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**SPARC SERVERS**

An Oracle White Paper  
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# Driving Up Price/Performance and Driving Out Cost with Oracle's SPARC T5 Servers

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## Executive Overview

IT organizations are facing critical challenges due to the massive explosion of data and increased requirements to deliver application services to users faster than ever. With limited IT personnel, it is no longer possible to maintain and operate physical servers in silos due to the high cost and complexity associated with management. Overburdened IT staffs are finding it increasingly difficult to respond to service requests in a timely manner, and systems that require periodic downtime or frequent maintenance create challenges in delivering an always-on computing infrastructure. Further, underused and aging systems are a burden to maintain and update, and become more expensive to operate over time due to increases in services costs and incompatibility with software. Companies looking to solve these problems are seeking best-of-breed servers that will help them achieve new levels of operating efficiency, improved cost of operation, and higher levels of uptime combined with faster time-to-application service delivery.

## Introduction

The biggest challenge facing IT today is how to do more with less. A consolidation of system providers in the industry also means that there are fewer choices available for solving problems. The positive benefit to this consolidation of suppliers is the extent to which these companies can deliver software, hardware, and complementary technologies, like virtualization and systems management, as an integrated solution that makes it easier to operate and delivers a superior total cost of ownership (TCO). A recent major industry analyst report predicted that by 2015, around 35 percent of IT deployments would be in the form of integrated systems, such as engineered systems or optimized and bundled solutions. However, this means that IT organizations still will be relying on best-of-breed server options for 65 percent of their computing requirements. To that end, customers are looking to acquire and operate compute assets that enable high degrees of flexibility while driving cost out of operation. The ideal compute platform for next-generation data centers is the one that is versatile enough to

handle the variety of workloads needed to run the business, without performance gaps or limitations, and integrates key features and functionality at a minimal cost.

Oracle's SPARC systems running Oracle Solaris address high-priority customer challenges with a scalable, secure, and integrated offering that delivers high performance for business workloads while allowing customers to improve on operating efficiency. Oracle continues to build on the huge momentum of SPARC T4 servers by introducing the new SPARC T5 family of systems that delivers a massive performance increase, higher scalability, reliability, and serviceability enhancements, while continuing to deliver best-in-industry value and price/performance with the Oracle Solaris 11 operating system, Oracle VM Server for SPARC virtualization, and systems management included at no extra cost. SPARC T5 systems are ideal for IT organizations seeking to drive out cost and complexity in operation, while improving levels of service and application delivery to internal and external customers. In addition, SPARC T5 systems and Oracle Solaris 11 include a host of features specifically designed to optimize the performance of Oracle Database and Oracle Fusion Middleware, and are only available to customers running Oracle's SPARC systems and Oracle Solaris.

SPARC T5 systems deliver customer value in three key areas:

- **Operating Cost Reduction**—SPARC T5 systems and Oracle Solaris enable IT departments to drive down the cost of running systems over three to four years compared to competing solutions.
- **Delivering Faster Business Results**—SPARC T5 systems provide the opportunity to run business applications faster and improve SLAs for internal and external application consumers.
- **Optimization for Oracle Database and Oracle Fusion Middleware**—SPARC T5 systems and Oracle Solaris incorporate new and exciting features that accelerate performance for key Oracle software assets and are *only* available on SPARC T5 systems.

This paper will introduce SPARC T5 servers and explore the business benefits of these exciting new systems, including compelling total cost of ownership examples and new world-record performance benchmarks that deliver real-world application acceleration that customers can take advantage of today.

## SPARC T5—Scaling Higher and Executing Faster

SPARC T5 systems build on the incredible success of SPARC T4 products that were released in 2011 and have been the fastest ramping SPARC products in history. The SPARC T5 processor borrows the same internal core architecture from SPARC T4, but due to a change in manufacturing technology, SPARC T5 builds in twice as many compute cores as SPARC T4 and thus results in systems that deliver about twice the performance of SPARC T4. The SPARC T5 processor also increases core clock speed to 3.6 GHz, a 20 to 30 percent increase over the frequencies offered in SPARC T4. Applications that are single-thread or response time oriented should see an increase of around 1.3x over the SPARC T4. For mixed workloads, SPARC T5 systems deliver up to 2.3x more throughput performance compared to similarly configured SPARC T4 systems.

SPARC systems have always been designed with a focus on complete system performance and improvements needed to deliver higher scalability by improving other areas of the system that are critical to Java, database, and business application performance. SPARC T5 systems feature faster I/O technology and faster subsystem access to main memory, both of which provide benefits for business applications and help avoid transaction bottlenecks that can plague competing products.

### SPARC T5 Portfolio Overview

Oracle's SPARC T5 systems will be offered in four different form factors and introduced into the market as an extension to the SPARC T4 line of products that thousands of customers worldwide have adopted since their introduction in 2011. Customers that want to continue to invest in SPARC T4 to build out their infrastructures can count on an extended lifecycle for SPARC T4 systems. As clients evaluate and discover the increased scalability, performance, and value in SPARC T5 servers, they can adopt SPARC T5 into their infrastructure when it fits budget cycles, and do so with little or no additional qualification required due to the huge similarities between the form factors of the two families of products. Ease of transition to SPARC T5 from other SPARC servers is enhanced based upon the built-in guaranteed SPARC binary compatibility and Oracle Solaris application compatibility that Oracle has provided for almost 20 years. Below is a brief introduction to the four new systems in the SPARC T5 family of servers.

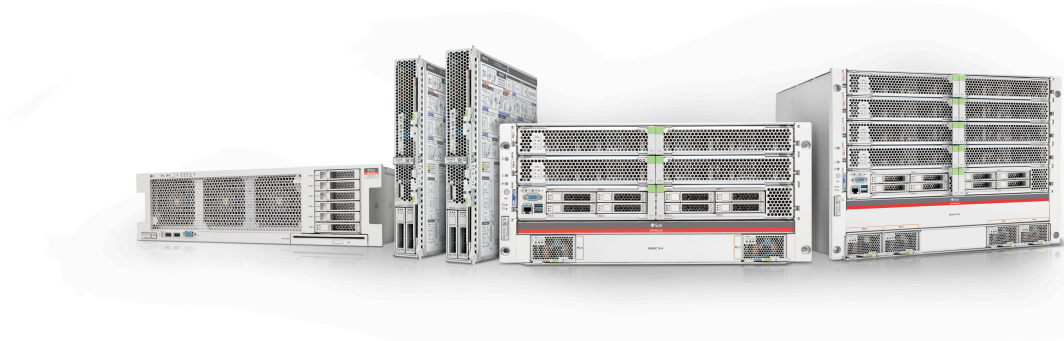


Figure 1. Oracle's SPARC T5-1B server module and SPARC T5-2, SPARC T5-4, and SPARC T5-8 servers deliver up to 2.3x the throughput performance of SPARC T4 products.

#### **SPARC T5-1B—Single-Socket Dense, Scalable Blade Server**

The SPARC T5-1B is a blade server designed for streaming media, virtualization/consolidation, and other horizontally scaled back office applications, middleware, and online transaction processing (OLTP) databases. The SPARC T5-1B fits into Oracle's existing Sun Blade 6000 modular system and offers an ideal platform for consolidation of multiple SPARC workloads and the ease of growing capacity as compute requirements expand.

#### **SPARC T5-2—Dual-Socket Data Center Consolidation and Back Office Server**

The SPARC T5-2 offers two processors of SPARC T5 performance in a tightly coupled 3U package. The SPARC T5-2 is ideal for customers looking to optimize transaction and Web services, including Java application services, enterprise resource planning (ERP)/customer relationship management (CRM), supply chain management, and distributed databases. With considerable expansion capabilities and integrated virtualization technologies, Oracle's SPARC T5-2 server is also an ideal platform for consolidated tier 1 and tier 2 workloads, and for delivery of infrastructure as a service (IaaS) and other application-as-a-service cloud delivery models.

#### **SPARC T5-4—Quad-Socket Enterprise Server for Mission-Critical Workloads and Virtualization Farms**

The SPARC T5-4 supports up to four SPARC T5 processors running at 3.6 GHz, and up to 512 threads of computing in a power- and space-efficient 5U chassis. With breakthrough levels of price/performance, this server is ideally suited to the delivery of horizontally scaled transaction services as well as medium-to-large database applications and presents many opportunities as a foundational platform for delivering database as a service and on-demand application portals when using Oracle VM Server for SPARC virtualization and Oracle Enterprise Manager Ops Center.

### **SPARC T5-8—Eight-Socket Highly Scalable Enterprise Server for Massive Data Center Consolidation**

The SPARC T5-8 contains up to eight SPARC T5 processors running at 3.6 GHz, and up to 1,024 threads of computing and up to 4 TB of main memory in a space-efficient 8U chassis. With extreme performance and price/performance, this server sets the standard for midrange computing, offering more compute power in a higher density architecture than similar products in its class. The SPARC T5-8 is built for back office database workloads and business application consolidation, and it enables customers to accomplish the highest level of operating cost savings when building out new application services or data centers.

### **SPARC T5 Improves Cost of Operation**

Oracle's SPARC T5 systems provide clients with a breadth of choices and opportunities to extract cost out of data center operation, and they are priced attractively as IT departments continue to be asked to accomplish more with shrinking budgets. SPARC T5 allows customers to deliver higher levels of transactions and to perform even higher ratios of consolidation of existing and aging systems than ever before. Savings to the bottom line are delivered up front, with massive reductions in maintenance costs and reduced spending on power, space, and cooling. The purchase and maintenance of fewer assets allows IT personnel to focus on more strategic projects, rather than worrying about "keeping the lights on."

### **Enhancing Total Cost of Ownership**

While many customers can focus on reducing the upfront cost of acquisition of server assets, the real benefit for businesses comes with evaluating and calculating cost savings that are realized throughout the useful life of the assets. While SPARC T5 provides outstanding levels of performance and scalability for most workloads, customers stand to save the most money in operating cost when they evaluate complementary technologies used with servers such as virtualization and systems management. Oracle VM Server for SPARC and Oracle Enterprise Manager Ops Center are two technologies that complement SPARC T5 server deployments, and are offered at no additional cost when customers engage in a hardware support contract on SPARC T5 servers. Similar technologies from other vendors cost \$100,000 or more annually and add complexity to operation as they are not always completely integrated into hardware stacks.

### **Secure Computing Included at No Extra Cost**

The advanced SPARC T5 processor also includes integrated on-chip cryptographic support that provides wire speed encryption capabilities for secure data center operation. Customers can run applications leveraging up to 18 of the major crypto ciphers without paying a performance penalty in operation or having to acquire and manage additional hardware or add-in cards. The cryptographic framework built into Oracle Solaris adds a standards-based API that provides a single point of administration for cryptographic management, making the task of managing a secure environment less complex and more cost effective. Customers can also take advantage of Oracle Solaris security

features, including Oracle Solaris Trusted Extensions, which provide application isolation and control required by governments and financial institutions.

## SPARC T5 Delivers Extreme Performance

The complete SPARC T5 family of systems scales to meet growing data center requirements by supporting a full range of workloads across database, application, and Web tiers. By incorporating the same compute engine designed into the SPARC T4 processor, SPARC T5 systems provide performance for workloads that require fast single-thread performance and fast response times. They also deliver the highest levels of throughput performance for multithreaded applications for which Oracle SPARC T-Series systems have always excelled. Customers can deploy SPARC T5 confidently to achieve high levels of performance and scalability for consolidation and virtualization projects or new application build-outs across any tier of the data center.

With clock speeds reaching 3.6 GHz, batch transactions, application boot times, and legacy SPARC and Oracle Solaris applications will run at much higher performance rates and reduce the need for excess hardware. SPARC T5 also includes the critical thread functionality designed into SPARC T4, which enables the processor to automatically dedicate more core resources to heavily single-threaded applications and speed up processing times.

Customers already using SPARC T4 servers for mixed workloads should expect up to 2.3x more throughput performance when compared to similarly configured SPARC T5 systems. At the extreme end of the SPARC T5 line, the SPARC T5-8 is expected to deliver up to 4.5x more performance than the fastest SPARC T4 system.

## Performance Improvements Across All Tiers

The innovations present in SPARC T4 systems delivered more than 17 world-record benchmarks during 2011 and 2012, covering a wide variety of database, business applications, Java middleware, and security applications. SPARC T5 builds on that momentum and adds additional new benchmarks that extend the SPARC T-Series leadership position in the industry. New benchmark world records in the database space show that SPARC T5 is the optimal platform for database deployment, and it delivers high performance but at a lower cost of deployment versus the competition. SPARC T5-8 set a new world record for in database transaction processing, delivering 2.4x more performance per chip than IBM's published result. The SPARC T5-8 is also 2.5x less expensive in cost per transaction than IBM and beat the current single system world record. For more details on this metric, go to [www.oracle.com/benchmarks](http://www.oracle.com/benchmarks).

Benchmarks for Java middleware and business applications demonstrate the real-world capabilities of SPARC T5. Oracle's focus on benchmarks for SPARC continues to be around delivering performance examples that approximate what customers should expect to see when operating their applications. Certain performance metrics emphasized by the competition look impressive, but often have very little practicality in showing customers how their systems will perform when running the applications that actually drive the business. Again, SPARC T5-8 sets a new standard for Java middleware performance, delivering a new world record benchmark for Java operations per second. The SPARC T5-8 provides

3.4x better performance than IBM's published result at almost one-fourth lower list price than the IBM configuration. Details on this benchmark are available at [www.oracle.com/benchmarks](http://www.oracle.com/benchmarks).

### **SPARC T5-8 and SPARC T5-4 Linear Scalability Gains**

One of the innovations built into SPARC T5-8 and SPARC T5-4 systems is a "glueless" one-hop scalability model that enables SPARC T5-8 and SPARC T5-4 systems to scale more linearly than other eight-processor systems in the industry. This glueless design minimizes the negative effect of latency that systems normally incur by going through external communication chips, or "glue chips," when doing chip-to-chip communications in the system. Oracle's design has positive impact on linear scaling performance as these systems can accomplish more work than competing four- and eight-socket x86 and IBM designs that still use glue chips or ASICs. Customers can achieve higher levels of performance while acquiring fewer hardware assets.

### **SPARC T5 Optimizes Oracle Software**

Oracle has focused considerable resources in research and development around SPARC processors and Oracle Solaris to improve the performance of Oracle Database and Oracle Fusion Middleware applications running on SPARC servers. Since February 2010, when the acquisition of Sun Microsystems was completed, Oracle has invested heavily in increasing the quantity of engineering resources behind SPARC and Oracle Solaris. In addition, Oracle has located engineers from those teams directly into the product groups for Oracle Database and Oracle Fusion Middleware in order to create synergies around feature developments. To that end, SPARC T5 processors and the Oracle Solaris 11 operating system include exciting new advances that provide better performance and functionality and are only available to customers running SPARC systems with Oracle Solaris 11.

### **SPARC T5: Best Platform for Oracle Database**

New innovations are built into the processor level and can be taken advantage of by Oracle Solaris to improve the operation of Oracle Database. Future SPARC and Oracle Solaris products in development will incorporate even more functionality that will make Oracle Database operation even faster. Currently, the new benchmarks for database performance published for SPARC T5 demonstrate to the industry the leadership position of SPARC T5 servers. From a feature perspective, SPARC T5 systems now exhibit the capability to shut down and start up databases eight times faster than previously possible, and there is no downtime for resizing of the system global area (SGA). All of these performance benefits can be delivered while the system is fully encrypting data for secure operation. In Oracle Solaris 11.1, improvements were made in the scheduling of key database threads and transactions, and Oracle Solaris can now assign these to be executed faster using the critical thread technology in the SPARC T5 processor. Further optimizations have been made in Oracle Solaris 11.1 to the memory management subsystem and the cryptographic framework. All these improvements are designed to enable database administrators to see higher levels of performance and reduce the quantity of assets required to operate typical database loads.

## **SPARC T5: Best Platform for Oracle Middleware and Java**

Oracle also delivers superior performance and value for customers evaluating platforms for middleware and Java applications. New features have been added to optimize how Java transactions are handled, including advancements in Oracle Java Mission Control, which profiles Java runtime environments to better manage and monitor multiple Java Virtual Machine (JVM) instances and eliminate memory leaks that can impact performance. Large page support has been introduced out of the box for up to 2 GB sizes, and new instructions have been added into SPARC T5 systems to remove some of the bottlenecks in Java performance due to wait/lock contention. Oracle Solaris 11.1 is now able to store local Java objects in memory and decrease the latency required to access storage systems off the server. Additionally, Oracle Solaris 11.1 integrates the DTrace feature probes that can help administrators quickly and nondisruptively identify any performance issues. In summary, the host of features added to SPARC T5 and Oracle Solaris 11.1 will present system administrators with more Java environments that deliver better performance to users and avoid challenges with scalability of multiple JVMs on a system.

## **Conclusion**

Companies planning out their IT investments for the next three to five years will continue to look at consolidating assets in order to reduce the cost of operation. However, the requirements to expand capacity with reduced budgets and personnel create a massive challenge. While more and more companies continue to look to distributed computing models and the adoption of cloud and on-demand utility models, the need to acquire and deploy best-of-breed server assets will still represent almost two-thirds of the systems purchased.

Anticipating those trends, Oracle has introduced the SPARC T5 family of systems that is complemented by the Oracle Solaris 11.1 operating system. SPARC T5 systems are extending the value and performance that Oracle already introduced into the market with SPARC T4 products. With faster clock speeds and over 2x faster throughput than SPARC T4, the new SPARC T5 systems help customers meet their needs to drive faster application performance while lowering total cost of acquisition and ownership.

SPARC T5 servers integrate cost-saving features that are included at no extra cost. Unlike competitors, Oracle does not charge a premium fee for use of data encryption capabilities, several virtualization technologies, or extremely powerful systems management.

Finally, SPARC T5 systems and the Oracle Solaris operating system deliver measurable benefits by optimizing Oracle hardware for Oracle software. Key features have been added in this new generation of products to enhance the performance and ease of use for Oracle Database and Oracle Fusion Middleware applications. SPARC T5 systems demonstrate leadership throughout the data center and are evidence of Oracle's continuing focus on investing in the complete Oracle red stack of products to deliver superior customer value.



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