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DATA CENTER CONSOLIDATION SUPPORTS U-M'S GREEN EFFORTS

University of Michigan's efforts to go green inspired a fresh look at its data centers, revealing an opportunity to reduce energy consumption and save money. By focusing on consolidation, U-M has been able to maximize individual data centers and server rooms, increasing the efficiency of its IT infrastructure while reducing carbon emissions and energy costs.

Michigan Administrative Information Services (MAIS, now a part of Information and Technology Services) provided a key area of opportunity for smarter computing. They operate more than 5,000 sq. ft. of data center space, comprised of hundreds of servers, and its data center is a main IT hub, supporting all of U-M's administrative systems.

A closer look at U-M's server rooms showed that some were underutilized and existing rooms weren't used to full capacity. These smaller, underutilized rooms used extra space, electricity, and air conditioning, wasting both energy and money. To improve efficiency and reduce energy consumption, MAIS launched a data center consolidation strategy.

Over the course of 6 months, the MAIS team closed down server rooms that were not fully utilized and moved servers to a central data center in the Administrative Services Building. It also moved server rooms with faltering air conditioning and ventilation to this data center.

Once the inefficient server rooms were consolidated, the team updated airflow and air conditioning in the central data center. Servers give off tremendous amounts of heat that needs to be moderated to keep equipment running at optimum levels.

By simply reorganizing the aisles in the current data center to an industry standard hot aisle cold aisle configuration the team was able to concentrate A/C where it was needed. They also added blanking panels in the computer racks to contain heat and reduce hot air, cold air mixing. In order to avoid air loss and contain air pressure under the raised floor, cold locks technology was used to minimize leaks the data center's raised flooring.

In addition to improving the room's layout and configuration, the project team went one step further and updated the data center's humidification and air handling system with newer more efficient air handling units. The new units work as one, looking at the room in a holistic fashion so the air handling unit's work together to control temperature and humidity. The new system optimizes free cooling through a closed glycol loop meaning compressors don't run as much, ultimately saving energy.

"Cooling is a big issue for data centers, because of the massive amount of heat given off by servers and related equipment," explained Mark Linsenman, Computer Operations Manager and manager of the consolidation effort. "Our efforts to monitor the air flow in the room are ongoing, so that we're consistently controlling and optimizing cooling throughout the data center.

Computing needs continue to increase, and so does the number of servers to support on-campus computing. To enable future efficiency in its Administrative Services Building data center, U-M utilizes custom software that allows them to model equipment placement in advance based on heat load and cooling requirements. This is a big asset in planning additions or changes to the server room.

"By focusing our efforts on maintaining the physical environment and hardware, we're now able to provide the most energy efficient computing in our consolidated data center," Linsenman added. "Our efforts save U-M money and reduce our carbon footprint without any sacrifice to computing power or capabilities." Focusing on the attributes of the physical

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U-M Peers Make Headway with Sustainable Data Centers

Throughout campus, data centers follow Climate Savers Computing Initiative @ U-M best practices. These best practices reduce U-M's carbon footprint, save the organization money and increase efficiencies from hardware maintenance to heating and cooling.

1 Karl Lewis

Manager of the College of Engineering's Computer Aided Engineering Network (CAEN) data center

By doing his homework, Karl Lewis, manager of the College of Engineering's Computer Aided Engineering Network (CAEN) data center, realized big potential savings through consolidation, virtualization, and purchasing. Karl assessed the equipment in the data center with an eye on power efficiency, getting rid of old, inefficient hardware through either virtualization or replacement with greener, eco-friendly systems. Today, 30 systems within the MACC data center are virtualized, with another 30 servers on tap for virtualization.

Karl also worked to consolidate his data center with Michigan Academic Computing Center (MACC), freeing up precious space within the building, and ultimately saving heating and cooling costs. To ensure even further costs-savings and carbon reductions, when new servers are purchased, CAEN buys units with either High Efficiency Power Supplies (90% efficient) or with Green Power Supplies (90-95% efficient).

2 Steve Gold

Senior Technical Analyst, Information Technology and Services

At Arbor Lakes data centers, Steve Gold is committed to measurement. To improve the eco-friendliness of the data centers he manages, he measures energy usage tied to hardware as well as cooling. In fact, Steve installed power meters to measure energy usage every step of the way, specifically, the power usage supplied to a rack by a single circuit.

Steve meters power in every data center to measure energy use every step along the way- the power usage of each circuit that supplies a rack.

Steve's measurements, in keeping with established best practices aimed at helping units work more efficiently, have paid off through tactical data center decision-making. He discovered he could raise the room temperature from 64 degrees to 74 degrees without loss of performance or threat to the hardware, resulting in significant energy savings over time. He discovered additional energy savings by decreasing relative humidity from 50 percent to 35 percent during the winter.

3 Rene Gobeyn

MACC Data Center Coordinator

Rene Gobeyn, who manages U-M's Michigan Academic Computing Center (MACC), integrated several best practices into a money and energy-savings effort. To reduce heating, cooling and humidity control costs, he practices strict hot and cold aisle arrangements in MACC and uses blanking panels to keep hot and cold air from mixing. Rene is also investigating using outside air to cool MACC versus air conditioning – a first for a data center on U-M's campus.

Rene worked to covert power demands in the room from 110 watts to 208 watts. This shift will enable 3 percent energy savings overall, adding up to significant savings over time.

By understanding the challenges and opportunities, data center managers can influence key drivers to maintain more eco-friendly computing.

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Virtualization Helps U-M Reduce Energy, Cut Costs

Based on the success of virtualizing servers for the University of Michigan's administrative and IT services, Virtualization as a Service (VaaS) is being offered to department system administrators across campus. VaaS has proven to be a cost-savings powerhouse; VaaS at Information Technology Services (ITS) alone has saved U-M hundreds of thousands of dollars in hardware acquisition, systems management, power, cooling and space.

VaaS is U-M's virtual service, where virtual servers can be leveraged by units across campus. Most physical servers run underutilized, wasting power, cooling, and space; As these servers are pooled together through VaaS, U-M benefits from substantial savings.

Consolidating multiple servers onto fewer physical servers results in less rack space and floor space used, less power consumed, and lower administration costs, while increasing server utilization by up to 80 percent.

VaaS reduces energy consumption as well as associated power and cooling costs of data centers and server rooms. Currently, U-M has 146 virtual servers through VaaS, running on 8 physical servers.

"The costs to house, cool and power servers adds up, especially when you consider that U-M has thousands of servers operating on campus, 24 hours a day, 7 days a week, 365 days a year," said Chris Wood, VaaS Product Manager. "VaaS is an incredibly green approach to meeting U-M's server needs. By virtualizing servers across campus, we're offering a simple way to save money, conserve energy, and better utilize available space for the University."

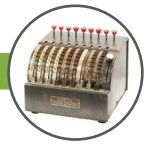
> "Wasting energy on multiple servers that could be consolidated into one doesn't make sense for the environment or the bottom line."

Few servers are used to their full capacity, in fact, many use 20 percent of their capacity or less. "Energy spent to power and cool a server running at 20 percent capacity results in a lot of wasted energy, " explained Wood. "Wasting energy on multiple servers that could be consolidated into one doesn't make sense for the environment or the bottom line."

In addition to its eco-friendly benefits, VaaS offers enterprise class storage, remote access, 24/7 monitoring, help desk support, data center security, maintenance, disaster recovery and file-level backup. VaaS currently supports Microsoft Windows, Linux, and the Solaris operating systems.

VaaS saves U-M money by reducing energy consumption.

Each server on U-M's campus consumes power to operate and cool the server, which represents a huge opportunity to reduce electricity use and associated costs. To get an idea of the impact VaaS can have, consider that servers run 24 hours a day, 7 days a week, totaling 8,760 hours/year of energy consumption. U-M's hourly cost of power is $0.087 / kWhr. The average server has a power rating of .350 kW.



Add it up:

Annual Cost to Power Server = 8,760 x 0.087 x .350

Annual Cost to Power Server = $266.74

Average Annual Cooling Cost to Power Server = $533.48
(depending on datacenter cooling efficiency or Power Utilization Efficiency - PUE)

Average Total Annual Cost to Power Server = $800.22

Multiplying the average total cost to power a physical server by the thousands of servers across U of M, illustrates the significant cost savings potential. Consider that VaaS has a consolidation ratio of 40:1 (40 physical servers can be consolidated to run on 1 physical server) and the long-term energy- and costs-savings become apparent.

University of Michigan's School of Social Work has a lofty goal: Run its entire server room without a single physical server. And by tapping in to U-M's VaaS, the School of Social Work is well on its way.

"Through VaaS, we've been able to virtualize one of our servers and are in the process of virtualizing the three others in our data center," explained Matt Walters, IT Manager, U-M's School of Social Work. "Moving to VaaS saves electricity and cooling costs, plus frees up the physical space where the servers are housed for other purposes. Servers are huge power hogs and we expect to see big costs-savings through virtualization."

His work with the U-M School of Social Work server room is Walters' first experience with virtualization. "I'm surprised by how easy it is to virtualize versus building a physical server," he added. "I'm able to offer the same computing power and capabilities without the hassle of configuring drivers, hardware settings and other details."

The School of Social Work expects to be fully virtualized by 2010.