

Case Study



University of Maryland Helps Solve Global Challenges Through Analysis Powered by High-Performance Computing

A CLOSER LOOK:

DataBank Colocation Data Center Delivers Required Power and Cooling To Optimize Compute Resource Performance

Enhancing Research Capabilities through DataBank's High-Performance Computing Solution

BACKGROUND: A WORLD-CLASS RESEARCH INSTITUTION

As a premier research institution, the [University of Maryland](#) transforms lives. It discovers and puts to work knowledge to benefit the state, nation, and global community. The breadth of research is fueled by 4,600+ faculty and students who develop innovative solutions for critically important challenges. The university's [Division of IT](#) supports this mission and advances its research impact, scale, and visibility through IT infrastructure technologies.

CHALLENGE: MAINTAINING 24X7 DATA CENTER POWER AND COOLING

The division started deploying HPC clusters at the turn of the century in on-campus data centers. These originally were set up to support 5kW of power per rack with limited redundancy and backup power. For cooling, the data centers relied on computer room air conditioner (CRAC) units.

The data centers met the university's HPC needs, but the support staff on campus wasn't set up for 24-hour operations. If something went wrong during off-hours, researchers would stop using the system until someone traveled from home to fix the issue.

"Our research demands grew. As we started running multiple-rack systems requiring 100kW or more, we could no longer wait half an hour to fix cooling problems," said Kevin Hildebrand, High-Performance Computing Architect for the University of Maryland. "At times, a CRAC would go offline, and we'd shut down because the support team couldn't reset the system right away."

Solving the challenge: The university first tried leasing a shared colocation space off campus. However, the managed services provided by the colocation facility failed to meet expectations. The campus team ended up taking over. This presented the same support challenges faced by the on-campus data centers.

With continuing power and cooling issues and an expiring lease at the shared colocation space, Hildebrand and team explored alternatives. They looked for a colocation partner who could provide necessary power, cooling, and 24x7 management for their HPC resources.

"We also wanted a partner who could deliver liquid cooling because of increasing density in High-Performance Computing racks," Hildebrand said. "Back then, we were not yet at the point of requiring liquid cooling. We knew we'd get there in the near future and wanted to be ready ahead of time."

SOLUTION: COST-EFFECTIVE LIQUID COOLING AND REDUNDANT POWER

The first colocation data center the university considered could provide the necessary rack space and required power and cooling. However, they wanted the university to pay all build-out costs upfront -- not a viable financial model for the university.

Hildebrand was then referred to DataBank by Zayo, a global communications infrastructure platform provider that delivers fiber services for UMD. DataBank offered colocation space to them at its nearby [McLean Data Center](#) (IAD2) in Virginia.

To accommodate the needs of the University of Maryland, DataBank rebuilt the first floor of its IAD2 facility to provide an optimal high-performance computing environment:

“ DataBank agreed to build out the first floor of IAD2 for us while working the costs into the lease. This allowed us to spread out our payments and work the cost into our allocated budget. That was a big factor in partnering with DataBank – and their ability to provide liquid cooling at a reasonable cost. Just as important, DataBank gives us a team of experts that can ensure our infrastructure keeps running 24x7.”

– Kevin Hildebrand, the High-Performance Computing Architect for the University of Maryland

- 14' x 28' footprint to accommodate racks for 20 cabinets and a cold aisle.
- APC AR3300 racks, 30" wide/48" deep.
- 2 CoolIT Chx750 coolant distribution units (CDUs) with redundant A/B power for liquid cooling.
- Aquatherm cooling loop, featuring polypropylene piping.
- 10 water-cooled cabinets for servers that handle research processing.
- 10 air-cooled cabinets for networking gear and storage devices.
- 3 dedicated 3-phase A/B/C power distribution units that provide power redundancy to the cabinets with forty 415-volt/60-amp/3-Phase/560c6W power whips.

The environment can pull up to 350kW+ power depending on the number and type of simulations researchers need to run at the same time.

Because CDUs provide most of the cooling, it takes less than one computer room air handler (CRAH) to cool the infrastructure. This enables the environment to achieve a Power Usage Effectiveness (PUE) rating of approximately 1.50. It also helps the university achieve its green initiatives.

OVERCOMING SUPPLY CHAIN ISSUES DURING COVID

In addition, DataBank offered UMD one end of the first floor and the right-of-first-refusal for the rest of the floor. “DataBank helped us design the power layout and the rack layout. They worked with vendors to pick the cooling distribution units,” said Hildebrand. “It was also a bonus that they are giving us room to expand our space if the need arises.”

As DataBank was building IAD2 to accommodate the environment for the university, the world was contending with COVID. When supply chain issues emerged in sourcing the PDUs, DataBank arranged for a temporary workaround by shipping isolation transformers from another DataBank data center. DataBank also allowed the university to install servers, storage devices, and networking gear without paying the monthly lease until permanent PDUs arrived.

“It was a big help getting the cluster built and fully cabled until we were able to power it,” said Hildebrand. “For cooling, DataBank set up liquid to the chip with manifolds in each rack and hoses going to each server so there’s extra water running through each server.”

RESULTS: NO MORE POWER OUTAGES AND IMPROVED CPU PERFORMANCE

The flagship computing cluster deployed by the university’s Division of Research in the IAD2 data center is known internally as Zaratan. The compute resources are available to any researcher on campus that has High-Performance Computing needs.

Research spans the fields of astronomy, physics, biology, social sciences, and Artificial Intelligence. Scientists also used the cluster to analyze data from the Deep Impact project—where NASA crashed a satellite into a comet to determine its internal composition.

Using the more stable data center facility provided by DataBank eliminates power outages. The liquid cooling system Hildebrand had to foresight to install is also paying big dividends in the performance of the cluster.

“Liquid cooling allows the 64-core CPUs in the Zaratan servers to run faster,” Hildebrand explained. “Typically, if you air cool and fully load all the cores, the heat causes the cores to slow down. However, by running water to the chip, we can operate the cores at full speed and extend the life of the CPUs.”

For cost savings, the university can avoid the expense of staffing its data centers 24x7 to monitor and manage cooling and power.

“More savings come from DataBank providing N+1 cooling and power,” Hildebrand added. “We did not have that level of redundancy in our on-premises data centers due to the cost.”

With Zaratan deployed in the DataBank data center, the university was able to repurpose its on-campus data centers for research and other IT needs that do not require High-Performance Computing. Zaratan also will help Hildebrand decrease the occurrence of “Shadow IT” where users sometimes install servers on their own.

“ Our Zaratan cluster in IAD2 is a great shared resource that all our researchers can tap into. With DataBank’s help and expertise, it’s an environment we can control and keep secure to ensure we optimize our compute resources and protect the intellectual property of the university.”

– Kevin Hildebrand, the High-Performance Computing Architect for the University of Maryland

MAKING A GLOBAL IMPACT

The Zaratan High-Performance Computing infrastructure, powered and cooled by the DataBank IAD2 data center is allowing researchers at the University of Maryland to explore complex problems, engage in competitive research opportunities, and discover novel research applications. Here are a few examples of how researchers use Zaratan to transform their ideas into positive global impact and drive science and society forward:

- Statistical genomics, epigenetics, and computational biology methods to decipher genome-to-phenome relationships in livestock animals.
- Advanced visual computing tools with immersive technologies that can be used for emergency medicine, non-opioid pain management, and innovative medical training.
- State-of-the-art computational modeling techniques to design materials and interfaces of solid-state batteries at an atomic scale.
- RNA sequencing transcriptome assemblies to understand fish vision and how they rely on opsin to see different colors.
- High-fidelity numerical simulations of turbulent fires and numerical modeling of fire-related phenomena, including buoyancy-generated turbulence and combustion-generated toxic products.
- Quantitative marketing research with advanced data analytical techniques to study consumer purchasing behaviors and retail strategies in the digital and multi-channel shopping environment.
- Simulations of granular dynamics in low gravity to better understand the surface and interior structure of rubble-pile asteroids, believed to be the dominant type of small asteroids in the solar system.
- Computational tools to perform structure-based design and modeling of proteins, with an emphasis on immune recognition by antibodies and T cell receptors.
- Integrating thermodynamics and statistical mechanics with artificial intelligence to solve problems of human health and energy.

WHY DATABANK?

- DataBank offloads the risk, allowing organizations to scale while ensuring compliance with their requirements, especially [HPC requirements](#).
- Clients' data infrastructures, websites, and applications always stay up because we do more than fix problems—we keep them from happening in the first place.
- Our engineers are an extension of your team, enabling you to focus on running your business instead of getting the runaround from less proactive providers.
- We keep our promise to provide the industry's best data center, cloud, and interconnection services.
- Plus, we deliver all that with no-surprise pricing.