



Fujitsu PRIMEPOWER Server Family Offers Industry-Leading Capabilities

September 2005

PREPARED FOR

Fujitsu

TABLE OF CONTENTS

Executive Summary	1
PRIMEPOWER Revealed	1
Key PRIMEPOWER Components	3
Industry-Leading Solaris	3
The Fujitsu SPARC Microprocessor	4
PRIMEPOWER System Architecture	4
PRIMEPOWERs Combine in a PRIMECLUSTER	6
Scalability Server	7
Parallel Server	7
HA Server	7
Enterprise Edition	8
PRIMEPOWER System Management	8
Resource Management	8
High-Availability Management	9
Security Management	9
Review of Key Points	10
Endnotes	12

ABOUT THIS DOCUMENT

This paper offers an overview of the PRIMEPOWER family of servers. It is one in a series of six white papers that highlight PRIMEPOWER hardware and software capabilities from a customer-benefits perspective. Further information concerning PRIMEPOWER's attributes can be found in the other five white papers in this series, and on the Fujitsu websites: www.fujitsu.com/global/services/computing/server/unix/.

Executive Summary

Fujitsu's PRIMEPOWER series is a state-of-the-art server family suitable for standalone server or cluster use. Based on the industry-standard Solaris Operating System and the Fujitsu SPARC64 V microprocessor as well as many novel system architecture features, the PRIMEPOWER family offers many benefits to CIOs, CTOs, and other IT team members responsible for selecting the optimum infrastructure. PRIMEPOWER's industry-leading capabilities in performance, scalability, manageability, high availability, and other areas beneficial to the infrastructure place it in a strong position. As a result, the end user infrastructure customer will be able to enjoy new levels of service quality.

Although CIOs and CTOs need not understand the drill-down details of PRIMEPOWER's capabilities, they must appreciate how such capabilities can benefit their IT environment. As such, this white paper provides a suitable overview for IT executives of PRIMEPOWER's industry-leading capabilities.

PRIMEPOWER Revealed

With headquarters in Tokyo and \$44.5 billion in revenues for the fiscal year ending March 31, 2005, Fujitsu maintains nearly 160,000 employees in 65 countries. Fujitsu is a leading global OEM of computer hardware and software.¹ Its range of platform products includes the SPARC64-based PRIMEPOWER offerings, the Intel-based PRIMERGY, PRIMEQUEST, and many notebook and tablet (mobile) product offerings. The firm also offers disk arrays and other hardware.

Fujitsu is number four in worldwide UNIX market share and plans to double its UNIX market share in the next three years. Worldwide coverage is provided by Fujitsu in Japan and the AP (Asia-Pacific) region, Fujitsu Computer Systems (FCS) in the United States, and Fujitsu Siemens Computers (FSC) in the EMEA (Europe-Middle East-Africa) region. Fujitsu has shipped more than 60,000 PRIMEPOWER servers, which have an excellent industry benchmark record.²

Fujitsu bases its PRIMEPOWER platforms on the firm's mainframe heritage³ to provide superior reliability, availability, and serviceability (RAS) characteristics for both the PRIMEPOWER server and the new SPARC64 V microprocessor. The company also relies on its supercomputer heritage to provide a superior server architecture (e.g., a high-speed crossbar interconnect).

This document is copyrighted © by Ideas International, Inc. (IDEAS) and is protected by U.S. and international copyright laws and conventions. This document may not be copied, reproduced, stored in a retrieval system, transmitted in any form, posted on a public or private website or bulletin board, or sublicensed to a third party without the written consent of IDEAS. No copyright may be obscured or removed from the paper. All trademarks and registered marks of products and companies referred to in this paper are protected.

This document was developed on the basis of information and sources believed to be reliable. This document is to be used "as is." IDEAS makes no guarantees or representations regarding, and shall have no liability for the accuracy of, data, subject matter, quality, or timeliness of the content. The data contained in this document are subject to change. IDEAS accepts no responsibility to inform the reader of changes in the data. In addition, IDEAS may change its view of the products, services, and companies described in this document.

IDEAS accepts no responsibility for decisions made on the basis of information contained herein, nor from the reader's attempts to duplicate performance results or other outcomes. Nor can the paper be used to predict future values or performance levels. This document may not be used to create an endorsement for products and services discussed in the paper or for other products and services offered by the vendors discussed.

Table 1. New PRIMEPOWER Series Models Compared

PRIMEPOWER	Model 900	Model 1500	Model 2500
Server Function	Rack-mount midrange	Enterprise-class business	High-end enterprise class business
Maximum Number of System Boards	2	4	16
Number of CPUs	Up to 16	Up to 32	Up to 128
Amount of PC266 DIMM (with ECC)	128 GB	256 GB	512 GB
Number of Maximum PCI Slots	36 (33/66 MHz x12, 33 MHz x24)	72 (33/66 MHz x24, 33 MHz x48)	320 (33/66 MHz x96, 33 MHz x224)
Maximum Ethernet Ports	8	16	80
Maximum Serial Ports	8	16	80
Maximum Storage Bays	16	32	128
Redundant Power Supply	200 VAC	200 VAC	200 VAC
Redundant Air Cooling	Front-to-back	Bottom-to-top	Bottom-to-top
Hard Partitions with Dynamic Reconfiguration	8	15	15

The PRIMEPOWER offerings include the PRIMEPOWER 900, 1500, and 2500. These SMP machines all run on, and are shipped with, the Solaris Operating System. PRIMEPOWER servers use the new 2+ GHz Fujitsu-designed SPARC64 V microprocessor. This microprocessor complies with the SPARC International V9 Level 2 specification. Table 1 (above) compares the main features of these PRIMEPOWER models.

Table 2 (next page) compares the high-availability features of the three high-end PRIMEPOWER models. The key below the table highlights the underlying technology fundamental to providing some of these capabilities. Table 2 shows that PRIMEPOWER provides built-in high availability for its component parts that is second to none in the server industry.

Table 2. New Series Models 900, 1500, and 2500 High-Availability Features Compared

PRIMEPOWER Component		Redundancy	Hot Plug	900	1500	2500
System Board with Solaris Kernel	Processor	Y (DD)	Y (DR)	Y	Y	Y
	Memory	Y (CK)	Y (DR)	Y	Y	Y
	PCI Connection	Y (IOMP)	Y (DR)	Y	Y	Y
	DC-DC Converter	Y	Y (DR)	NA	NA	Y
PCI	PCI Board ⁴	Y (IOMP)	Y (DR)	Y	Y	Y
	PCI Card	Y (IOMP)	Y (PHP)	Y	Y	Y
Crossbar-to-Backplane	L2 Crossbar ⁵	Y	NA	NP	NA	Y
	Clock Distributor	Y	NA	NP	NA	Y
	DC-DC Converter	Y	NA	NP	Y	Y
Power Supply		Y	Y	Y	Y	Y
Cooling (Fan Tray)		Y	Y	Y	Y	Y
System Control	Control Board	Y	Y	NA	Y	Y
	Remote Cabinet Interface (RCI) ⁶	Y	Y	NA	Y	Y
	Control LAN	Y	Y	NA	Y	Y
Network		Y (IOMP)	Y	Y	Y	Y
Storage (FC and SCSI)		Y (IOMP)	Y	Y	Y	Y

Key: DD=Dynamic Degradation; DR=Dynamic Reconfiguration; IOMP=I/O Multipathing; CK=Chipkill-Like Technology; PHP=PCI Hot Plug; NA=Not Applicable; NP=Not Present; Y=Yes

Key PRIMEPOWER Components

The operating system and microprocessor are key components of any mission-critical server and the PRIMEPOWER models are no exceptions. Recognizing the need to provide an industry-leading operating system and microprocessor, Fujitsu's earlier PRIMEPOWER servers used the best selling Solaris Operating System and a SPARC-compliant microprocessor.

Industry-Leading Solaris

The Solaris tradition of industry-leading robustness and performance continues. The PRIMEPOWER strategy is to use Solaris as a global standard for high independent hardware vendor (IHV) and independent software vendor (ISV) support as well as to allow Fujitsu to develop its own server components for high performance and high availability.

Solaris is a well-known, industry-accepted (first in UNIX market share) operating system and is the subject of a separate white paper in this series. From the IT infrastructure point of view, it is important to remember that:

» Almost every UNIX application of interest to the IT community has been ported to Solaris (over 8,000).

SPARC64 V MICROPROCESSOR REVEALED

The latest in a long line of Fujitsu-designed, SPARC International specification-compliant microprocessors, the SPARC64 V brings new power and mainframe high-availability features to the SPARC environment. The microprocessor has some 260 million transistors and is built on 90 nm copper technology. It consumes a low 65 watts at a clock speed of 2+ GHz. Since such high clock rates usually produce high levels of heat (up to twice as high as slower speeds), this low power consumption contributes to the PRIMEPOWER's reliability.

For speedy operation on PRIMEPOWER information, the SPARC64 V enjoys an on-chip, non-blocking Level 1 128 KB instruction and a 128 KB data cache, as well as an on-chip 4 MB Level 2 cache. These caches help ensure optimum PRIMEPOWER performance by having data and instructions ready for the microprocessor's use as soon as possible.

To further speed PRIMEPOWER operation, the SPARC64 V uses state-of-the-art branch prediction, speculative fetch, and parallel and out-of-order instruction execution for six arithmetic units (two for address generation, two for floating point, and two for fixed point). Up to six general or four floating-point operations can run simultaneously.

Mainframe High Availability

A completely novel feature set of the SPARC64 V is its mainframe-like high-availability capabilities. As a result of the presence of this feature set, no other microprocessor for the UNIX domain is comparable to the SPARC64 V's ability to reduce errors and enhance server system availability in the IT infrastructure.

The SPARC64 V maintains parity protection on its arithmetic units and architecture registers, guaranteeing data path integrity. Moreover it has Error Correcting Code (ECC)-based single-bit automatic correction and double-bit detection of errors on its built-in Level 2 cache for both data and tags. It also provides ECC on its Level 1 cache for data duplicates the Level 1 tag array in the Level 2 cache. Thus, if there were a Level 1 tag error, immediate recovery is possible by restoring the tag information from the copy in Level 2 cache. Finally, ECC is provided on the microprocessor's low-latency, high-throughput internal buses.

For automatic error recovery, the SPARC 64 V allows automatic, hardware-based instruction retry for intermittent errors. In addition, while there is ECC- or duplication-based automatic correction for cache errors, if the number of correctable errors occurring in a processor or cache exceeds a threshold, Solaris recognizes the condition as a prediction of an uncorrectable error and can logically take the offending unit offline.

- » Solaris is based on, and is compatible with, the open SPARC V9 Level 2 architecture and fully supports 64 bits including a 64-bit virtual address space and 64-bit file systems. It is also compatible with 32-bit applications. For the vast majority of 32-bit applications, no recompilation is necessary.
- » Due to Solaris's affinity with SPARC and its scalability, IT applications that run on the high-end PRIMEPOWER will also run on other PRIMEPOWER platforms, and, in fact, will run on a wide range of servers (from workstations to large SMP machines and clusters) from other Solaris-based server manufacturers.
- » In addition to the Solaris media kit, Fujitsu ships additional Solaris-compliant software called the Enhanced Support Facility (ESF). This software covers system administration, automatic power control, and various drivers for PRIMEPOWER hardware such as the System Control Facility (SCF).

It is clear from the first three bullets above that Solaris provides an IT infrastructure with the power needed for today's advanced applications. For the infrastructure using PRIMEPOWER, the additional software mentioned in the fourth bullet, which does not interfere with Solaris in any way, provides still more value.

The Fujitsu SPARC Microprocessor

The Fujitsu-designed SPARC microprocessor lies at the heart of the PRIMEPOWER family of servers. It has been designed by Fujitsu to include, for example, mainframe RAS features to ensure high availability and unique internal caches and buses for performance. An overview of the SPARC64 V microprocessor is given in the sidebar, "SPARC64 V Microprocessor Revealed." (This microprocessor is also the subject of a separate white paper in this series.)

To further enhance RAS, the previously mentioned SCF handles notification of hardware-based error occurrences. Error information, both fatal and non-fatal, and error history are accumulated by the SCF for further analysis. This information is obtained from the SPARC64 V through its industry-standard, dedicated JTAG⁷ interface pins, which in turn pass the error information to the SCF.

PRIMEPOWER System Architecture

PRIMEPOWER's hardware architecture is based on Fujitsu's long experience with mainframe and supercomputer architectures. Much of this hardware remains unique. Consider, for example, the interconnect fabric, known as the crossbar, which links PRIMEPOWER system boards on the Models 1500 and 2500.⁸ This is a fabric switched crossbar connection between backplanes, which is, in turn, attached to PRIMEPOWER system boards.

In a fully populated Model 2500, the crossbar connects two backplanes with a total of sixteen system boards. Each system board installs eight SPARC64 V microprocessors and 64 GB⁹ of ECC memory. Fujitsu's crossbar runs at an unheard of 520 MHz¹⁰ (Models 900 and 1500 use a 270 MHz clock) and provides an aggregate 133 GB/sec. bandwidth (provided through two 66.5 GB/sec. crossbars that may be degraded if necessary). Throughput is 8.3 GB/sec. in or out for each system board.

Crossbars speed up performance and increase system availability. They minimize the distance between system boards and reduce latency, lower the number of parts, and eliminate the use of cabling. The crossbar system actually comprises two 66.5 GB/sec. crossbars. Should a crossbar suffer a failure, it can be isolated, and the remaining crossbar can be reconfigured and restarted to use the remaining crossbar resources. With these features, the PRIMEPOWER server does not have to be removed from service.

Infrastructures that need to deal with the high-performance requirements of high-system or peak-load situations in OLTP, data warehousing, or other channel-intensive applications will be best served by PRIMEPOWER with this state-of-the-art, industry-leading, high-clock-rate, high-bandwidth crossbar.

There are other architecture features of interest as well that enhance the IT infrastructure. For example, as Table 2 indicates, PRIMEPOWER offers a dual-clock configuration. At the failure of the operating clock, an automatic reboot reconfigures the PRIMEPOWER to the second clock.

PRIMEPOWER also features industry-leading resource dynamic reconfiguration, I/O Multipathing, and PCI board hot swap. Finally, hard partitioning for error containment and system security with software partition-like granularity (down to one CPU and 1 GB of memory¹¹ with PRIMEPOWER's new Extended Partitioning [XPAR]) provides the best features of both hardware and software partitions.¹² XPAR allows dynamic, real-time resource modification and redistribution to match varying loads. The result is a large decrease in cost of ownership as different workload situations can be accommodated with the same server. XPARs are electronically separated partitions. In combination with containers from Solaris 10, the partitioning capabilities of the PRIMEPOWER platforms have endless partitioning flexibility.

Finally, the new PRIMEPOWER series offers architectural flexibility through the separation of its PCI slots for I/O from its system boards. Previously, a server had to add system boards to increase I/O. This is no longer necessary as the PCI expansion is physically separate in PRIMEPOWER's I/O (PCI/Disk) boxes. Each Model 2500 system board connects to two such PCI/Disk boxes. (Further details on all of these architectural features and functions and their value to the IT infrastructure are available in the PRIMEPOWER system architecture white paper in this series.)

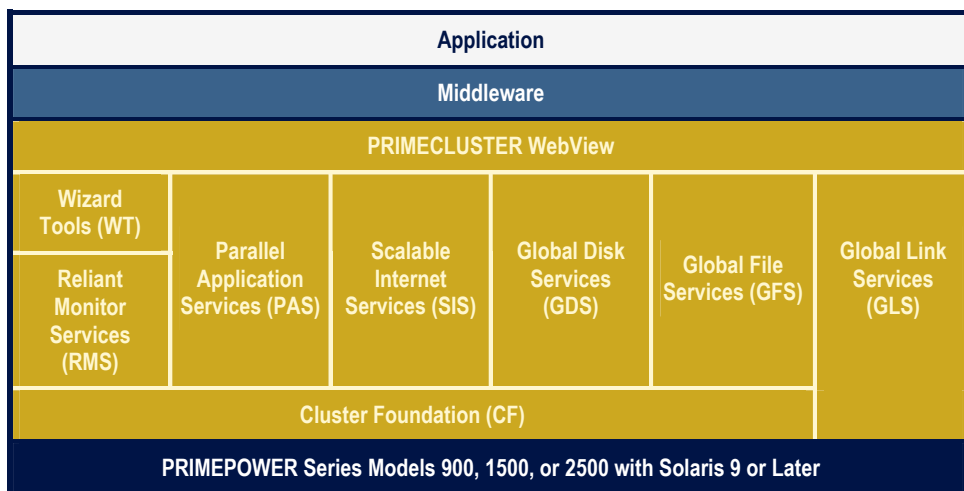
PRIMEPOWERs Combine in a PRIMECLUSTER

PRIMEPOWER servers are designed for the highest levels of availability and scalability. When PRIMEPOWER nodes are combined using Fujitsu's fourth-generation PRIMECLUSTER with its state-of-the-art clustering software modules, the optimum IT infrastructure is possible.

PRIMECLUSTER is a modular software-based product. Its modules can be mixed and matched to meet cluster node, storage, and network infrastructure needs for high availability, scalability, parallel database operation, and manageability. PRIMECLUSTER grows out of Fujitsu's long history with UNIX-based clusters. This experience spans clusters with mainframe-based technology (SynfinityCLUSTER) and a mature cluster system offered by Fujitsu Siemens Computers (Reliant UNIX), which is rooted in technology derived from Pyramid Technologies.

The modular software architecture of PRIMECLUSTER is shown in Figure 1. A WebView module provides a Java-based GUI administrative view, enabling PRIMECLUSTER to be managed from a single console. The modular structure built on the Cluster Foundation (CF) module allows the easy addition of future modules to accommodate other cluster needs as they arise.

Figure 1. PRIMECLUSTER Modular Software Architecture



The separately purchasable, yet fully integrated modules required for the four PRIMECLUSTER products (Scalability Server, Parallel Server, HA Server, and Enterprise Edition) are shown in Table 3 along with a brief module description in the table key. (Further details on these modules and PRIMECLUSTER may be found in a separate white paper in this series.)

Table 3: PRIMECLUSTER Module Requirements

PRIMECLUSTER Product	Module							
	CF	RMS	WT	PAS	SIS	GDS	GFS	GLS
Scalability Server	R				R			
Parallel Server	R			R		R	R	R
HA Server	R	R	R			R	R	R
Enterprise Edition	R	R	R	R	R	R	R	R

Key: R = Required. The CF module provides cluster architecture components. RMS provides failover management components. WT provides Wizard tools for applications. PAS provides parallel database components. SIS provides load balancing components. GDS provides storage mirroring and management components. GFS provides file-sharing and scalability components. GLS provides components for network or card failures.

Scalability Server

The PRIMECLUSTER Scalability Server provides service to client requests (via the Internet or direct connections). Typically, it is suitable for a front-end web or proxy server or an application server in a tiered architecture. It is configured with a gateway node with one or more backup gateway nodes. Various other cluster nodes (service nodes) provide the responses to the user requests. In the Scalability Server configuration, PRIMECLUSTER provides dynamic load balancing for TCP/IP-based multi-instance applications. This load balancing provides scaling capabilities for these applications that are often CPU-intensive. To provide high availability for this scaling, especially if a node fails, the load can be redistributed. Those responsible for the IT infrastructure use Scalability Server to accommodate unpredicted or time-varying loads in their business environment.

Parallel Server

PRIMECLUSTER Parallel Server provides the cluster operating environment for parallel databases such as Oracle9i RAC and Oracle 10g. It is suitable for the database tier of a multi-tiered architecture. For optimum use of Oracle's unique small message and lock caching scheme, Cache Fusion, PRIMECLUSTER employs a private, low-latency, message-passing protocol. With Parallel Server, the database is available even if a node fails. Moreover, database parallel access is synchronized, and the preferred architectural concept of a single database design with a database instance on each cluster node can be maintained for the IT infrastructure.

HA Server

The HA Server is suitable typically as an application server in a tiered architecture. It delivers application high availability through resource monitoring (by means of "detectors" in the PRIMECLUSTER nodes, network, and applications), failure detection, local recovery where possible, and failover services. With the HA Server, PRIMECLUSTER administrators can choose the cluster architecture environment's most appropriate configuration. The choice of configurations includes the commonly used multiple node backup, multiple node failover, cascading failover, selective failover, manual or automatic failover, and local recovery.

Enterprise Edition

The Enterprise Edition is the high-end PRIMECLUSTER offering and it performs all the required cluster operations for the business-critical IT infrastructure. It is possible, for example, to put together a multi-node PRIMECLUSTER with the PRIMEPOWER Model 2500 servers. Each of these servers can have an unheard of 128 SPARC64 V microprocessors, 512 GB of PC266 ECC RAM, 320 PCI I/O slots, and 15 hard partitions with dynamic degradation and dynamic reconfiguration capability. Such a cluster exceeds the capability of anything other available in the industry.

PRIMEPOWER System Management

The optimum delivery of all of the PRIMEPOWER capabilities discussed in this white paper requires the highest level of server system management. This high level of system management means that all of the system's mission-critical attributes are available at the same time. This quality of service is critical. Without it the attributes lose most, if not all, of the value they provide to the IT infrastructure user and those responsible for providing and maintaining that infrastructure.

Fujitsu provides PRIMEPOWER system software and dedicated hardware facilities to manage the three key components of the server family's operation. These components include computing resource management, high-availability management, and security management. All of these management capabilities are accommodated in an integrated manner through the use of PRIMEPOWER's GUI-based Server System Manager (SSM) browser.

Resource Management

The ability to divide a single physical system into multiple virtual systems has long been available in mainframes. Such hardware partitioning is available today for UNIX-based SMP machines. PRIMEPOWER's hardware partitioning offers virtual system performance and quality of service guarantees. It provides defective device isolation until repair can be accomplished, which occurs without taking the partition out of service. Also available is inter-partition security so that one virtual system does not become a security risk to another. Such hardware partitioning is often of greater value than firmware-controlled software or logical partitioning wherein faults can affect other partitions that share joint resource ownership.

With PRIMEPOWER XPAR, it is possible to achieve partition granularity down to one CPU and 1 GB of memory (a part of a system board),¹³ similar to the granularity levels expected of software partitioning, but with the isolation advantages of hardware partitioning. Moreover, XPARs use dynamic reconfiguration to add or remove partition resources without taking the partition down. The partition continues to be highly available for user service. This flexibility is also similar to what has been traditionally achieved with software partitioning.

Where even the flexible XPARs are not sufficient to meet resource allocation needs, PRIMEPOWER offers Solaris 10 containers for CPUs and memory allocated to processes within an XPAR (but not across XPARs).

Resource management is not possible without knowing the status of the PRIMEPOWER resources. PRIMEPOWER administrators use GUI-based tools to track the state of their partition or server resources. With the aid of such monitoring, administrators can review workloads and performance, use dynamic reconfiguration to change resources to meet changing needs, and more.

High-Availability Management

To ensure the best in high availability, PRIMEPOWER monitors itself during system boot-up and system operation so that defective subsystems and components can be isolated. In this manner, any effect on system availability is held to a minimum. In the long term, PRIMEPOWER's goal is to autonomically perform such detection and isolation without the need for human intervention. Table 2 outlines PRIMEPOWER's industry-leading managed high-availability features and functions.

Monitoring of PRIMEPOWER's processors, memory subsystem, operating system, and disk storage is performed by PRIMEPOWER's redundant System Control Facility (SCF). SCF depends on an independent processor for its system management capabilities. It operates independently of the system's SPARC64 V microprocessors.

During system boot-up, the SCF looks for the possibility of system "hangs" generated by hardware failures. If a defective, or potentially defective, device is detected, the system is restarted after the defect is isolated. Note that when the SCF detects a CPU failure (even during boot-up), for example, it reports this event to the System Management Console (SMC). In turn, the SMC keeps logs and reports to the Remote Customer Support System (REMCS).

All of these processes, including whether or not a partially failed device is still used, and when it is replaced, is subject to the particular operating policy of the IT environments. Such dynamic degradation is under the control of the system administrator. Even after the PRIMEPOWER has booted successfully, the SCF is monitored to detect undesired operation. Here too, a failing or failed device is isolated to minimize the need to bring the system down.

Finally, PRIMEPOWER minimizes system downtime when a defective system board is replaced. Its Flexible Memory Architecture (FMA) feature supports such hot swapping even if the system board is loaded with the Solaris kernel. This capability represents an advance over previous PRIMEPOWER servers in which a kernel-loaded system board could not be hot swapped.

Security Management

PRIMEPOWER's XPAR, as noted earlier, offers the advantages of hard partitioning together with the granularity capabilities of software partitions. The hard boundaries between XPARs prevent users and applications in one XPAR from breaching the security of another XPAR. A secure system for an enterprise environment requires additional elements. Fujitsu provides PRIMEPOWER and third-party-based security management capabilities such as:

- » Security for the SMC required for the PRIMEPOWER 900/1500/2500

- » Solaris Operating System security, which includes an integrated firewall and IPSec security functions for data integrity and protection
- » Third-party package support for a variety of scalable firewalls, trusted operating systems, VPNs, intrusion detection, enterprise security management packages, and real-time monitoring

The combination of these security offerings, which are based on the security policies of an IT environment, provide PRIMEPOWER installations with the highest achievable security levels and ensure system uptime even in the face of overt attacks and software glitches.

Review of Key Points

This white paper provides an overview of Fujitsu's PRIMEPOWER servers and how they meet the needs of the business-critical IT environment for performance, high availability, use of industry standards, low cost of ownership, system and resource management, and more. All of these PRIMEPOWER features and attributes are the basis for PRIMEPOWER's ability to deliver a high quality of service to the IT environment.

This quality of service continues a long Fujitsu tradition in high-performance computing that began with supercomputers and highly available mainframes. Fujitsu's low-latency, high-speed PRIMEPOWER interconnect grows out of its supercomputer experience. In addition, the Fujitsu-designed SPARC64 V microprocessor – at the heart of PRIMEPOWER – achieves a unique level of high availability based on the Fujitsu mainframe's legacy of high-availability error detection, isolation, and recovery.

Fujitsu's goal of providing low cost of ownership and high performance in the same offering extends to PRIMECLUSTER, the cluster available in PRIMEPOWER. Based on a software module approach wherein the modules can be mixed and matched to provide highly available, scalable, database or enterprise clusters, PRIMECLUSTER provides the highest level of cluster capability.

PRIMEPOWER's capabilities provide the IT infrastructure with numerous advantages in today's volatile business environment. These advantages include:

- » PRIMEPOWER supports the market's demand for fast, cost-effective processing based on its industry-leading hardware and software architecture geared to handle the most challenging applications.
- » PRIMEPOWER enables the quick change of business strategies thanks to its fast accommodation of new applications, changing application workloads, and growth.
- » PRIMEPOWER minimizes user downtime and maximizes quality of service for users because of its high-availability features and functions.
- » PRIMECLUSTER reduces cluster cost of ownership (especially the "people cost" component) due to its extensive use of GUIs, Wizards, and automated operation and administration.

- » PRIMEPOWER and PRIMECLUSTER offer world-record performance as published by results showing the PRIMEPOWER nodes and clusters continuing to demonstrate industry-standard benchmark leadership on Oracle, SAP, and SPEC.
- » PRIMEPOWER and PRIMECLUSTER are ideal for server consolidation due to their ability to reduce costs and add redundancy with minimal effort.
- » PRIMEPOWER and PRIMECLUSTER enjoy industry-leading scalability thanks to their use of state-of-the art components such as the SPARC64 V microprocessor and a supercomputer-based crossbar switch.
- » PRIMEPOWER employs the industry-standard Solaris Operating System and the SPARC International-compliant SPARC64 V microprocessor. As a result, the system offers maximum “openness” and consequent lower costs due to the availability of trained personnel and more than 8,000 applications.
- » PRIMEPOWER and PRIMECLUSTER are tuned for optimum performance with industry-standard Oracle9i RAC and Oracle 10g including Cache Fusion support for speedy transmission of Oracle locks and data.
- » PRIMECLUSTER offers tight integration with PRIMEPOWER hardware features such as partitioning, dynamic reconfiguration, and error detection and correction to ensure the highest availability cluster.

Simply put, PRIMEPOWER offers industry-leading hardware and software features in one package to ensure the highest performance, best availability, easiest management, and lowest cost of ownership. PRIMEPOWER is available worldwide along with local service so that multinational corporations using PRIMEPOWER may enjoy hardware, software, and personnel economies of scale at all of their locations.

Considering these advantages and the other technologies discussed in this white paper, it is clear that PRIMEPOWER should be a short-list candidate for single SMP server or clustered SMP server operation in the business-critical IT infrastructure. Further information concerning PRIMEPOWER's attributes can be found in the other five white papers in this series, and on the Fujitsu websites.

Endnotes

- 1 Fujitsu's Annual Report may be obtained through www.fujitsu.com.
- 2 These world-leading benchmarks are a matter of public record and include SAP, Oracle, SPEC, and others. They can be found on the appropriate industry or benchmark organization websites as well as at www.primepower.fujitsu.com/en/benchmark.html.
- 3 Amdahl's mainframe and Fujitsu Siemens Computers' mainframe are based on Fujitsu's mainframe hardware architecture.
- 4 A PCI board is considered part of a system board.
- 5 PRIMEPOWER 1500 and 2500 both have an L1 and L2 crossbar. L1 is in the system board crossbar while L2 is in the inter-system board crossbar.
- 6 RCI is an interface to manage the power supplies of multiple units by simple operations. The RCI may be used for clustered systems or Model 2500 cabinets.
- 7 Joint Technical Advisory Group (JTAG) is a specification for instrumenting chips so that internal chip errors may be monitored, detected, gathered, and distributed outside of the chip through dedicated chip pin connections.
- 8 The Model 900 uses direct connection and does not require a crossbar.
- 9 Each system board of PRIMEPOWER2500 supports up to 64 GB of memory. However, note that the maximum supported memory capacity of the total system is 512 GB.
- 10 This figure is achieved as a result of Fujitsu's supercomputer-like wave pipeline technique to raise the crossbar clock frequency while keeping data skew at a low level using a novel clock and data transmission synchronization method.
- 11 XPAR can achieve single-processor partitions on the PRIMEPOWER 900 and 1500 models. The minimum PRIMEPOWER 2500 XPAR configuration contains two processors. For a fuller explanation, please refer to the companion white paper *PRIMEPOWER Server Architecture Excels in Scalability and Flexibility*.
- 12 This is discussed later in the Resource Management section of this white paper.
- 13 XPAR can achieve single processor partitions on the PRIMEPOWER 900 and 1500 models. The minimum PRIMEPOWER 2500 XPAR configuration contains two processors. For a fuller explanation, please refer to the companion white paper *PRIMEPOWER Server Architecture Excels in Scalability and Flexibility*.

Americas

Ideas International, Inc.
800 Westchester Avenue
Suite S620
Rye Brook, NY 10573-1330
USA
Tel + 1 914 937 4302
Fax +1 914 937 2485

Asia/Pacific and Worldwide Headquarters

Ideas International Limited
Level 3
20 George Street
Hornsby, NSW, 2077
Australia
Tel +61 2 9472 7777
Fax +61 2 9472 7788

Europe, Middle East, Africa

Ideas International Europe
1 Deanes Close
Steventon
Oxon OX13 6SZ
United Kingdom
Tel +44 (0) 1235 437 850
Fax +44 (0) 1235 437 851

www.ideasinternational.com

