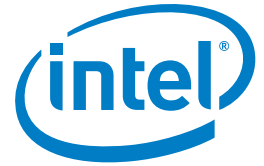


CASE STUDY

Intel® Xeon® processor 5600 series

Performance for Data Intensive Computing
Virtualization



Serving virtual desktops

Georgia Tech improves performance, density, and costs with Intel® Xeon® processors 5600 series



"We have been able to exceed our initial target of 36 virtual desktops per server. That target may seem very conservative compared to other virtual desktop interface (VDI) projects, but our virtual desktops are sized at a minimum with two virtual CPUs and 3 GB of memory per virtual machine to support a variety of engineering applications."

– Didier Contis,
Director of Technology Services,
Georgia Tech College of Engineering

The Georgia Institute of Technology (Georgia Tech) College of Engineering (COE) Virtual Lab (Vlab) project allows students to remotely access dozens of engineering applications from their personal computing devices. In the fall of 2010, COE upgraded its Vlab servers to the Intel® Xeon® processor X5650, gaining 50 percent more cores and twice as much memory per server as it had on its Intel Xeon processor E5520-based servers. The results: increased performance and density, a better experience for users, and cost savings for IT.

CHALLENGES

- **Convenient access to complex applications.** Traditional computer labs are costly and inconvenient, and engineering applications tend to be too expensive to license for students' individual use.
- **Data center infrastructure for virtual desktops.** Engineering applications are both performance- and memory-intensive, placing heavy demands on the server, network, and storage infrastructure.

SOLUTIONS

- **Balanced server performance.** COE has standardized on Dell PowerEdge* R610 servers and M610 blades, using the Intel Xeon processor X5650 with 96 GB of RAM, Intel® Virtualization Technology (Intel® VT), and Intel® 10 GB Ethernet Server Adapters.
- **High-performance storage.** COE enhances storage with storage area network (SAN) solutions from multiple vendors, all based on the Intel Xeon processor.
- **Flexible virtualization technologies.** COE uses Citrix XenDesktop* 4.0 and 5.0 with multiple hypervisors: currently VMware vSphere* ESX 4.1 with a transition to Microsoft Hyper-V* in process and to be completed in Fall 2011 as part of a larger deployment of Microsoft Windows 7*-based virtual desktops.

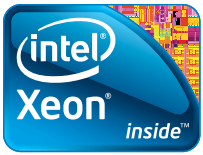
IMPACT

- **Higher density.** COE's new servers handle more than twice as many virtual desktops as its previous Intel Xeon processor E5520-based servers with 48 GB of RAM.
- **Better user experience.** Performance remains high even though more virtual desktops are contending for resources. COE can support Vlab's 20 percent growth rate over the previous semester.
- **Lower costs.** COE's key price metric, the cost per virtual machine (VM) running slot, drops by an average of 21 percent, not counting network and storage costs.
- **Foundation for strategic initiatives.** COE has more flexibility as the university expands its global reach and explores innovative approaches to curriculum delivery.

Just-in-time access to engineering applications

Computer labs are an unavoidable part of life for most college engineering students, but they're far from ideal. "They're inefficient and inconvenient for students, and they present physical security and support

issues for the college," says Didier Contis, director of technology services for COE. "In addition, our student population is increasingly mobile and geographically dispersed. Computer labs are impractical when students can be anywhere in the world."



COE doubled the memory per server and more than doubled the number of virtual desktops

Since initiating Vlab in the 2007/2008 school year, Contis has seen the service grow steadily. "With Vlab, we're trying to provide just-in-time software access so students don't have to plan ahead and figure out when they're going to visit a physical lab," Contis says. "We are empowering the students so they can access what they need when they need it."

COE students use many of the same computationally and graphics-intensive engineering applications that are prevalent throughout the industry. Contis says it's too expensive for the college to license the applications for students to run on their PCs, or even to stream them for local execution. Instead, whenever feasible, Vlab uses a virtual desktop interface (VDI) model to execute the applications on back-end servers and display them on clients.

Demanding workloads

To perform VDI with performance-hungry applications, COE needs reliable infrastructure that delivers computational performance, memory bandwidth, I/O throughput, and virtualization support. COE standardized on the Intel Xeon processor E5520 in 2009 and advanced to the Intel Xeon processor X5650 in 2010. He boosts performance further by choosing Intel 10 GB Ethernet Server Adapters for their high throughput and support for Intel VT. Contis says he has an eye on the Intel Xeon

processor E7 family as a way to increase scalability, I/O, and memory capacity during COE's next round of hardware expansion.

The Intel Xeon processor X5650 has proven well-matched to COE's demanding workloads. "We are constrained more by memory than by CPU," Contis explains. "With the upgrade, we doubled our server memory footprint and stepped up the amount of memory allocated to each VM to 3 GB. We went from 8 cores to 12 and from 16 threads to 24 while staying a cost-effective solution. We were also able to take advantage of the faster memory bus by configuring our servers with 1,333 MHz 8 GB DIMMs."

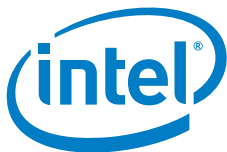
The net result is a dramatic increase in VM density and a comparable drop in the cost per virtual desktop. COE more than doubled the number of VMs per server, meeting—and in many cases exceeding—its VM target density. The cost of a VM running slot dropped by 21 percent, not including storage and network.

Equally significant, the student experience is better. "The gain in the number of cores and threads resulted in an overall increase in responsiveness despite the growth in density," Contis says. "Our students have a more responsive experience that is more like being in a brick-and-mortar computer lab, but is more convenient for them."

SPOTLIGHT ON GEORGIA TECH

Based in Atlanta, the Georgia Institute of Technology consistently ranks in the top five universities in the U.S. Its College of Engineering (COE) is the largest engineering college in the U.S. and is ranked fourth among national universities that offer doctoral degrees by *U.S. News & World Report*. It is also the largest of the Institute's six colleges, enrolling more than 60 percent of Georgia Tech's students and offering more than 50 degree programs at the bachelor's, master's, and doctoral levels through its main Atlanta campus and satellites around the world.

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¹ <http://www.coe.gatech.edu/content/us-news-ranks-tech-graduate-engineering-programs-4th-nation-0>

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