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Accelerating Multidisciplinary Research at Florida State University

New servers based on Intel® Xeon® processors deliver up to four times faster application performance for HPC workloads without requiring re-coding

The Research Computing Center (RCC) at Florida State University (FSU) supports multidisciplinary research that spans a broad array of fields, from biophysics to atmospheric science. To help speed research projects and support growing demand for resources, FSU recently added new Dell PowerEdge* servers based on the Intel® Xeon® processor E5 family to its high-performance computing (HPC) environment. The new systems are accelerating applications up to four times without requiring additional coding. The new platform's density is helping FSU significantly boost the overall capacity of HPC resources available to researchers while controlling power, cooling, and real estate costs.

CHALLENGES

- **Enhance performance.** As part of its continuous refresh process, the FSU team needed to significantly enhance the performance of its HPC resources to accommodate increasing demand and speed results for cutting-edge research.
- **Support legacy applications.** The RCC needed to ensure that new systems would continue to support a wide range of existing applications as they are, without requiring research groups to conduct additional coding.
- **Control energy consumption and footprint.** FSU wanted to expand the capacity of its HPC resources while avoiding excessive increases in power, cooling, and real estate.

SOLUTION

- **Dell PowerEdge servers based on the Intel Xeon processor E5 family.** FSU selected Dell PowerEdge C6220 servers equipped with the Intel Xeon processor E5 family, adding 1,344 cores to its HPC environment.

TECHNOLOGY RESULTS

- **Improved performance by two to four times.** Researchers are able to speed up results by up to four times, enabling them to meet tight deadlines.
- **Avoided the need for re-coding.** Researchers can run legacy applications on the Intel Xeon processor–based systems without requiring any modifications.
- **Increased capacity and controlled real estate.** The additional systems increased performance 28 percent with only 13 percent more cores. FSU is providing extra capacity while keeping power, cooling, and real estate costs in check.

BUSINESS VALUE

- **Fostering more exploration.** By accelerating results, the new systems give researchers increased time to experiment and explore more complex questions.
- **Attracting new researchers.** Offering more robust HPC resources helps attract and retain world-class faculty and graduate students to the university.

"With the new servers based on the Intel® Xeon® processor E5 family, our researchers have achieved a speedup of two to four times on existing applications....Improved performance helps researchers meet very tight project deadlines and sponsors more curiosity-driven research."

– James Wilgenbusch,
Director,
Research Computing Center,
Florida State University

The Intel® Xeon® processor E5 family boosts performance for legacy applications

At FSU, multidisciplinary teams rely on robust computing resources to help address challenging research objectives. For example, researchers from the Aero-Propulsion, Mechatronics and Energy Building use the university's HPC resources to design more energy-efficient aircraft, automated guided vehicles, and more effective lithium-ion batteries.

The RCC continuously refreshes its HPC resources to support a growing number of researchers with increasingly complex problems to solve. "We add to and update our HPC environment every year," says James Wilgenbusch, director of the RCC at FSU. "Our plan this past year was to deliver a sizeable increase in performance. We need to support more cutting-edge research while helping researchers meet tight project deadlines."

Incorporating the new systems seamlessly was a high priority. "We wanted to make sure that newly added systems could accommodate legacy codes without requiring additional coding," says Wilgenbusch. "We didn't want researchers to have to spend time porting code or resort to building and maintaining their own systems in a closet somewhere on campus."

Expanding Resources with Intel Xeon Processors

Although the existing HPC environment used non-Intel processors, FSU's RCC team decided to explore Dell servers equipped with Intel Xeon processors for this recent expansion. Engineers from Intel and Dell assisted with the selection and evaluation of systems. "The decisions we make today will have an important impact on what we and our researchers can do in the future," says Wilgenbusch. "Intel and Dell engineers enabled us to pinpoint the right systems and components for our present and future goals."

Benchmark testing—conducted with assistance from research groups—helped solidify choices. "We ran our four most heavily utilized codes on the actual systems that we were evaluating," says Wilgenbusch. "We were able to run legacy code without modifications and obtain very impressive results."

The FSU team selected Dell PowerEdge C6220 servers equipped with the Intel Xeon processor E5-2670. "The Intel Xeon processor E5 family's combination of strong floating-point performance, memory bandwidth and capacity, and I/O is very helpful for meeting the needs of such a diverse range of applications at FSU," says Wilgenbusch.

The systems run a wide range of software, such as Gaussian*, AMBER*, Charm*, WRF*, HYCOM*, MRBAYES*, and an array of custom-built applications. The RCC offers researchers several compilers and libraries, including Intel® Compilers and the Intel® Math Kernel Library (Intel® MKL), to help optimize application performance.

Accelerating Application Performance up to Four Times

The new systems are delivering exceptional application performance for researchers. "With the new servers based on the Intel Xeon processor E5 family, our researchers have achieved a speedup of two to four times on existing applications compared with running those applications on the same number of cores in the existing environment," says Wilgenbusch. "Improved performance helps researchers meet very tight project deadlines and sponsors more curiosity-driven research. Researchers now have the breathing room to experiment more with parameters."

Achieving a Seamless Transition without Re-Coding

Selecting the Intel Xeon processor–based servers helped ensure that legacy applications can run without problems. "This upgrade was one of our most seamless experiences to date," says Wilgenbusch. "Researchers can run their existing code and achieve significant performance improvements without having to spend time re-coding or building customized clusters."

The RCC expects increased performance when its code is optimized for new capabilities, such as Intel® Advanced Vector Extensions (Intel® AVX). "Without a recompile, researchers can achieve twice the number of floating-point operations per cycle on legacy codes," says Wilgenbusch. "The performance gain will be even greater when users recompile and take advantage of extensions such as Intel AVX."
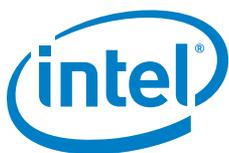
Delivering Greater Capacity with Less Infrastructure

Selecting a dense and powerful hardware platform enables FSU to add capacity without significantly increasing operating expenses. "The new systems represent 13 percent of our total cores, but they deliver 28 percent of our overall performance," says Wilgenbusch. "As we continue to refresh our resources at the same rate, we will quickly have added 50 percent to our total capacity while controlling power, cooling, and real estate."

Attracting World-Class Research to FSU

Ultimately, the new Intel Xeon processor–based systems will play a key role in enabling FSU to continue to support cutting-edge, multidisciplinary work that touches a wide range of fields. According to Wilgenbusch, "The new systems are helping us attract world-class faculty and provide current faculty and graduate students the resources they need for groundbreaking research."

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