Case study

Sandia explores the future of computing with HP Moonshot

National research lab drives high-performance computing to exascale on HP's 64-bit ARM servers

Industry
Scientific and technical research

Objective
Evaluate 64-bit ARM technology for large, complex workloads to identify innovative computing architectures that support high performance and processing efficiency at exascale

Approach
Conduct a wide range of laboratory tests on the HP Moonshot System configured with HP ProLiant m400 Servers based on 64-bit ARM technology

IT matters
- Achieved uniform high performance while scaling computations from one to eight cores
- Gained equivalent of 360 servers in 90% less space compared to traditional infrastructure
- Conserved floor space and reduced system maintenance with single, integrated enclosure housing multiple infrastructure technologies

Business matters
- Enabled researchers to extend the range of calculations to be much larger and more complex to solve bigger scientific and technical challenges
- Overcame power limitations to meet energy goal of less than 20 megawatts as research environments approach exascale
- Provided an efficient platform for innovation to advance Sandia's research goals

"When you have a first-of-a-kind system like the HP Moonshot test bed, our users are interested in testing the capabilities, which gives us a glimpse into what the future of high-performance computing architectures may look like."

– James Ang, Technical Manager, Scalable Computer Architecture, Sandia National Laboratories

Sandia National Laboratories is constantly looking for innovative ways to solve very large scientific and technical challenges. Through its pilot testing of the HP Moonshot System with HP ProLiant m400 Servers, the lab extended the amount of memory capacity it can exploit in a single server, opening opportunities for high-performance computing at exascale, and advancing its goals for achieving high performance and efficiency when running sophisticated computations against large, complex data sets.

Customer at a glance

HP Moonshot System

- HP ProLiant m400 Servers
- HP Moonshot 1500 Chassis

Software

- Ubuntu 14.04.1

For more than 60 years Sandia National Laboratories has been applying science and technology to solve some of the world's most complex problems. From national security to climate change, Sandia's researchers work to uncover new insights from an ever-growing volume of data.

As the amount of data climbs well past terabytes and into petabytes and exabytes, the research lab is challenged to uncover advanced high-performance computing architectures that can perform at this massive scale. So when key members of Sandia's technical staff discovered HP Moonshot, they found the HP ProLiant m400 Server and its unique 64-bit ARM "server-on-a-chip" design of particular interest.

Simon Hammond, senior member of Sandia's technical staff, explains, "64-bit ARM is really important for us because it extends the amount of memory capacity we can deliver in a single server. And when you're trying to solve really large, complex data sets, having that extra memory capacity is an absolutely key aspect to delivering great performance and great levels of efficiency."

Supports larger, more complex analytics jobs

To prove the ProLiant m400 as a viable option for running Sandia's complex algorithms and advanced scientific applications at exascale, the lab ran a wide range of workloads on the HP Moonshot System, from molecular dynamics and hydrodynamics to large data analytics jobs. The early results have been impressive.

"We've been able to scale our computations from one to eight cores and achieve very uniform performance," reports Hammond. "We're seeing strong threading performance and we're seeing great memory bandwidth from this processor. And that's enabling us to extend the range of our calculations to be much larger and more complex, which is a major goal of our program."

James Ang, technical manager for scalable computer architecture at Sandia, adds, "What was very interesting about the ProLiant m400 was that HP has exposed all the memory channels, indicating. That's important for us because it indicates very efficient use of the processor."

Meets energy efficiency goals at exascale

At less than 90 watts per server, HP Moonshot also provides Sandia with energy-efficient solutions to run its large workloads. The fact is when big systems are used to run big data, power demand—and cost—rise very quickly. The lab has a goal to stay below 20 megawatts for an entire program infrastructure, yet just one application platform based on traditional servers can draw up to 10 megawatts.

Jim Laros, principal member of Sandia's technical staff, notes, "Energy efficiency is incredibly important for our program. As we approach exascale, we could easily run into power limitations. But HP Moonshot provides a low-power architecture to help us meet our energy goals as our research environments grow."

In addition, the flexibility and space efficiency of HP Moonshot offers Sandia an added advantage. For example, with 45 servers in a 4.3U chassis sharing power, cooling, and networking, Moonshot can support the equivalent of 360 traditional x86 servers in 90% less space.

"Having multiple technologies in a single enclosure allows us to conserve floor space and reduce maintenance," says Laros. "HP Moonshot also offers us the flexibility to replace aging technologies with newer technologies as they emerge."

Ang remarks, "The HP Moonshot is giving us a glimpse into what the future of high-performance computing architectures may look like."

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