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Improving Data Center Infrastructure with Oracle's Sun x86 Systems

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Executive Overview

Virtualization and cloud computing have become increasingly important as a means to increase flexibility and support growing business requirements for new IT services. Many organizations have deployed virtualized IT infrastructures based on x86 servers to take advantage of lower costs and open architecture that enables a choice of vendors for software components such as operating system, virtualization software, and management tools.

An unfortunate reality with these multivendor environments, however, is that they can lead to increased complexity and higher operating costs. Management costs can escalate due to factors such as the need for administrators to become proficient in multiple tools, multiple support contact points, and the need to verify patches or upgrades across all components of the hardware and software stack before they can be deployed in production. Many IT organizations spend the bulk of their resources just maintaining and operating their existing IT services. They are looking for ways to reduce this effort so that more time and resources can be spent on rolling out new IT services that can drive revenue growth or create a competitive edge.

As the only x86 systems vendor that can offer a complete hardware and software stack for virtualized x86 infrastructures, Oracle is in a unique position to help organizations overcome these challenges. Oracle's Sun x86 systems are designed to provide optimal performance and experience for running Oracle software as well as other enterprise applications. They include everything needed for a complete cloud infrastructure with all components of the hardware and software stack fully supported by Oracle. The operating system, virtualization software, and Oracle's unique application-to-disk systems management environment are included at no extra charge.

Oracle's approach of delivering an integrated, optimized, and fully supported stack results in performance advantages, enhanced reliability, and perhaps most important, significant cost savings. All of the components are designed to work together and are supported through a single support organization, enabling IT organizations to reduce the time and cost of maintaining existing IT services and focus more resources on new IT services. Software license and support costs are significantly reduced because the systems include everything needed for running and managing the hardware and software

infrastructure. An independent study by Edison Group identified up to 50 percent cost savings over three years when comparing Sun x86 systems to competitive systems with fully supported operating system and virtualization software¹.

Sun x86 systems are powered by Intel's highest performing Intel Xeon processor E5-2600 product family and are offered in three models with multiple configurations to meet a broad range of application requirements. The following products are included in the portfolio:

- **Sun Fire X4170 M3 server**—The Sun Fire X4170 M3 server is a versatile IT infrastructure building block that comes in an energy-efficient 1U enclosure. With architecture that balances compute power, memory capacity, and I/O capabilities in a small form factor, this server is ideal for running Oracle middleware or Oracle enterprise application workloads. It excels at general enterprise IT and Web infrastructure needs.
- **Sun Fire X4270 M3 server**—The Sun Fire X4270 M3 server offers superior scalability for I/O-intensive applications and includes support for more than 37 TB of storage and up to 7.8 TB of flash storage capacity. It is an ideal platform for clustered databases, virtualized workloads, and enterprise applications and databases.
- **Sun Blade X6270 M3 server module**—The versatile Sun Blade X6270 M3 server module is supported within Oracle's Sun Blade 6000 modular system and combines large memory capacity with unmatched I/O bandwidth in a two-socket blade server.

These servers and server module not only extend the performance and capacity of their predecessors, the Sun Fire X4170 M2 and X4270 M2 servers, and the Sun Blade X6270 M2 server module, but also include everything needed for a complete cloud deployment with a fully supported Oracle stack.

¹ Source: Edison Group, "The Optimized Stack: Reducing Total Cost of Ownership through Vertical Integration." First publication July 2011.

Best x86 Platform for Running Oracle Software

Sun x86 systems are the best x86 platform for running Oracle software. The complete hardware and software stack from application to disk is engineered to work together and undergoes extensive in-house testing as well as production use within Oracle, resulting in proven enterprise reliability and optimum performance. Oracle's Sun Fire X4170 M3 and Sun Fire X4270 M3 servers have 33 percent more processing power than the previous generation of servers while remaining within the same physical and environmental footprint². In order to maintain a balanced architecture, the storage capabilities have been significantly enhanced with the introduction of hard disk drives (HDDs) that support the faster SAS-2 interface and the addition of enterprise solid-state drives (SSDs). Higher memory density with increased memory frequency provides faster memory performance.

33% More Processing Power and Optimized Performance

Oracle has worked closely with Intel Corporation to bring to market a broad server family based on the latest Intel Xeon processor E5-2600 product family. These Intel processors feature up to eight cores, enabling Oracle's current generation of Sun x86 systems to deliver up to 33 percent more processing power than the previous generation of servers while remaining within the same physical and environmental footprint.

Sun x86 systems have achieved a number of world-record benchmarks and serve as a key building block for Oracle engineered systems, such as Oracle Exadata, which themselves have achieved a 10x performance gain through integration and optimization.

Simplicity of Single-Vendor Support

An important customer benefit of running Oracle software on Oracle hardware is the simplicity and reliability of having a single vendor to call for support. In multivendor support environments, production teams can spend hours debugging or tracing an issue before they can determine whether the source of the problem is the application, the virtual machine, the operating system (OS), or the hardware server. When running an all-Oracle stack, Oracle Support can be engaged right away, enabling faster and easier problem resolution to help avoid downtime. Oracle Support Engineers can address service and support issues from a holistic vantage point and can gain access, if necessary, to engineering resources at all levels of the stack. Also, it is easy

² The Intel Xeon processor E5-2600 product family CPUs used in Sun Fire X4170 M3 and Sun Fire X4270 M3 servers support up to eight CPU cores, compared to the previous-generation Intel Xeon processor 5600 series CPUs, which supported up to six cores.

"Oracle gets kudos for raising the bar and actively including mission-critical database, middleware, and application self-service provisioning and dynamic scaling in the corporate cloud management discussion. Oracle is also commended for developing a comprehensive cloud lifecycle approach and being remarkably clear on the steps needed to plan, implement, and manage clouds to derive business value from increasingly complex applications."

"Oracle Enterprise Manager 12c Embraces the Cloud,"

Mary Turner and Tim Grieser, IDC

for Oracle to replicate a customer's entire hardware and software stack for support purposes because Oracle owns and uses all of the products in the stack.

Maintaining an all-Oracle stack is much easier than maintaining a multivendor stack. Oracle software patches are delivered with assurance to work across the entire hardware and software stack, enabling administrators to deploy patches immediately upon receipt from Oracle. In multivendor environments, administrators sometimes wait weeks to deploy patches because they must check for interoperability conflicts.

Oracle Enterprise Manager Ops Center, which is included with Sun x86 systems, features an automated service request (ASR) capability, which detects and reports potential system issues to the Oracle support center without user intervention, helping to assure maximum service levels and simplified support. Additionally, Oracle will automatically advise customers of any resolution that has been created for similarly configured Oracle stacks as soon as it is released.

Making Cloud Provisioning and Management Easy

Sun x86 systems include a complete lifecycle system management solution that provides deep visibility and control across the entire stack of Oracle hardware and software components, including both physical servers and virtual machines. This visibility throughout the stack enables faster, simpler, and better diagnosis of problems because it's easier to identify which layer of the stack is involved and to drill down for details. All layers of the stack can be monitored and controlled within Oracle Enterprise Manager 12c, and administrators can drill down for details in hardware, OS, and virtual machine layers using Oracle Enterprise Manager Ops Center and other Oracle Enterprise Manager components³.

Oracle software environments can be provisioned rapidly on Sun x86 systems by leveraging the included Oracle VM virtualization platform. Oracle VM Templates are used to deliver pretested,

³ Additional Oracle Enterprise Manager components are available to offer detailed monitoring and control the application and middleware layers.

preconfigured installations of Oracle Database and Oracle Applications that can be deployed quickly. Oracle VM Templates can make installation and setup up to 80 percent faster than installing and configuring the application and virtual machine environments independently. Even when deploying third-party applications on Sun x86 systems, Oracle VM Templates can be used to accelerate deployment of the OS, virtualization, and middleware infrastructure. For example, a Sun Blade 6000 modular system with 10 Sun Blade X6270 M3 server modules can be deployed with Oracle VM and Oracle Solaris Cluster in approximately one hour, compared with up to 13 business days for a typical multivendor build.

Save Money

Cost reduction is often one of the top reasons that organizations purchase x86 systems. The increasing power of x86 systems in recent years coupled with the trend of using virtualization and cloud computing technologies to increase utilization of x86 server resources has helped drive down hardware costs.

Virtualization has changed the cost structure of x86 deployments, making the server hardware a smaller portion of total cost of ownership. In a typical virtualized x86 enterprise infrastructure, software licensing and support costs for operating systems and virtualization often represent the biggest costs. On a two-socket system, these costs can represent as much as 67 percent of total cost of ownership over a three-year period⁴.

Sun x86 systems create a radical shift in the cost landscape for x86 systems by including all software licenses needed for a cloud-enabled deployment with every system that is protected by an Oracle support contract. The following are included in Sun x86 systems at no extra cost:

- Oracle VM 3 virtualization software with no limits on RAM or number of CPU sockets or cores
- Choice of OS (Oracle Linux or Oracle Solaris)
- Oracle Enterprise Manager framework with Oracle Enterprise Manager Ops Center module for managing the Oracle hardware and software stack as a cloud infrastructure-as-a-service (IaaS) environment

This holistic approach of providing a combined hardware and software environment sets Oracle apart from competitive x86 systems. In addition to enabling enhanced performance and reliability, the combined environment provides significant opportunities for cost savings. Figure

⁴ Source: Edison Group, "The Optimized Stack: Reducing Total Cost of Ownership through Vertical Integration." First publication July 2011.

1 highlights the results of an Edison Group study that shows how Oracle's approach of including OS and virtualization software with its Sun x86 systems can yield up to 50 percent cost savings over three years for a two-socket x86 system⁵.

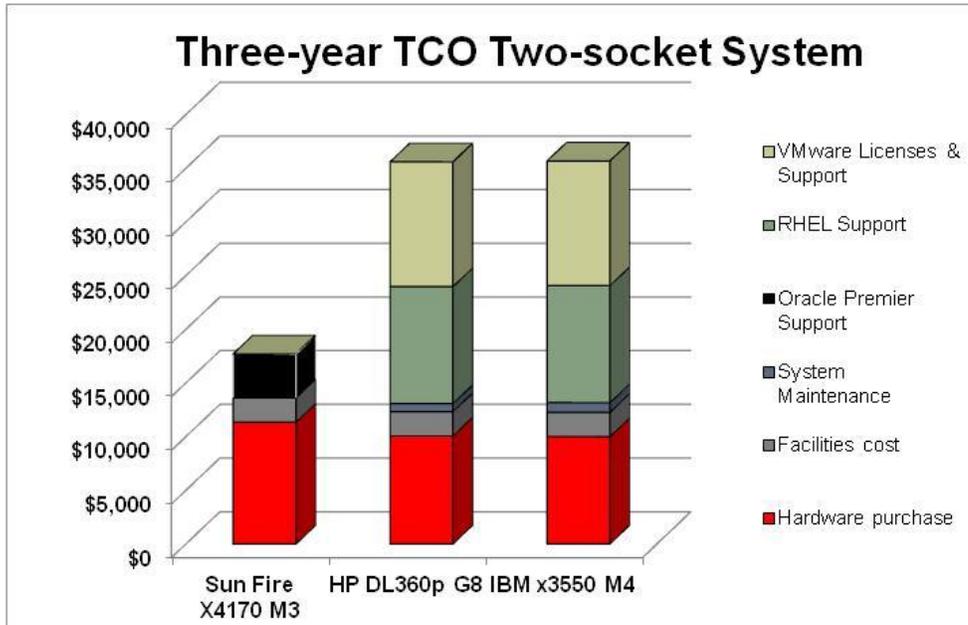


Figure 1. Up to 50 percent savings over three years for a two-socket Sun x86 system.

The opportunities for cost savings with Sun x86 systems go beyond those measured in the Edison Group study. Oracle's strategy of offering a complete x86 infrastructure also helps reduce complexity and risk so that organizations can spend fewer resources on deploying and supporting their x86 infrastructures and the applications running on them.

⁵ The Edison Group study is based on the previous generation of Sun Fire X4170 M2 and X4270 M2 servers since Oracle's latest generation of Sun Fire X4170 M3 and X4270 M3 servers was not yet available. The bulk of the cost savings are due to software licensing which has not changed significantly since the 2011 study. The results of the study can be found in the white paper, "The Optimized Stack: Reducing Total Cost of Ownership through Vertical Integration." First publication July 2011.

Reduce Risk

In addition to delivering cost savings and high performance, Sun x86 systems help reduce risk through open interfaces and testing of the complete hardware and software stack. The systems utilize open, industry-standard interfaces to maximize interoperability and protect investments in existing applications and infrastructure components. The systems also are subject to thorough testing and large-scale production use within Oracle to help ensure reliable performance for Oracle customers.

Designed and Tested for Interoperability

The hardware server platform for Sun x86 systems follows industry standards and the servers have been tested with major third-party operating systems and virtualization platforms. This helps to ensure that existing software applications and IT infrastructures run smoothly on Sun x86 systems. Third-party system management tools that utilize industry standard x86 interfaces can be used on Oracle x86 systems.

Oracle's own management environment interoperates with third-party hardware servers. The virtualization management component of Oracle Enterprise Manager Ops Center can manage and migrate virtual machines across any x86 system running Oracle VM. In addition, Oracle develops and tests all of its own x86 application software on Sun x86 systems, assuring that server hardware and OS adheres to all x86 industry standards and will reliably run third-party x86 software. Furthermore, the software environment leverages open source assets that help ensure interoperability and reduce risk. For example, Oracle VM is an enhanced version of the open source Xen virtualization framework, making it easy for customers to engage developers and administrators who already understand Xen.

Protect Investments in Applications—Choice of Operating Systems

Sun x86 systems help protect investments in existing application and management infrastructures by providing support for all of the major x86 operating systems, including Oracle Solaris, Oracle Linux, Red Hat Enterprise Linux, SUSE Linux Enterprise Server, and Microsoft Windows Server. Sun x86 systems also offer compatibility with legacy 32-bit software applications as well as emerging 64-bit applications that take full advantage of Intel's 64-bit processors.

Oracle Solaris represents the standard in data center-quality UNIX. It combines key computing elements—virtualization, security, deployment, availability, and performance—into a stable, secure, mission-critical foundation on which many data centers have depended for years. When running the Oracle Solaris operating system, Sun x86 systems take advantage of the years of optimization work that have enabled Oracle Solaris to run fast and efficiently on Intel processors.

Oracle offers two versions of Linux. One is an enhanced version of the open source Linux, which means that applications targeted for Red Hat Enterprise Linux can be run on Oracle

hardware without the need to pay for Red Hat Enterprise Linux support. The interoperability between Oracle Linux and Red Hat Enterprise Linux is so solid that Oracle has never received a service request that resulted in the identification of an incompatibility between Red Hat Enterprise Linux and Oracle Linux.

The second version is an enhanced superset of the open source Linux. It is based on a more current release of the open source Linux kernel and includes advancements for enterprise use. The most important enhancement is the Ksplice feature, which allows customers to apply patches and fixes to the running Oracle Linux kernel without the need to reboot or power down. This allows critical security and performance patches to be deployed immediately rather than at a time when the system can be taken offline. The enterprise version of Linux includes free use of Oracle Clusterware, enabling multiple systems to appear as one for high availability purposes. In addition, Oracle's policy of back-porting product fixes and enhancements means that customers can maintain their currently deployed version without necessarily upgrading to a new version in order to realize additional benefits.

Proven in Production at Oracle

Sun x86 systems are tested thoroughly with the software stack, and the systems are used heavily within Oracle to run Oracle Applications on an all-Oracle stack, thus offering assurance that the different components of the stack work well together in a production environment. Oracle engineering teams engage in more than 20 million product testing hours per week running Oracle software on Sun x86 systems. And Oracle's in-house deployment of enterprise applications consists of more than 20,000 x86 servers running an estimated 200,000 virtual machines.

This large-scale deployment of Oracle software on Oracle's Sun x86 systems gives Oracle engineers the opportunity to see firsthand if production issues arise, enabling many issues to be resolved before products reach Oracle customers. Additionally, Oracle uses its own Sun x86 systems in Oracle on Demand cloud services, demonstrating Oracle's faith and commitment to delivering high service levels for Oracle software on Sun x86 platforms.

Key Features of the New Generation of Sun x86 Systems

There are three base configurations for the Sun Fire X4170 M3 and Sun Fire X4270 M3 servers, each with different disk density and CD/DVD components. All systems share a similar system board design and include all of the software components mentioned above.

The Sun Blade X6270 M3 server module provides similar features using the Intel Xeon processor E5-2600 CPU in a blade form factor. Table 1 highlights the target applications and competitive advantages for each of these types of servers.

TABLE 1. TARGET APPLICATION AREAS AND COMPETITIVE ADVANTAGES

	SUN FIRE X4170 M3 SERVER	SUN FIRE X4270 M3 SERVER	SUN BLADE X6270 M3 SERVER MODULE
Target Applications	<ul style="list-style-type: none"> • Oracle Fusion Middleware and Oracle Applications workloads • Enterprise IT and Web infrastructure such as directory service, identity management, network management, and systems management • Software development 	<ul style="list-style-type: none"> • Oracle Database, especially cluster deployments • Virtualized workloads • Enterprise application and database server software 	<ul style="list-style-type: none"> • Virtualization • Business applications • Databases
Key Competitive Advantages	<ul style="list-style-type: none"> • Extreme Java application performance 	<ul style="list-style-type: none"> • Fast storage I/O with up to 26 disk spindles and up to 7.2 TB flash memory • Built-in 10 GbE support 	<ul style="list-style-type: none"> • Greater memory density than competitive systems • Double expansion slots of previous generation

Configuration Options for Sun Fire X4170 M3 and X4270 M3 Servers

Tables 2 and 3 highlight the configuration options for the different models of Sun Fire X4170 M3 and Sun Fire X4270 M3 servers respectively. The Sun Fire X4170 M3 server provides up to 3.5x the memory capacity, 10x the network bandwidth, and 1.7x the compute performance of its predecessor, the Sun Fire X4170 M2 server. The Sun Fire X4270 M3 server provides up to 1.8x the memory capacity, 10x the network bandwidth, and 1.4x the compute performance of its predecessor, the Sun Fire X4270 M2 server.

TABLE 1. SUN FIRE X4170 M3 SERVER COMPARISONS

FEATURE	SUN FIRE X4170 M3, 4X 2.5" DISK	SUN FIRE X4170 M3, 8X 2.5" DISK	SUN FIRE X4170 M3, 4X 3.5" DISK
Chassis	1U	1U	1U
CPUs	1 or 2 Intel Xeon processor E5-2600 CPUs	1 or 2 Intel Xeon processor E5-2600 CPUs	1 or 2 Intel Xeon processor E5-2600 CPUs
Memory capacity	Up to 512 GB	Up to 512 GB	Up to 512 GB
Number of PCIe 3.0 slots	4 total - 1 x16 external, 3 x8 (2 external, 1 internal)	4 total - 1 x16 external, 3 x8 (2 external, 1 internal)	4 total - 1 x16 external, 3 x8 (2 external, 1 internal)
Number of 10 GbE ports	4 onboard	4 onboard	4 onboard
USB ports	2 front, 2 rear, 2 internal	2 front, 2 rear, 2 internal	2 front, 2 rear, 2 internal
RAS components	<ul style="list-style-type: none"> • Hot-swappable and redundant power supplies, fans, disk drives • RAID 0, 1, 10, 1E, 5, 6, 50, 5EE, 60 provided via SAS-2 RAID HBA 		

TABLE 1. SUN FIRE X4170 M3 SERVER COMPARISONS

FEATURE	SUN FIRE X4170 M3, 4X 2.5" DISK	SUN FIRE X4170 M3, 8X 2.5 DISK	SUN FIRE X4170 M3, 4X 3.5" DISK
OS support*	All models support Oracle Solaris, Oracle Linux, Oracle VM, Red Hat Enterprise Linux, SUSE Linux Enterprise Server, Microsoft Windows Server		
Virtualization	Oracle VM included and VMware ESX/ESXi supported		

* Please refer to <http://www.oracle.com> for the most up-to-date information on supported versions of operating systems for each platform.

TABLE 2. SUN FIRE X4270 M3 SERVER COMPARISONS

FEATURE	SUN FIRE X4270 M3, 8X 2.5" DISK	SUN FIRE X4170 M3, 24X 2.5 DISK	SUN FIRE X4170 M3, 12X 3.5" DISK
Chassis	2U	2U	2U
CPUs	2 Intel Xeon processor E5-2600 CPUs	2 Intel Xeon processor E5-2600 CPUs	2 Intel Xeon processor E5-2600 CPUs
Memory capacity	Up to 256 GB	Up to 256 GB	Up to 256 GB
Number of PCIe 3.0 slots	6 total - 1 x16 external, 5 x8	6 total - 1 x16 external, 5 x8	6 total - 1 x16 external, 5 x8
Number of 10 GbE ports	4 onboard	4 onboard	4 onboard
USB ports	2 front, 2 rear, 2 internal	2 front, 2 rear, 2 internal	2 front, 2 rear, 2 internal
RAS components	<ul style="list-style-type: none"> • Hot-swappable and redundant power supplies, fans, disk drives • RAID 0, 1, 10, 1E, 5, 6, 50, 5EE, 60 provided via SAS-2 RAID HBA 		
OS support*	All models support Oracle Solaris, Oracle Linux, Oracle VM, Red Hat Enterprise Linux, SUSE Linux Enterprise Server, Microsoft Windows Server		
Virtualization	Oracle VM included and VMware ESX/ESXi supported		

* Please refer to <http://www.oracle.com> for the most up-to-date information on supported versions of operating systems for each platform.

Figures 2 and 3 provide photos of the base models of the Sun Fire X4170 M3 and Sun Fire X4270 M3 servers, respectively.



Figure 2. Sun Fire 4170 M3 server—4 x 2.5" disk bay with DVD—front view.



Figure 3. Sun Fire 4270 M3 server—8 x 2.5" disk bay with DVD —front view.

Sun Blade X6270 M3 Server Module

The Sun Blade 6270 M3 server module is a follow on to the Sun Fire X6270 M2 server module. It implements the newest Intel processor architecture and offers up to 128 GB of memory, enabling 1.7x the memory capacity and 1.4x the compute performance of the previous-generation server. These powerful blade servers are designed to deliver optimal performance for both I/O-intensive and compute-intensive application workloads.

Figure 4 highlights the key features on the Sun Blade X6270 M3 server module.

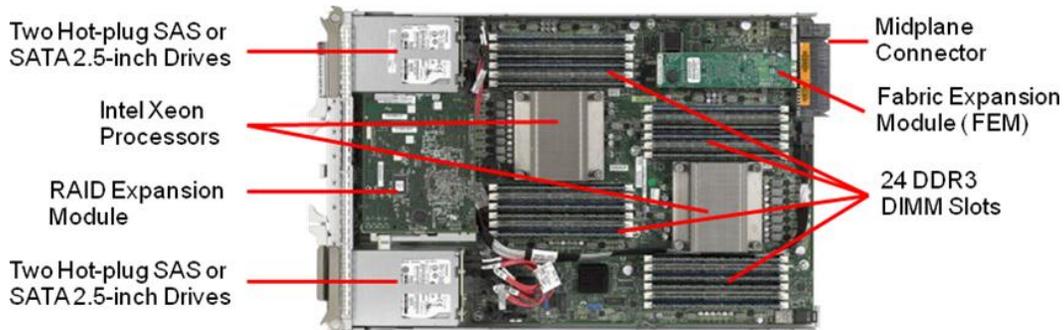


Figure 4. Sun Blade X6270 M3 server module.

Conclusion

Sun x86 systems are the best x86 platform for running Oracle software. They provide not only optimal performance and reliability based on an integrated and fully supported Oracle stack, but also include everything needed for a cloud-enabled deployment. Every model comes complete with virtualization, choice of OS, cloud provisioning, and Oracle's unique application-to-disk system management environment—all at no extra charge. This enables Sun x86 systems to offer up to 50 percent savings in cost of ownership over three years compared to similar competitive offerings.

Sun x86 systems have demonstrated proven performance with world-record benchmarks as well as proven enterprise-class reliability in production use running Oracle Applications at Oracle. Sun x86 systems are the industry's only x86 hardware and software stack that offers the simplicity and reliability of a single vendor to call for support.

For more information about Oracle's Sun x86 systems, visit oracle.com or call +1.800.ORACLE1 to speak to an Oracle representative.



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Hardware and Software, Engineered to Work Together