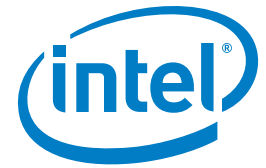


SOLUTION BRIEF

Intel® Xeon® Processor 7500 Series
Dell™ PowerEdge™ Servers
Red Hat® Enterprise Linux* 5



PUSHING DATA CENTER LIMITS UPWARD: Dell, Intel, and Red Hat

Dell™ PowerEdge™ servers based on the Intel® Xeon® processor 7500 series running Red Hat® Enterprise Linux* 5 deliver scalable performance, advanced reliability, and flexible virtualization, for low TCO and fast ROI.



Growth in data volumes has become the standard expectation in businesses across every industry, and at the same time, IT organizations are being asked to do more with less. Those two factors combine to create pressures that require intelligent, novel approaches to alleviate them. One positive trend in this area is the ongoing migration of business-critical applications from expensive proprietary architectures, such as UNIX* on RISC hardware, to more cost-effective open platforms, such as Linux* on Intel® architecture.

With the introduction of the Intel® Xeon® processor 7500 series, the industry now has the means to accelerate that trend, drawing on very high scalability, performance, and a broad range of new reliability, availability, and serviceability features. To provide further business-critical support, Dell™ PowerEdge™ servers deliver system-level innovation that improves on the processor platform's capabilities and makes overall TCO all the more favorable. Red Hat® Enterprise Linux is the perfect OS for the solution stack, providing very high performance, scalability, and reliability for both virtualized and non-virtualized workloads.



INTEGRATED SOLUTION STACK FROM DELL, INTEL, AND RED HAT

<p>Operating System Level: Red Hat® Enterprise Linux* 5</p>	<ul style="list-style-type: none"> ▪ High Capacity: NUMA-aware support for 255 CPUs and 1 TB main memory ▪ Reliable and Secure: Advanced Error Recovery; collaboration with the United States National Security Agency ▪ Virtualization Leadership: Red Hat Enterprise Virtualization; Huge Pages and standards support
<p>System Level: Dell™ PowerEdge™ Servers</p>	<ul style="list-style-type: none"> ▪ PowerEdge R910: High-reliability four-socket 4U server for core business-critical applications ▪ PowerEdge R810: Scalable two- or four-socket 2U server for performance density ▪ PowerEdge M910: High-reliability four-socket blade server for business-critical applications
<p>Processor Level: Intel® Xeon® Processor 7500 Series</p>	<ul style="list-style-type: none"> ▪ Scalable Performance: World-record performance; up to 32 processors, 16 DIMMs per processor ▪ Advanced Reliability: Keeps your servers running strong with Machine Check Architecture Recovery ▪ Flexible Virtualization: Combine servers from multiple generations into the same virtualized server pool

Scalable Performance Accelerates Return on Investment

The Intel Xeon processor 7500 series provides the combination of raw muscle and sophisticated intelligence that endcustomers need to power their data centers. Dell PowerEdge servers innovate at the system level on that foundation, with features and capabilities that tailor the platform to an IT organization's specific requirements. Red Hat Enterprise Linux unleashes those resources on enterprise workloads to meet today's most demanding computing needs.

Engineers from Dell, Intel, and Red Hat have collaborated extensively to ensure that the unique qualities each building block brings to the larger solution are optimized to work together smoothly. Together, they form a hardware/software stack that delivers state-of-the-art scalable performance to drive ROI.

Red Hat Enterprise Linux and Dell PowerEdge servers based on the Intel Xeon processor 7500 series are an excellent combination that scales up infrastructure to support data- and memory-intensive data center workloads.

The processor architecture is designed to support as many as 32 sockets per system and 16 DIMMs per socket, for massive headroom.

The Intel Xeon processor 7500 series delivers intelligent performance, a set of capabilities that enables it to adapt dynamically to the workload with measures such as increasing the processor speed and engaging Intel® Hyper-Threading Technology to increase throughput when needed. The Intel® Intelligent Power Node Manager is also enabled to meet the need for drastic power saving.

Dell's price-performance leadership and the open application ecosystem for Intel architecture help make the stack more cost effective than proprietary system architectures, and a variety of platform options meet the needs of a diverse install base:

- **Dell PowerEdge R910.** For business-processing, performance, and large-scale applications, this four-socket 4U rack-optimized server is great for mission-critical applications in corporate data centers that need the highest performance, reliability, and I/O scalability.

- **Dell PowerEdge R810.** For memory-intensive, performance-driven applications and virtualization, this two- or four-socket 2U rack-optimized server is great for corporate data centers and remote sites that need performance and memory scalability for mission-critical applications in an efficient 2U form factor.

- **Dell PowerEdge M910.** For medium or large general-purpose implementations, high virtual machine density, and medium to large databases, this four-socket blade is great for mission-critical applications in data centers that need very high performance, reliability, density, and I/O scalability in a blade server.

Red Hat Enterprise Linux includes features designed specifically to take advantage of the hardware architecture. As a result, infrastructures based on Red Hat Enterprise Linux and Intel Xeon processors deliver excellent performance and support very large workloads. Low overhead, NUMA-aware memory management, and advanced thread scheduling help drive up performance.

SCALABLE PERFORMANCE—FEATURES AND BENEFITS

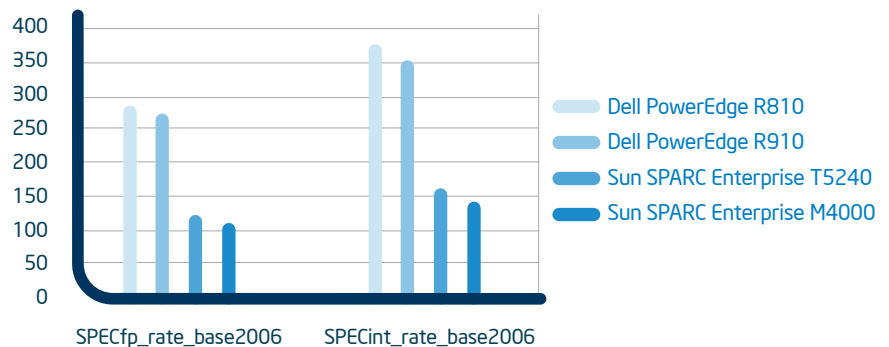
Intel® Xeon® Processor 7500 Series	Dell™ PowerEdge™ Servers	Red Hat® Enterprise Linux*
<ul style="list-style-type: none"> ▪ Intel® QuickPath Interconnect. CPU-to-chipset bandwidth supports up to 6.4 gigatransfers per second, as much as 8x higher than predecessors ▪ Integrated memory controllers. DDR-3 memory connects locally to each processor, dramatically improving overall latency ▪ Intel® Turbo Boost Technology. Increases operating frequency on demand according to software needs ▪ Increased core count. Up to eight execution cores provide increased parallelism for today's highly-threaded workloads 	<ul style="list-style-type: none"> ▪ FlexMemory Bridge Technology. Allows four-socket systems populated with only two processors to access all 32 of the server's DIMMs ▪ High system density. Supports two to four sockets in either a rack-optimized form factor or a blade for flexible implementation options with high memory scalability ▪ Dual 10 Gigabit Ethernet (10GbE). Optional 10GbE small form factor (SFP+) LAN on Motherboard connectivity provides high throughput with SR-IOV support while taking up minimal space 	<ul style="list-style-type: none"> ▪ Expanded physical server limits. NUMA-aware support for up to 255 CPUs and 1 TB main memory enhances system scalability ▪ Monitoring and tuning tools. kTune script assists kernel tuning, OProfile profiles all running code, and the SystemTap utility dynamically monitors applications ▪ Generic Receive Offload. Hardware assist on network interfaces with receive checksum offload builds TCP performance ▪ Advanced parallelism. Efficient use of software threads and Intel® Hyper-Threading Technology help deliver high performance

Superior Floating-Point and Integer Performance

Lab testing by Principled Technologies demonstrates 1.47x higher and 1.42x higher floating-point benchmark performance from two-processor Dell PowerEdge R810 and R910 servers, respectively, relative to competing Sun SPARC® Enterprise servers.¹ The integer benchmark performance is even more compelling, with 1.65x and 1.57x higher performance by the two-processor Dell PowerEdge R810 and R910 servers, compared to their Sun SPARC Enterprise server counterparts.¹ These results are presented in the top chart in Figure 1.

Additional benchmark testing shows that the four-processor Dell PowerEdge R910 server delivers 1.21x higher floating-point performance and 1.58 higher integer performance than competing Sun SPARC Enterprise servers.² These results are presented in the bottom chart in Figure 1.

Floating-Point and Integer Performance: Two-Processor Dell™ PowerEdge™ R810 and R910 Servers versus Sun SPARC® Enterprise Servers



Floating-Point and Integer Performance: Four-Processor Dell™ PowerEdge™ R910 Servers versus Sun SPARC® Enterprise Servers

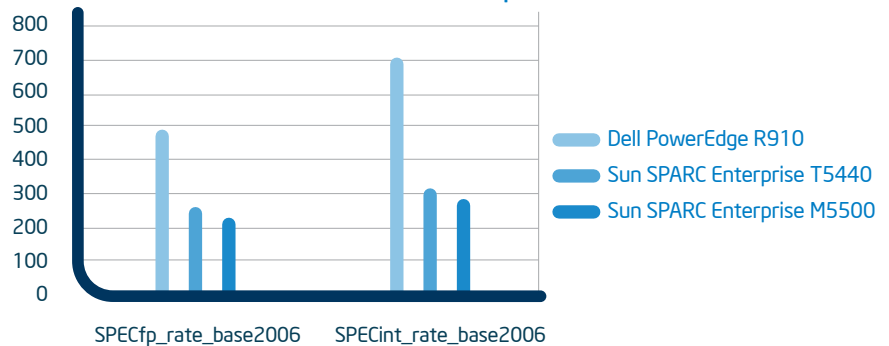


Figure 1. Dell™ PowerEdge™ servers based on the Intel® Xeon® processor 7500 series outperform competing Sun SPARC® Enterprise servers on floating-point and integer industry benchmarks.^{1,2}

Superior Java* Performance

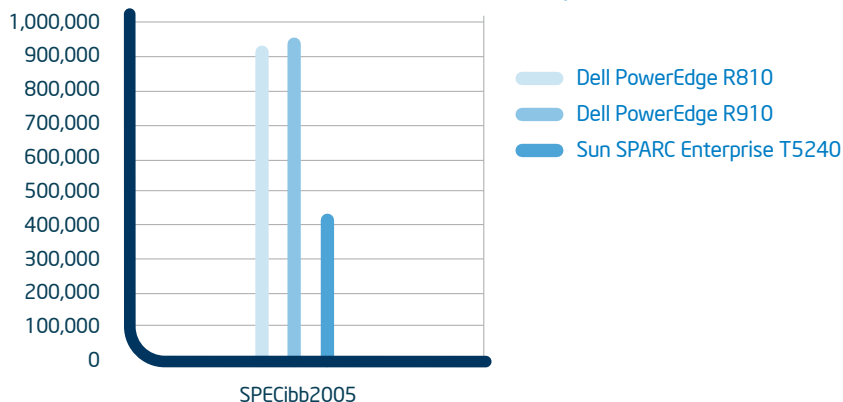
Principled Technologies also reports that two-processor Dell PowerEdge R810 and R910 servers deliver 1.23x and 1.20x higher Java* performance, respectively, compared to competing Sun SPARC Enterprise servers.³ Lab testing on the four-processor Dell PowerEdge R910 server showed 1.22x higher Java performance than competing Sun SPARC Enterprise servers.⁴ These results are presented in Figure 2.

Advanced Reliability and Security Supports Mission-Critical Workloads

PowerEdge servers based on the Intel Xeon processor 7500 series, running Red Hat Enterprise Linux 5, can help end-customers decrease the cost of running mission-critical applications. With advanced reliability features and the software intelligence to take advantage of them, this combination provides a strong alternative to RISC/UNIX and other proprietary architectures.

Thousands of customers run millions of PowerEdge servers based on Intel architecture and Red Hat Enterprise

Java* Performance: Two-Processor Dell™ PowerEdge™ R810 and R910 Servers versus Sun SPARC* Enterprise Servers



Java Performance: Four-Processor Dell PowerEdge R810 and R910 Servers versus Sun SPARC Enterprise Servers

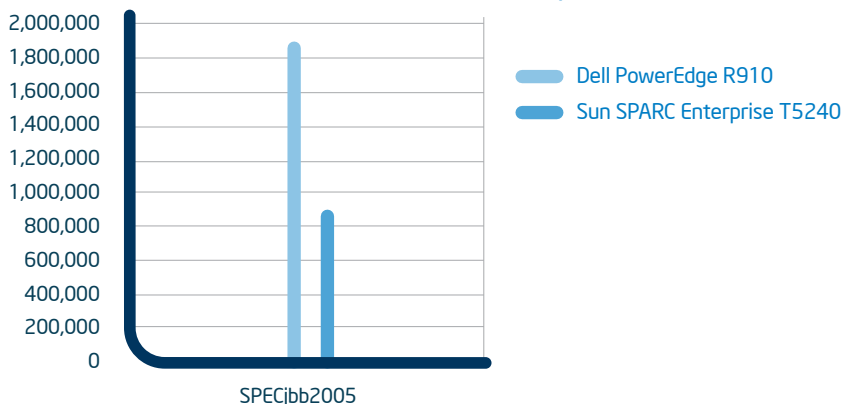


Figure 2. Dell™ PowerEdge™ servers based on the Intel® Xeon® processor 7500 series outperform competing Sun SPARC* Enterprise servers on floating-point and integer industry benchmarks.^{1,2}

ADVANCED RELIABILITY AND SECURITY—FEATURES AND BENEFITS

Intel® Xeon® Processor 7500 Series	Dell™ PowerEdge™ Servers	Red Hat® Enterprise Linux*
<ul style="list-style-type: none"> ▪ Machine Check Architecture Recovery (Available in Red Hat® Enterprise Linux* 6.0). Enables automatic detection of hardware errors so the OS can take corrective action to prevent an outage ▪ PCI Hot Plug*. Allows PCI components to be added or removed without shutting the server down, helping preserve operational integrity ▪ Predictive Failure Analysis. Identifies signs of failure in memory areas or DIMMs in advance, enabling the system to take actions that will reduce or eliminate the effect of those failures 	<ul style="list-style-type: none"> ▪ Embedded management. Instant on, pre-loaded management software for faster deployment, continual monitoring, and problem diagnosis, and automated system updates, with no external media necessary ▪ Dual internal SD modules. Unique offering provides embedded hypervisor redundancy, removing a potential single point of failure ▪ Interactive LCD panel. Simplifies problem diagnosis with plain-language interaction so users can set up, monitor, and maintain servers more easily 	<ul style="list-style-type: none"> ▪ Advanced Error Recovery for PCI Express*. Allows better reporting and recovery from both correctable and non-correctable errors ▪ SELinux*. Offers very high security by default; created in collaboration with the United States National Security Agency ▪ Highly certified. Received Common Criteria certification at Enterprise Assurance Level 4 (EAL 4+) under the Controlled Access Protection Profile (CAPP), Label Security Protection Profile (LSPP), and Role-Based Access Control Protection Profile (RBACPP)

Linux, including systems that host their most mission-critical workloads. With the launch of the Intel Xeon processor 7500 series and the collaborative enablement by all three companies, these servers deliver a high level of reliability.

Complementing the reliability features described in the Advanced Reliability and Security—Features and Benefits table, PowerEdge servers provide innovations around manageability that make it simpler and more cost effective to maintain optimal operation of the servers hosting mission-critical workloads. These benefits are the result of Dell’s “embedded management” strategy.

Under this strategy, hardware platforms come with all the elements and tools needed for complete life cycle management embedded onto the system. This approach eliminates the time-consuming need to load drivers, tools, and utilities from external media (for example, CDs or DVDs) and results in simplified, streamlined systems management throughout the complete life cycle of the server:

- **Pre-OS server provisioning and OS installation** occur faster and with fewer steps.

- **Hardware configuration** and any subsequent re-configuration for replaced parts are accomplished in an automated fashion, saving time and reducing potential for error.

- **Monitoring and problem diagnosis** occur continually and automatically, for servers located both locally and remotely, providing systems administrators greater awareness of the health of their IT resources.

- **Driver updates** are discovered proactively and applied automatically according to administrator-controlled schedules.

All of this results in high availability of server resources, ensured performance metrics for application workloads, reduced network congestion, and in general a simplified, more straightforward management experience for systems administrators.

In addition to reliability features, Red Hat Enterprise Linux helps to enhance system security through a continuing body of innovation that is highly regarded by the industry. Red Hat Enterprise Linux offers very high security by default with SELinux*, which is the result of a collaboration between Red Hat and the United States National Security Agency (NSA). SELinux defines access rights for each individual user, application, process, and file on the system, enabling multi-level security policies that provide extremely granular control over the system.

Red Hat Enterprise Linux carries an extremely large number of certifications and has passed the Common Criteria process 12 times on four different hardware platforms. Red Hat Enterprise Linux 5 has even received Common Criteria certification at Enterprise Assurance Level 4 (EAL 4+) under the Controlled Access Protection Profile (CAPP), Label Security Protection Profile (LSPP), and Role-Based Access Control Protection Profile (RBACPP), providing a level of security and a feature set that was previously unheard of from a mainstream operating system.

FLEXIBLE VIRTUALIZATION—FEATURES AND BENEFITS

Intel® Xeon® Processor 7500 Series	Dell PowerEdge* Servers	Red Hat® Enterprise Linux*
<ul style="list-style-type: none"> ▪ Intel® Virtualization Technology FlexMigration. Allows new servers to participate in virtualization pools with older ones, protecting investments ▪ Extended Page Tables. Increased efficiency in translation between physical and virtual memory dramatically improves virtualized performance ▪ Intel® QuickPath Architecture. Provides very low data latency to multiple processing cores that have access to large amounts of memory, allowing large-scale consolidation 	<ul style="list-style-type: none"> ▪ Redundant embedded hypervisor. Dual internal SD modules house embedded hypervisors for dependable virtualized operation ▪ Advanced memory subsystem. High memory density and FlexMemory Bridge Technology reduce memory bottlenecks for large-scale virtualized workloads ▪ Price-performance leadership. Maximizes the benefit of reduced server counts enabled by consolidating servers in the virtualized data center 	<ul style="list-style-type: none"> ▪ Red Hat® Enterprise Virtualization. End-to-end virtualization supports up to 500 guests, allocating up to 16 virtual processors with 64 GB RAM each ▪ Huge Pages support. Prevents memory pages from being swapped out, reducing the kernel’s memory-management ▪ Single-Root I/O Virtualization. Red Hat provides leading support for this PCI-SIG* standard, which decreases the processing overhead associated with virtualized I/O

Flexible Virtualization Optimizes Server Consolidation and Other Virtualized Usage Models

Dell PowerEdge servers, Red Hat Enterprise Linux 5, and the new Intel Xeon processors bring the next level of virtualization capabilities to the data center, with performance and capacity headroom to spare and the flexibility to automate unpredictable shifts in workload demand.

With every part of the stack well-optimized for the others, this combination delivers excellent virtualized performance that drives up consolidation ratios and enables innovative virtualized usage models for high organizational agility and low operating costs. And thanks to Intel® Virtualization Technology (Intel® VT) FlexMigration, you can combine servers from multiple generations into the same virtualized server pool to extend failover, load balancing, and disaster recovery.

Using PowerEdge servers based on the Intel Xeon processor and Red Hat Enterprise Linux 5 also accelerates enterprise cloud deployments, since the combined technologies provide flexibility and automation to dynamic and heterogeneous workload and infrastructure environments in data centers.

PowerEdge servers take the virtualization features of the Intel Xeon processor 7500 series to the next level with innovative memory capabilities such as FlexMemory Bridge Technology (described in the table, Scalable Performance— Features and Benefits) and other performance features. As a result, end-customers have an effective way to drive up virtualized performance, as shown in Figure 2.

With excellent support for next-generation Intel VT integrated into the Linux kernel, Red Hat Enterprise Linux provides excellent performance for both Linux and Windows* guests, as well as cutting-edge management, availability, and live migration features. Red Hat Enterprise Virtualization for Servers is an end-to-end virtualization platform that builds on Red Hat Enterprise Linux and consists of the following components:

- **Red Hat Enterprise Virtualization Manager for Servers.** A feature-rich server virtualization management system that provides advanced capabilities for hosts and guests, including high availability, live migration, storage management, system scheduler, and more.

- **Red Hat Enterprise Virtualization Hypervisor.** A modern hypervisor using Kernel-based Virtual Machine (KVM) technology, which can be deployed either as a standalone bare-metal hypervisor (included) or with Red Hat Enterprise Linux 5 (purchased separately) installed as a hypervisor host and managed through Red Hat Enterprise Virtualization Manager for Servers.

These technologies can be complemented by a host of comprehensive offerings available from Red Hat Services. Designed to speed time to implementation while maximizing ROI and related skill sets, Red Hat Training and Red Hat Consulting provide the means for customers to optimize Red Hat Enterprise Virtualization and core competencies in any environment. For a full list of service offerings, including assessment and implementation services, training, and the new Red Hat Certified Virtualization Administrator (RHCVA), visit <http://www.redhat.com/promo/RHEVservices>.

Conclusion

Drawing on the combined expertise of three industry leaders and many years of collaborative co-engineering, the combination of the Intel Xeon processor 7500 series, Dell PowerEdge servers, and Red Hat Enterprise Linux deliver the next generation of mission-critical computing for the enterprise. This hardware/software stack is the foundation for cost savings that will benefit businesses migrating away from architectures such as UNIX on RISC as well as those who choose it for new mission-critical implementations.

Dell, Intel, and Red Hat now deliver the kind of scalable, reliable performance for virtualized or non-virtualized environments that used to be associated only with expensive, proprietary architectures. End-customers all over the world are already seeing the benefits.



Learn more about Dell™ PowerEdge™ servers: www.dell.com/poweredge

Learn more about Intel® Xeon® processors: www.intel.com/xeon

Learn more about Red Hat® Enterprise Linux*: www.redhat.com/rhel



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