



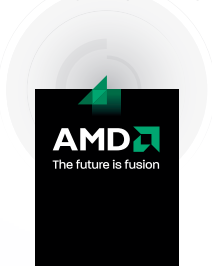
SGI and 12-Core AMD Opteron™ Processors

The Solution to Your Complex, Demanding Server Workloads

Contents

- AMD and SGI: A Next-Gen Optimization Partnership that Helps Lower TCO 2**
- Transforming Server Performance. 2**
- Delivering Space-Saving Density 3**
- Cutting Costs with Leading-Edge Energy Efficiency 4**
- Optimizing with Design-to-Order 5**
- Planning Your Data Center of the Future 5**
- Ensuring Serviceability and Reliability. 5**
- Stabilizing Budgets Under Pressure with Virtualization 5**
- Supporting You 6**
- SGI and AMD: The Right Solutions 6**

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As data and transaction volumes mushroom, managing the huge infrastructures that power Internet services firms like Google, Amazon, Yahoo!, and Facebook consume a lot of energy, require a lot of space, and require very complex infrastructure. As such, managing them can be a nightmare.

Fortunately, a new generation of x86 multi-core processors and servers are being designed to address these challenges in cost-effective ways. So now even midsize businesses can afford to operate data-intensive infrastructures.

Thanks to AMD's new 12-core AMD Opteron™ 6100 Series processors and the leading-edge ways SGI implements them in its rackmount server designs, you can now:

- Boost server density to reduce space requirements
- Get systems configured to your particular needs
- Scale your servers up as well as out, thanks to built-in upgrade paths
- Reduce energy use
- Improve serviceability and reliability
- Achieve new levels of computing performance
- Accelerate virtualization efforts
- Ease management burdens
- Deploy flexible, affordable storage solutions



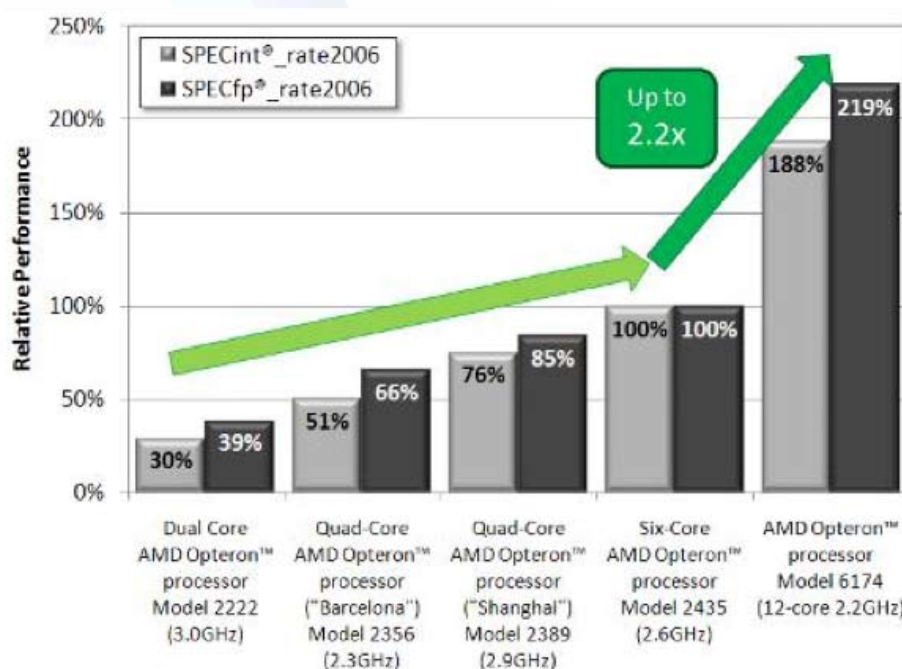
>> Not only does the AMD Opteron 6100 Series processor bring you a low-priced 12-core processor, its innovations in power, memory, and virtualization were designed to increase your energy-efficiency and provide you with a stable, consistent platform that can scale for the future.

AMD and SGI: A Next-Gen Optimization Partnership that Helps Lower TCO

By combining multi-core AMD Opteron™ processors with advanced HyperTransport™ links, AMD has changed the x86 server landscape. Not only does the AMD Opteron 6100 Series processor bring you a low-priced 12-core processor, its innovations in power, memory, and virtualization were designed to increase your energy-efficiency and provide you with a stable, consistent platform that can scale for the future.

When the AMD Opteron processors power rackmount server designs that focus on high density and high configurability for cluster computing, the results are SGI's designed-to-order, open-architecture SGI® CloudRack™ and Rackable™ Half-Depth Servers and its SGI InfiniteStorage servers.

Performance Summary: Two-Socket Servers (including AMD Opteron™ 6100 Series Processor)¹



Transforming Server Performance

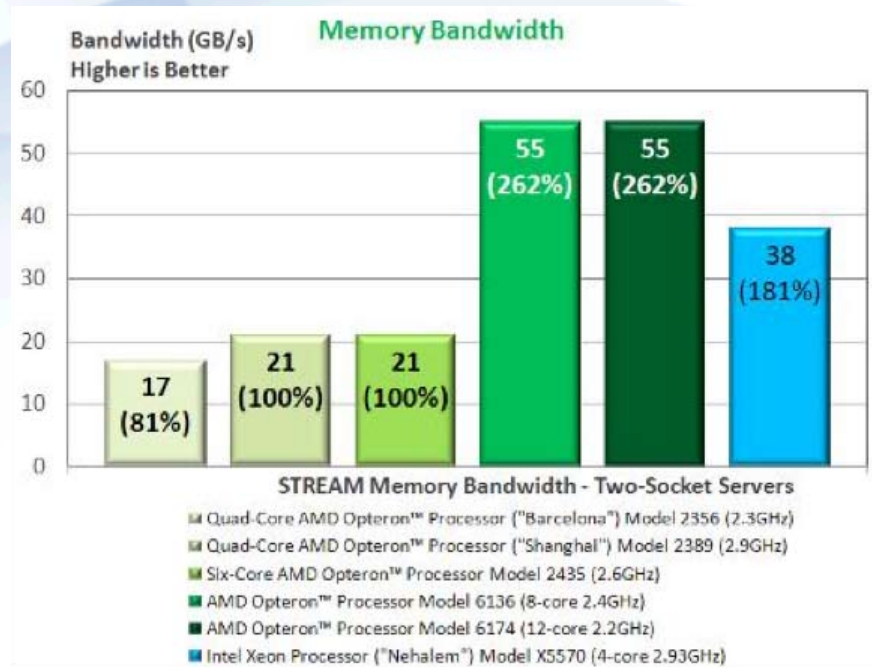
Servers based on the AMD Opteron™ 6100 Series processor can deliver nearly two times the memory and I/O bandwidth of previous-generation 2P and 4P servers while consuming similar amounts of energy.²

Direct Connect Architecture. AMD's Direct Connect Architecture balances raw processing power, memory performance, I/O throughput, power efficiency, and scalability to provide low-latency, high-bandwidth memory access.

Fully software- and virtualization-compatible with previous generation AMD Opteron™ processors and designed to simultaneously run 32- and 64-bit applications, the AMD Opteron™ 6100 Series processor's Direct Connect Architecture 2.0 directly connects processors, memory controller, and I/O to the CPU.



Memory Bandwidth (STREAM) — Two-Socket Servers (including AMD Opteron™ 6100 Series Processors)³



A NUMA (non-uniform memory architecture) design enables the processors to resolve their own memory fetches rather than create delays by sending the request to a chipset component that engages a memory bus. The AMD Opteron 6100 Series processor also includes on-die integrated four-channel DDR3 memory controller with Error Correcting Code (ECC) and up to 12 DIMMS per CPU. Thus, the Opteron 6100 Series processors offer available memory bandwidth (STREAM) up to 55 GB/s (with DDR3-1333) in a two socket server.⁴

Doubling Memory and I/O Throughput. AMD Opteron™ 6100 Series processors offer up to 48 cores in a 4P configuration and provide 128-bit SSE floating-point capabilities. Since servers based on the AMD Opteron 6100 Series processor can deliver nearly two times the memory and I/O bandwidth of previous-generation 2P and 4P servers², your cache-sensitive applications are likely to perform better.

The AMD Opteron also includes HyperTransport™ Technology Assist (HT Assist), which enables high-speed I/O to help reduce memory latency, improve resource sharing, and increase overall system performance for virtualization workloads in multi-socket systems. And HyperTransport™ 3.0 technology (HT3), which is backward compatible to HT 1.0, helps improve overall system balance and scalability. The HT 3.0 generation delivers interconnect rates up to 102.4GB/second peak bandwidth per processor.

And in anticipation of your future needs, AMD plans to ensure that Opteron™ 6100 Series processors are socket-compatible with the next generation AMD Opteron™ processor, which will be based on AMD's next generation core, codenamed "Bulldozer."

Delivering Space-Saving Density

SGI's designed-to-order, open-architecture CloudRack and Rackable™ Half-Depth Servers make the most out of the AMD Opteron™ processor.

Rackable Half-Depth Servers: Meeting Hot Aisle/Cold Aisle Challenges. With SGI's Half-Depth Server designs, you can mount servers back-to-back for higher server density and improved SGI innovative thermal management. Since the center of the cabinet becomes the hot aisle, the back-to-back approach allows you to reduce

>> **CloudRack has been designed to deliver breakthrough energy efficiency and high reliability.**

hot-aisle/cold-aisle thermal issues by evacuating the hot aisle out of the data center above the cabinet. Many data centers are choosing this implementation of hot-aisle containment to help improve their energy efficiency.

In addition to helping improve thermal efficiency, Rackable Half-Depth servers can also achieve twice the density of typical rackmount servers. They can be deployed with SGI's award-winning DC power technology or high-efficiency AC power supplies to help improve price performance per watt and reduce operating costs. And to ease deployment, SGI Half-Depth Servers are delivered fully racked, cabled, and tested. All of these advantages can significantly lower your total cost of ownership.

CloudRack: with Cluster Computing in Mind. Based on a new rack-centric server design, SGI's CloudRack™ can achieve extreme densities for cloud computing and other large scale-out server deployments. CloudRack takes a new approach by redesigning the rackmount server at the rack level. With power and cooling functions shifted to the cabinet, CloudRack's server trays simply comprise one or more server boards, CPUs, memory, and hard drives. Gone are individual power supplies and power-consuming 1U server cooling fans. In short, CloudRack has been designed to deliver breakthrough energy efficiency and high reliability.

Available in a variety of form factors designed for scalable workgroup clusters all the way to scale-out data centers, CloudRack systems are optimized to each customer's computing environment and applications and are built ready to take advantage of next-generation AMD Opteron™ processors. SGI rigorously tests, CloudRack systems to ensure they are ready for immediate integration.

SGI InfiniteStorage Servers. SGI's AMD processor-based storage servers offer enhanced storage capacity and performance in addition to all of the benefits of AMD server technology available in our Rackable and CloudRack server lines.

Available in both half-depth and standard-depth rackmount form factors, SGI InfiniteStorage servers feature up to 18 hot-swap SAS or SATA II disk drives for up to 36TB of local storage capacity using 2TB SATA II hard drives. SGI InfiniteStorage servers come with high-efficiency power supplies, memory, and processors that help lower your data center's operational costs.

SGI's Cluster Management Software. SGI server solutions are available with a tightly integrated, comprehensive software stack, including SGI ProPack™ performance software and ISLE systems and cluster management software.

ISLE Cluster Manager enables you to monitor essential system metrics from a single point of control. ISLE's improved software maintenance procedures allow you to automate repetitive tasks — so you can spend less time and resources administering systems. The result: low total cost of ownership and increased productivity.

Cutting Costs with Leading-Edge Energy Efficiency

Choosing AMD Opteron™ processors for your SGI servers can save you plenty when it comes to energy use.

Energy Control without Compromise. Not only do the new AMD Opteron™ configurations offer advanced performance at affordable prices, they have double the cores of a six-core system without requiring a major increase energy consumption.

The AMD Opteron 6100 Series processor is available in a wide range of high-efficiency (HE) and high-performance (SE) energy footprints that provide the same full set of features as AMD's standard power versions, allowing for flexibility in controlling energy consumption without compromising performance of individual servers or the overall cluster.

And the AMD-P 2.0 suite of power management technologies help cut your energy requirements:

- APML (advanced platform management link) monitors and controls platform power consumption as well as monitoring power/cooling
- AMD CoolSpeed technology uses precision thermal monitoring to allow servers to automatically adjust the speed of their processor when thermal environments exceed safe levels. Then, CoolSpeed technology can bring the processors back up to full speed when conditions go back to normal



>> **CloudRack servers are also thermally optimized to allow data centers to operate at much higher temperatures — up to 104°F (40°C). This can allow you to substantially lower air conditioning power consumption, which in turn would help reduce operating costs.**

- C1E helps reduce energy consumption by powering down the cores, memory controller, and HT links on systems that are in idle beyond a certain threshold
- LV-DDR3 memory support will also help with keeping energy consumption under control

Efficient Use of Data Center Power. SGI's CloudRack servers' fan-less and cover-less 1U server trays utilize Power XE™, a next-generation cabinet-level power distribution:

- Virtually eliminates the data center stranded-power problem (a data center's power capacity which is paid for but ultimately unused) and provides incredible phase balancing
- Significantly improves power delivery efficiency by converting incoming AC power to 99 percent efficient 12V DC power via hot-pluggable, N+1 redundant rectifiers
- Eliminates server-level power supplies for improved reliability

CloudRack servers are also thermally optimized to allow data centers to operate at much higher temperatures — up to 104°F (40°C). This can allow you to substantially lower air conditioning power consumption, which in turn would help reduce operating costs. Plus CloudRack's autonomic fan arrays can reduce fan power by over 80 percent as compared to conventional AC enclosures.

Optimizing with Design-to-Order

Now, with the AMD Opteron™ 6100 Series processors, you can match your workloads with versatile, right-fit processors and get superior, energy-efficient performance that won't break your budget.

And SGI's design-to-order processes means that the servers you order are optimized for your computing environment while eliminating unnecessary costs. The high degree of configuration flexibility in SGI design-to-order servers gives you the freedom to choose the processor architecture that best meets your workload needs.

Planning Your Data Center of the Future

Socket compatibility and ease of management are key features of AMD's Opteron™ 6100 processor.

Socket Compatibility. AMD currently plans to ensure that the Opteron™ 6100 Series processor is socket-compatible with future generations of Opteron processors, which means that planning for today can also be planning for tomorrow.

Easy Management. The AMD Opteron™ processor architecture requires fewer software images and drivers to manage, and minimizes pre-production testing. This can make managing servers based on AMD technology easier and allow for seamless upgrades to next-generation capabilities without changing platforms.

Ensuring Serviceability and Reliability

The AMD Opteron 6100™ Series processor's reliability-availability-security (RAS) features help reduce your downtime risks and meet peak workload service-level agreements while controlling costs and power usage. SGI takes powerful advantage of those capabilities.

Hot-swappable. Many SGI servers are made more reliable and available thanks to hot-swappable power supplies and hard drives. SGI's CloudRack servers also feature hot-swappable, redundant rack-level power supplies with no incremental cost or loss of efficiency. Redundant, hot-swap power supplies are also available as an option in the Rackable server line.

Lights-Out Remote Management. In addition, SGI's CloudRack and Rackable half-depth servers are both designed with front facing I/O to simplify maintenance and maximize serviceability. IPMI-based remote management technology offers complete lights-out remote management.

Stabilizing Budgets Under Pressure with Virtualization

The AMD Opteron 6100 Series processor includes features like AMD Virtualization™ (AMD-V™) technology, which can help customers maximize embedded system efficiency, security and provide new innovative embedded system architectures..



For more information about how AMD and SGI can make a difference for your business, go to:

www.sgi.com/AMD

or contact an SGI representative at 1-800-800-7441 (US and Canada)

www.amd.com/opteron

www.amd.com/benchmarks

AMD-V™ 2.0. Developed in collaboration with leading virtualization software providers, AMD-V 2.0 helps to improve performance of software-based virtualization solutions. AMD-V 2.0 includes I/O Virtualization technology which helps to reduce the level of hypervisor intervention for I/O operations, and provides a hardware mechanism to enhance the security and integrity of each virtual machine instance.

VMware Ready. Meanwhile, SGI offers a complete line of 'VMware Ready'-certified systems designed to meet the needs of even highly complex virtualized environments. SGI fields over a hundred fifty different system configurations certified for VMware so that you can find the right platform and configuration choices to meet your requirements and help reduce your TCO.

Supporting You

To ensure optimum performance of your SGI systems, SGI offers a variety of comprehensive support programs that emphasize personalized and quality service from technical experts. And SGI's state-of-the-art electronic support provides automated system monitoring to protect against costly downtime.

In addition, you can access SGI's deep experience with high-performance computing and data centers via its custom consulting, assessment, and file management services offerings. Customer education and managed services are also available to dramatically simplify your administration burden.

SGI and AMD: The Right Solutions

With AMD's new generation of x86 processors powering SGI's breakthrough server designs, even midsize businesses can operate compute-intensive infrastructures. Now you can transform your data center's capabilities by boosting performance while bringing cost-, space-, energy-, and management efficiency to the most demanding data-intensive applications and large-scale infrastructures.

The competitive opportunities unleashed by AMD processors and SGI servers are limited only by your own imagination and acumen.

Notes:

- 1 SPEC, SPECint, and SPECfp are registered trademarks of the Standard Performance Evaluation Corporation. The results for AMD Opteron processor Model 6174 are based upon data submitted to Standard Performance Evaluation Corporation as of March 17, 2010. The other results stated above reflect results published on <http://www.spec.org/cpu2006/results/> as of March 17, 2010. The comparison presented above is based on the best performing two-socket servers using AMD Opteron™ processor Models 2222, 2356, 2389, 2435, and 6174. For the latest SPECint®_rate2006 and SPECfp®_rate2006 results, visit <http://www.spec.org/cpu2006/results/>.
- 2 Increase in memory based on quad channel DDR3-1333 for AMD Opteron™ 6100 Series processor vs. dual channel DDR2-800 for Six-Core AMD Opteron™ processor. Increase in I/O performance based on 3x HyperTransport™ technology links @ up to 4.8 GT/s (up to 14.4 GT/s total bandwidth) for Six-Core AMD Opteron™ processor vs. 4x HyperTransport™ technology links @ up to 6.4 GT/s (up to 25.6 GT/s total bandwidth) for AMD Opteron™ 6100 Series processor.
- 3 Based on measurements at AMD labs as of March 17, 2010.
Configuration Information:
2 x Quad-Core AMD Opteron™ processors ("Barcelona") Model 2356 in Supermicro H8DMU+ motherboard, 16GB (8 x 2GB DDR2-667) memory, SuSE Linux® Enterprise Server 10 SP2 64-bit
2 x Quad-Core AMD Opteron™ processors ("Shanghai") Model 2389 in Supermicro H8DMU+ motherboard, 16GB (8 x 2GB DDR2-800) memory, SuSE Linux® Enterprise Server 10 SP2 64-bit
2 x Six-Core AMD Opteron™ processors Model 2435 in Supermicro H8DMU+ motherboard, 16GB (8 x 2GB DDR2-800) memory, SuSE Linux® Enterprise Server 10 SP2 64-bit
2 x AMD Opteron™ processors Model 6136 in "Dinar" reference design kit, 32GB (8 x 4GB DDR3-1333) memory, SuSE Linux® Enterprise Server 11 64-bit
2 x AMD Opteron™ processors Model 6174 in "Dinar" reference design kit, 32GB (8 x 4GB DDR3-1333) memory, SuSE Linux® Enterprise Server 11 64-bit
2 x Intel Xeon processors Model X5570 in Dell PowerEdge R710 server, 24GB (6 x 4GB DDR3-1333) memory, SuSE Linux® Enterprise Server 11 64-bit
- 4 55GB/s using 2 x AMD Opteron™ processors Model 6174 in "Dinar" reference design kit, 32GB (8 x 4GB DDR3-1333) memory, SuSE Linux® Enterprise Server 11 64-bit

