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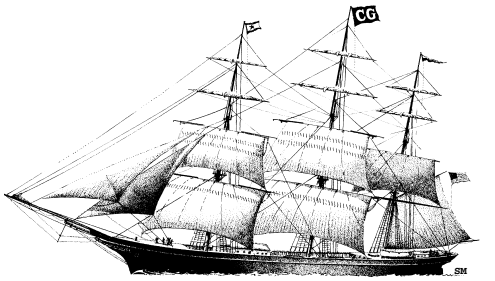

Navigating Information Technology Horizons℠

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Raising the Ceiling on Datacenter Performance — and Lowering the Entry-Level, as Well

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Management Summary

Make no mistake about it: we have fallen in love with our toys, our gadgets. We do not go anywhere without our mobile phone. We do not leave the house without an *iPod* or other device to entertain us. In fact, we do not leave the house without our GPS so that we can reach our destination without having to stop and ask for directions (*what man would do that*?). Moreover, if we are leaving on vacation, or merely going for a hike, we would not think of going out without a digital camera or our portable media recorder – in order to record that perfect moment. In addition, there was a Netbook or laptop to keep us connected with our email, applications, and data. **We took so many devices that we looked like *Batman* with his utility belt (not to mention the bevy of power adapters left in the Bat Cave)!** That is, until now, when they all have been merged into today's multifunctional smart phones, which handle just about all of life's most important chores. **All of that contained in the palm of your hand.**

Consolidation is not unique to our personal lives. It is also essential in restoring order to our enterprises, as well, in the form of simplifying datacenter operations. Every datacenter, from the largest corporation to the SME, is being overrun by a plethora of older servers in need of replacement in order to stop the outflow of unnecessary expenses. They were deployed to satisfy the needs of a growing enterprise, with, every new requirement being deployed on a new server, configured to run a single application. This has led to significant complexity as the IT staff installs UNIX servers from IBM, HP, or Oracle for some mission-critical applications, IBM *System i* servers for other business-critical requirements, while deploying Linux or Windows servers for web-facing requirements, such as email. In March, IBM introduced their POWER7 architecture as the foundation for a new series of mid-range enterprise servers for the datacenter being overrun by the proliferation of both UNIX and x86 servers. The new POWER7 servers enabled UNIX, IBM i, and Linux applications to come together under the same infrastructure, simplifying operations for those datacenters. Unfortunately, the platforms announced in March did not address the requirements of the largest enterprises, nor were they priced to meet the budget restrictions of smaller datacenters.

Now, IBM has done just that! With the *Power 795*, IBM can satisfy the appetite of the most demanding enterprise. With their new *Power Systems Express* servers, IBM can meet the functionality and performance needs of the most budget conscious SME CIO. To learn more about IBM's POWER7 offering, please read on.

IN THIS ISSUE

Challenging the Smarter Datacenter

Today's enterprise datacenter is faced with a myriad of problems, starting with the sprawl of under-utilized servers that proliferate not only throughout the datacenter, but also throughout the enterprise as a whole. This sprawl contributes to

the increase in the total cost of ownership (TCO) of the IT infrastructure, not only due to the wasted compute cycles, but also due to the wasted resources required to operate the servers and cool the IT environment. In addition, the datacenter is spending an exorbitant amount for server administration and maintenance on this heterogeneous mix of under-utilized systems.

What servers make up this complex data-sharing nightmare? First, and foremost, are the mission-critical UNIX applications servers. This class of server is primarily deployed with one of three platform families: IBM's *Power Systems*, HP's *Integrity Servers*, and Oracle's (née Sun) *Sun Fire Systems*. Other mission-critical and business-critical applications run on the Power Systems platform running IBM i, while many Internet infrastructure applications run on commodity x86 servers under *Windows* or *Linux* operating systems. Due to a variety of issues, many of these platforms are anywhere from three to five years old, inefficient, and expensive to operate due to maintenance charges, energy consumption, and costly software licensing. ***Why are five-year-old systems still responsible for the most important enterprise applications?***

First of all, we cannot ignore the economy. Many CIOs are hesitant to make large capital investments. However, in the datacenter where an ROI of less than a year is common, reluctance may be more a result of the FUD factor – the fear, uncertainty, and doubt, associated with changing server platforms (i.e., upgrading existing HP Integrity Systems and Oracle SPARC Sun Fire systems). HP's Integrity platform is based upon Intel's *Itanium* microprocessor, a CPU with a history of delays and performance shortfalls. (Because of this, many in the industry have taken to calling it the *Itanic*.) These delays partially can be attributed to the investments that Intel chose to make in their *Xeon* architecture, creating a multi-core environment, in order to compete with the AMD *Opteron* challenge. Further doubt has been created by the decision by both Red Hat and Microsoft to drop Itanium support in future versions of their operating systems – due to lack of market interest. Intel finally released their quad-core Itanium (*Tukwila*) earlier this year, while, at the same time, their Xeon CPU platform has expanded to up to eight cores per processor. At the same time, AMD has upgraded their *Opteron* architecture (*Magny-Cours*) to eight and 12 cores. Is it any wonder that enterprise CIOs have been reluctant to reinvest in HP's Integrity servers?

At the same time, the acquisition of Sun Microsystems by Oracle finally has been completed, after a year of indecision waiting for government approval of the acquisition, not only in the U.S., but in Europe as well. While Oracle/Sun was in stealth mode, many Sun-based datacenters began to question Oracle's intentions with regard to SPARC. The CIOs at these enterprises are concerned with the lack of a specific hardware roadmap for SPARC-based systems extending more than a few months and a similar lack of definition on plans for their *Solaris* operating system. The most recent new product for the SPARC family is the *UltraSPARC* processor known as *Niagara*, which was released in 2008, two years ago. With no new roadmap available, this may be the end of the road for Niagara. The natural successor to SPARC, which was code-named *Rock*, has been cancelled, so we may be looking at the end of SPARC, as well.

Additional concerns have been raised by Oracle's decision to move to a new pricier and less flexible Sun hardware support policy. As a result, many of these datacenters are now migrating away from SPARC and toward IBM's Power Systems, with migrations to POWER occurring under the auspices of the IBM Migration Factory. IBM has reported that during 2009 alone, they have effected over 500 migrations to Power systems, 90% of which were either Sun SPARC servers or HP Integrity platforms (or their predecessors), with a similar number for the first half of 2010[1]. Why would mission-critical enterprise datacenters be moving to IBM Power?

The answer is simple. While Itanium may be floundering (or sinking) and as Niagara falls, POWER has a clear and impressive roadmap for additional performance, while *AIX*, IBM's UNIX variant, makes POWER7[2] the most powerful and scalable UNIX processor, in fact, the future of UNIX for any mission-critical datacenter looking for scalable consolidation with simplified, highly-available cluster management. With *PowerVM*, IBM can drive server utilization to over 90% with dynamic scalability; with *PowerHA*, IBM can deliver resiliency without downtime for continuous availability; and with their *EnergyScale* tech-

[1] IBM claims a total of 2,600 migrations since the inception of their Power Migration Factory in 2006.

[2] For more on POWER7, see **The Clipper Group Navigator** entitled *IBM Takes Command of the UNIX Datacenter - POWER7 Enables Growth, Lower Cost* dated September 21, 2009, and available at http://www.clipper.com/research/TCG2009040.pdf.

nologies to optimize energy consumption, IBM can reduce energy use by 70-90% to lower the TCO. With *VMControl*, IBM can manage server virtualization automatically to reduce administrative chores.

Power Systems focus on analytics for the smarter datacenter looking to store, analyze, and take action on a variety of workloads, along with workload optimization and other consolidation and virtualization tools for transaction environments. This includes the exploding workload requirements being created to read energy meters, traffic sensors, building controls, or even handling an ever-increasing volume of phone calls. This becomes critical when you are an electric utility that now needs to read 500,000 meters every 15 minutes instead of once a month.

POWER7 was introduced in February for mid-sized datacenters.[3] Now, IBM is completing the commercial rollout with the introduction of solutions for both the high-end datacenter, with the *Power 795*, and the SME datacenter with their *Power Systems Express* servers for the most affordable Express systems for x86 consolidation, increasing reliability and server utilization for these datacenters while reducing TCO by over 50%.

IBM Power 795

With the widespread acceptance of embedded sensors everywhere, the enterprise, the world, is becoming more and more instrumented. These sensors are being deployed in automobiles, appliances, cameras, phones, even the roads and pipelines that make up our transportation infrastructure. There are literally trillions of sensors interconnected to provide the datacenter with oceans of data needing to be analyzed. The smarter enterprise needs a smarter solution; it needs to have the applications and compute power to interpret what these sensors are conveying. It needs to scale dynamically with workload optimization. It must be reliable and save energy to lower the TCO of the IT infrastructure. It must have automated management to manage virtualization. For the most part, these solutions require the integration and performance that IBM has delivered in their new Power Systems to help the enterprise datacenter leverage their critical business assets, their data, to make better decisions.

With the availability of the Power 795, IBM has taken the term "high-end computing" to new heights. IBM already had the highest rating for any system tested by the TPC[4], 10,366,254 TPM[5], with a clustered Power 780 with 24 POWER7 processors running at 3.86 GHz, 192 cores, and 768 threads. A single Power 780 running at 4.14 GHz with two processors and eight cores has a TPM rating of 1,200,011. While the Power 795 has not yet been tested under the TPC benchmark, it has more configurability than the Power 780 and should set an even higher ceiling for the competition to meet. The TPC tested 780 has an IBM *rPerf*[6] value of **115.86**, while a fully configured Power 795 has an rPerf rating of **2,812.72**, a factor of more than **24:1**. This is not to say that the Power 795 will test out on all applications at 24 times the Power 780, but the Power 795 will set a very high bar for others to reach.

IBM has consolidated four 64-core *POWER6 595* systems into a single 256-core Power 795 delivering over 46% more performance, reducing energy consumption by 58% and reducing floor space by 50%. The energy conservation is a direct result of unique innovations implemented by IBM to simplify facilities needed for power and cooling in the area of high-voltage AC and DC inputs and an integrated battery feature. This is all a part of an advanced EnergyScale technology to deliver a new level of monitoring and control, including redundant thermal, power management devices for each node and power capping. If the datacenter is going to use the Power 795 as a consolidation tool, the IT staff must have the highest confidence level in the availability of the system. To that end, IBM has included an extensive array of RAS features in the Power 795. (See Exhibit 1 on the next page.)

The Power 795 can be configured with up to 32 POWER7 processors (each with eight cores). These processors give the datacenter access to 256 cores running at 4.0GHz or 128 cores running at 4.25GHz in *TurboCore* mode. With 8TB of memory, the Power 795 can activate 1,000 virtual machines using IBM's PowerVM capability, far

[3] See **The Clipper Group Navigator** dated March 4, 2010, entitled *Optimizing the Enterprise Datacenter – POWER7 Powers a Smarter Infrastructure*, available at http://www.clipper.com/research/TCG2010006.pdf.

[4] Transaction Processing Performance Council. See http://tpc.org/.

[5] Transactions Per Minute.

[6] An estimate of commercial processing performance relative to other IBM UNIX systems. It is derived from an IBM analytical model which uses characteristics from IBM internal workloads, TPC and SPEC benchmarks. The model simulates some of the system operations such as CPU, cache and memory.

Exhibit 1 –
Power 795 RAS Features

- Processor instruction retry
- Alternate processor recovery
- Selective dynamic firmware updates
- ECC L2 cache, L3 cache
- Redundant service processors with automatic failover
- Redundant system clocks with dynamic failover
- Hot-swappable disk bays
- Hot-plug/blind-swap PCI slots
- Hot-add I/O drawers
- Hot-plug power supplies and cooling fans
- Dynamic processor deallocation
- Dynamic deallocation of logical partitions and PCI slots
- Extended error handling on PCI slots
- Battery backup and optional redundant battery backup

Source: IBM

greater than the scalability allowed by VMware on an x86 architecture, up to 32 times the number of VMs on a single system. In fact, PowerVM allows a single VM to scale from one tenth of a POWER7 core to 256 cores, and back. This enables applications to get the capacity they need when they need it in order to maintain agreed-upon SLAs. With the availability of Capacity-on-Demand and TurboCore Mode, the Power 795 can be optimized for energy efficiency and for database or other transactional workloads, reducing licensing costs for applications licensed per core. With enterprise RAS features and a 24X7 warranty, the Power 795 provides the datacenter with the reliability required for mission-critical environments. Moreover, with an integrated capability to run not only AIX, but also *IBM i* and *Linux* as well, the Power 795 can unify datacenter operations, while reducing operational complexity with IBM *Systems Director*. In addition to 1,000s of *Linux on Power* applications, there is a wide range of 32-bit x86 Linux applications enabled with *PowerVM Lx86*.

Furthermore, two Power 795s can be paired up into a *Power Flex* configuration in order to deploy a comprehensive virtualization infrastructure in support of the most demanding business resiliency objectives. Power Flex enables active-active availability and the capability to allocate and rebalance processor and memory assignments, including planned maintenance. It enables live partition mobility for flexible workload movement and enables seamless growth with capacity on demand. The datacenter can also implement on/off processor days for extra capacity.

How does the Power 795 compare to the competition? Let's take a look at the HP *Integrity Superdome* in terms of energy efficiency. A 128-core Superdome has a *SPECint_rate2006* value of 1650 (peak) with a maximum energy consumption of 24,392 Watts per hour, can be consolidated into an equivalent 32-core Power 795, with a peak rating of 1,440, consuming only 8,341W. In another example, ten 128-core Superdomes, utilized at 50%, with an effective rating of 8,250, can be consolidated into one Power 795 utilized at 80%, with an effective rating of 8,960. This is a 10:1 consolidation advantage in favor of the Power 795. In terms of energy, the Superdome cluster would consume 243,920 watts while the 795 consumes only 41,129 watts, representing a significant savings in TCO. On a performance per core basis, the Superdome is rated at 12.89, while the Power 795 has a rating of 43.75, almost 3.5:1.[7]

The comparison to an Oracle SPARC system is even greater. A *Sun SPARC Enterprise M9000* with 256 cores has a *SPECint_rate2006* value of 2,586, which equates to 10.1 per core with a total energy consumption of 38,180 Watts per hour. The Power 795 has greater than a 4:1 advantage in scalability and performance and consumes up to 26% less energy.

In fact, according to IBM, a single Power 795 system with the ability to virtualize AIX, IBM i, and Linux applications, can replace an entire floor of heterogeneous systems, including 100 HP *DL380 G5s*, 50 *Sun T5220s*, 5 *Sun M4000s*, 5 *HP rx6600s*, and 2 HP Superdomes – with an IBM *Power 570* tossed in for good measure.

IBM Power Systems Express Servers

At the other end of the processing spectrum are IBM's new Power Systems Express servers. These one- and two-socket rack-mount and tower platforms provide enterprise-class performance and functionality at entry-level pricing for the smaller enterprise, or department or branch of one of the largest corporations. The *Power 710 Ex-*

[7] Based on data and analysis by IBM, using publicly-available data from HP and Sun.

press and the *Power 720 Express* provide the datacenter with one-socket economy with high levels of service, outstanding energy efficiency, and the workload optimization usually only found in enterprise-class systems. The 710 Express comes in a 2U format with the same operating system options as the Power 795, and the same applications catalog. With up to eight cores and 64GB of memory, the 710 Express is a densely packed, low-cost server that will fit into your existing IT infrastructure. The 720 Express is an affordable 4U rack or tower system ideal for distributed applications or a complete, integrated business system with IBM i. Configurable with up to eight cores, the same as the 710 Express, it supports up to 128GB of memory with up to 8 SFF SSD or SAS drives, with a capacity of up to 2.4TB and up to 2 PCIe 12X I/O drawers and up to 4 PCI-X DDR 12X I/O drawers.

The *Power 730* and *Power 740 Express* servers are two-socket platforms with the same operating system, application, and RAS features as the 710 and 720. The 730 Express has a 2U rack-mount design for high performance and energy efficiency ideal for running multiple application and infrastructure workloads in a virtualized environment. It supports up to 16 cores and 128GB of memory. The 740 Express is available as either a 4U rack-mount or a tower with up to 16 cores and 256GB of memory. The 740 also comes with up to 8 SFF SSD or SAS drives, with a capacity of up to 2.4TB and up to 4 PCIe 12X I/O drawers and up to 8 PCI-X DDR 12X I/O drawers., making it an ideal target as a high-performance, flexible midsize database and consolidation server. As with all POWER7 servers, the 740 Express supports AIX, IBM i, and Linux, as well as the complete applications catalog.

Using results from the *SPECjbb2005* benchmark from www.spec.org, you can consider using the Power 730 Express server to replace a collection of older Oracle *Sun SPARC Enterprise T2000* servers. With a SPECjbb2005 rating of 1,216,983, the 730 clearly outperforms the T2000 with a rating of 74,356. When you factor in virtualization capabilities, the results can be impressive: as determined by IBM for an actual telecommunications customer, a datacenter can consolidate 49 T2000s into a single 730 Express, saving 95% on software licensing, 97% on floor space, and 94% on energy.

Conclusion

If there is one word that you could use to describe IBM's POWER7 family of servers, that word would be ***VALUE***, for while it is nice to "be green", it is even better to "save green". IBM has spent a lot of time and money in integrating the enterprise RAS features and the workload optimization characteristics from their mainframe *System z* into their AIX family of Power Systems. With *PowerVM*, IBM has instilled a capability of virtualization without limits. With *PowerHA* and *Power Flex*, they have endowed the datacenter with the reliability and availability required by a mission-critical server. With *System Director*, IBM has ensured that all of the servers in the Power family are easy to use with automated management features. With AIX, IBM i, and Linux integrated into a single processing infrastructure, Power Systems enable the datacenter to deploy more processing capacity for new applications with less human intervention.

With POWER7 at its core, IBM has been taking share with Power Systems for over five years now, raising the performance and reliability ceiling, yet again, to enable every datacenter, regardless of size or budget, to have the processing capability to address enterprise goals in a world of continuing change. Where other vendors have tried and failed, IBM continues to innovate with their POWER family providing business continuity to the datacenter.

If your datacenter has reached that fork in the road where a decision must be made to continue with an aging legacy platform or to take the path of innovation, you owe it to yourself and your enterprise to look into IBM's Power Systems. From the single-socket, 1U rack-mount to the industry's most performant UNIX engine, the Power 795, IBM can provide your data center with a consolidation vehicle that just might propel you to superhero status. Regardless, you can be sure that IBM has a POWER solution to fit your requirements and your budget.

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