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Navigator™

IBM Extends the Reach of POWER7+ —
Introducing POWER7+ Servers for the Rest of Us

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Management Summary

In sports, there is an adage that goes something like this: ***if you are standing still, you are losing***. This applies to every team in every sport, including the champions. Teams are always striving to get better: stronger, faster, and more athletic. In baseball, teams are looking for the player who can hit the ball farther; in football, they strive to pass better and run faster; in the other football (soccer), you need to find someone with better ball control and a killer kick into the goal and someone else to keep it out on the other end. The champions in every sport know that their competition is always trying to improve in order to catch them; they need to improve to continue winning and retain their position as #1. There is a corollary to this, as well: ***if you are standing still while others are improving, you are falling behind.*** Thus, you need to improve just to keep your position with respect to others

The same is true in the data center of every business or organization. The IT staff is always on the lookout for the newest technology that will enable them to deliver information faster and support their customers better. In a world of Big Data and Analytics, the information is out there; the IT staff needs to deploy the architecture and solutions that will enable them to put the right data in the right place at the right time. Think of this as *just-in-time answers*. For example, during the Super Bowl, millions of dollars ($3.5M to be exact) will be spent on a single 30-second commercial. In fact, we could see a battle with ads for competing products, such as Coke and Pepsi, trying to generate new demand for their products. A large retailer with sharp analytics deployed might be the first to sense the winner, with an immediate upsurge in demand, enabling that retailer to acquire the extra inventory necessary to meet that demand, It might take a little longer for the upstream retailer to sense this new demand. Thus, the retailer who increases inventory faster is more likely to get what limited supply is in the pipeline.

Without question, based upon the applicable industry application benchmarks, the company with the most performant server capabilities is IBM. Since its *Power Systems* architecture, debuted in 1990, IBM has led the way in providing the data center with the computing horsepower required to keep your data center ahead of your competition. When *POWER7* processers were announced in 2010, IBM provided a highly scalable processing environment to reach that goal. Not satisfied with simply being #1 in open systems' processing performance, IBM introduced further improvements to that architecture in August 2012. These *POWER7+* updates provided enterprise data center with high-end servers that had higher processing speeds, more cache and integrated accelerators, to ensure that IBM's largest clients had the latest and the greatest, thus retaining and further expanding their lead over the competition. **Now, IBM is applying POWER7+ technology throughout the Power Systems family, from 2U one- and two-socket servers for the SMB and enterprise departments to 5U four-way processor platforms for the mid-sized enterprise, and beyond.** To learn more about IBM's extensions to the POWER7+ family of servers and how they can lower the TCO for the rest of us, please read on.

SMB and Mid-Sized Data Center Concerns

In order to stay ahead of, or at least keep pace, with the competition, every business and organization must become smarter and more efficient with the use of its IT infrastructure. Data centers today are gathering more and more information every day, every minute, in fact, every second. This information must be stored, dissected, and analyzed, usually in short order, to provide the insights needed to make better decisions. The analysis of both the structured and unstructured data required to accomplish these tasks is very compute-intensive, requiring the deployment of new compute-intensive workloads throughout the enterprise environment, not merely the data center. Enterprise departments, branch offices, and other remote facilities often have the same needs that the home office does with the enterprise servers behind the glass walls. In fact, every SMB and mid-sized enterprise also has the same problems to solve.

The new services demanded to perform these functions may require expansion of the data center's compute capabilities. Unfortunately, the ability of the IT staff to meet these needs usually is constrained by the IT budget that is barely capable of supporting the existing facilities and staff. In order to address this conundrum to provide the smarter environment needed to comply with new standards and satisfy government regulations, the IT staff must find a way to make the existing IT environment more performant, more efficient, and easier to use. These include businesses involved in healthcare, with an expanding dependency on imaging (MRIs, X-rays, etc.); banking, with the requirement to provide a single-view of all services to their customers; and insurance, where claim fraud needs to be investigated and a myriad pile of forms need to be simplified. This does not even begin to address the needs of government agencies working to improve their procedures in dealing with citizens like you and me or the requirements of the new world of mobile computing and social media.

The IT staff must find a way to improve the process by which they deliver IT to their customers, both internal and external. They need to reduce the total cost of ownership (TCO) on an infrastructure that in some cases may be more than five years old, consolidating and virtualizing applications in order to make better use of the infrastructure in smaller data centers. This could well be the case for any business that last upgraded well prior to the market collapse and finds itself with an infrastructure that cannot meet the needs required today,

regardless of the installed systems and architectures, due to its inability to make even modest capital expenditures over the past few years. These organizations might well have an infrastructure that does not have the horsepower required to support organic business growth which, for many, has returned with a vengeance, as a result of the infrastructure falling behind the performance curve.

Expanding, or upgrading, existing infrastructure can be problematic for some data centers, especially if they are forced to change hardware architectures or operating environments. However, these upgrades may be a requirement in order to reduce the operating expenses of maintaining inefficient platforms, which may continue to damage severely the TCO for the IT infrastructure. Every year we see an increase in CPU performance, thus enabling the IT staff to not only improve compute capability, but also reduce the footprint of their server network and reduce the licensing and maintenance costs for application software. In fact, the savings from upgrading an existing infrastructure may well pay for the acquisition costs within a year.

IBM, the company that brought us a new *Jeopardy* champion in *Watson*[1] (based on *POWER7* processors), always has paid close attention to the performance capability of its servers. With their POWER7 architecture introduced in 2010, IBM not only delivered to the data center the best performance available, exceeding that of its own *POWER6* processor, the previous champion, but also improved in the areas of scalability, virtualization, availability, and security. Then, in 2012, IBM upgraded once again, this time to *POWER7+* in the *Power Systems 770* and *Power Systems 780*, in order to ensure their lead in the larger enterprise data center[2]. Now, IBM has turned their attention to the SMB and mid-sized data center, raising their ceiling with POWER7+, as well.

The POWER7+ Technology

IBM's POWER7+ processors enable the data center to continue a decades-long period of continuous improvements in the areas of performance and efficiency dating back to the introduction of the POWER architecture in 1990 and continued with

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[1] See **The Clipper Group Navigator** dated May 10, 2011, entitled *With Enhanced Power Systems, IBM Raises the Ceiling, Again*, available at http://www.clipper.com/research/TCG2011018.pdf.

[2] See **The Clipper Group Navigator** dated October 16, 2012, entitled *Raising the Ceiling for a Cloud Data Center – IBM Enhances Power Systems*, available at http://www.clipper.com/research/TCG2012022.pdf.

Exhibit 1 — IBM's POWER7+ Processors & Architecture

Faster Performance
- Higher frequencies
- 10 MB L3 Cache per core
- Random number generator
- Enhanced Single Precision Floating Point

Increased Efficiency and Flexibility
- Active Memory Expansion accelerator
- On-chip encryption acceleration for AIX
- More performance per watt
- Enhanced energy / power gating
- 20 Virtual Machines per core

Better Availability
- Self-healing capability for L3 Cache functions
- Processor re-initialization
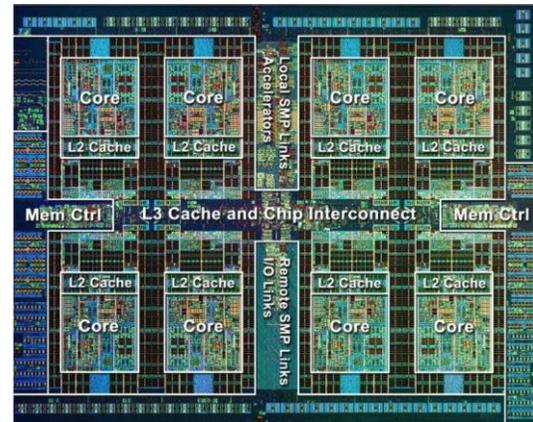
POWER7+
32 nm

Source: IBM

POWER5 in 2004, POWER6 in 2007 and POWER7 in 2010. This regular drumbeat of improvements has enabled the data center to continue to reduce the TCO, including costs for licensing, management, maintenance, energy consumption, and floor space. This, in turn, has enabled IBM to secure its position as the system of choice for high-performance UNIX computing and for high-performance analytics, as well as enabling the consolidation of *IBM AIX*, *Linux,* and *IBM System i* applications onto the same platform, further lowering the TCO of the IT environment.
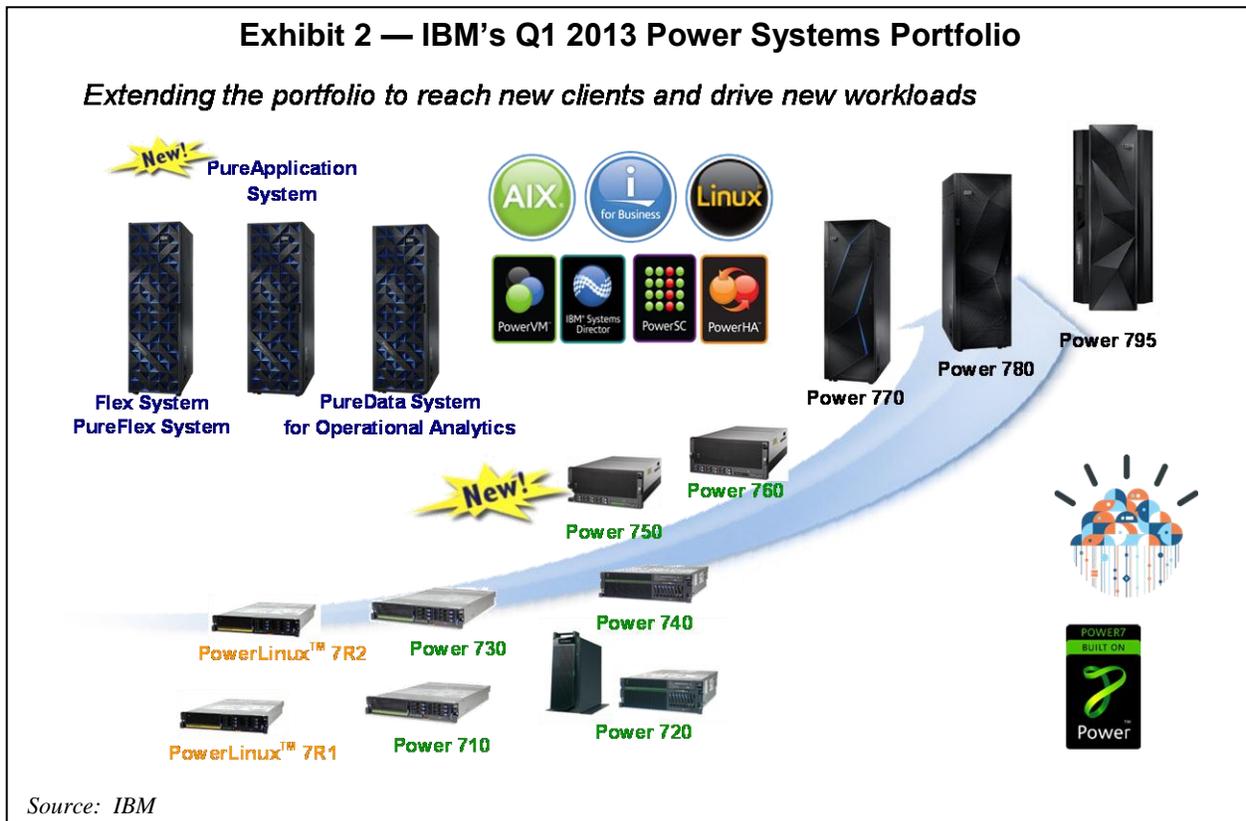
The POWER7+ processor can help you make your business or organization even smarter, by increasing the performance that you need to improve the dynamic efficiency of the IT infrastructure. This improves access to data for the purpose of business analytics (as demonstrated with Watson) and assures the security and compliance of that data to ensure the protection of critical data and services throughout your smarter enterprise.

IBM's POWER7+ processor has been designed using two billion transistors in a 32nm technology, reduced from the 45nm form factor used in the POWER7 architecture, resulting in increased performance, up to 40% faster, and up to twelve cores per socket. (See Exhibit 1, above.) Faster performance also is aided by each of the following.

- **The inclusion of an expanded integrated cache, along with memory controllers and accelerators.** In fact, each POWER7+ core is supported by a 256KB L2 cache and 10MB of L3 cache, the latter to be compared with 4MB in POWER7; all made possible because eDRAM only requires two transistors to represent a bit. 10MB of L3 cache per core helps keep active data closer to the CPU to improve performance.
- **Higher CPU frequencies of up to 4.4GHz** to provide the POWER7+ with an edge over the POWER7, with speeds up to 3.92GHz.
- **The addition of hardware accelerators** to improve the speed of memory compression (for better utilization of physical memory) and to enable *AIX* file system encryption, both achieved while minimizing impact on application performance.
- **Improvements to the processor** to provide a random number generator, and twice the single precision floating point performance.

Picking the Right Platform for You

IBM has continued to invest heavily in the POWER architecture. In fact, they have invested $4.2B in POWER7 and POWER7+ to assure their position as the #1 open system performance engine, driving half of the world's ten fastest super-

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Exhibit 2 — IBM's Q1 2013 Power Systems Portfolio

Extending the portfolio to reach new clients and drive new workloads

Source: IBM

computers, along with the lead in over 100 industry standard benchmarks. To select the right platform for your data center, many factors need to be considered to determine the right delivery vehicle to handle the rapid growth of data and compute intensive workloads needed to support your growing business, yet still remain within budget constraints. Not the least of these is the operating system and virtualization solution. Do you need x86 compatibility to run *Windows* and/or *Linux* applications or are you now running a variant of *UNIX*, such as IBM's *AIX* or *PowerLinux*, or *IBM i*, all running on Power Systems? According to IBM, its POWER Systems have more performance, reliability and security than an equivalent x86-based server.

Power Systems enable the data center to consolidate all of their AIX, Linux, *and System i* applications on a single platform. In the past, because of CAPEX restrictions, some data centers made their server procurement decisions based solely on an acquisition cost and thus settled for the x86 option. Today, however, decisions are being made on a TCO basis, incorporating system efficiency, operating costs, energy management, data security, and software licensing costs (over the life of the system) into the decision making process. With its latest POWER7+ microprocessor, IBM aggressively has lowered the acquisition cost of entry-level Power Systems servers to be comparable to an x86

system (according to IBM).

Following up on the announcement of POWER7+ in new enterprise-class Power Systems 770 and Power Systems 780 servers last October, IBM has announced an entire family of updated servers to satisfy the needs of smaller and midrange data centers. (See Exhibit 2, above.)

- **The IBM *Power Systems 750 Express* and *Power Systems 760* 5U servers** enable workload consolidation, analytics, and transaction processing in a smaller enterprise data center;
- **The IBM *Power Systems 720 Express* and *Power Systems 740 Express* 4U servers** provide affordable and flexible rack or tower systems for the SMB or entry enterprise data center needing a complete, integrated business system;
- **The *Power Systems 710 Express* and *Power Systems 730 Express*, low-cost, dense, single-socket 2U servers** provide high-performance and energy efficiency for those looking for an entry-level system; and
- **The *PowerLinux 7R1* and the *PowerLinux 7R2* 2U servers** are Linux only to provide the many demanding Linux workloads with the performance and capabilities that they require at the lowest possible price.

In addition, IBM's *PureSystems* family, consisting of *PureFlex*, *PureApplication*, and *PureData*, has

been upgraded with POWER7+.

PowerVM Virtualization

IBM provides *PowerVM* virtualization as optional on all models, for AIX, IBM i, and Linux. PowerVM allows the data center to add workloads easily as the business grows, so that each partition gets the resources it needs. It enables all applications to utilize the capability of the system fully, in order to improve efficiency and reduce costs and to provide the data center with the ability to handle unexpected workload peaks by sharing resources. PowerVM comes in three versions: *Express Edition*, *Standard Edition*, and *Enterprise Editions*[3]. The Power Systems 750 and 760 servers come with three years of 24x7 service, while the Power Systems 710 through 740 servers carry a three-year, 9x5 warranty.[4]

Exhibit 3 —
Power Systems' RAS Features

- ECC memory with Chipkill
- Processor Instruction Retry
- Alternate Processor Recovery
- Service Processor with Fault Monitoring
- Hot-plug disk bays
- Hot-plug and redundant power supplies and cooling fans
- Dynamic component deallocation

Source: IBM

Power Systems servers also have extensive RAS features to ensure the reliability, availability and serviceability of the platform (See Exhibit 3, above, for a partial list.) Power Systems have been designed to optimize new workloads, such as analytics, providing (at the extreme) the performance required to process 200 million pages of structured and unstructured data in three seconds, according to IBM. For example, Watson has matured from playing games on TV to a healthcare platform designed deliver personalized medicine and help in cancer research. Other new workloads emerging in the data center are being addressed with new application solutions designed by IBM, including *IBM Solution for WebSphere Mobile and Web Applications on PowerLinux*, enhancements for *DB2*, and systems management and collaboration in *IBM i 7.1 Technology Refresh 6*.

Let's take a look at the myriad of new options that IBM and POWER7+ now provide.

IBM Power Systems 760

The quad-socket Power Systems 760 has been redesigned to provide the same secure and reliable performance as its big brothers, the Power Systems 770 and Power Systems 780. It is a system that is designed to operate continuously, runs your applications on high-performance processors, expands to meet growth requirements, *and* fits your budget. With better results on SAP 2-tier benchmarks than the leading eight-socket Intel systems, the Power Systems 760 provides the kind of scalability usually only found in top-of-the-line enterprise servers, in this case, *Processor on Demand* for seamless scalability. The Power Systems 760 is ideal for the virtualized consolidation of application workloads, such as SAP and analytics, with the capability to optimize those workloads for peak efficiency. It can support up to 20VMs per core.

The Power Systems 760 supports up to 48 POWER7+ cores running at up to 3.4 GHz, in a 5U form factor, with up to 2TB of memory, twice that of the Power Systems 750. It has six PCIe Gen 2 slots and six small form factor (SFF) bays for I/O, and several storage expansion options. It comes with either dual 10Gbps NIC-only and dual 1Gbps Ethernet ports, or with dual 10Gbps CNA[5] (FCoE and/or NIC) and dual 10/1Gbps (NIC) ports. It also has improved RAS features and energy efficiency, with *ENERGY STAR*-compliance. The Power Systems 760 also comes with installation provided by IBM.

IBM Power Systems 750 Express

The quad-socket Power Systems 750 Express provides similar secure and reliable performance to the Power Systems 760, but without the capability of Processor on Demand. It has been completely resigned in order to take advantage of the unique capabilities of POWER7+.

The Power Systems 750 supports up to 32 POWER7+ cores running at up to 4.0 GHz, in a 5U form factor, with up to 1TB of memory, twice the previous Power Systems 750. It supports up to 20 VMs per core, enabling even greater levels of configuration flexibility to meet the demands of consolidation, lowering the TCO of the IT infrastructure. It also has six PCIe Gen 2 slots and six small form factor (SFF) bays for I/O and storage expansion. It also comes with dual 10Gbps and dual 1Gbps Ethernet ports, or with dual 10Gbps CNA (FCoE and/or NIC) and dual 10/1Gbps (NIC) ports. The Power Systems 750 also has improved RAS features and energy efficiency, and is

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[3] Express Edition is not available on the Power Systems 750 or Power Systems 760.

[4] Warranty and support terms vary by the country.

[5] CAN=Converged Network Adapter.

ENERGY STAR-compliant. According to IBM, the Power Systems 750 has 30-40% more performance than other 32-core systems.

IBM Power Systems 720 and 740 Express

Both the Power Systems 720 Express and Power Systems Express 740 provide the data center with improved performance at an affordable price for either rack or tower deployment. They deliver enterprise-class virtualization capabilities with improved energy efficiency and reliability. They provide the ideal platform for the SMB or enterprise department that needs to consolidate and virtualize AIX, Linux, and IBM i applications. They also are ideal as a distributed application or mid-size database server for DB2, *Oracle*, or *Sybase*.

The Power Systems 720 and Power Systems 740 have a 4U rack form factor, with the Power Systems 720 also available in a tower format. The Power Systems 720 is a one-socket server with up to eight POWER7+ cores running at 3.6 GHz, and 512GB of memory while the Power Systems 740 has two sockets, with up to 16 POWER7+ cores, at up to 4.2 GHz, and 1TB of memory.

IBM Power Systems 710 and 730 Express

The Power Systems Express 710 and Power Systems 720 Express provide the smaller data center that has less-demanding consolidation requirements the dense, attractively priced solution they need. They have the high performance of POWER7+ that may be needed by the smaller data center, along with energy efficiency, to deliver an ideal server platform to run multiple applications and infrastructure workloads, while carrying a list price similar to that of an x86 server.

The Power Systems 710 and Power Systems 730 have a 2U rack form factor. The Power Systems 710 is a one-socket server with up to eight POWER7+ cores running at up to 4.2 GHz, with 256GB of memory, while the Power Systems 730 has two sockets, with up to 16 POWER7+ cores, at up to 4.3 GHz, and 512GB of memory.

IBM PowerLinux 7R1 and PowerLinux 7R2

These two models have been specifically designed to deliver the performance of POWER7+ to the data center with demanding Linux workloads. Priced competitively with comparable x86 servers, PowerLinux servers deliver improved performance, scalability (up to 20 VMs per core), and comparable energy efficiency to their predecessors with less powerful cores. They are pre-configured for easy customer set-up.

The PowerLinux 7R1 and PowerLinux 7R2 come in a 2U rack form factor. The PowerLinux 7R1is a one-socket server with up to eight POWER7+ cores running at up to 4.2 GHz, with 256GB of memory, while the PowerLinux 7R2 comes with two sockets, and up to 16 POWER7+ cores, running at 3.6 or 4.2 GHz, with 512GB of memory.

Conclusion

The modern data center is constantly on the lookout for new ways to transform how they deliver IT to their customers, staff, and partners. They require processor efficiency in terms of consolidation and virtualization, energy efficiency to preserve the environment, and the highest performance possible to extract the most information they can from the data that they have and continue to amass. New compute-intensive workloads appear daily in response to ever-changing business trends, such as a mobile work force, exploding data, at previously unheard of rates, and the madness caused by the social media proliferation of the Internet.

In order to stay on top of their industry, the smarter, forward-thinking business or organization must stay on top of its IT infrastructure because, as we have stated before, ***Infrastructure Matters!*** In order to deploy the most performant, most efficient, and most economical infrastructure, you need the latest and greatest technology available (at an affordable price, of course).

In today's SMB and enterprise data center, that technology comes from IBM Power Systems. With over 9,000 Power Systems' patents issued since 2001, IBM's POWER architecture provides the data center with the ultimate system for compute-intensive workloads. No matter what the size of your data center, no matter what the size of your budget, IBM has a POWER7+ configuration to meet *your* needs. From the smallest entry-level deployment through the largest enterprise data center, now there is a POWER7+ configuration to enable your business to stay ahead. If you are running out of compute capability, and also budget headroom, you need to review the advantages of a POWER7+ solution for your enterprise. While it might help, you don't need to be Watson to reach this conclusion.

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