IBM @server pSeries 650

7014-T42 rack for pSeries 650 server

Highlights

- ***Delivers unparalleled performance, capacity and value on demand***
- ***Provides unmatched configuration flexibility for scalability and ease of management***
- ***Offers unprecedented high-end management capabilities to help lower total cost of ownership***

Accept no compromises

Traditionally, selecting the right mid-range UNIX® server to address on demand business needs has required compromises. Often, businesses have faced a difficult tradeoff between price and critical features supporting reliability, flexibility and performance—until now. With the IBM @server™ pSeries™ 650, there is no need to compromise.

To be competitive, organizations require powerful, flexible e-business infrastructures that meet budgetary constraints—without sacrificing the performance, reliability and function that mission-critical applications demand. To meet this need, IBM has created the pSeries 650, a member of the IBM @server product line—advanced servers that can help lower costs, improve efficiency and speed-transformation to e-business on demand.

Because IBM does not believe in compromising function and reliability for cost, no capability was spared in the design of the pSeries 650, one of our most advanced mid-range servers. The pSeries 650 utilizes the company's most innovative 64-bit chip—POWER4+™—the next generation of the POWER4™ microprocessor family. In addition, the pSeries 650 continues the same mainframe-inspired autonomic computing reliability, availability and serviceability (RAS) features as the high-end pSeries 690 server. And astonishingly, it delivers all this at a significantly better price/performance than the popular pSeries 660 Model 6M1.

The pSeries 650 is a winning proposition for small- and medium-size companies, or large enterprises with distributed branch servers conducting vital business processes such as enterprise resource planning (ERP), supply chain management (SCM), customer relationship management (CRM) and business intelligence (BI). For e-businesses, the pSeries 650 excels as a highly reliable and available business-to-business Web server.

Building on the best

The pSeries 650 offers an extremely dense package—with two to eight processors—ideal for supporting exceptional performance in a small package. With 1.2 or 1.45 GHz, 64-bit processor speeds and from 2GB to 64GB of main memory, it offers high-end performance and capacity at a mid-range price.

The pSeries 650 incorporates the latest advancement in leadership chip technology from IBM, the POWER4+ microprocessor, a design enhancement of POWER4. These copper/silicon-on-insulator (SOI) chips are among the fastest 64-bit processors in the world[1].

POWER4 technology represents an enhanced "SMP-on-a-chip" design for UNIX servers. Two processors with 1.5MB of shared Level 2 (L2) cache are incorporated on each chip and mounted on a processor card. Also on the card is shared Level 3 (L3) cache. The L3 cache helps stage information more efficiently from system memory to application programs and provides an up to 15.4GB/second L3 to processor card bandwidth (61.9GB/second for an eight-way system).

The processor card is packaged with the system memory in a rugged unit that protects the components in a rigid structure for greater reliability. This design greatly simplifies upgrades. Plugging in additional two-way processor cards with their L3 cache and memory creates an up to 8-way system. Up to 16GB of memory is available with a two-way system. This maximum memory increases by 16GB for each additional two-way processor.

The rest of the system is designed to match the incredible speed of the POWER4+ processors. The pSeries 650 features a peak aggregate memory to L3 cache bandwidth of 25.6GB/second for an 8-way configuration. In addition, aggregate I/O bandwidth is up to 16GB/second. The result is a remarkable combination of system architecture, speed and power that delivers efficient and cost-effective data sharing and application throughput.

Partitioning for quick response to change

IBM's logical partitioning (LPAR) implementation provides outstanding flexibility in matching resources to workloads, facilitating higher efficiency and lower total cost of ownership (TCO), while providing robust isolation of operating environments. The pSeries 650 system can be divided into up to 8 independent logical servers or partitions, each with its own memory, processors, I/O and copy of the AIX 5L™ or Linux® operating system. By enabling consolidation of applications using both operating system onto a single platform, the pSeries 650 can increase system utilization, provide greater flexibility of managing the dynamics of multiple workloads in a single server, reduce complexity and deliver significant administration savings.

Based on business requirements and application needs, administrators can assign and manage resources in any combination using a single interface—the Hardware Management Console for pSeries. This dedicated workstation is used to define and manage the allocation of processors, memory and I/O resources to partitions. Dynamic LPAR, a function of AIX 5L Version 5.2, even allows reallocation of system resources without rebooting the affected partition and

Feature	Benefits
POWER4+ microprocessors with L3 cache	• Provide improved system performance and higher reliability in a smaller, more efficient dual-processor chip • Enable capacity to grow to eight processors
Copper and SOI technology	• Improve processor performance and reliability while using less power and producing less heat to help conserve energy and help lower operational costs
High memory and I/O bandwidth	• Remove performance bottlenecks that can occur when fast processors must wait for data to be moved through the system
Up to 64GB Chipkill™ ECC, bit-steering memory	• Allows exploitation of 64-bit addressing for large database and key critical business applications • Provides growth options with much greater throughput • Significantly lowers number of memory failures that cause system outages, thus increasing system availability • Provides memory spares that are activated when multiple memory errors are encountered
Capacity Upgrade on Demand	• Offers flexibility to cost effectively and easily add permanent processing and memory capacity to help meet workload growth
On/Off Capacity on Demand	• Provides temporary processor use to meet unexpected workload demands
Processor card packaging	• Protects processor and memory components against accidental disconnection and/or contamination for improved reliability • Allows for easier servicing
Logical Partitioning (LPAR)	• Permits up to 8 UNIX or Linux operating system servers to be consolidated on a single server, easing maintenance and administration • Offers greater flexibility in using available capacity and dynamically matching resources to changing business needs (requires AIX 5L v5.2)
Up to 63 hot-plug or 55 hot-plug/blind-swap PCI/PCI-X adapter slots	• Provide growth options for significantly increased capacity at a low cost • Support many commonly used adapters for increased availability at a lower cost • Allow adapters to be added or removed without interrupting the system
Hot-swappable disk and media bays	• Provide greater system availability and smooth growth by allowing swapping or adding of disk drives and media devices without powering down the system
Built-in service processor	• Continuously monitors system operations and takes preventive or corrective actions for quick problem resolution and high system availability • Allows diagnostics and maintenance to be performed remotely
Redundant hot-plug power and cooling subsystems	• Enhance system availability since cooling fans and power supplies can be changed without interrupting operations • Provide backup power and cooling if primary unit fails
Dynamic processor and PCI bus slot deallocation	• Designed to automatically deallocate resources when impending failure is detected, so applications continue to run uninterrupted
IBM @server Cluster 1600	• Provides centralized management of multiple inter-connected systems • Provides ability to handle unexpected workload peaks by sharing resources • Allows for more granular growth so user demands can be readily satisfied
Linux operating system	• Enables access to thousands of 32- and 64-bit Open Source Linux applications • Provides a common operating environment across IBM @server platforms
AIX 5L operating system	• Delivers maximum throughput for mixed workloads without the need for complex system configuration or tuning • Provides upward binary compatibility to help preserve software investments • Extends application choices with Linux affinity

the creation of new partitions from resources removed from one or more partitions. Unused I/O expansion PCI slots and disk bays can also be populated concurrent with system operation to create new partitions. IBM's dynamic partitioning capabilities mean that partition changes can take effect much more rapidly, enabling companies to respond faster to changing requirements.

Big power, small footprint

The pSeries 650 server offers exceptional configuration flexibility to meet unexpected growth needs. It includes an industry standard 19-inch rack-mount system drawer (eight EIA Units-8U) containing processors, cache, memory, PCI-X adapter slots, hot-swappable disk bays, two hot-swappable media bays and other integrated controllers. Each pSeries 650 system is mounted in an IBM 7014-T00 (36U) or T42 (42U) or OEM 19-inch rack. The system can be optionally configured with additional 7311-D10 I/O drawers that mount side-by-side in a 4U rack enclosure and provide additional PCI/PCI-X slot expansion or with 7311-D20 4U I/O drawers providing additional PCI-X slot expansion and hot-swappable disk bays. A maximum of up to eight I/O drawers are supported.

The pSeries 650 comes standard with seven PCI-X adapter slots—with a combined bandwidth of 4GB/second—packaged in the system drawer. Each 7311-D10 I/O drawer adds six adapter slots; each 7311-D20 adds seven slots. Thus, the maximum slots available on a pSeries 650 is 63 and the maximum I/O bandwidth is 16GB/second. All slots are hot-plug; the pSeries 650 and 7311-D10 slots are also blind-swap, so customers can add or remove adapters without moving the I/O drawer to a service position—and without system interruption. The pSeries 650 also features recoverable PCI buses, helping to ensure that parity errors do not cause system failure.

The pSeries 650 server provides four hot-swappable internal disk bays that can accommodate 36.4GB, 73.4GB or 146.8GB drives for a disk storage capacity of up to 587.2GB. Attaching the 7311-D20 can add 12 additional disks bays accommodating a storage capacity of 1.7TB. A fully configured pSeries 650 with eight 7311-D20s can have over 14.6TB of disk storage on-line. Additional external disk storage can also be mounted in the racks. Products such as the IBM 2104 Expandable Storage Plus (Ultra3 SCSI) and the IBM 2105 Enterprise Storage Server™ provide terabytes of highly reliable, high-performance, hot-swappable disk storage.

There is significant flexibility in the number of pSeries 650 system and I/O drawers that can be mounted in a rack, for a high degree of compute and I/O power per square foot of floor space. In its maximum configuration, a pSeries 650 server comprises one system drawer with eight 1.45 GHz POWER4+ processors and eight 7311-D20 I/O drawers for a total of 40 EIA units (40U) of rack space (8U for the system drawer, 4U for each I/O drawer). Such a configuration would have 63 adapter slots and 100 disk bays. Depending on the number of attached I/O drawers, up to four pSeries 650 systems may be installed in a T00 rack and up to five systems may be installed in a T42 rack.

Keeping businesses running

Several innovations stemming from the IBM autonomic computing initiative—a blueprint for self-managing systems—help contribute to uncompromising pSeries reliability, manageability and serviceability. Its goal is to create an intelligent IT infrastructure that responds to unexpected capacity demands or to system failures while

pSeries 650 server with optional I/O drawers

at the same time helping to control spiraling pressure on critical skills, software and service/support costs.

To boost availability, an integrated service processor in every p650 server monitors system health. This feature can detect error conditions within the hardware and automatically place a service call to IBM, often before the problem becomes apparent to users. Then, if repairs are necessary, the service processor can initiate dynamic reconfiguration to correct the failure. In this manner, automated monitoring helps businesses minimize costly outages and reduce administrative overhead and support costs.

First Failure Data Capture (FFDC) identifies and logs both the source and root cause of system failures to help prevent the reoccurrence of intermittent failures that diagnostics cannot reproduce. Designed to prevent outages and reduce repair time by identifying failing components in real time, FFDC also contributes to outstanding pSeries system availability.

To help prevent system shutdowns caused by main memory and L2/L3 cache errors, error checking and correcting (ECC) memory detects both single- and double-bit errors and can correct all single-bit errors dynamically—complementing Chipkill memory to improve reliability. In addition, the pSeries 650 includes redundant, spare main memory chips. Through a technique known as bit-steering, these spares can be dynamically activated and replace a failing memory chip in the event multiple memory bit errors exceed a threshold.

The use of IBM Chipkill memory technology allows detection and correction of most multi-bit memory errors. This protection from memory failures helps prevent costly system memory crashes and improves pSeries reliability. In fact, IBM studies show that systems with Chipkill memory are up to 100 times less likely to have outages because of memory failure[2].

The pSeries 650 server also features the ability to deallocate critical system resources, including the processors and PCI-X bus slots. In the unlikely event that one of these components fails or indicates an impending failure, this capability—working with AIX 5L and the service processor—can dynamically take the faulty component offline. The system automatically reassigns the workload to other processors to avoid interruption. If the system must be rebooted, previously deallocated components will not be included to avoid repetition of the error condition. Failing components can be replaced during normal service to minimize system and application downtime.

Reliability and availability features also include in both the pSeries 650 system drawer and I/O drawers, redundant hot-plug power supplies and cooling fans, which can be easily replaced without affecting system operations. Environmental monitoring functions—such as temperature monitoring that increases the fan speed in response to above-normal temperatures—boost reliability by helping to maintain the correct conditions for sound system operation.

For near-continuous availability, from two to 32 pSeries 650 servers can be clustered with High Availability Cluster Multiprocessing (HACMP) software from IBM. HACMP helps to minimize downtime of systems and applications, providing a superior base for high availability—an essential ingredient of business-critical environments.

Clustering for on demand availability

Clustering—an advanced computing technique designed to promote performance, scalability and availability—allows multiple servers to be interconnected into a single computing resource. Designed to improve availability, scalability and performance in an on demand environment, the IBM @server Cluster 1600 can deliver manageability, continuous access to business-critical data and applications, and investment protection through the coexistence of old and new technology. It is especially well suited for diverse engineering and scientific workloads where sharing data and maximizing job throughput is important, for solving large and complex HPC problems, and for hosting extremely large and growing corporate databases.

With the Cluster 1600, companies can manage up to 128 AIX 5L operating system images from a single point-of-control. A higher scalability limit of 512 is available via special order. Up to 64 pSeries 650 servers, each with one to eight LPARs can be included in a Cluster 1600 (maximum of 128 LPARs). Each server can be clustered with either an industry standard Ethernet or SP Switch2 interconnection with the SP Switch2 PCI-X adapter.

Open standards for e-business

The pSeries 650 server is matched with AIX 5L—the advanced, open, scalable UNIX operating system from IBM. Providing real value in reliability, availability and security, AIX 5L is tuned for e-business application performance and is recognized as state-of-the-art in systems and network management.

AIX 5L delivers Java™ technology, Web performance and scalability enhancements for managing systems of all sizes—from single servers to large, complex e-business installations. Web-based remote management tools control the system and monitor key resources such as adapter and network availability, file system status and processor workload. AIX 5L also incorporates Workload Manager, which can help ensure that critical applications remain responsive even during periods of peak system demand.

The pSeries 650 exemplifies the IBM @server commitment to application flexibility through open standards. In addition to including enhanced Java scalability and performance, AIX 5L provides application programming interfaces (APIs) that allow popular Linux Open Source applications to run on AIX 5L with a simple recompilation. The AIX Toolbox for Linux Applications provides utilities, editors, debuggers and other application development tools to aid in this recompilation.

Linux support offers versatility

The Linux operating system, available for the pSeries 650 from SuSE, “SuSE Linux Enterprise Server 8,” offers a

package that includes a full complement of Open Source tools and applications. Linux does not require the use of AIX. Linux applications can run natively or in an LPAR and benefits from many of the same performance features of the pSeries 650[3]. IBM Global Services and SuSE both offer full service and support for Linux.

Greater application choice

The IBM @server product line offers uncompromising flexibility in selecting, building and deploying the applications businesses need to succeed in today's on demand world. Toward that end, IBM offers one of the industry's broadest range of platforms and operating systems. IBM is committed to industry-standard, cross-platform technologies—that form the core of a flexible e-business infrastructure.

Support for these standards in our key middleware—including DB2® Universal Database™, WebSphere® Application Server and MQSeries®—means that companies need not get locked into a single platform as their business grows. By embracing open standards, organizations gain the flexibility to deploy applications in a cost-effective way.

Managing an on demand business

The IBM @server product line is backed by a comprehensive suite of offerings and resources that provide value at every stage of IT implementation. In addition to building on IBM innovations in chip technology, clustering and multi-platform design, the pSeries 650 also leverages flexible capacity on demand features to provide one of the most scalable and rapidly adaptable servers available today. The result is an easier way to help businesses handle complexities and rapid growth in an on demand world.

pSeries 650 1.45 GHz systems can be ordered with Capacity Upgrade on Demand (CUoD) features, which allow the activation of additional processors and/or memory[4] as needed. For a fee, CUoD allows customers to anticipate growth and workload requirements by pre-installing inactive capacity on their server and activating these additional resources incrementally as needed.

Up to six CUoD 1.45 GHz processors can be installed and later activated in increments of two processors. Up to 56GB of CUoD memory can be installed and later activated in increments of 4GB. Dynamic LPAR makes this activation seamless. By bringing capacity online as processing demands grow, customers can easily and economically scale to meet market requirements.

On/Off Capacity on Demand for pSeries 650 1.45 GHz processors also gives organizations the ability to handle business spikes. This feature works like a debit card, allowing the temporary activation of pairs of reserve processors. Companies pay only for the processing power they need, when they need it—which makes the pSeries 650 a great server to support unanticipated peak workloads.

In environments with CUoD and AIX 5L v5.2, an availability capability known as Dynamic Processor Sparing allows the inactive processors to act as "dynamic spares". An inactive processor is transparently activated if a failing processor reaches an error threshold, thus helping to maintain performance and improve system availability. When the failing processor is returned to service, the spare is returned to the inactive CUoD pool of resources.

pSeries 650 at a glance

Minimum configuration	
Microprocessor:	2-way SMP (one processor card); 1.2 GHz or 1.45 GHz POWER4+
Level 3 (L3) cache:	8MB-1.2 GHz; 32 MB-1.45 GHz (ECC)
RAM (memory):	2GB
Internal disk drive:	One 36.4GB Ultra3 SCSI
Internal disk bays:	Four hot-swappable; up to 587.2GB (36.4GB, 75.4GB and 146.8GB disk drives) available
Media bays:	Two (one available) hot-swappable
PCI slots:	Seven PCI-X hot-plug/blind-swap adapters (six 64-bit; one 32-bit)
PCI bus width:	32- and 64-bit
Standard features	
I/O adapters:	Dual ported integrated Ultra3 SCSI controller; Ethernet 10/100 controller
Ports:	Four serial, two ports for connecting Hardware Management Console for pSeries, keyboard, mouse
System expansion	
SMP configuration:	4-, 6-, 8-way SMP (one, two or three additional processor cards); 1.2 GHz or 1.45 GHz POWER4+
L3 cache:	8MB per 1.2 GHz processor card (32MB maximum); 32MB per 1.45 GHz processor card (128MB maximum)
RAM:	Up to 64GB (ECC, Chipkill)
PCI expansion slots:	Up to 48 hot-plug/blind-swap adapters (40 64-bit PCI-X; eight 64-bit PCI) via up to eight 7311-D10 I/O drawers (six adapters each) Up to 56 hot-plug adapters (64-bit PCI-X) via up to eight 7311-D20 I/O drawers (seven adapters each)
Disk bay expansion:	Up to 96 hot-swappable via up to eight 7311-D20 I/O drawers (12 bays each); Up to 14.0TB of additional disk storage available
RAS features:	
	Copper, SOI microprocessors Chipkill ECC, bit-steering memory ECC L2 cache, L3 cache Service processor Hot-swappable disk bays Hot-swappable media bays Hot-plug/blind-swap PCI slots in p650 system unit and 7311-D10 I/O drawer Hot-Plug power supplies and cooling fans Dynamic Processor Deallocation Dynamic Processor Sparing Dynamic deallocation of logical partitions and PCI bus slots Redundant power supplies and cooling fans
Operating systems:	AIX 5L Versions 5.1/5.2 SuSE Linux Enterprise Server 8
Power requirements:	200v to 240v AC
System dimensions:	
System drawer:	13.8"H x 17.5"W x 29.9"D (351 mm x 445 mm x 760 mm); Weight 205 lb (93 kg)*
Two 7311-D10 I/O Drawers:	6.9"H x 17.5"W x 28.0"D (175 mm x 445 mm x 711 mm); Weight 86 lb (39.1 kg)*
7311-D20 I/O Drawer:	7.0"H x 19.0" W x 24.0"D (178 mm x 482 mm X 610 mm); Weight 101 lb (45.9 kg)*
Warranty:	On-site, 8 A.M. to 5 P.M. next-business-day for one year (limited) at no additional cost; Warranty upgrades and maintenance are available

* Maximum configuration. Weight will vary when disks, adapters and other peripherals are installed.

IBM Global Financing offers a wide range of financing options to help manage the bottom-line and meet the varying needs of e-business on demand™.

In addition, IBM Global Services experts can help with business and IT consulting, business transformation and total systems management services, as well as customized e-business solutions.

More value

Pre-configured Express Configurations for pSeries 650 systems are easy to order with extensive features to meet the needs of mission-critical environments. They are available for AIX 5L or Linux at a cost savings from standard prices for an outstanding value.

Backed by IBM

pSeries 650 systems are backed by worldwide service and support from IBM. The one-year basic warranty is end-to-end and includes AIX 5L operating system support, hardware fixes, manned phone hardware support and call tracking.

The basic hardware warranty provides 8 A.M. to 5 P.M., on-site, next-business day service, and warranty upgrades are available including 24x7x365 coverage with a 4-hour response time objective. The warranty terms and conditions may be different in some countries. Please consult your local IBM marketing representative or IBM Business Partner for country-specific terms and conditions.

Summary

Leveraging advanced technology from across the IBM @server product line, the pSeries 650 server delivers uncompromising performance and functionality—with exceptional price/performance characteristics for impressive business value. In addition, the pSeries 650 offers the same mainframe-inspired reliability, availability and self-management capabilities as high-end servers in its class—at a fraction of the price.

The features of the pSeries 650 make it an excellent server foundation to meet the demands of key applications such as ERP, CRM, SCM, BI and Web serving. In addition, the pSeries 650 serves as an excellent platform for workload and application consolidation.

The pSeries 650 demonstrates the most impressive performance, flexibility and manageability of any IBM mid-range UNIX server. It is a solution that helps an on demand business meet its critical e-business infrastructure needs—without sacrifice or compromise.

For more information

To learn more about the IBM @server pSeries 650, contact your IBM marketing representative or IBM Business Partner, or visit the following Web sites:

- **ibm.com**/eserver/pseries
- **ibm.com**/servers/aix
- **ibm.com**/servers/solutions
- **ibm.com**/ibmlink

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[1] Based on SPEC CPU2000 benchmarks as of May 6, 2003, available at www.spec.org

[2] IBM Study by Timothy J. Dell, "A White Paper on the Benefits of Chipkill-Correct ECC for PC Server Main Memory," (November 25, 1997) available at:
ibm.com/servers/eserver/pseries/campaigns/chipkill.pdf

[3] Many of the p650 features described in this document are operating system dependent and may not be available with the Linux operating system. For more information, please check:
ibm.com/servers/eserver/pseries/linux/whitepapers/linux_pseries.html

[4] CUoD memory requires AIX 5L Version 5.2.

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