A Customer Success
from the Experts in
Business-Critical Continuity™

University of Illinois

Since its founding in 1867, the University of Illinois at Urbana-Champaign has earned a reputation as a world-class leader in research, teaching and public engagement. Serving nearly 42,000 students annually, the university offers more than 150 undergraduate and graduate programs of study.

Background

The University of Illinois at Urbana-Champaign conducts highly technical research requiring massive computing performance to support fields ranging from molecular biology to electromagnetic theory. The university decided to update its aging supercomputer array and data center to provide world-class computing support for its world-class research.

Case Summary

Location: Urbana, Illinois

Products/Services:

- Liebert Deluxe System/3 Precision Cooling
- Liebert XDP Pumping Unit
- Liebert XDV Rack-Top Cooling Modules

Critical Needs: Develop an adaptive cooling solution within space and time constraints, for a clustered supercomputer.

Results

- Fully redundant cooling system supports continuous operation of vital campus supercomputing center.
- Temperatures are stabilized throughout the rack while computer achieves processing speeds of five teraflops.
- Highly scalable system enables future expansion.

Liebert

EMERSON
Network Power

The Situation

Noting the growing obsolescence of its existing 208-node, Linux-based supercomputer array, the university's interdepartmental Computational Science and Engineering (CSE) program sought a replacement that would maximize computing capacity while minimizing infrastructure upgrade costs. The data center was built in the 1960s and required a complete overhaul.

After evaluating various options, CSE settled on a design incorporating 640 Apple® Xserve G5 rack-mounted dual-processor servers. The cluster was projected to generate more than 550,000 BTU/hr cooling load, requiring 45 tons of new cooling capacity in the data center.

Beginning in July 2004, university design engineer Tom Durbin and construction supervisor Tom Graham oversaw a complete overhaul of the 2,000-square-foot data center, stripping the facility to the bare walls and ceiling. The old, 12-inch raised floor was replaced by a new sub floor plenum of 16 inches.

"The system has been great, and we haven't had any problems," Dick says. "And it's very scalable, which will allow us to adapt to future needs."

*William A. Dick, executive director (right),
Computational Science and Engineering program,
University of Illinois*

*Tom Durbin, design engineer (left),
Faciltiy and Services Department,
University of Illinois*

The Solution

For help with the cooling system design, the university called on Emerson Network Power for its Liebert XD cooling system, the preferred choice for cooling high-density computing environments. The Liebert XD family provides a flexible, scalable and waterless solution that delivers sensible cooling of heat densities higher than 500 Watts per square foot. Liebert XD modules use an environmentally friendly refrigerant to achieve high efficiencies and waterless cooling. The refrigerant is pumped as a liquid, converts to a gas within the heat exchangers, and then is returned to the pumping station, where it is re-condensed to liquid.

After evaluating airflow requirements for the room, Emerson Network Power and university engineers configured the servers in 22 racks, including two racks for the high-speed Myrinet switching fabric. Each of the 22 racks contained 32 to 35 Xservers. Racks were arranged in two rows and positioned back-to-back to create a hot aisle between the rows.

Ensuring reliable cooling system scalability was the number one concern for Durbin and CSE executive director William A. Dick. They recognized that continuing to rely solely on under-floor cooling would prove insufficient considering the continued growth in computing power required by the university.

Durbin collaborated with Liebert Representative Jeff Bilsland of Sepco Inc. to create an adaptive cooling architecture using under-floor cooling in combination with the Liebert XD cooling system. Under-floor air flow computer modeling was used to verify the university's design specification for the traditional and high density supplemental equipment.

The adaptive architecture included three separate cooling systems to provide an N+1 level of cooling redundancy:

1) Base-level under-floor cooling and humidity control is provided through the campus-wide chilled-water and building air-handling systems. Cold air rises up through perforated tiles in front of the racks and goes in to the racks. The hot air from the racks is exhausted in to the hot aisle and circulated back to the air conditioning units where it is chilled down again and re-circulated in the raised floor back to the perforated tiles.

2) The Liebert XDV rack-mounted cooling modules deliver supplemental cooling to the front of the racks. XDV modules are connected to the building chilled water systems through a Liebert XDP pumping unit, which isolates the building chilled water circuit from the pumped refrigerant circuit. The XDP circulates the refrigerant to the XDV modules at a temperature always above the actual dew point to prevent condensation.

3) The 10- and 20-ton Liebert Deluxe System/3 precision cooling units provide precise, reliable control of room temperature, humidity and air flow as needed, in addition to serving as backup cooling to base building chilled water systems.

"The Liebert XDV units have a low profile, allowing them to fit on top of the racks without changing the ceiling height or requiring major modifications to the new ceiling."

Tom Durbin, design engineer,
Facility and Services Department,
University of Illinois

Currently, the temperature in the cold aisle averages 60 degrees, while hot aisle temperatures average 80 degrees. To conserve space on the raised floor, cooling units for the two under-floor systems are located outside of the data center.

Durbin says that limited floor space and ceiling height were two of the reasons the university chose the Liebert XD as a supplemental solution. "The Liebert XDV units have a low profile, allowing them to fit on top of the racks without changing the ceiling height or requiring major modifications to the new ceiling."

Dick notes that the critical nature of the research done at the university makes redundant cooling an essential component of the data center design. "Maintaining continuous, reliable operation is vital because the supercomputer is often used for complex calculations that cannot be interrupted," he says. "If the computing equipment fails, the calculations in process would have to be restarted, causing researchers to lose valuable time."

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The Results

In February 2005, the University of Illinois officially commissioned its Turing Cluster, named after Alan Turing, the famed British mathematician credited with founding the field of computer science. A few months later, the cluster was clocked at processing speeds of more than five teraflops, supplying more than enough computing capacity for critical research conducted through the University's CSE.

Liebert equipment provides reliable, scalable and cost-effective cooling for this demanding environment, supporting the university's goal of continuous operation for the cluster.

"The system has been great, and we haven't had any problems," Dick says. "And it's very scalable, which will allow us to adapt to future needs."