "simple". The IT staff needs to deploy an infrastructure that improves flexibility and the utilization of all mission- and business-critical applications in the data center environment. Replacing an aging infrastructure, or supplementing it, with an infrastructure that increases the number of applications per server can be a giant first step to simplification. This often requires more memory than traditionally has been in underutilized servers. This replacement may also enable the data center to improve the SLAs for applications that are being overwhelmed by insufficient compute cycles.

Operations can be simplified by a, modular architecture capable of meeting mission-critical needs, with a common network fabric connecting servers and with a common management interface. This simplified infrastructure can deploy resources to optimize workload delivery, thus eliminating bottlenecks. Additionally, the storage side of the equation also needs to be simplified and improved to make better use of the information that already exists (both current and archived) to improve insight via business intelligence and analytics.

Doing IT Differently

Achieving all of this may lead to doing IT differently (but not necessarily radically different). There is a thin line between doing consolidation and virtualization within the data center and doing it "in the cloud". The methods and requirements are the same, but the ownership and location can be different. From an IT perspective, the commonality is ease of provisioning and

administration, increased optimization of IT resources largely through automation, and generally lower unit costs for service delivery. The key point here is that someone needs to do all of these things, whether it is done in an enterprise data center or provided by an external supplier via the Internet. The paradigm shift "to the cloud" can happen in the enterprise data center as a private cloud.[2] In the final analysis, you likely will find that the same kinds of infrastructure are being deployed.

Doing IT Better

Deploying an infrastructure with more powerful processors is not a cure by itself. In order to achieve the desired flexibility, new servers need to support more cores, have more memory, and deliver more I/O throughput. This should enable the data center to improve the utilization of each server, with more applications per core, with larger Virtual Machines (VMs), and with faster access to larger databases without bringing the entire infrastructure to its knees. *How much memory is enough? How fast is fast enough?*

Critical business applications, in general, will take advantage of whatever memory is available! With flexible processors and more memory, the IT staff can improve not only processor utilization, but overall system utilization as well, including CPUs, memory, I/O, and storage. With greater density, the data center can lower the TCO of the infrastructure, while also lowering floor space and increasing energy efficiency for all server form-factors: towers, racks, and blade systems.

The administrative and economic flexibility provided by sharable and scalable servers is most important where the sharing of resources is of paramount importance. In addition, every enterprise has a business requirement to secure its data with improved features such as built-in encryption, as well. Furthermore, it is critical to maintain ease of deployment and ease of use. This flexibility depends upon an improved open systems architecture, with improved performance and reliability. To execute more and larger VMs in an x86 environment generally requires the latest generation of processors, with more cores and, especially, access to more memory.

Intel's E5-2600 Microprocessor

All of this leads us to the newest Intel Xeon processors, the E5-2600, based on the Sandy *Bridge-EP micro-architecture with the Romley-E5-2600 processor.* Once again, Intel has raised the ceiling for performance and functionality. In order to meet the requirements of demanding high-end business applications, Intel has designed the E5-2600 to provide the enterprise-class server with the features necessary to meet the demands of mission-critical applications. Intel has delivered the E5-2600 with support for more cores, more memory, and more I/O. This enables the data center to deploy fewer, more powerful servers in a scalable architecture, which has become the standard for achieving more processing power in data centers through the deployment of additional CPUs, cores, and memory, and meet the needs of an expanding user community with room to grow even more. With Intel's latest Xeon processor, the IT staff can consolidate and virtualize their application set, improving performance and application density, reducing footprint, and lowering the TCO of their infrastructure.

With an improved range of performance, increased memory capacity, and expanded I/O functionality, enterprise servers can readily adapt to changing short-term requirements, while maintaining long-term business growth. The E5-2600 also has the features necessary to provide advanced reliability and security necessary to simplify standard data center application processing, as well as operating in the cloud.

The E5-2600 can have up to eight processing cores with up to 16 threads[3], up to 20MB of L3 cache, expanded memory with support for LR-DIMMs[4], and Intel's *Hyper-Threading Technology*. It has an integrated 6Gb per second SAS interface, integrated PCIe technology, and contains Intel's *Advanced Vector Extensions*. The E5-2600 also supports *Advanced Encryption Standard - New Instructions (AES-NI)* and Intel's *Trusted Execution Technology*.

In fact, the E5-2600 can be configured with four, six, or eight cores. The CPU comes in a variety of processor performance levels, up to 3.3GHz, with ever-decreasing power requirements, with the highest level drawing 135W and

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[2] See the issue of **Clipper Notes** dated January 25, 2012, entitled *Moving to a Private Cloud? Infrastructure Matters,* available at http://www.clipper.com/research/TCG2012001.pdf.

[3] There are two threads per core.

[4] Load-Reduced Dual In-line Memory Module allows the memory module to run at a higher clock speed and allows for more memory chips on each channel.

the most energy-efficient rated at 60W. There are enough steps between these two points to support any performance requirement, while consuming only 70W, 80W, 95W, 115W, or 130W per processor.

Furthermore, each CPU supports up to four memory channels. Each E5-2600 supports up to 24 slots for RDIMM[5] memory and 16 slots for UDIMM[6] memory for enhanced flexibility.[7] With 24 slots configured, the processor can support up to 768GB of memory at up to 1600 MHz. This significant increase in memory support becomes critical in virtualized environments where more memory correlates directly with being able to deliver more (and bigger) VMs. However, there is more to making a server than just a processor chip.

IBM System x M4

IBM has integrated the Intel Xeon E5-2600 into the fourth generation of System x, the *M4*. This latest, and most advanced generation of System x platforms is available in rack, tower, blade, and *iDataPlex* models, including the *System x3550 M4* and *System x3650 M4* rack systems, along with the *System x3500 M4* tower. This enables every format of System x to deliver more of what you seek. The rack and tower models all provide an 80% improvement in performance over their M3 models, which can provide faster processing or more virtualization. The various models of System x M4 all can provide critical business applications with the right speed and power requirements for the right use: the choice can be left to the IT staff. M4 models all come with more integrated memory options than previous iterations to enable more virtualization and the enough memory to satisfy burgeoning needs. In addition, M4 models provide the storage choices so important to data center and cloud operations, from the highest performing SSDs to the highest capacity SATA drives.

These System x features can greatly benefit mission- and business-critical applications as exemplified by the superior results achieved by IBM in a variety of commodity benchmarks. IBM achieved a #1 ranking with the System x3650 M4 in the *TPC-E*, *SAP*, and *SPECvirt*

benchmarks. Respectively, these represent up to a 128% improvement over a comparable M2 model in TPC-E, up to a 54% improvement over the previous generation for SAP users, and up to an 83% improvement in the number of VMs supported by previous generations. Your OLTP, data warehouse, and business analytics applications all will experience accelerated response times, but the actual improvements are dependent on your specific workloads.

M4 servers also come with better motherboard integration to reduce the need for PCIe adaptors. All rack and tower models also have multiple USB and VGA ports, with two USB ports in front, four in back, and two internal, and one VGA port in front and one in back, along with a *Light Path Diagnostics* panel in front.

In addition, IBM has created a new blade, the *BladeCenter HS23* with a 62% increase in performance over previous models, and a new *DX360 M4* drawer for iDataPlex, with 120% increase in performance. All of these systems will support up to two E5-2600 processors. However, IBM has bestowed different configurations and capabilities to each of its M4 server platform, in order to meet a wide range of specific requirements.

System x M4 models come with a variety of system software utilities that improve the ease of managing System x servers and the applications that run thereon. These comprehensive systems management tools include an *Integrated Management Module II* (*IMM2*) to make it easy to deploy, integrate, service, and manage, along with IBM *System Director*, and *VMcontrol Enterprise*. The improved management application provides a faster boot response, enables a new remote presence for high performance, a new Web interface with a new look and feel. It also has a common UI with Systems Director.

The new Systems Director provides improved quality with faster inventory and discovery, faster startup times, and can manage twice the number of endpoints, even in a heterogeneous environment with non-IBM platforms. It also improves time to value with simple installation and setup and simplified operations. The new VMcontrol provides optimized system pools and manages virtual libraries. IBM's M4 family can provide the data center with the right server for the right use. Let's look at each of these new System x M4 models.

IBM System x3550 M4

Designed by IBM to be low-cost and dense,

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[5] Registered Dual In-line Memory Module. Registered memory is of a certified quality.

[6] Unregistered Dual In-line Memory Module. These are less expensive that registered modules.

[7] RDIMM memory provides more capacity than UDIMM. You can install more RDIMMs than UDIMMs

the *System x3550 M4* is a two-socket, 1U rack-mounted x86 server with 4-, 6-, or 8-core E5-2600 CPUs, with the 8-core version running at 2.9GHz and consuming up to 135W. The x3550 M4 comes with a wide variety of processor speeds, so that you can select the right performance level (and corresponding power consumption). It can handle business-critical application workloads, proving once again that big things do come in little packages.

With 24 slots for up to 768GB of memory, the x3550 M4 can support more workloads than ever before and run them faster, as well. This represents 2.6 times the processing power of the IBM's previous generation.

The x3550 M4 has great flexibility and increased storage capacity for a 1U platform, with eight 2.5" or three 3.5" bays for up to 7.2TB using 900GB 2.5"SAS drives, 8TB using 1TB 2.5" nearline SAS/SATA drives, or up to 9TB with 3TB 3.5" nearline SAS/SATA drives. When using 2.5" drives, there is room for an optional optical device. It comes with a slotless RAID capability (no separate card needed) and has enhanced RAID options.

The x3550 M4 comes with rich networking options and is optimized for both density and performance. It comes standard with a quad-port 1Gb Ethernet capability; a dual-port 10Gb slotless port is optional. Both are available without occupying any PCIe slots. It also has increased PCIe support, with a PCIe x16 low-profile, half-length interface, and a PCIe x8 full-height, half-length interface for a single-CPU configuration and a single x16 interface for dual CPUs. The x3550 comes with two redundant, hot-swap power supplies and up to six hot-swappable, redundant fans; four are standard and two more are additional for the optional second CPU.

IBM System x3650 M4

Designed by IBM for the ultimate blend of reliability, performance, and I/O flexibility, with density and cost efficiency, the System x3650 M4 is a two-socket, x86 server in a 2U rack-mount format, with up to two E5-2600 CPUs consuming up to 135W. It, too, can handle increased business-critical application workloads, and offers more configurable storage than the previous generation. It comes with more PCIe slots than the System x3550 and is optimized for both configuration flexibility and the same performance leadership. It comes with the same memory configurability as the x3550 and runs

more workloads than on the previous x3650 M3, and runs them faster, as well. It has 2.6 times the memory capacity of the previous generation. It has more storage bays, for increased capacity with the 2U format, with sixteen 2.5" or six 3.5" bays in support of SAS or SATA drives and SSDs, with an optional DVD bay and tape bay. It comes with RAID on the motherboard and enhanced RAID options.

The x3650 M4 also has a quad-port 1Gb Ethernet connection along with an optional dual-port 10Gb interface, on the motherboard. However, it has a greater x16/x8 PCIe capability than the x3550 with up to six ports, depending upon the configuration. The x3650 comes with a variety of power supply options and four hot-swappable, redundant fans.

IBM System x3500 M4

The IBM System x3500 M4 is an all-in-one business solution that you can put under your desk or, optionally, mount in a rack as a 5U drawer. It comes as a two-socket tower server designed to meet the most demanding needs of a growing business, with a variety of four-, six-, and eight-core E5-2600 CPUs available, including a high-performance processor running at 2.9GHz and consuming 135W. The four-core version runs at 3.3GHz. Like the other rack-mounted systems, the x3500 M4 supports up to 768GB of LRDIMM memory at 1600 MHz or 64GB of UDIMM memory for support of more VMs and faster applications. Furthermore, the x3500 has flexible storage options that can be configured with up to 32 2.5" or 8 3.5" SAS or SATA drives for increased storage capacity. The x3500 also comes with DVD and tape bay, standard. For RAID support, the x3500 comes with a 6Gb Cache RAID adapter, either an M5115 or an M5125.

The x3500 also comes with up to eight PCIe 3.0 slots (six are standard), with one PCIe Gen2 x16 (can handle up to 225W), four PCI Gen2 x8 (2 with Electric x4), and one PCIe Gen2 x8 (Electric x4) supported by the first processor.[8] The additional two PCIe slots support the second CPU. The x3500 has multiple redundant power supplies with 3+3 simple-swap, redundant fans for greater energy efficiency.

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[8] The number of supported active channels is specified by the quantity following "Electric". What this means is that the slot has a higher potential number of active channels than the card is capable of using.

IBM IDataPlex dx360 M4

The IBM *IDataPlex dx360 M4* is a fast, cool, dense, and flexible platform that provides great scalability and TCO savings without compromising performance or energy efficiency. It provides great performance for your most demanding applications, such as analytics, imaging, and simulation workloads. With a half-depth design, the dx360 provides power and cooling efficiency and the ultimate in data center space savings. The dx360 is easy to deploy, integrate, service, and manage.

It comes as a 2U rack-mount shelf with up to 120% performance boost over its previous generation. It is designed to meet the growth needs of the largest enterprise with a variety of E5-2600 CPUs available, including a high performance processor with eight-cores running at 2.7GHz and consuming up to 130W. The data center can deploy up to 168 E5-2600 CPUs per iDataPlex rack. Each drawer supports up to 256GB of RDIMM memory at 1600 MHz or 64GB of UDIMM memory for support of more VMs and faster applications. Furthermore, the dx360 has one 3.5" HDD, two 2.5" HDD/SSD, and four 1.8" SSD bays in support of SAS, SATA, or SSD drives. There is a hardware RAID adapter, and two PCIe x16 ports.

IBM BladeCenter HS23

The IBM *BladeCenter HS23* is a blade that provides outstanding performance with the latest Intel Xeon processor E5-2600. It has an integrated 10GbE virtual fabric for high-bandwidth networking to gain flexibility and easy scalability and is compatible with all of IBM's BladeCenter chasses. The HS23 supports up to two eight-core E5-2600 CPUs with up to 256GB of 1600 MHz memory, with mirroring and sparing supported. It has two bays for 2.5" hot-swap SAS or SSD drives, for up to 2TB of internal storage.

The HS23 comes with integrated tools such as IBM *System Director Active Energy Manager* and *Blue Path Cooling* to deliver outstanding power management. *Blue Path Cooling* creates virtual wind tunnels through the entire blade to keep all parts cool, even under strenuous conditions. The HS23 also provides remote management capabilities through the Integrated Management Module (IMM) and light path diagnostics to facilitate maintenance.

In addition, with the announcement of the BladeCenter HS23, IBM has delivered a new utility, IBM *FastSetup*, to automate server setup and enable the IT staff to speed up time to de-ployment – *from days to minutes*! FastSetup, designed for simplicity and ease-of-use, provides templates to enable automated actions with low-touch, set-once, and walk-away features. Announced with HS23, FastSetup is also now available for download for IBM HS22, HS22V, and HX5 blades, all at no extra charge.

Conclusion

In the enterprise data center, *infrastructure really does matter.* In order to deploy the optimum architecture for any environment, traditional data center, private cloud, or public cloud, *choice matters,* in terms of server architecture and server format. With System x M4 servers, IBM provides many choices: (a) choice in format between rack, tower, and blade; (b) choice in processor speed to utilize system compute resources properly without wasting energy; and (c) choice in storage between SAS and SATA for high performance and high capacity requirements or SSD for the highest, most demanding, critical applications.

System x M4 servers will provide the features you need to benefit the performance in everything from data processing to HPC, delivering improvements in functions such as handling concurrent users and ease of maintenance, while lowering energy consumption and TCO. With a 10Gb/second throughput, System x can handle peak enterprise workloads.

System x M4 models also will provide the ease of use that is required to facilitate deployment and management of your mission- and business-critical applications, with features such as the Integrated Management Module II, the monitoring of vital energy resources, and the encryption required to secure enterprise data. When you are acquiring the next-generation servers that will carry you forward in the years to come, it is important to look under the covers and ensure that you are acquiring the best, easy-to-use infrastructure. With so many System x M4 choices, IBM probably has exactly what you need.

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