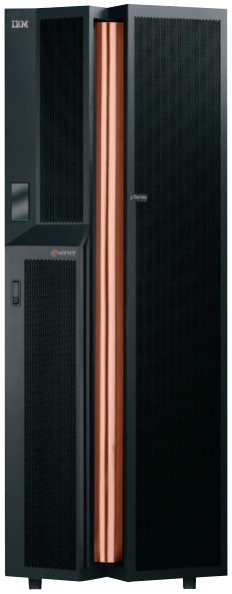
IBM @server pSeries 655



System frame for pSeries 655 server

Highlights

- ***Exceptional price/performance characteristics for demanding HPC applications***
- ***Flexible, ultra-dense packaging designed for scalable growth***
- ***Rich suite of software for workload management, parallel file system capability and cost-effective cluster management***

Setting the standard

To meet the demands of high performance computing (HPC) and business intelligence (BI) applications, IBM has created the IBM @server® pSeries® 655—a member of its family of technologically advanced, 64-bit, symmetric multiprocessing (SMP) servers. Building on an advanced UNIX® server design, pioneering mainframe-inspired technologies, and a heritage of HPC innovations, this powerful server delivers the performance, price/performance, flexibility, reliability and manageability features needed for cluster-optimized server environments such as large-scale computational modeling and multi-terabyte databases.

The pSeries 655 server is an integral part of the IBM @server product line—advanced servers that can help lower costs, speed innovation, and solve larger and more complex problems rapidly with improved efficiency. The foundation of this server is innovative technology from across IBM.

The pSeries 655 is an ultra-dense packaged server specifically designed for building high-performance clusters, including participation in the IBM @server Cluster 1600. The Cluster 1600 includes pSeries servers, IBM cluster management software, optional cluster software for HPC, and a choice of an industry standard, pSeries High Performance Switch (HPS) or SP™ Switch2 interconnection. It draws on more than a decade of IBM clustered and massively parallel system leadership to deliver high-performance on demand and industry-leading technological capabilities—raising the bar for supercomputing-class UNIX servers.

Building on the best

With the very densely packaged pSeries 655, up to 16 servers with as many as 128 processors can be supported in a single 24-inch, 42U system frame (IBM 7040-W42). This is more compute power than eight 16-way pSeries 670 servers. Multiple frames can be aggregated together to form even larger clusters—ideal for many HPC and BI applications. Based on IBM leadership microprocessor technology, the pSeries 655 offers high performance and very favorable price/performance characteristics.

The pSeries 655 server incorporates advanced chip technology, POWER4+™, the next generation of the POWER4™ processor. These copper/silicon-on-insulator (SOI) microprocessor chips are among the fastest 64-bit processors in the world[1].

The POWER4 processor represents the first "SMP-on-a-chip" design for UNIX servers. Up to two processors with Level 2 (L2) cache are incorporated on each chip.

Advanced Multichip Module (MCM) packaging, similar to that used in IBM @server zSeries® servers, places four or eight 1.7 GHz POWER4+ processors into a package that can fit in the palm of your hand. To further enhance performance, 128MB of Level 3 (L3) cache is packaged with each MCM. L3 cache helps stage information more efficiently from system memory to application programs.

The rest of the pSeries 655 is designed to match the speed of the processors. It features memory from 4GB to 64GB and peak aggregate memory to L3 cache bandwidth of 51.2GB/sec. In addition, the peak aggregate I/O bandwidth of the pSeries 655 with POWER4+ processors is 4GB/second. The result is a combination of system architecture, speed and power that delivers extremely efficient and cost-effective data sharing and application throughput.

A flexible package

The physical design of the pSeries 655 server provides tremendous flexibility and ample room for growth. It is packaged as a single MCM-based "thin node" in a half-wide 4U drawer that fits in the system frame. This package includes the processors, system memory, L2 and L3 caches, two hot-swappable Ultra320 disk bays for up to 293.6GB of internal disk storage, three hot-plug/blind-swap PCI-X slots, and integrated 10/100 Mbps Ethernet and serial ports.

In addition to pSeries 655 servers, the system frame can contain up to five 4U I/O drawers (IBM 7040-61D), each with up to 16 hot-swappable 36.4GB, 73.4GB or 146.8GB Ultra3 SCSI disk drives. Each pSeries 655 can have a single I/O drawer attached resulting in up to 2.6TB of disk storage. A frame with five pSeries 655 servers and five I/O drawers can hold up to 13.2TB of disk storage.

The I/O drawer also contains 20 hot-plug/blind-swap PCI or PCI-X bus slots. These slots support 64-bit adapters and offer backward compatibility for 33 MHz 32-bit cards, thus providing investment protection and ample room for growth. The slots allow adapters to be inserted or removed with the I/O drawer in place without system interruption for improved system availability. The pSeries 655 also has recoverable PCI/PCI-X buses, helping to ensure that parity errors do not cause system failure.

Feature	Benefits
POWER4+ microprocessors with L3 cache	• Provides excellent system and application performance and high reliability in a small, efficient dual-processor chip • Offer capacity to grow with 4- and 8-way systems
Dense packaging	• Delivered in 4U high, half-wide drawer package • Supports up to 16 servers (up to 128 processors) per system frame, for superior processing power in minimal footprint
Copper and SOI technology	• Improves 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	• Helps remove performance bottlenecks that can occur when fast processors must wait for data to be moved through the system • Delivers increased memory bandwidth for the needs of HPC applications
Up to 64GB Chipkill™, bit-steering ECC memory	• Allows exploitation of 64-bit addressing for large database or HPC applications • Provides growth options with outstanding throughput • Significantly lowers number of memory failures that can cause system outages, thus increasing system availability • Automatically activates memory spares when multiple memory errors are encountered
Logical partitioning (LPAR)	• Permits up to four UNIX or Linux partitions 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 requirements (requires AIX 5L™ v5.2)
Separate I/O drawer (7040-61D)	• Provides significant increase in disk storage capacity (16 additional disk bays) • Offers significant increase in attachability options (20 additional I/O slots)
Built-in service processor	• Continuously monitors system operations and takes preventive or corrective action for quick problem resolution and high system availability • Allows diagnostics and maintenance to be performed remotely
HPS attachment	• Offers maximum performance, scalability and throughput for parallel message-passing applications • Allows attachment of up to 16 servers (and 32 links) • Provides significantly better peak bandwidth and lower latency than SP™ Switch2
IBM @server Cluster 1600	• Provides centralized management of multiple interconnected 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 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 complex system configuration or tuning • Provides upward binary compatibility to help preserve software investments • Extends application choices with Linux affinity

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 655 system can be divided into up to four 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 systems onto a single platform, the pSeries 655 can increase system utilization, provide greater flexibility of managing the dynamics of multiple workloads in a single server, help 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 v5.2, even allows reallocation of system resources without rebooting the affected partition and 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.

Clustering for growth

Clustering—an advanced computing technique designed to promote performance, scalability and availability—allows multiple servers to be interconnected into a single, unified computing resource. Clusters of pSeries servers, which may include the pSeries 655 are known as the IBM **@server** Cluster 1600. Using software that has been designed to simplify and streamline the management of tens or hundreds of pSeries servers or server partitions in an on demand environment, the Cluster 1600 can help reduce the cost of datacenter administration, while ensuring continuous access to business-critical data and applications.

The Cluster 1600 with pSeries 655 nodes 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 operating system images from a single point-of-control. A higher scalability limit of 512 is available via special order. Up to 64 pSeries 655 servers, each with one to four LPARs can be included in a Cluster 1600 (maximum of 128 LPARs per cluster). Each pSeries 655 server can be interconnected to the High Performance Switch (HPS) with AIX 5L v5.2 and Cluster Systems Management (CSM) cluster management software. The scaling limit for a pSeries 655/HPS cluster is 16 servers and 32 HPS links. As of July, 2004, this scalability limit will be increased to 64 pSeries 655 servers and 128 HPS links. Higher scalability limits are available by special order.

pSeries 655 servers can also be interconnected with cluster networks such as Ethernet or SP Switch2. This provides investment protection for customers who want to add pSeries 655 servers to existing clusters without also having to upgrade the interconnection network.

Outstanding cluster management software

IBM provides a broad array of clustering software which offers distinct advantages in terms of manageability and performance.

For AIX 5L environments, cluster manageability is provided through Parallel System Support Programs (PSSP) for AIX® or Cluster Systems Management for AIX 5L (CSM) software. In Linux environments, cluster manageability is provided through CSM for Linux on pSeries. These products are a collection of functionally rich cluster software tools designed to provide a foundation on which to scale-out workloads and cost-effectively manage hundreds of Cluster 1600 nodes and servers including the pSeries 655. Designed to deliver high performance and extreme horizontal and vertical scalability, they offer low cost, highly effective clustered systems management; easy, continuous upgrades for today's growing workload requirements; and high levels of system, application and data availability.

The cluster management software is designed to build on the systems management tools and commands of AIX 5L, providing "cluster-aware" tools for hardware and software configuration and installation, device management, security administration, error logging, problem management, system recovery and resource accounting—all from a single control workstation.

In a typical cluster, it is common for some processor nodes to be overworked while others are under-utilized—leaving valuable resources unused, especially during off hours. LoadLeveler® for AIX 5L software is designed to optimize cluster resources through dynamic job scheduling and workload balancing, supporting thousands of jobs across a cluster of pSeries 655 servers running the AIX 5L operating system.

File system performance on a pSeries 655 AIX 5L cluster is enhanced with General Parallel File System (GPFS) for AIX 5L. GPFS is a high-performance, shared-disk file system that can provide fast data access to all nodes in a cluster. GPFS is designed to deliver scalable performance and failure recovery across multiple file system nodes, while complying with UNIX file standards.

Parallel Environment for AIX is a high function development and execution environment for parallel applications using pSeries 655 servers. It is designed to provide a complete solution for organizations that need to develop, debug, analyze, tune and execute parallel programs on AIX 5L.

The Parallel Engineering and Scientific Subroutine Library (Parallel ESSL) for AIX and the Engineering and Scientific Subroutine Library for AIX 5L are also available to aid in serial, parallel and scientific application development.

In Linux environments, the Parallel ESSL for Linux on pSeries and ESSL for Linux on pSeries software products provide equivalent functionality.

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 features. Its goal is to create an intelligent IT infrastructure that responds to unexpected capacity demands or to system failures, while at the same time controlling spiraling pressure on critical skills, software and service/support costs.

To boost availability, an integrated service processor in every pSeries 655 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.

The use of IBM Chipkill technology allows detection and correction of most multi-bit memory errors on the pSeries 655. 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].

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 655 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 pSeries 655 system frame includes an 8U 350 volt bulk power supply subsystem. The frame also includes reliability and availability features such as optional Internal Battery Backup (IBB) to keep the system running during brownout conditions and to provide for orderly shutdown in the event of loss of power. For full power loss protection, the pSeries 655 system frame supports optional uninterruptible power supply (UPS) systems in addition to, or in place of, the IBB features.

For near continuous availability, from two to 32 pSeries 655 servers can be clustered with High Availability Cluster Multiprocessing for AIX 5L (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.

The AIX 5L advantage

The pSeries 655 system 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 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 installations. Web-based remote management tools give administrators centralized control of the system, enabling them to 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.

Linux support offers versatility

The Linux operating system is available for the pSeries 655 from one or more Linux distributors, offering packages that include a complement of Open Source tools and applications. Linux does not require the use of AIX 5L although AIX 5L must exist either in the system or in the network to extract diagnostic information. Linux applications can run independently in an LPAR, which allows them to utilize I/O resources and benefit from many of the performance features of the pSeries 655[3]. IBM Global Services and Linux distributors offer service and support offerings for Linux.

Greater application choice

The entire 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 hardware platforms and systems software. IBM is committed to industry-standard, cross-platform technologies that form the core of a flexible computing infrastructure.

Support for these standards in key middleware—including DB2® Universal Database™—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.

The pSeries 655 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.

pSeries 655 at a glance

Minimum server configuration	
Processor drawer (4U)	
Microprocessor:	4-way 1.7 GHz POWER4+ SMP (one 4-way MCM); or 8-way 1.7 GHz POWER4+ SMP (one 8-way MCM)
RAM (memory):	4GB
Internal disk drives:	Two 36.4GB Ultra320 SCSI
Internal disk bays:	Two hot-swappable; up to 293.6GB (36.4GB, 73.4GB and 146.8GB disk drives available)
Expansion slots:	Three hot-plug/blind-swap PCI-X (64-bit)
PCI bus width:	32- and 64-bit
Standard features	
I/O adapters:	Two integrated Ultra320 SCSI controllers
Integrated ports:	Two 10/100 Ethernet; two serial ports for connecting Hardware Management Console
Server expansion	
RAM:	Up to 64GB (ECC, Chipkill)
System (frame) expansion	
p655 server drawer:	Up to 16 half drawers per frame
I/O drawer:	Up to five per frame (one per pSeries 655 server)
Optional battery backup:	Up to six per frame
I/O drawer - 7040-61D (4U)	Maximum of one per pSeries 655
I/O slots:	20 hot-plug/blind-swap PCI or PCI-X slots (64-bit)
Disk bays:	Up to 16 hot-swappable Ultra3 SCSI disk bays; up to 2.0 TB (36.4GB, 73.4GB and 146.8GB disk drives available)
Cluster features	
Cluster attachment:	CSM v1.3 with AIX 5L v5.2 CSM v1.3 with Linux on pSeries PSSP v3.5 with AIX 5L v5.1/5.2
Cluster Interconnect:	Ethernet (CSM and AIX 5L or Linux; PSSP and AIX 5L) High Performance Switch (CSM and AIX 5L) SP Switch2 (PSSP and AIX 5L)
RAS features	Copper, SOI microprocessors Chipkill ECC, bit-steering memory ECC L2 cache, L3 cache Service processor Hot-swappable disk bays Hot-plug/blind-swap PCI/PCI-X slots Dynamic Processor Deallocation Dynamic deallocation of logical partitions and PCI bus slots Battery backup (optional) UPS (optional)
Operating systems	AIX 5L Versions 5.1/5.2 Selected Linux distributions*
Power requirements	200 to 240v; 380 to 415v; 480v AC
System frame dimensions	79.7"H x 30.9"W x 56.8"D (202.5 cm x 78.5 cm x 144.3 cm); Weight: 3,613 lb (1,642 kg)**
Warranty:	On-site 24x7 for one year (limited) at no additional cost

* Details on supported Linux distributions may be found at **ibm.com**/servers/eserver/pseries/linux/whitepapers/linux_pseries.html

** With slim-line doors and populated with 16 pSeries 655s. Weight will vary when disks, adapters and other peripherals are installed.

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. These can help companies test possible solutions, obtain financing, plan and implement applications and middleware, manage capacity and availability, improve performance and obtain technical support across their entire infrastructure. The result is an easier way to help businesses handle complexities and rapid growth in an on demand world.

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

Backed by IBM

pSeries 655 systems are backed by worldwide service and support from IBM. The one-year, end-to-end basic warranty includes AIX 5L operating system support, hardware fixes, manned phone hardware support and call tracking.

The hardware warranty provides 24x7x365 coverage. 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.

Flexible Financing

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™.

Summary

Leveraging advanced technology from across the IBM @server product line, the pSeries 655 delivers powerful performance and density for HPC applications, enhanced flexibility and cluster management capabilities, and advanced management capabilities designed for uninterrupted operation and lower total cost of ownership.

The sophisticated features and cluster configurability of the pSeries 655 make it an excellent platform to meet the demands of applications such as scientific and technical computing including both large-scale computational modeling and consolidation of diverse HPC workloads and BI.

When clustered as part of a system frame, pSeries 655 servers can form, quite simply, the most powerful, flexible and manageable high-end UNIX system available from IBM today. It is a solution that will help businesses meet their HPC and BI needs—today and into the future.

For more information

To learn more about the IBM @server pSeries 655, 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**/common/ssi

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All performance estimates are provided “AS IS” and no warranties or guarantees are expressed or implied by IBM. Buyers should consult other sources of information, including system benchmarks, to evaluate the performance of a system they are considering buying.

[1] Based on SPEC CPU2000 benchmarks on a 1.7GHz POWER4+ pSeries 655 processor available at www.spec.org. Submitted to SPEC on January 27, 2004.

[2] IBM Study by Timothy J. Dell, “A White Paper on the Benefits of Chipkill-correct ECC for PC Server Main Memory,” (November 19, 1997) available at:
ibm.com/servers/eserver/pseries/campaigns/chipkill.pdf

[3] Many of the p655 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

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