

# Sun and AMD—Taking 64-Bit Computing to the Edge



## Sun Fire™ Servers with AMD Opteron™ Processors



### Key Business Benefits

- Experience the extreme performance of AMD Opteron™ processors at compelling price points as Sun combines proven 64-bit technology with the industry economics of x86 technology
- Rely on the Solaris™ OS (x86 Platform Edition) for AMD Opteron-based systems for maximizing your application performance and enabling a seamless growth path (later this year, Sun will add full Solaris support for 32-bit and 64-bit computing on the AMD Opteron platform)
- Choose among leading 64-bit Linux distributions—Red Hat Enterprise Linux and SuSE Linux Enterprise Server—for your AMD Opteron systems
- Satisfy the demand for compute power by transitioning to 64-bit x86 while leveraging current 32-bit x86 investments
- Realize the power of 64-bit computing with the Sun Fire™ Compute Grid System (featuring inter-node networking through Myrinet, InfiniBand and Ethernet technologies), a ready-to-deploy solution to reduce administration costs and improve compute resource utilization
- Sun demonstrates its leadership in 64-bit computing with Opteron, SPARC®, Solaris OS, Linux, Java™, and Sun Java™ Enterprise System technologies

### Reference Solutions

- Sun Infrastructure Solution for Grid Computing

Having the ability to execute both 32-bit and 64-bit applications with extreme performance at the most compelling prices, AMD Opteron™ processor-based Sun servers have redefined the world of x86 64-bit computing.

### A Quantum Leap in x86 64-Bit Computing

64-bit computing, historically the realm of data center and high-performance technical applications, has just made a quantum leap into the world of edge computing. With the introduction of Sun Microsystems servers based on the AMD Opteron microprocessor, you can experience extreme-performance x86 64-bit computing at the most compelling prices and ensure investment protection for your existing 32-bit applications.

Over the past decade, commodity 32-bit x86 systems have played a major part in lowering the costs of server computing, especially when used in edge applications. 32-bit systems have been used for “good enough” computing where their favorable price and acceptable performance have made them an economical alternative to 64-bit systems.

Sun and AMD have now redefined the rules to deliver an affordable range of 64-bit Sun Fire™ systems featuring a wide range of microprocessor technology enhancements that will run your native 32-bit applications with extreme levels of performance. As a result, you have the flexibility to decide when to migrate to an x86 64-bit-ready environment.

Sun is offering a choice of operating systems—the Solaris™ Operating System (x86 Platform Edition) and two standard Linux distributions—to enable you to take full advantage of Opteron-based Sun Fire servers. Building upon its solid history of 32-bit to 64-bit computing with the SPARC® processor and Solaris OS, Sun will provide its customers and ISVs with a seamless growth path to 64-bit computing through 32-bit and 64-bit application coexistence. The 32-bit Solaris 9 OS (x86 Platform Edition) runs on Opteron-based systems today and a 64-bit release will be available later this year. In addition, Sun offers 32-bit and 64-bit distributions of Red Hat Enterprise Linux and SUSE Linux Enterprise Server, allowing you to deploy your operating system of choice while taking advantage of Sun’s global and comprehensive support infrastructure.

The Sun Microsystems and AMD alliance pulls together Sun’s vast experience in 64-bit computing (which has been established over the past decade with the Sun SPARC range of

# Sun Fire servers with AMD Opteron processors: Choice on a grand scale.

microprocessors) and the industry economics of AMD's innovative x86 processors to give you flexibility, performance, and value.

## Deploy a High-Performance 64-bit Architecture Now and Migrate at Your Own Pace

The computer industry is built on continuous development of new technology, and the 4 GB restriction of memory sizes in the 32-bit world is already threatening to hinder advances being made in memory technologies. This is a clear limitation to 32-bit systems and the time is approaching when more will be needed. Hence, the evolution from 32-bit to 64-bit computing is inevitable. Yet this transition must be made carefully in order to protect current investments in 32-bit applications.

With AMD Opteron-based servers from Sun, you can easily deploy a 64-bit environment now and migrate at your own pace. The AMD Opteron architecture allows 32-bit and 64-bit applications to coexist on the same system — enabling you to migrate to 64-bit only where needed and to follow your normal “end of life” cycles for your 32-bit applications.

## Native Execution of 32-bit Applications—Not Software Emulation

While other 64-bit architectures use a combination of hardware and software emulation techniques to execute 32-bit x86 application code (that is, if 32-bit code execution is supported at all), Sun's AMD Opteron systems are based on

the AMD64 architecture, which implements the AMD64 Instruction Set Architecture (ISA).

The AMD64 ISA simply extends the existing 32-bit x86 ISA and natively executes 32-bit application code without software emulation to degrade performance. The AMD64 platform is unique in its approach to delivering 64-bit capabilities while maintaining highly competitive 32-bit performance. AMD Opteron-based products from Sun will enable a much faster transition from 32-bit to 64-bit computing than the previous transition from 16-bit to 32-bit computing.

## Instant Benefit for 32-Bit Applications

In a 32-bit server, both the operating system and applications share the same, small 32-bit virtual memory space. This space is limited to a maximum of 4 GB, which can lead to small data set sizes and a lot of paging.

The same 32-bit application set run on a 64-bit server can take advantage of the larger range of addressable memory space. A 64-bit operating system can provide each 32-bit application with exclusive use of a 32-bit virtual memory space, limited only by the amount of system memory available. The operating system can use virtual memory space above 4 GB — leading to execution of larger data sets and a significant reduction in paging.

Your 32-bit applications will also gain instant performance advantages with features on the AMD Opteron microprocessor such as an integrated memory controller, which runs at

processor speeds rather than front side bus (FSB) speeds, and HyperTransport™ technology, which provides high-speed, asynchronous chip-to-chip board level interconnects between CPUs and I/O devices.

## Balanced Performance

For many years, the computer industry has witnessed an imbalance between the advancements in microprocessor clock speeds (Moore's Law states that the doubling of microprocessor speeds occurs approximately every 18–24 months) and the far slower improvements in system memory bandwidth. As a result, more applications have become memory bound, and increased processor speeds have had little impact on overall application performance.

AMD Opteron-based Sun Fire systems have been designed to improve this balance between processor speed and bandwidth. Two key features which contribute to the balanced system performance of the AMD Opteron processor are the integrated memory controller and the revolutionary HyperTransport system interconnect.

## Scalable Memory Bandwidth

Integrating the memory controller into the AMD Opteron processor helps to lower latency and increase effective memory bandwidth. In addition, by eliminating the FSB, the memory controller no longer runs at the bus speed but at the processor clock speed.

This approach also delivers direct memory bandwidth scalability for multiprocessor systems. Every processor that is added brings an additional memory controller to the system. Each processor has an independent connection to its local memory, so the memory in the system is physically divided among the processors.

When a processor wants to address memory associated with another processor, the request goes through the HyperTransport bus and is handled by the local memory controller. With this approach, the processors do not have

to contend with a single central memory resource.

*High-Performance Chip-to-Chip Interconnect*  
HyperTransport technology is a high-speed on-chip interconnect that facilitates communications between processors and I/O devices with low-latency point-to-point links that operate up to 48 times faster than some existing technologies.

HyperTransport processing is on chip but occurs in a separate unit from the processor core so that interconnect processing transpires without interrupting the memory controller or the processor.

HyperTransport technology was invented at AMD with contributions from industry partners and is managed and licensed by the HyperTransport Technology Consortium, a non-profit corporation. Sun is a strong promoter of HyperTransport technology and a charter member of the HyperTransport Technology Consortium.

### **Sun and AMD Opteron: The New Alternative for Technical Computing**

The world of High Performance Technical Computing (HPTC) has evolved significantly over several decades. Early massively parallel computers using proprietary processors gave way to reduced instruction set (RISC) computers utilizing single-chip microprocessors with Moore's Law enhancements in processor speed occurring over time. Typical HPTC applications are found in electronic design automation (EDA), mechanical computer-aided engineering (MCAE), natural resource exploration, life sciences research, and other compute-intensive applications.

The most recent progression of HPTC is based on an architecture of clustered commodity components whereby standard "off-the-shelf" microprocessor systems are aggregated as needed to provide the compute fabric for processing batch-oriented applications. To date, standard 32-bit systems have been very successful in this environment due to a combination of price and performance.

Even when running slower double precision calculations, 32-bit systems have been cost effective when compared to 64-bit alternatives.

However, technical computing also has solid requirements for 64-bit precision, high floating-point computation speeds, and large memory address spaces. With AMD Opteron-based Sun servers, you can now realize the power of 64-bit computing at price performance levels never previously possible.

The balanced system performance of the AMD Opteron architecture, combined with the HPTC software tools and integrated technical computing solutions from Sun, establish Sun Fire systems with AMD Opteron processors as the new alternative for technical computing.

### *Sun Fire™ Compute Grid Rack System: Integrated HPTC Solutions*

Long a leader in technical computing, Sun is committed to delivering world-class HPTC development and management tools. Through internal research and development, acquisition of technology and expertise (for example, the acquisition of the Thinking Machines Corp. parallel development group), product licensing, and strategic alliances with top HPTC technology providers, Sun delivers one of the industry's most comprehensive, integrated tool suites for high performance computing.

In addition to providing world-class HPTC software tools, Sun also offers a range of integrated ready-to-deploy solutions that meet the needs of your technical computing infrastructure. The Sun Fire Compute Grid Rack System incorporates a collection of high density, entry-level servers and easy-to-use management software in an integrated solution that delivers excellent price/performance.

Sun Fire servers form the hardware platform for the Cluster Grid Manager and the compute nodes. Combined with the very latest high-speed interconnects (such as Myrinet, InfiniBand, and Gigabit Ethernet), a terminal server, and a keyboard/video/mouse shelf integrated in a Sun™ Rack, the Sun Fire Compute Grid Rack System makes an ideal building block for implementing flexible and scalable grid computing.

Cluster Grid Manager is the management node of the compute grid and comes preloaded with both system management and distributed resource management software. This integrated management software stack, featuring an easy-to-use, browser-based interface, helps to reduce ongoing administration costs as well as improve resource utilization of the compute grid.

With the Sun Fire Compute Grid Rack System, you can achieve rapid deployment,



The AMD Opteron processor-based Sun Fire™ V20z server provides an entry-level platform that redefines the world of 64-bit computing.

reduce administration costs, and improve your compute resource utilization.

### Conclusion

At Sun Microsystems, we recognize that our customers have different network computing needs. You need systems that can “scale up” to handle larger workloads, as well as systems that can “scale out” to handle a greater percentage of the workload in your business.

Sun remains committed to both approaches, and now offers the choice of “scaling out an infrastructure” on industry-standard Sun x86 platforms running either the Solaris Operating System (x86 Platform Edition) or Linux.

The alliance of Sun Microsystems and AMD joins together over 20 years of enterprise computing experience with industry-standard economics, targeting the delivery of systems that feature extreme performance at compelling prices.

The introduction of AMD Opteron-based systems into the Sun Fire server product line provides an entry-level platform choice unparalleled in the industry. Further, Sun and AMD are working together to optimize the Solaris Operating System and the Java™ platform and developer tools for AMD Opteron 64-bit processors, which will enable you to take advantage of the industry’s number one UNIX® platform and experience binary compatibility between 32-bit and 64-bit environments.

Sun and AMD intend to work jointly with the Linux community to define and promote a 64-bit UNIX-Linux Application Binary Interface (ABI) to enable interoperability. Sun and AMD also plan to provide ISVs and developers with the Sun/AMD Developer Resource Kit, which includes information, tools, and community resources required to speed solutions to market.

Many independent software vendors are already embracing Sun’s AMD Opteron-based offering as the standard in network computing, including: BEA Systems, Cadence Design Systems, Inc., Computer Associates, Documentum, MatrixOne Inc., Oracle, Synopsys, Inc., and SAP AG.

Get the details.

For more information on the Sun and AMD alliance, visit [sun.com/amd](http://sun.com/amd).

For more information on the Sun Fire server range of products, visit [sun.com/servers](http://sun.com/servers).

For more information on the Sun Fire Compute Grid Rack System, visit [sun.com/servers/computegrid](http://sun.com/servers/computegrid).

For more information on the Sun Infrastructure Solution for Grid Computing, visit [sun.com/solutions/infrastructure/grid](http://sun.com/solutions/infrastructure/grid).

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