Case study

Opus College of Engineering at Marquette University

HP Z1 Workstations empower students to tackle real-world problems

Industry
Higher education

Objective
Provide reliable, high-performance computing for engineering education

Approach
The Opus College of Engineering at Marquette University has equipped two student labs with HP Z1 Workstations, and many engineering students opt for HP ZBook Mobile Workstations for their personal use

IT matters
- Tool-less design enables quick, easy access to internal components for hardware support
- All-in-one design facilitates easy repositioning for flexibility in modular lab

Business matters
- Time required to run complex simulations reduced from hours to minutes
- Reliability of HP Z Workstations substantially reduces simulation crashes

MARQUETTE UNIVERSITY
BE THE DIFFERENCE.

"HP Z Workstations deliver the power and speed needed for modeling, simulations, big data analysis, computer-aided design, and visualization applications, all of which translate to real solutions for a better world."

– Kristina Ropella, dean, Opus College of Engineering at Marquette University

Marquette University is a private, Catholic research university located in Milwaukee, Wisconsin. Its enrollment includes almost 8,400 undergraduate and 3,300 graduate and professional students. The Opus College of Engineering offers programs in biomedical, electrical, mechanical, civil, construction, environmental and computer engineering. An engineering computer lab provides students with real-world technology tools that are widely used in professional engineering settings, including high-performance HP Z1 Workstations for both classwork and research projects.

A graduate student in engineering at Marquette University was using a computer model to optimize the design of an artificial limb. But modeling was progressing at a glacial pace. Each time he ran the model on his notebook PC, it took hours. Then he would change a variable and run it again. Over and over and over.

Associate Professor Phil Voglewede introduced him to the university's engineering lab featuring HP Z1 Workstations. Now that model runs in minutes.

"It's amazing to see how quickly a computer like the HP Z1 Workstation can run simulations," Voglewede says. "Students can explore so many more options and get much more done."

Technology tackles problems in laboratory

Education at Marquette University's Opus College of Engineering is all about preparing students to solve real-world problems. But how schools approach that mission differs widely.

> "It's important for us to expose students to the kind of technology they will use in their careers. HP Workstations serve as the latest professional technology tool to empower students to do incredible things."
>
> – Kathy Lang, chief information officer, Marquette University

Marquette's Engineering Hall is designed to be an integrated research and teaching facility. The physical structure and support systems of the building—glass, beams, concrete and more—feature embedded sensors left exposed so that students can study the engineering behind the very building where they learn. This "engineering on display" environment is intended to help students, faculty and visitors learn to create, innovate and problem-solve in the 21st century.

"Our mission in the Opus College of Engineering is to prepare students to lead in innovative, entrepreneurial and collaborative environments, where curiosity, creativity and critical thinking translate to change for the benefit of humanity," says Dean Kristina Ropella.

She expects Engineering Hall to play a significant role in transforming engineering education at Marquette. And while Engineering Hall itself is a major learning tool, the university's strategy of providing students with leading edge engineering tools goes well beyond the building itself.

HP Workstations: technology for education

Students also are exposed to real-world technology that they will use in professional engineering settings. The engineering computer lab, and a second construction automation lab for students in the Civil Construction and Environmental Engineering programs, are both equipped with HP Z1 Workstations. A third lab will also be upgraded with the Workstations soon, bringing the total number of HP Z1 Workstations available for student use to nearly 60.

In addition, the school has other HP Z Workstation models—ranging from the base HP Z200 series up through the more powerful HP Z800 series—dedicated to various research projects.

All students in the Opus College of Engineering are required to purchase a notebook computer that will run the school's standard engineering software. The HP ZBook Mobile Workstation is a recommended choice, selected for both its powerful processing and small, ultra-light form factor.

"It's important for us to expose students to the kind of technology that they will use in their careers," says Kathy Lang, chief information officer for Marquette. "Students come with very high expectations for the technology around them. In Engineering Hall, we think we've not only met those expectations, but exceeded them. HP Workstations are a great example of giving students the latest professional technology as an enabler to help them do incredible things."

Adds Dean Ropella, "High-performance computing is central to the process of discovery, problem-solving and innovative thinking required of our students and faculty as they tackle complex global challenges. HP Workstations offer the power and speed needed for modeling, simulations, big data

analysis, computer-aided design, and visualization applications, all of which translate to real solutions for a better world."

HP Z1 Workstations, the world's first all-in-one workstations with a 27-inch diagonal display, feature quad-core Intel® Xeon® processors with NVIDIA® Quadro® 3D graphics support. Powerful processors, professional graphics and error-correcting code (ECC) memory combine to speed processing and reduce crashes significantly.

"Initially, some of the faculty were actually a little jealous of the students working in the labs," says Brad Bonczkiewicz, director of technology for the Opus College of Engineering. "The Z1 Workstations are faster, higher performance machines than many professors have in their offices, though some have now purchased Z1 Workstations for themselves."

He says students have told him the HP Z1 Workstations run substantially faster than desktop computers in other labs. And they work reliably, even when running the most complex models or simulations.

Overcoming roadblocks with HP technology

High performing workstations can be a key to achieving engineering breakthroughs. Just ask Voglewede. He has been working to find a way to help amputees walk with a more natural gait using a new ankle-foot prosthesis.

"In the long run, we want to create something that will be totally integrated—a motorized, assistive device that enables someone to walk in a way that's indistinguishable from everyone else. So it acts like a normal limb. We're not there yet, but we're making progress."

Achieving the final goal will require a thorough understanding of the complex dynamics of human kinetics associated with walking, and the forces that facilitate similar movement in artificial limbs. To reach that understanding, Voglewede's research involves using repetitive computer simulations designed to optimize both motion and force.

"When we put all this into an optimization routine, it takes a lot of time. It's a lot of calculations," he notes. Some simulations developed by his graduate students would require eight hours or more to run on a standard desktop computer.

"That's just too long. If it takes eight hours, the researcher has to wait a full day to observe results. And in that time, you can lose momentum and sight of the big picture."

One of the graduate students working on the project was working on a specific aspect of that study: how weight affects the swing of a prosthesis. The current thinking is that a prosthesis should be as light as possible. "That's what amputees will tell you," he explains. "We're working to determine if that's the best approach. Perhaps they would be better served by a prosthesis that is more closely matched to the weight of a normal limb."

The student found his progress was slowed to a crawl when he ran the simulation on his notebook PC. But when he was introduced to

Customer at a glance

Hardware
- HP Z1 Workstation
- HP ZBook Mobile Workstation

Software
- AutoDesk AutoCAD, Civil 3D, Revit, 3ds Max
- ANSYS
- SIEMENS NX
- SOLIDWORKS
- National Instruments LabVIEW& Circuit Design Suite
- MathWorks MATLAB

the engineering lab and moved his simulation over to an HP Z1 Workstation, it ran in 15 minutes or less.

"Running the simulation on the HP Z1 Workstations enabled him to explore multiple variables in the model in very little time," says Voglewede. "When the student showed me the results, I was amazed that it came so close to matching the normal flexion and extension patterns of knee motion."

Why Z1 Workstations?

Bonczkiewicz says Marquette was prepared to buy traditional, multi-component workstations for the engineering lab when he learned about the all-in-one design of the Z1 Workstation.

"When I first saw the HP Z1 Workstations, I thought they were amazing. The form factor, the 27-inch diagonal monitor, the accessibility to the interior of the machines for hardware support, and the scalability of the workstations with additional processors and RAM—they were all perfectly matched to what our engineering students need."

> "Running the simulation on the HP Z1 Workstations enabled him to explore multiple variables in the model in very little time."
>
> – Phil Voglewede, associate professor, Opus College of Engineering at Marquette University

The all-in-one design was particularly welcome because the engineering lab is intended to be a modular workspace. Furniture and other components were chosen so that students could easily reposition them into small working groups, fostering creative collaboration on student projects. The HP Z1 Workstation's all-in-one design fits that dynamic perfectly, says Bonczkiewicz.

Students can move a workstation in one piece, quickly and easily, without having to move multiple components connected by cables.

> "Our techs can open up the HP Z1 Workstation very easily to swap out components, thanks to its tool-less design. That's important to us because the lab is available to students 24x7. We expect the workstations will attract use around the clock."
>
> – Brad Bonczkiewicz, director of technology, Opus College of Engineering at Marquette University

Z1 Workstations are also certified to run the most demanding engineering programs. Independent certification processes ensure HP Workstations perform as expected with solutions from leading software companies. "Hardware certifications are very important to us. In fact, we wouldn't have chosen HP Z1 Workstations if they weren't certified by the software vendors for our most demanding applications," says Bonczkiewicz.

Physical accessibility is also important to Bonczkiewicz, since Marquette's technicians actually take care of all hardware support, including RAM or processor upgrades. "Our techs can open up the HP Z1 Workstation very easily to swap out components, thanks to its tool-less design," he says. "That's important to us because the lab is available to students 24x7. We expect the workstations will attract use around the clock."

Learn more at
hp.com/zworkstations
hp.com/go/educationworkstation

Sign up for updates
hp.com/go/getupdated

Share with colleagues

Rate this document

4AA4-6547ENW, January 2016, Rev. 2