
A Shared-infrastructure Solution for Maximized HPC

The Dell™ PowerEdge™ C6145 featuring AMD Opteron™ 6100 Series processors

INTRODUCTION

High-performance computing (HPC) applications push the capabilities of practically every relevant variable related to server design: performance, density, connectivity, physical footprint, thermal output, power usage, and more.

Whether it's computing massive amounts of physics data from a supercollider in the search for new particles, simulating human protein structures to develop better drugs with fewer side-effects, or designing new automobiles with enhanced fuel efficiency, HPC users generally strive to maximize the computation capabilities of their clusters within fixed limits of budget, space, and energy consumption.

The Dell PowerEdge C6145 server is designed specifically for the needs of today's cutting-edge HPC users running symmetric multiprocessing-based (SMB) applications — including Bioinformatics, Weather, Oil and Gas, CAD, Medical Imaging, and Physics.

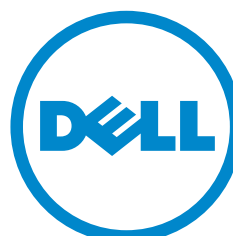
To keep up with the demands of intensive computational research of public and enterprise customers, PowerEdge C6145 servers rely on AMD Opteron™ 6100 Series processors. With up to twelve cores each, these processors are designed to deliver exceptional memory bandwidth, powerful floating point capabilities, and valuable energy efficiency. They're the highest performing processors released by AMD to date.

To put that processing power to good use, Dell engineers have designed a server with the benefits of a shared infrastructure — saving space, weight, and energy. A shared-infrastructure server pools resources in a single chassis and spreads them across independent server nodes within that same chassis to achieve optimized performance. It offers the potential of reducing the total-cost-of-ownership (TCO) for large clustered deployments. PowerEdge C6145 servers share chassis, fans, power, and cooling.

The combination of AMD processing technology and Dell's shared-infrastructure design delivers a server solution that addresses three highly critical factors for today's HPC user: Density, Performance, and Value.

Table of Contents

Introduction	1
Power of concentration	2
Transcendent performance	2
Outstanding value	3
A Total Server Package for Public or Enterprise HPC	3



POWER OF CONCENTRATION:

The densest server solution in the industry. Period.

As HPC application data sets continue to get larger and more complex, customers need more cores, more memory, and more I/O to keep up with the demands of intensive computational research. While expanding the physical cluster space to add more servers is a potential solution, for many customers it's neither pragmatic nor cost-effective.

To maximize budget allocations, the majority of today's HPC customers are seeking to increase compute capabilities within their existing datacenter footprint. They strive to pack more processing and memory into the same amount of space — or in even less space.

With up to two independent 4-socket server nodes in a 2U chassis, each PowerEdge C6145 server may include eight 12-core AMD processors — or a total of 96 processing cores per server. That's twice the core count of competing 2U servers on the market.

The energy-efficient design of the AMD Opteron™ 6100 Series processor (formerly code named "Magny-Cours") enables Dell engineers to maximize core density in a 2U envelope. Customers can effectively double their core count within an existing footprint, or maintain their current count in half the available space.

In addition to processing density, the PowerEdge C6145 also offers superior memory density with 32 x DDR3 RDIMMs and up to 12 x 2.5" or 6 x 3.5" HDDs per node¹. The PowerEdge C6145 also has 200% more cores and at least double the processor density in 2U than traditional 4-socket servers².

The PowerEdge C6145 provides the highest 4-socket density of any competitive shared-infrastructure design on the market. In terms of cluster design for HPC customers, having fewer 4-socket versus more 2-socket servers not only provides improved density, but also easy management for IT support. More cores in fewer nodes can offer a highly simplified and streamlined cluster design.

TRANSCENDENT PERFORMANCE:

Advanced processing and connectivity abilities.

The driving factor behind the desire for higher and higher core counts within existing cluster footprints is performance. Increased core count translates to greater computer power for HPC customers — which in turn can mean faster answers to the problems researchers are trying to solve.

On top of enabling more processing cores per cluster, AMD Opteron™ 6100 Series processors also offer 127%³ higher performance and 5x greater performance per rack unit versus competing processor solutions⁴. They also provide memory bandwidth that exceeds that of any competing processor on the market⁵.

To help get massive amounts of heavy data into those powerful processing engines, Dell PowerEdge C6145 servers also offer an array of high-speed connectivity options for industry leading I/O.

Each node features three x16 PCIe slots; one x8 Mezzanine slot; and one dedicated Host Interface Card (HIC) port, which can be used to connect to graphics processing units (GPUs) — such as the Dell PowerEdge C410X PCIe expansion chassis, which features 16 GPUs and up to 16.5 teraflops of additional computing throughput. This array of ultra-fast connectivity options enables multiple 10 Gigabit Ethernet and/or multiple InfiniBand connections.

The sum-total of all of that processing and connectivity horsepower in one design? In recent benchmarks the PowerEdge C6145 ranked as the highest performing x86 2U shared-infrastructure server on the market based on SPECfp_rate2006 results. In addition, the PowerEdge C6145 can deliver up to a 496% better price-per-performance at a fifth of cost and a quarter of the rack space when compared to HP's ProLiant DL980 G7⁶.

For one Oil & Gas customer who uses HPC for seismic mapping in the Gulf of Mexico, the standard calculations per job using their previous-generation cluster took 16 hours. With the PowerEdge C6145, they were able to cut that time down to 2 hours — a massive savings of 14 hours per job. Reducing the customer's time to market helps them turn around more maps, have more information to sell, and maximize company sales.

OUTSTANDING VALUE:

Maximizing your HPC budget today—and tomorrow.

For many HPC customers, the principal limiting factor for their system is budget. To get the most performance-per-dollar is an almost universal objective for compute-intensive researchers — regardless of discipline or market sector.

The Dell PowerEdge C6145 features 4P processors at the price of 2P processors⁷. It's able to achieve remarkable value through its cost-efficient, shared-infrastructure design — with multiple nodes sharing the same power supply and cooling components in a single enclosure; and the inclusion of AMD Opteron™ 6100 Series processors, which offer a significant cost-per-core advantage over comparable processors from a competing CPU manufacturer⁸.

But purchase price isn't the only variable in calculating the total value of a server cluster. System power consumption and cooling requirements are both becoming increasingly important factors in HPC requests for proposal (RFPs). Over time, these overhead costs can contribute to an escalating total-cost-of-ownership for a large cluster system.

When compared to the previous processor generation, the AMD Opteron™ 6100 Series processor in the PowerEdge C6145 provides 115% better performance-per-watt⁹. The server's shared infrastructure contributes by not only reducing component costs, but also by helping use less floor space, less power, and less cooling. High core density and a small footprint help reduce the overall node count, which in turn can reduce the overall power consumption of the compute center.

A Total Server Package for Public or Enterprise HPC

With a shared-infrastructure design that directly addresses the critical factors of density, performance, and value, Dell Data Center Solutions engineers have created an HPC building block that gives customers linear scalability to address some of the world's most critical needs and problems through massive computational capabilities and throughput.

Designed for demanding symmetric multiprocessing-based applications, the Dell PowerEdge C6145 featuring AMD Opteron™ 6100 Series processors provides not only an industry-leading tool for HPC workloads, but also the ability for companies and institutions to do much more with their IT budget.

And as datasets expand and applications grow more complex, the PowerEdge C6145 is designed to scale for added compute and GPU capacities. Its socket-compatible design also offers an upgrade path, thanks to its compatibility with the next generation of AMD Opteron™ processors (based on the new “Bulldozer” core architecture)¹⁰. This in turn can help increase the life-cycle of the cluster — and the long-term value of the customer's HPC investment.

It's an outstanding solution designed for rigors of cluster environments — whether you're working to cure cancer, discovering new sources of energy, or unlocking the deepest mysteries of quantum mechanics.

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¹ http://www.dell.com/us/business/p/poweredge-c6145/pdf?c=us&l=en&s=bsd&cs=04&baynote_bnrnk=0&baynote_irrank=0&-ck=baynoteSearch&redirect=1

² AMD Opteron™ 6100 Series processors have up to 12 cores vs previous Six-Core AMD Opteron™ Series Processors which have up to 6 cores performance and scalability

³ SPEC and SPECfp are registered trademarks of the Standard Performance Evaluation Corporation. The results stated above reflect results published on <http://www.spec.org/cpu2006/results/> as of January 7, 2011. The comparison presented above is based on the best performing four-socket server using AMD Opteron™ processor Model 6168 and the best performing two-socket server using Intel Xeon processor Model X5680 operating at each processor's default frequency. Pricing reflects 1kU tray pricing on www.amd.com and www.intel.com for total system processor price as of January 7, 2011, and is subject to change. For the latest SPECfp@_rate2006 results, visit <http://www.spec.org/cpu2006/results/>. Configuration: 257 (\$3326 total processor price) using 2 x Intel Xeon processors Model X5680 in Fujitsu PRIMERGY RX300 S6 server, 48GB (12 x 4GB DDR3-1333) memory, SuSE Linux® Enterprise Server 11 64-bit, Intel Professional Compiler v11.1 and 584 (\$2976 total processor price) using 4 x AMD Opteron™ processors Model 6168 in Dell PowerEdge R815 server, 128GB (32 x 4GB DDR3-1333) memory, SuSE Linux® Enterprise Server 11 64-bit, x86 Open64 4.2.3 Compiler Suite.

⁴ SPEC and SPECfp are registered trademarks of the Standard Performance Evaluation Corporation. The Dell PowerEdge C6145 result stated above is based on results submitted to www.spec.org as of March 1, 2011. The other result stated above is based on results published on www.spec.org as of March 1, 2011. The comparison presented above is based on the highest performing results for Dell PowerEdge C6145 and HP ProLiant DL980 G7 servers. For the latest SPECfp@_rate2006 results, visit <http://www.spec.org/cpu2006/results/>. Configuration: 1310 using 8 x AMD Opteron™ processors Model 6180 SE in Dell PowerEdge C6145 server, 128GB (32 x 4GB DDR3-1333) memory, SuSE Linux® Enterprise Server 11 64-bit, x86 Open64 4.2.4 Compiler Suite (21 x 2U servers in 42U rack) and 1150 using 8 x Intel Xeon processors Model X7560 in HP ProLiant DL980 G7 server, 1TB (128 x 8GB DDR3-1333) memory, SuSE Linux Enterprise Server 11 64-bit, Intel Composer XE 2011 v12 (5 x 8U servers in 42U rack)

⁵ Based on measurements at AMD labs as of March 17, 2010 using STREAM

⁶ 4 x AMD Opteron™ processors Model 6174 in “Drachma” reference design kit, 64GB (16 x 4GB DDR3-1333) memory, SuSE Linux® Enterprise Server 11 64-bit vs 4 x Intel Xeon processors Model X7460 in Supernic X7QC3+ motherboard, 32GB (16 x 2GB DDR2-667) memory, SuSE Linux® Enterprise Server 10 SP1 64-bit

⁶ Based on testing by Dell Labs. Dell PowerEdge C6145: SPECfp_rate2006 of 1310 in 2U as compared to HP ProLiant DL980 G7: SPECfp_rate2006 of 1150 in 8U. SPEC® and the benchmark name SPECfp® are registered trademarks of the Standard Performance Evaluation Corporation. Competitive benchmarks stated above reflect results published or submitted to www.spec.org <<http://www.spec.org>> as of Feb 14, 2011. The comparison presented above is based on the best performing 8-chip x86 servers. For the latest SPECfp_rate2006 benchmark results, visit <http://www.spec.org/cpu2006>. Actual performance will vary based on configuration, usage and manufacturing variability. HP ProLiant is priced at \$130,806.51 with a performance score of 1150; price-performance of 121.12 vs Dell PowerEdge C6145 Price of \$24,997.42 with a performance score of 1310; price performance of \$19.08 = 496% better price performance at a fifth of the cost.

⁷ Based on standard power Six-Core AMD Opteron™ processor Model 2435 1ku pricing of \$989 as of 10/19/09 vs. standard power AMD Opteron™ processor Model 6172 ("Magny-Cours") 1ku pricing of \$989 at time of launch.

⁸ Calculated using AMD Opteron™ processor model 6168 (\$744 1ku/12 cores = \$62.00) vs Intel Xeon X7550 (\$2729 1ku/8 cores = 341.00)

⁹ Performance per watt gain of 115% of C6145 calculated using SPECpower_ssj2008 comparing PowerEdge 2970/R805 using Six Core AMD Opteron™ Model 2435 with a score of 1144 vs C6145 using AMD Opteron™ Model 6176 SE with a score of 2357. SPEC and SPECpower are registered trademarks of the Standard Performance Evaluation Corporation. For the latest SPEC benchmark results, visit www.spec.org.

¹⁰ May require BIOS firmware upgrade

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