

IBM @server pSeries 655



System frame for pSeries 655 server

Highlights

- ***Provides exceptional price/performance characteristics for demanding high performance computing (HPC) applications***
- ***Offers flexible, ultra-dense packaging designed for scalable growth***
- ***Includes 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 and business intelligence (BI) applications, IBM has created the IBM @server™ pSeries™ 655 — the latest member of its family of technologically advanced, 64-bit, symmetric multiprocessing (SMP) POWER4™ 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 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 high performance computing, and either an industry standard or SP™ Switch2 interconnection. It draws on IBM clustered and massively parallel system leadership to deliver 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 equivalent to the compute power of 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 favorable price/performance characteristics — delivering both 1.1 and 1.3 GHz, 64-bit processor speeds and up to 32GB of main memory.

The pSeries 655 server incorporates advanced chip technology, the POWER4 microprocessor. This copper/silicon-on-insulator (SOI) microprocessor chip is among the fastest 64-bit processors in the world.¹ In fact, POWER4 microprocessors are so advanced that they have received the best workstation/server processor award from MicroDesign Resources.²

POWER4 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 either four 1.3 GHz or eight 1.1 GHz POWER4 processors into a package that can fit in the palm of one’s hand. To further enhance performance, 128MB of Level 3 (L3) cache is packaged with the MCM. L3 cache helps stage information more effectively from processor memory to application programs.

The rest of the pSeries 655 is designed to match the speed of the POWER4 processors. It features a maximum memory of 32GB and a memory bandwidth of 51.2GB/sec. In addition, the aggregate I/O bandwidth of the pSeries 655 is 4GB/sec. (2GB/sec. in the base server and 2GB/sec. in the optional I/O drawer). 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 single MCM-based “thin nodes” in a half-wide 4U drawer that fits in the system frame. This package includes the 1.3 GHz or 1.1

GHz processors, 4GB to 32GB of system memory, L2 and L3 caches, two disk bays for up to 293.6GB of internal disk storage, three hot-plug/blind-swap PCI-X slots, and integrated 10/100 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 18.2GB, 36.4GB, 73.4GB or 146.8GB Ultra3 SCSI disk drives. Each pSeries 655 server 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 bus slots for a maximum of 23 per pSeries 655. 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 PCI 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 buses, helping to ensure that parity errors do not cause system failure.

Feature	Benefits
POWER4 microprocessors	<ul style="list-style-type: none"> • Provide improved system performance and higher reliability in a smaller, more efficient package ("SMP-on-a-chip") • Expand performance and memory bandwidth for HPC workloads • Provide capacity to grow with 4- and 8-way systems • Offer reliability due to multichip module design
Dense packaging	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Improves processor performance and reliability while using less power and producing less heat to help conserve energy
L3 cache	<ul style="list-style-type: none"> • Provides increased application performance
High memory and I/O bandwidth	<ul style="list-style-type: none"> • 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 (1.3 GHz processors)
Up to 32GB memory	<ul style="list-style-type: none"> • Allows exploitation of 64-bit addressing for large database or HPC applications • Provides growth options with much greater throughput
Chipkill™, bit-steering ECC memory	<ul style="list-style-type: none"> • Significantly helps to lower number of memory failures that cause system outages, thus increasing system availability • Provides memory spares that are activated when multiple memory errors are encountered
Logical partitioning	<ul style="list-style-type: none"> • Permits multiple applications to be consolidated on a single server, reducing the number of systems to manage and maintain • Offers greater flexibility in using available capacity and matching resources to changing business requirements
Separate I/O drawer	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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
Concurrent 32- and 64-bit application support	<ul style="list-style-type: none"> • Allows running 32- and 64-bit applications at the same time, helping to protect existing investments while enabling a move to more advanced technology
SP switch attachment	<ul style="list-style-type: none"> • Allows attachment to a high-speed SP Switch2 providing performance advantages in a cluster environment
IBM @server Cluster 1600	<ul style="list-style-type: none"> • Provides centralized management of multiple systems • Provides ability to handle unexpected workload peaks by sharing resources • Allows for more granular growth so user demands can be readily satisfied
AIX 5L™ operating system	<ul style="list-style-type: none"> • 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

Building on IBM mainframe heritage, the pSeries 655 delivers logical partitioning (LPAR). Each system can be divided into up to two “virtual” servers, each with its own memory, processors, I/O and copy of the AIX® operating system. Unlike partitioning techniques available on other UNIX servers, IBM’s LPAR implementation provides greater flexibility in matching resources to workloads. Based on business requirements and application needs, resources can be assigned and managed in any combination using a Hardware Management Console for pSeries workstation. The use of LPAR can result in more efficient use and greater availability of the system.

Clustering for growth

Clustering allows multiple servers to be interconnected into a single computing resource for improved availability, scalability, manageability and performance. The pSeries 655 as a Cluster 1600 node builds upon more than a decade of IBM cluster management technology — providing leadership administration at greatly reduced costs.

With the Cluster 1600 and AIX operating system, 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 32 pSeries 655 servers, each with one or two LPARs, can be included in the Cluster 1600. Each LPAR has its own AIX operating system image. pSeries 655 servers can be clustered together with either an industry standard (10/100 Mbps Ethernet or 1 Gbps Ethernet) or SP Switch2 interconnection with the SP Switch2 PCI-X adapter.

The Cluster 1600 with the pSeries 655 is especially well suited for diverse engineering and scientific workloads where sharing data and maximizing job throughput is important, for solving the world’s largest and most complex problems in HPC, and for hosting extremely large and growing corporate data warehouses.

Outstanding cluster management software

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

In a typical cluster, it is common for some processor nodes to be overworked while others are underutilized — leaving valuable

resources unused, especially during off hours. LoadLeveler® for AIX Version 3.1 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.

File system performance on a pSeries 655 cluster is enhanced with General Parallel File System (GPFS) for AIX Version 2.1. 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 Version 3.2 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.

The Parallel Engineering and Scientific Subroutine Library (Parallel ESSL) for AIX Version 2.3 and the Engineering and Scientific Subroutine Library for

AIX Version 3.3 are also available to aid in serial, parallel and scientific application development.

Cluster manageability is provided through Parallel System Support Programs (PSSP) for AIX software. This product is a collection of functionally rich cluster software tools designed to provide a foundation on which to scale 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, PSSP offers 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 latest release, PSSP 3.5, 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.

The AIX 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 is tuned for application performance and is recognized as state-of-the-art in systems and network management.

The pSeries 655 is supported by AIX 5L Version 5.1 with plans announced to support Version 5.2 in the second quarter of 2003. At that time, IBM also plans to allow customers to manage clusters of pSeries 655 servers with the Cluster Systems Management for AIX 5L product running under AIX 5L v5.2.

AIX 5L delivers Java™ technology, Web performance and scalability enhancements for managing single servers to large, complex 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 incorporates Workload Manager, which can help ensure that applications remain responsive even during periods of peak system demand.

High availability, all day, every day

To help ensure strategic applications remain highly available, the pSeries 655 incorporates additional enterprise-class technology.

Each pSeries 655 system includes an integrated service processor — a computer within a computer — that constantly monitors the system's vital signs. In the event of a malfunction, the service processor — working with the AIX 5L operating system — is capable of "calling home" by automatically dialing out to an IBM service center, often before any problem is apparent to users or system administrators. In this fashion, the service technician may be able to correct the problem and restore system function remotely without interruption.

The pSeries 655 uses error checking and correcting (ECC) memory technology to enhance reliability and error correction of L2 and L3 cache memory, as well as main memory. ECC technology is designed to detect single- and double-bit errors and correct all single-bit errors.

To further maximize system availability, the pSeries 655 server has built-in fault and error correction functions. For main memory, Chipkill ECC memory technology — developed by IBM for mainframe servers — detects multiple bit errors and corrects most of them transparently. IBM studies indicate that IBM systems with Chipkill memory are up to 100 times less likely to experience an outage due to memory failure.³ In addition, the pSeries 655 provides 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 bit memory errors exceed a threshold.

pSeries 655 servers also feature 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 is designed to dynamically take the faulty component offline. Replacement of the failing component can be scheduled during normal service to minimize system and application downtime.

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 (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 Linux advantage

For customers who have a requirement for running the Linux[®] operating system, IBM anticipates that support for the pSeries 655 will be available from one or more Linux distributors in the first half of 2003.

This opens up the possibility of simplifying a computing infrastructure by providing a pervasive, open platform for application development and deployment. Linux applications can benefit from many of the reliability, flexibility and performance advantages of the pSeries 655.⁴

Greater application choice

The IBM **@server** product line is about uncompromising flexibility in selecting, building and deploying the applications businesses need. 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 are at the heart of a flexible computing infrastructure.

Support for these standards in our key middleware, including DB2[®] Universal Database™, means that companies do not need to be locked into a single platform as their businesses grow. The result is the flexibility to deploy applications in a cost-effective way.

The pSeries 655 server represents the IBM **@server** commitment to true 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 and Open Source applications to run on AIX with a simple recompilation. The AIX Toolbox for Linux Applications provides utilities, editors, debuggers and other application development tools to aid in this recompilation.

Tools for managing a business

The IBM **@server** product line is backed by a comprehensive suite of offerings and resources that provides value at every stage of IT implementation. These tools 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 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 basic warranty is end-to-end and includes operating system support, hardware fixes, manned phone hardware support and call tracking.

The basic warranty provides 8AM - 5PM, on-site, next-business-day service, and warranty upgrades are available for same-business-day service or 24x7x365 coverage with a four-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 655 delivers powerful performance and density for high performance computing 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 needs — today and into the future.

pSeries 655 at a glance

Minimum server configuration

Processor drawer (4U)

Microprocessor:	4-way 1.3 GHz POWER4 SMP (one 4-way MCM); or 8-way 1.1 GHz POWER4 SMP (one 8-way MCM)
RAM (memory):	4GB
Internal disk drive:	Two 18.2GB Ultra3 SCSI
Internal disk bays:	Two
Expansion slots:	Three PCI-X (64-bit)
PCI bus width:	32- and 64-bit

Standard features

I/O adapters:	Two integrated Ultra3 SCSI controllers for two 18.2GB disk drives
Integrated ports:	Two 10/100 Ethernet; two serial ports for connecting Hardware Management Console

Server expansion

RAM:	Up to 32GB
Internal disk storage:	Up to 293.6GB (36.4GB, 73.4GB and 146.8GB disk drives available)
Attachment:	SP System Attachment Adapter for use in a Cluster 1600 configuration

System (frame) expansion

p655 server drawer:	Up to 16 half drawers per frame
I/O drawer:	Up to five per frame
Optional battery backup:	Up to six per frame

I/O drawer (4U)

I/O slots:	20 hot-plug/blind-swap PCI slots (64-bit)
Internal disk storage:	Up to 16 hot-swappable Ultra3 SCSI disk bays; up to 2,348.8GB (18.2GB, 36.4GB, 73.4GB and 146.8GB disk drives available)

RAS features:

Copper, SOI microprocessors
Chipkill ECC, bit-steering memory
ECC L2 cache, L3 cache
Service processor
Hot-swappable disk bays in I/O drawer
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 system:	AIX 5L Version 5.1
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Power requirements:	200 to 240v; 380 to 415v; 480v AC
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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)*
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Warranty:	On-site, 8AM to 5PM M-F, next-business-day for one year (limited) at no additional cost; Warranty upgrades and maintenance are available
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* With slim-line doors and populated with 16 pSeries 655s. Weight will vary when disks, adapters and other peripherals are installed.

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/ibmlink



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¹ SPECcpu2000 benchmarks as of November 12, 2002 available at www.spec.org

² Source: www.mdonline.com, January 30, 2002

³ 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: www.ibm.com/servers/eserver/pseries/campaigns/chipkill.pdf

⁴ 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: www.ibm.com/servers/eserver/pseries/linux/whitepapers/linux_pseries.html