



**PUND-IT, INC.**

**MARKETPLACE UPDATE**

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**Server Partitioning Unplugged**  
**What Businesses Need to Know About**  
**IBM System p LPAR solutions**

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## Introduction

Server partitioning is sparking growing interest among business IT clients, and with good reason. For years after it first appeared in the 1970s, partitioning was relegated to mainframe computing environments, but solutions are now available for virtually all server platforms, providing a means for businesses to better address server workload and consolidation issues, potentially reducing the total cost of ownership (TCO) of their IT infrastructures and processes. However, considering partitioning to be a singular entity is a singular mistake. The capabilities of individual partitioning technologies vary significantly in scope and performance. In addition, some partitioning offerings are in a state of flux as vendors continue or prepare for transitions to new platforms and processor architectures. Does this variability and uncertainty color all partitioning solutions — or are there options that blend cutting-edge performance with notable platform stability?

We believe that there are indeed partitioning offerings which deliver significant performance and stability. IBM POWER5 (p5) processor-based System p (System p5 and p5) servers are notable examples which support a number of solutions including logical partitioning (LPAR) inspired by IBM mainframe technologies, in servers ranging from the entry-level p5-505 to the top-of-the-line enterprise-class p5-595. IBM also offers features including dynamic logical partitioning (LPAR) which is standard with POWER5 systems, and complement IBM Advanced POWER Virtualization (APV) an option which incorporates features such as Virtual I/O, Virtual Ethernet, and Partition Load Manager. As a result, IBM System p LPAR solutions can help enhance business and IT processes ranging from elementary small business and remote office server consolidation efforts to the highest levels of on demand computing.

## Server Partitioning – What It Is

Server partitioning provides greater flexibility in using a server's computing power by allowing the user to divide up server resources (e.g., processors, memory, disks/ tape, and I/O adapters) into discrete groupings, each appearing to the user as a separate "logical server" with its own operating system and applications. Practically speaking, server partitioning allows the user to get more "bang for the buck" by allowing one physical server to act like and perform the workloads of many servers.

Server partitioning solutions may be *static* — that is, the resources that a partition controls are fixed, unless the server is brought down and partitions changed — or *dynamic* — in which a partition's share of overall server resources may be changed "on the fly", while the server is running. Dynamic partitioning therefore gives the user even more flexibility in allocating and leveraging a server's computing resources.

While there are many ways to sort out the capabilities of various types of server partitioning and related products, one of the simplest is to distinguish between three levels of partitioning. Note that these types of server partitioning do not exclude each other — in many situations, a user may employ all three levels.

1. The **hardware** level - Server partitioning at this level acts to isolate each partition physically, so that operating systems and applications run separately without the need for additional software. For example, IBM mainframe physical partitioning technology handles running an application without the need for additional software. Hardware-level partitioning is best for supporting workload changes that are infrequent and essentially predictable.
2. The **software** level - Server partitioning at this level utilizes only one OS kernel, but allows for different sets of processes to run in their own isolated environments. Each software partition has its own set of resources, using "infrastructure" software between the operating system and application levels to supply each application its own server-like "environment."

3. The **hypervisor or firmware** level – Server partitioning at this level uses operating-system-level software, sometimes embedded in the hardware, to change physical partitions dynamically or to create a “virtual machine” that can utilize a pool of system resources as needed but appears to the applications above it as a full “logical server.” Firmware-level partitioning is especially appropriate where changes in workload are moderately frequent and where users want to run multiple operating systems on the same machine to avoid spending money on less cost-effective platforms.

In essence, server partitioning allows companies to more efficiently configure their server resources to meet shifting business demands, and can also help decrease datacenter footprints by consolidating the workloads of multiple, often distributed servers, applications, and even datacenters onto single or smaller numbers of multi-processor machines. More specifically, partitioning solutions can help businesses better utilize IT resources by:

- Simplifying IT management by supporting multiple software releases and patch levels on the same platform
- Increasing business flexibility through dynamically matching server capacity to demand, therefore enhancing response to disaster recovery and high availability scenarios
- Improving returns on IT investments via reduced inventory management, facilities expenses, cabling, port, and I/O adapter costs, and potentially reduced CPU-based software license fees.

## **IBM LPAR – Where It Came From**

IBM first introduced virtual machines on its mainframe systems in the late 1960s, and the company and Amdahl developed partitioning technologies in the mid-1970s as a means to allocate compute resources more efficiently in their respective mainframe offerings. IBM introduced LPAR solutions on its mainframe systems in the late 1980s.

IBM’s first non-mainframe sub-processor partitioning solutions arrived in 2001 for the company’s POWER4 processor-based pSeries and iSeries servers. LPAR became an added feature in the company’s upgraded POWER4+ pSeries servers beginning in 2003, supporting up to four “micro-partitions” per processor. When IBM introduced its POWER5 processors in March 2004 (and dynamic LPAR features later that summer) the new chips supported the IBM POWER Hypervisor and up to 10 micro-partitions per processor in System p and System i servers.

## **What It Does**

Although some partitioning technologies offer relatively narrow capabilities, IBM System p servers support a range of processor and server methodologies, and, as a result, deliver a wider variety of technical and business benefits. IBM Advanced POWER Virtualization uses a combination of firmware and software-based tools to leverage micro-partitions on individual processors, simplifying server, workload, or business unit consolidation. Companies can also mix production and test environments to achieve more efficient server utilization. Low priority and batch workloads can be shifted among idle resources, and priority workloads can be allocated to achieve increased system performance. Advanced POWER Virtualization can be implemented on all POWER5 processor-based servers, running up to 10 micro-partitions per individual processor. In addition, the IBM POWER Hypervisor technology allows users to run multiple AIX 5L, Linux and i5/OS LPARs on the same System p or System i machine. The company’s dynamic LPAR solutions allow each partition to be altered without rebooting as business or processing requirements shift.

IBM optional APV solutions include a host of virtualization technologies and services that complement System p partitioning by simplifying IT management by allowing system resources to look and act as one. Virtual I/O Server supports the sharing of physical resources including virtual SCSI and virtual networking, allowing more efficient utilization of physical resources

and easing server consolidation. Virtual Ethernet supports high-speed inter-partition communication in multiple protocols. Additional Micro-Partitioning support and Partition Load Manager can help enhance system flexibility and ease-of-use. By leveraging APV, IBM's partitioning solutions deliver the company's clients measurable means of realizing the maximum benefits of their IT investments.

## Why Clients Should Care

IBM System p partitioning solutions offer a prime example of the congruence of technological capabilities and business values. For example, IBM clients can leverage LPAR solutions for consolidating and significantly reducing their server infrastructures and related costs. Additionally, IBM System p server partitioning solutions support virtualization efforts, centralizing and streamlining IT management processes. Moreover, server partitioning solutions can help increase server and application utilization through dynamic provisioning, enhancing the efficiency of key IT resources and the performance of critical IT solutions. Overall, partitioning can help enterprises rapidly respond to changing market conditions, and flexibly grow or shrink server capacity to match business needs.

In addition, by reducing the number of required systems and software licenses, IBM's server partitioning solutions have shown that they can significantly improve the TCO of IT infrastructures and also help drive savings in cost of capital and operations through decreased administration costs, simplified systems management, and reduced downtime. According to IBM, one study suggests that the company's LPAR solutions can help organizations realize substantial savings across a variety of areas such as staffing (31-45%, related to salaries and benefits), facilities expenses (52-61%, including occupancy, power, and cooling equipment), software (65-69%, due to reduced license, subscription, and support fees) and maintenance (69-76%, related to fewer new servers and maintenance contracts).

Partitioning solutions also support efforts to achieve greater server utilization and improved workload quality of service (QoS). These are important issues for nearly every business, but are especially critical for companies trying to rein in or even shrink datacenter expenses. In other words, at a time when businesses of every kind are looking for ways to leverage technology investments for increased business value, IBM server partitioning solutions offer a proven means for cutting costs and enhancing IT and business performance.

## IBM Server Partitioning Solutions – Real World Examples

Theory and opinion aside, what can enterprises reasonably expect from deploying System p server partitioning solutions? While no two businesses are exactly alike, we believe that the following examples highlight some of the potential and provable benefits offered by these IBM solutions.

### *Sinopec Corporation*

Headquartered in Beijing, Sinopec is China's largest producer and marketer of oil products, employing more than 443,800 people. The company's activities include the exploration, development, production, and marketing of crude oil and natural gas; the production and sale of petrochemicals; and the storage and pipeline transportation of crude oil. China's ascension to the World Trade Organization exposed Sinopec to multi-national competition, so the company needed to expand its market share and remain competitive nationally. To help achieve this, Sinopec focused on minimizing IT investments and enhancing operational efficiencies. The company's existing SAP-based enterprise resource planning (ERP) system, supported by more than 100 aging Sun Microsystems servers, was showing signs of instability that inhibited its performance. Sinopec's Sun investment also included a storage area network (SAN), which was suffering from performance inconsistencies.

To improve operational efficiencies, the company replaced its Sun servers with 70 IBM – p5 servers running IBM AIX 5L V5.3. A total of 50 servers support the company's SAP application, and the remaining 20 run IBM Tivoli Storage Manager V5.3 to back up the company's data storage environment. To provide consistent availability and performance levels, the System p servers are equipped with IBM High Availability Cluster Multiprocessing (HACMP) technology, Partition Load Manager, and dynamic LPAR. More than 1,000 Sinopec employees now regularly access the System p SAP ERP server. After deploying the new IBM hardware, Sinopec enjoyed vastly improved ERP and storage performance, resulting in enhanced operational efficiencies and a 15 percent increase in sales revenues. In addition, the company says the new solution has helped it save approximately US\$5 million over its previous Sun environment. According to Sinopec, the IBM System p server environment offers a stable, scalable, and cost-effective platform for SAP systems, allowing the company to make quicker and better-informed business decisions.

### ***Alstom Information Technology Centre (ITC) GmbH***

Alstom ITC is a transport engineering and power generation concern with 76,800 employees in over 70 countries. In Germany, the company's Power Generation division employs 7,000 people at 20 manufacturing locations where SAP software is used to support manufacturing, accounting, and logistics. While planning to migrate away from an unsupported UNIX OS variant, the company also wanted to boost its server and storage power and capacity, which was struggling to meet business requirements. Alstom wished to deploy a complete solution from a single vendor, and after extensive testing selected IBM as the best provider based on server virtualization capabilities and balanced price/performance metrics.

Working with IBM Business Partner CENIT AG Systemhaus, Alstom successfully deployed two clustered IBM p5 570 systems, each with 16 POWER5 processors running AIX 5L V5.3, and migrated two separate SAP implementations with more than 1,000 users to the new infrastructure in only ten weeks. The company's new SAP software environment consists of around 30 virtual servers, and the testing and development environments are located in separate, dedicated logical partitions. The company also employs other components of the System p servers' Advanced POWER Virtualization (APV) capabilities; the Virtual I/O Server – a specialized partition that manages a physical resource such as a network or disk adapter, and Virtual LAN technology that supports high-speed inter-partition communication between logical partitions via virtual Ethernet connections. Overall, the p5-570 systems gave the company a significant boost in overall SAP performance, doubling the number of transactions processed per second. Additionally, Alstom expects to see a significant drop in total cost of ownership, based on enhanced hardware amortization, and reduced personnel and infrastructure costs.

### ***Acquedotto Pugliese***

Acquedotto Pugliese (AQP) provides drinking water and waste-water services for four million inhabitants in southwestern Italy. Once state-owned, AQP is now a privately-held company headquartered in Bari, Italy with 1,600 employees. Like other utilities, AQP needs to manage an enormous number of customer accounts, producing accurate and timely billing statements. The company must also maintain a large network of pipelines, reservoirs, pumping stations, and purification plants. As a result, AQP relies heavily on computerized systems, whose capabilities and efficiency directly affect the company's performance. Needing greater processing speed and better price-performance, AQP decided to replace four existing IBM pSeries 620-6H1 servers, two of which supported the company's SAP R/3 ERP system, while the others ran its client relationship and LOGOS billing systems. Since AQP had been very satisfied with its IBM pSeries solutions, it decided to migrate to the new generation of IBM POWER5 technology.

Working with IBM Global Services, AQP replaced its pSeries servers with two IBM p5-570 systems running AIX 5L Version 5.3. The new systems enabled the company to consolidate from four physical servers to two without losing any robustness, and also provided additional system flexibility. Micro-Partitioning allows AQP to dynamically balance resources available to each LPAR, easily handling peaks in transactional volumes while also keeping performance

high and responding rapidly to new business requirements. Enhanced performance is another benefit of the new IBM infrastructure. The time required for preparing monthly billing statements has been halved to just one week, freeing IT resources and improving customer service. Underlying benefits are equally or even more important. According to AQP, the new systems are easier to manage, delivering optimal performance even as workloads change, so company IT staff members have more time, capacity, and power to focus on developing new business services. In addition, monthly infrastructure costs have fallen by around 25%. As a result, AQP says IBM System p solution allows the company to pay less and achieve more.

### ***The United States Tennis Association (USTA)***

The US Open is both the flagship event of the USTA and the world's single largest annual sporting event. In 2005, more than 650,000 spectators and 1,300 members of the press attended the US Open, and 4.5 million users (over 50 times the regular number of unique visitors and a 75% increase from 2004 site traffic) logged onto USOpen.org site during the competition, visiting nearly 27 million times and viewing almost 155 million pages. As the US Open's official IT provider since 1995, IBM works closely with the USTA to give tennis fans around the globe a virtual seat at the tournament. Most of the year, the USTA manages the USOpen.org site, but during the US Open, IBM takes over designing, publishing, producing, and hosting the site. To simplify management, control costs, and meet the USTA's requirements of 100 percent availability, scalability, and security, IBM needed a flexible infrastructure that could scale to meet the massive resource demands of the two week tournament and then resume normal operation at the end of the event.

For optimal availability and manageability, IBM decided to virtualize and automate the IT infrastructure supporting USOpen.org. Server virtualization through logical partitioning provides the means to aggregate and allocate physical IT resources so that they can be treated as a pool accessed and managed according to demand—rather than by physical location. IBM first consolidated infrastructure monitoring functions onto pSeries 615 systems running IBM AIX 5L V5.3, while a p5-550 and a p5-570 at one of IBM's three hosting locations supported Web serving processes on Linux logical partitions (LPARs) and IBM WebSphere applications on AIX 5L LPARs. The advanced IBM Virtualization Engine capabilities of System p servers enable the USTA and IBM to utilize multiple, geographically dispersed servers to handle the substantial increase in site traffic during the tournament. When the event is over, those resources are re-distributed to serve other functions. As a result, the USTA gained a scalable, highly responsive infrastructure that complements its existing systems without requiring a large capital investment in an IT infrastructure that would be under-utilized the rest of the year.

### ***Victoria Partnership for Academic Computing (VPAC)***

In 2000, seven universities in the Australian state of Victoria created the Victoria Partnership for Advanced Computing (VPAC), a nonprofit agency that provides high performance computing (HPC) services in fields including computational engineering and software development, grid computing, geospatial sciences, and life sciences. Clients include research hospitals, government agencies, and automotive manufacturer General Motors. VPAC supports computing projects ranging from aggregating colorectal cancer databases and mining large marine research datasets to analyzing oil products and consumer buying habits. Additionally, VPAC received government funding to help establish a national computational grid from the Australian Partnership for Advanced Computing (APAC). Initially, grid processing severely affected VPAC's infrastructure performance. The company's Compaq AlphaSC supercomputer was performing well below current industry standards, and was expensive to maintain and operate. In the end, VPAC management decided it would be cheaper to purchase a new supercomputer than to continue using the AlphaSC system.

Because VPAC is committed to open standards and the fact that most of its systems already ran Linux, the agency's IT team wanted the new solution to support Linux, as well. After considering systems from competitors including Sun Microsystems and Hewlett-Packard, VPAC purchased a high-performance IBM Linux cluster that consisted of 37 IBM ~ OpenPower 720

servers featuring SUSE Linux Enterprise Server (SLES) V9 for POWER. 36 of the OpenPower 720 servers are clustered into computing nodes to support VPAC's HPC workload, and one server is partitioned separately for head and management nodes. The new IBM Linux cluster augments the agency's two existing IBM Cluster 1350 servers, giving VPAC a total of three IBM Linux cluster environments. By leveraging OpenPower system features, VPAC has achieved 80 to 90 percent processor utilization. Also, the system has had minimal downtime in the eight months since VPAC deployed it, displaying extreme dependability and energy efficiency compared to the Compaq AlphaSC and thus delivering substantial savings in energy costs. The new IBM OpenPower 720 cluster has helped VPAC be more responsive to clients needs, boosting system availability for demanding workloads and providing a significant increase in computing power over its previous solution.

## Mission Accomplished?

Once relegated to mainframe computing environments, server partitioning is now a common feature available for virtually all business IT solutions, from small servers for SMB organizations to the highest performance enterprise systems. But the benefits of partitioning are not simply technological. At a time when organizations of every kind are looking for ways to better leverage their IT resources, server partitioning can help companies significantly enhance their business performance and reduce IT costs. However, considering all vendor server partitioning offerings as equal is a gross mistake, since individual solutions vary significantly in scope and performance.

IBM supports a variety of partitioning solutions across the company's POWER processor-based servers that are designed to enhance numerous business and IT processes. In particular, the server partitioning solutions available with IBM System p solutions deliver the robust flexibility and stability businesses need to support efforts ranging from elementary small business and remote office server consolidation to the highest levels of on demand computing. In addition, IBM System p server partitioning solutions provide companies a robust middle path to virtualization that delivers significantly better reliability, availability, and security performance than x86-based servers, at a more affordable price than mainframe solutions. Businesses considering server partitioning would do well to investigate IBM System p server solutions.

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