

FAST ACCESS TO HIGH PERFORMANCE

Dell Data Center Solutions helps R Systems upgrade an HPC cluster in under two months, delivering 200 percent better performance in less than half the space of a second cluster



R Systems prides itself on providing faster, easier access to high-performance computing (HPC) resources than universities or government-run organizations can offer. So when Wolfram Research asked R Systems to use the powerful 576-node “R Smarr” cluster to host the launch of its Internet-based Wolfram|Alpha™ computational search engine, the team at R Systems wanted to say yes. The search engine was designed to make a world of quantitative knowledge immediately computable and accessible to researchers, students, or anyone else. Wolfram anticipated a tremendous number of search requests from across the globe during the initial launch.

SOLUTION
• CLUSTERING



CUSTOMER PROFILE

COUNTRY: United States

INDUSTRY: Technology

FOUNDED: 2006

WEB ADDRESS: www.rsystemsinc.com

CHALLENGE

Upgrade a high-performance computing (HPC) cluster to the latest Intel® architecture in less than eight weeks to offer clients outstanding performance and high memory bandwidth while minimizing data center space and energy consumption.

SOLUTION

The Dell Data Center Solutions (DCS) Division designed a Dell™ Cloud Computing Solution™ that includes customized Dell servers equipped with the latest Intel® Xeon® processors to deliver exceptional performance plus an expanded on-site parts kiosk to help avoid downtime.

BENEFITS

Get IT Faster

- Upgraded one cluster in less than two months and freed up resources on a second, helping to meet the needs of two key clients

Run IT Better

- Provided one customer with a 200 percent aggregate performance increase while using half as many nodes by migrating to the latest Intel architecture
- Minimized downtime for multiple HPC clusters by using a Dell on-site parts kiosk

Grow IT Smarter

- Created room for expansion by deploying servers that consume 20 percent less power than previous servers

The Dell logo, consisting of the word "DELL" in a stylized, bold, sans-serif font, is centered within a circular graphic that has a blue outer ring and a black inner circle.



HOW IT WORKS

HARDWARE

- Dell™ Cloud Computing Solution™ with the Intel® Xeon® processor 5500 series

SOFTWARE

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

SERVICES

- Dell Data Center Solutions (DCS)

“THE CLOSE RELATIONSHIP BETWEEN DELL AND INTEL HELPED ENSURE THAT THE NEW HARDWARE COMPONENTS WERE AVAILABLE TO THE DELL TEAM WHEN THEY—AND WE—NEEDED THEM. AFTER WE OPENED THE PURCHASE ORDER, IT TOOK LESS THAN ONE MONTH FOR DELL DCS TO PRODUCE ALL THE SERVERS WE NEEDED....WE WERE ABLE TO ACCOMMODATE THE TIGHT DEADLINES OF BOTH CUSTOMERS.”

Brian Kucic, vice president, Business Development, R Systems

“The prospect of hosting the launch of Wolfram|Alpha was a tremendous opportunity for us,” says Brian Kucic, vice president of business development at R Systems. “Wolfram had been working on Wolfram|Alpha for years, and we knew that facilitating a successful launch would be an important and high-profile win for both them and us.”

There was just one problem: R Smarr was already being used by another R Systems customer. In fact, R Smarr had been designed and deployed just one year earlier with assistance from Intel and the Dell Data Center Solutions (DCS) Division to address that other customer’s needs for outstanding compute performance and memory bandwidth. Named after HPC pioneer and National Center for Supercomputing Applications (NCSA) founder Larry Smarr, the cluster features custom-built Dell servers, each equipped with two processors from the Intel Xeon processor 5400 series. R Smarr is on the Top500 list of the world’s highest-performing supercomputers.

“We had to find a way to accommodate Wolfram while still honoring our ongoing commitment to the other client,” says Kucic. “And we needed a solution quickly. The Wolfram request came just eight weeks before the launch.”

To complicate matters, the client that was already using R Smarr needed to expand its HPC workloads within the same time frame. “We had to provide even greater capacity than R Smarr alone could deliver,” says Greg Keller, principal at R Systems. “Adding HPC resources was an option, as long as we could ensure the utmost reliability and stability of the new system. And of course, new HPC resources would also have to provide sufficient density and energy efficiency to keep our costs under control.”

R SYSTEMS ENGAGES TRUSTED PARTNERS DELL AND INTEL

The team at R Systems had already been investigating the new Intel Xeon processor 5500 series from Intel. “We constantly test emerging technologies so we can offer our clients

cutting-edge resources as soon as possible,” says Kucic. “The teams from Intel and Dell had given us early access to the Intel Xeon processor 5500 series months before the Wolfram request. We evaluated the performance, energy efficiency, and stability of the new architecture, and we were very impressed with the results. There was no question that we would integrate the new architecture into our offerings.”

To accommodate both of its customers’ requests in a short time frame, the R Systems team decided to upgrade an existing cluster. They planned to leave the cluster’s fabric and power intact but install new servers equipped with the Intel Xeon processor 5500 series. R Systems would move the existing R Smarr customer to the upgraded cluster, allowing Wolfram to use R Smarr for the Wolfram|Alpha launch.

“We had an existing 288-node cluster that used Dell PowerEdge servers and a previous generation of Intel Xeon processors,” says Kucic. “By keeping the fabric and power of that cluster intact but

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Greg Keller, principal, R Systems

replacing the servers with new ones based on the latest Intel architecture, we had a better chance of delivering the performance required by both customers on time and on budget.”

R SYSTEMS WORKS WITH DELL DCS TO DESIGN NEW SERVERS

The R Systems team decided to work with the Dell DCS team once again to design and produce a customized Cloud Computing Solution for the cluster upgrade. “To complete this project successfully in such a short amount of time, we needed to work with a trusted partner that knows our business and our infrastructure,” says Keller. “Through the process of designing and deploying R Smarr last year, the Dell DCS team showed that they could deliver a solution that met our specific requirements for performance, energy efficiency, and density. They also provided valuable assistance in selecting components, conducting testing, and ensuring immediate availability of parts by implementing an on-site parts kiosk. It was an easy decision to work with Dell DCS again.”

As they did before, the teams from R Systems and Dell DCS designed a customized server—one based on the new Intel architecture. Each node included two processors from the Intel Xeon processor 5500 series plus 24 GB of Double Data Rate 3 (DDR3) memory. As with the R Smarr servers, the new Dell DCS servers fit four HPC nodes into each 2U of rack space, creating a very powerful and dense cluster. The servers currently run the Red Hat® Enterprise Linux® operating system. In the future, R Systems will likely offer Microsoft® Windows® HPC Server 2008 as an option.

Dell DCS created streamlined systems to help accelerate deployment of the servers and maximize cluster density. “The Dell DCS group was able to produce the servers more quickly without having to integrate some of the typical software components,” says Kucic. “By eliminating redundant power supplies and other components that are unnecessary in our particular deployment model, Dell DCS created a server with an extremely compact form factor.”

DELL DCS DELIVERS CUSTOMIZED SERVERS IN LESS THAN ONE MONTH

The Dell DCS team produced the new servers rapidly. “The close relationship between Dell and Intel helped ensure that the new hardware components were available to the Dell DCS team when they—and we—needed them,” says Kucic. “After we opened the purchase order, it took less than one month for Dell DCS to produce all the servers we needed.”

Once the hardware arrived, the R Systems team was able to get the servers up and running rapidly. “With just a small team, we were able to rack all 288 servers in under two days,” says Kucic. “In the end, we were able to accommodate the tight deadlines of both our customers.”

DELL DCS SERVERS DELIVER 200 PERCENT BETTER PERFORMANCE IN HALF THE SPACE OF R SMARR

With the new Intel architecture, the Dell servers are delivering dramatic performance improvements compared with the previous-generation

architecture. “The increased memory bandwidth of the Intel Xeon processor 5500 series has provided a considerable boost in performance for our customer’s code,” says Kucic.

“Achieving a 25 to 30 percent improvement in performance would be significant,” says Keller. “But with the Dell DCS servers and the new Intel Xeon processor 5500 series, we have seen a 400 percent increase in performance per node for our customer’s code compared with the previous architecture. That customer now has the power to complete much more work in the same amount of time as before.”

The increased performance of the upgraded cluster has been achieved without requiring additional data center space. “Just one year after R Smarr’s launch, we are able to provide greater processing power using half as many nodes and less than half the space,” says Keller. “With its 288 nodes, the upgraded cluster uses only 9 racks of space as opposed to 19 with R Smarr. We could have reduced the new cluster to just 5 racks if we had chosen to rework the cabling.”

ENERGY-EFFICIENT SERVERS HELP REDUCE POWER CONSUMPTION BY 20 PERCENT

While the upgraded cluster has amplified customer performance, it is using less power than even the previous 288-node cluster. “With each new generation of Dell servers and Intel processors, we are able to significantly reduce power and cooling requirements per server,” says Keller. “The current DCS servers are consuming approximately 20 percent less power per node

“THE CURRENT DCS SERVERS ARE CONSUMING APPROXIMATELY 20 PERCENT LESS POWER PER NODE THAN OUR PREVIOUS DELL SERVERS. THOSE SAVINGS ENABLE US TO ADD MORE HPC RESOURCES WITHOUT INCREASING OUR INFRASTRUCTURE COSTS.”

Greg Keller, principal, R Systems

than our previous Dell servers. Those savings enable us to add more HPC resources without increasing our infrastructure costs.”

R Systems is already capitalizing on that opportunity to expand. “There is no reason to permanently retire the servers that were previously part of the 288-node cluster—they are less than two years old,” says Keller. “By reducing power consumption and controlling the footprint of the upgraded cluster, we were able to redeploy 100 of the older servers so we can accommodate more customers and more services. It’s life cycle management at its best.”

ON-SITE KIOSK HELPS ENSURE SYSTEM UPTIME

As part of the Cloud Computing Solution, the R Systems team expanded the on-site parts kiosk established during the R Smarr project to help ensure that spare hardware components are immediately available for the upgraded cluster in the event of problems. The R Systems team can install a new part, send back the old part, and receive a replacement spare from Dell on the next business day. “Our customers often rely on using an entire HPC cluster, so we can’t afford to have a single node down while we wait to receive parts,” says Keller. “With the on-site parts kiosk, we can replace a part immediately and have the whole cluster up and running again within an hour. The on-site parts kiosk lets us deliver the high availability that our customers have come to rely on.”

R SYSTEMS LOOKS AHEAD WITH INTEL AND DELL

The Wolfram|Alpha launch on R Smarr was a complete success. “Within two months of the request, we were able to provide Wolfram with a very powerful supercomputer,” says Keller. “Going forward, we can continue to offer that exceptional R Smarr performance to Wolfram and other customers whenever they need it.”

Meanwhile, the migration of the other customer to the upgraded cluster was accomplished seamlessly. “We were able to provide our customer with reliable HPC resources that delivered a 200 percent increase in performance, all without increasing their costs. They were blown away,” says Keller. “Since the move to the new cluster, they have asked for even more capacity, and we are happy to accommodate them.”

After the success of this recent project, R Systems team is already looking ahead to future initiatives. “Within the next twelve months, we plan to work with Dell and Intel to upgrade our existing clusters and expand our capacity further,” says Keller. “By combining innovative technologies with deep engineering expertise and extensive support, the teams at Dell DCS and Intel are helping us sustain our competitive advantage in the marketplace. And in turn, we are helping organizations conduct groundbreaking research.”

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



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¹ Top 500 Supercomputer Sites, June 2009, www.top500.org/list/2009/06/100.

