

DESIGNING PERFORMANCE

Dell Data Center Solutions designs a customized Cloud Computing Solution for R Systems that increases application performance by approximately 40 percent



SOLUTION
• CLUSTERING



CUSTOMER PROFILE

COUNTRY: United States

INDUSTRY: IT

FOUNDED: 2006

WEB ADDRESS: www.rsystemsinc.com

CHALLENGE

Design and deploy a large-scale high-performance computing (HPC) system that can accommodate one particular client's need for performance and high memory bandwidth while offering the flexibility to provide services for a range of other clients.

SOLUTION

The Dell Data Center Solutions (DCS) Division helped design a 576-node Cloud Computing Solution using customized Dell servers equipped with quad-core Intel® Xeon® processors and an Intel Server Board. An innovative on-site parts kiosk helps eliminate system downtime and reduce costs.

BENEFITS

Get IT Faster

- Deployed the new solution in just two months, after Dell helped acquire leading-edge technology that was in high demand

Run IT Better

- Improved application performance by approximately 40 percent
- Reduced downtime and minimized costs with an on-site parts kiosk
- Enabled easy migration to and from the cluster by using a standards-based architecture

Grow IT Smarter

- Consumed approximately 30 percent less power than projected



It's ironic that gaining access to high-speed computing resources can be an agonizingly slow and cumbersome process for some organizations. One company is trying to speed the process by providing rapid responses to requests for HPC resources. R Systems is a for-profit business founded by a former administrator from the National Center for Supercomputing Applications (NCSA) that offers high-end computing and consulting services. "For many government groups, academic departments, and businesses, gaining access to the HPC resources can be a long process of applying for a grant or wading through a bureaucracy," explains Brian Kucic, R Systems' vice president of business development. "R Systems provides faster, easier access to resources so researchers and engineers can get to work right away."

“R SMARR USES APPROXIMATELY 30 PERCENT LESS POWER THAN WE PROJECTED FOR SUCH A POWERFUL SYSTEM. THE COST BENEFITS HELP US REMAIN COMPETITIVE IN THE MARKETPLACE, AND THE ENERGY EFFICIENCY HAS EARNED THE SYSTEM A RANKING ON THE GREEN 500 LIST.”²

Brian Kucic, vice president, business development, R Systems

In addition to accelerating access to HPC systems, R Systems can also help reduce research costs. "Many of our customers work with us because they cannot justify buying and managing a large infrastructure, especially one that will no longer meet their needs in a year," says Greg Keller, principal of R Systems. "We help our customers access the technology they need without the costs and burdens of owning the system themselves."

To accommodate one particular client, R Systems had to build a large cluster that could address two specific requirements: "We needed servers with the latest multi-core processor technology and high memory bandwidth," explains Kucic. "We realized that we might not find the right configuration in an off-the-shelf system."

At the same time, R Systems had to be sure that the system could ultimately serve additional clients over its life cycle. "When we design a system, it needs to work well for the greatest number of customers over its useful life," says Keller. "The system must employ a standards-based platform that can run a wide range of code. The platform also has to facilitate easy transitions from one system to the next as customers progress. And of course, we want cost-effective solutions that can maximize energy efficiency."

R SYSTEMS CHOOSES DELL TO BUILD THE NEW CLUSTER

The R Systems team decided to work with Dell to design the new cluster in part because of the strong existing relationship between Dell and R Systems team members. "We had worked with

HOW IT WORKS

HARDWARE

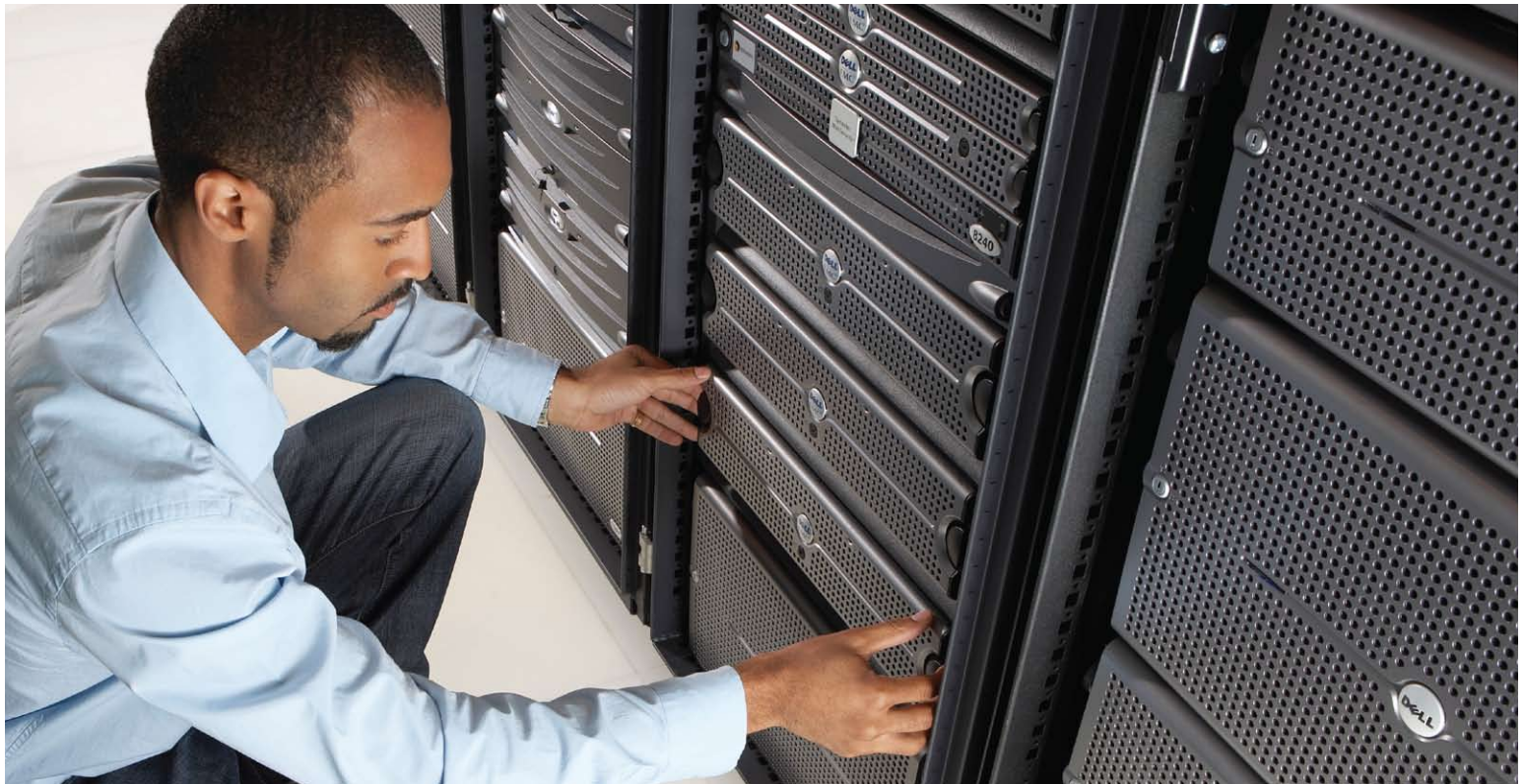
- Dell Cloud Computing Solution with the Intel® Xeon® processor
- Dell DCS CS23-SH server board, based on an Intel Server Board
- InfiniBand® interconnect

SOFTWARE

- Red Hat® Enterprise Linux® operating system
- Microsoft® Windows® HPC Server 2008

SERVICES

- Dell Data Center Solutions (DCS)



Dell at NCSA, and we had a strong relationship with the Dell team,” says Kucic. “Dell has a proven track record of delivering quality systems, and we have witnessed the exceptional response time Dell support can offer. We felt very comfortable working with Dell again.”

The R Systems team also had a positive experience working with Dell in building a 144-node cluster with Dell™ PowerEdge™ servers two years earlier. The company doubled the size of the cluster to 288 nodes after a year. “With help from Dell, we upgraded the system in record time,” says Kucic. “It was a great example of how quickly Dell can respond to our requests.”

“Dell is aggressive at meeting our technical and budgetary needs,” says Keller. “We always call Dell first if we have a new opportunity. In this case, the Dell team was far ahead of the competition in being able to meet our technical specifications.”

DELL DCS DESIGNS CUSTOMIZED SERVERS

The R Systems team worked with Dell DCS to design a customized server that could address specific requirements for its client. Dell DCS was created to help businesses maximize performance and reduce infrastructure costs. For customers with hyperscale “cloud” infrastructures, such as R Systems, Dell DCS can provide facility-level design recommendations, customized hardware, and tailored support options.

“We evaluated the standard Dell PowerEdge servers, but at the time, those systems did not offer a server board that could deliver the high memory bandwidth necessary for our client,” says Kucic. “That’s when Dell DCS stepped up and offered to design a system that could meet all of the requirements.”

The Dell DCS team evaluated a variety of processors, chipsets, and server boards to ensure that the Dell solution could deliver performance and memory bandwidth while also balancing power consumption and cost. Once the Dell team selected Intel components, they worked with Intel to provide R Systems with test systems so engineers could fully evaluate the technology options. “We were able to test the client’s software and make sure everything performed up to specifications,” says Keller. “We tested a range of processors to make sure we could achieve the best performance per dollar.”

OPTIMIZED SERVERS ADDRESS CUSTOMER REQUIREMENTS AND ENABLE RAPID DEPLOYMENT

The new 576-node cluster, named “R Smarr” to honor supercomputing pioneer and NCSA founder Larry Smarr, uses customized Dell servers with the Intel Xeon processor, Intel chipset, and an Intel Server Board, delivered to R Systems as Dell DCS CS23-SH boards. With a demonstrated 39.6 teraflops sustained across the entire system, the cluster is ranked among the world’s Top 500 supercomputers.¹

“We found that the Intel Xeon processor provided exceptional performance for this application, in part because of the larger cache size available per core,” says Doug Taylor, Dell DCS solutions architect. “By using quad-core processors instead of dual-core processors, we could run just two threads per processor and capitalize on a full 12 MB of cache per core. The result is a huge increase in system performance for this particular code set.”

The Intel chipset, meanwhile, balances processor performance, memory bandwidth, and I/O capacity. “The Intel chipset offers a 1,600 MHz front-side bus balanced with four channels of 800 MHz memory plus an x16 PCI Express Gen 2 slot,” says Taylor. “That combination of elements proved to be the right fit for this application.”

The server board helps deliver the high memory bandwidth R Systems’ client needed. “Most of the typical systems we evaluated did not have sufficient capacity for memory,” says R Systems’ Keller. “The Intel Server Board is a dual-socket board with 16 slots for RAM. With standard 2 GB memory modules, we can quickly ramp up the memory to 32 GB without paying an extreme performance penalty. The extra memory capacity gives us more flexibility to address customer needs as they change. We can simply add RAM without having to replace the board.”

“WITH OUR DELL CLOUD COMPUTING SOLUTION, WE’VE SEEN AN INCREASE OF APPROXIMATELY 40 PERCENT IN APPLICATION PERFORMANCE USING QUAD-CORE INTEL XEON PROCESSORS COMPARED WITH DUAL-CORE PROCESSORS.”

Greg Keller, principal, R Systems

Working together, Dell DCS and R Systems designed a streamlined server that included only the components that R Systems required. Without the unnecessary software and hardware elements that might have been found in other solutions, Dell DCS and R Systems were able to reduce both acquisition and operating costs. And because the Dell DCS team could focus on validating a system tailored to specific needs, the Dell team was able to help accelerate server deployment.

“By eliminating the software features that we didn’t need, we were able to get screaming fast technology nearly the day it was available from Intel without having to wait for software to be integrated,” says Keller. “We also removed the redundant power supplies, which are not as valuable in our hyperscale deployment model. The optimized server design from Dell DCS gave us the absolute fastest time to deployment while reducing our total cost of ownership.”

Dell was able to acquire components and assemble the systems quickly. “Whenever you are using leading-edge technology, you run the risk of delays in acquiring parts in the quantity you need,” says Keller. “In our case, there was a shortage of the right type of memory. But Dell got us what we needed. We started deployment in February and were able to turn the system over to our customer on April 15.”

R SMARR INCREASES APPLICATION PERFORMANCE BY APPROXIMATELY 40 PERCENT

Using the customized Dell servers with multi-core Intel processors, R Smarr has helped deliver outstanding application performance for R Systems’ client. “There is no question that multi-core architectures provide the best way to deliver excellent

performance per dollar and per watt,” says Keller. “With our Dell Cloud Computing Solution, we’ve seen an increase of approximately 40 percent in application performance using quad-core Intel Xeon processors compared with dual-core processors when we measure the same number of processes on the same number of nodes.”

The increased performance benefits both R Systems’ clients and R Systems’ business. “With enhanced performance, our clients can accelerate their research, tackle bigger problems, and produce higher-resolution results,” says Keller. “At the same time, our ability to offer outstanding performance helps us attract and retain more clients. It will be easy for our customers to justify working with us rather than building a system in-house.”

DELL CLOUD COMPUTING SERVERS USE APPROXIMATELY 30 PERCENT LESS POWER THAN PROJECTED

By building a powerful and dense infrastructure using streamlined servers, R Systems has also been able to create an energy-efficient environment. “R Smarr uses approximately 30 percent less power than we projected for such a powerful system,” says Kucic. “The cost benefits help us remain competitive in the marketplace, and the energy efficiency has earned the system a ranking on The Green 500 List.² R Smarr is clearly among the most powerful and energy-efficient systems in the world.”

R SYSTEMS REDUCES DOWNTIME AND COSTS WITH AN ON-SITE PARTS KIOSK

Dell DCS offers a range of tailored service options for its customers. R Systems is taking full advantage of the innovative on-site parts kiosk to eliminate downtime and reduce service costs.

“We instantly saw the benefit of having a parts kiosk on site,” says Kucic. “We have a cabinet with spare parts, a barcode scanner, and a laptop. If a problem arises, we can immediately swap out the part, scan the barcode of the new part, and send out the old part for delivery the next day. The automated system orders us a replacement part, which typically arrives on the next business day.”

“We might have an application that runs at full 576-node scale,” says Keller. “If a single node is down for too long, we could lose revenue for the entire system. With other service plans, we might have to wait four hours for a replacement part. But with the on-site parts kiosk, we can replace failed parts and get the system back up and running in about an hour. The on-site parts kiosk is extremely helpful in enabling us to deliver high system availability to our clients.

“This service model can also save us money compared with traditional service plans, which tie support to numerous individual servers,” continues Keller. “With a cabinet stocked with replacement parts and an automated replenishment system, we can avoid paying a premium for immediate service. The on-site parts kiosk is a much better fit for this homogenous, hyperscale system.”

INTEL ARCHITECTURE FACILITATES EASY MIGRATION TO NEXT-GENERATION SYSTEMS

With an Intel architecture as the foundation for R Smarr, R Systems can cater to a wide range of customers and increase the system’s long-term value. “We can attract more customers to R Systems because we can easily accommodate a wide range of applications on either Linux® or Microsoft® operating systems,” says Keller. “The Intel architecture also makes it simpler for customers to migrate

“THE OPTIMIZED SERVER DESIGN FROM DELL DCS GAVE US THE **ABSOLUTE FASTEST TIME TO DEPLOYMENT WHILE REDUCING OUR TOTAL COST OF OWNERSHIP.**”

Greg Keller, principal, R Systems

from one cluster to another. Some customers will scale up to R Smarr from smaller Intel processor-based systems. Others should be able to easily migrate from R Smarr to the next-generation Intel architecture. That flexibility is good for customers, and it also helps us maximize the value of the system during the course of its lifetime.”

The R Systems team is also helping to improve the performance of applications on R Smarr by enabling software vendors to fine-tune their code on the system’s Intel architecture. “We are working with independent software vendors such as Wolfram Research and SIMULIA to help their developers scale code and tune software for the system,” says Keller. “When their users start working on the system, they will be able to experience fast and reliable application performance.”

DELL DCS SERVERS HELP DRIVE FUTURE BUSINESS

For R Systems, one of the greatest benefits of building R Smarr is repeat business. “Having access to powerful technology is addictive for researchers and engineers,” says Keller. “Once they experience the performance of R Smarr, they want to find ways to continue their work on powerful clusters. We look forward to working with Dell again in the future to design and deploy systems at R Systems or at customer sites that can meet our customers’ ongoing HPC needs.”

For more information on this case study or to read additional case studies, go to DELL.COM/CaseStudies.

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¹Top500 Supercomputer Sites, November 2008, <http://www.top500.org/list/2008/11/100>.

²The Green 500 List, November 2008, www.green500.org/lists/listdisplay.php?month=11&year=2008&list=green500_200811.csv&start=1&line=101.



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