University Sets New Standard for Building Automation

Executive Summary

CARLETON UNIVERSITY

- **Industry:** Education
- **Location:** Ottawa, Ontario
- **Faculty:** Approximately 900
- **Employees**: Approximately 1,100
- **Students:** Approximately 26,000

CHALLENGE

- Integrate building automation systems (BAS) onto converged IP network, reducing need for multiple networks operated by two departments
- Facilitate building systems data collection and transfer to increase building operating effectiveness
- Facilitate collaboration among traditionally disparate university departments

SOLUTION

- Traditionally isolated building systems migrated onto one converged next-generation IP network
- Cisco Catalyst Core and Access switches utilizing Cisco EnergyWise
- Unique Power over Ethernet interface integrated into building automation system
- Application of ASHRAE 189.1 standard principles for higher energy efficiency and sustainability

RESULTS

- BAS devices run on and powered by one network and conveniently managed through IT department
- Faster and more accurate data transfer from BAS for more reliable and effective building operations
- Creation of "living lab" for engineering students for enhanced learning and research experience

Carleton University combines Facilities Management with IT for unprecedented level of convergence.

CHALLENGE

Carleton University is located in Canada's capital city of Ottawa, and has almost 26,000 full- and part-time students and more than 2,000 professors and staff members. As Canada's capital university, Carleton is dedicated to providing a superior learning experience for its students and is determined to be equipped with the most innovative facilities and IT systems, while setting new levels of sustainability standards.

In 2004, Carleton's IT department embarked on an ambitious project to upgrade its entire IP network infrastructure. Once the upgrade was completed, the university operated a high-speed backbone network with the ability for all campus buildings to be connected to one core network for new levels of connectivity and automation.

"Traditionally, a building automation system (BAS) runs on a discrete network installed and managed by the university's facilities management department," says Denis Levesque, assistant director of operations and infrastructure and acting CIO, Carleton University. "Once the new IP network was in place, it provided greater speed, easier data transfer, and less traffic congestion. The university realized it no longer needed disparate networks run by several departments, so we began to converge various automation systems such as security cameras, vending and door access technology, and finally BAS."

Darryl Boyce, assistant vice president of facilities management, had been hoping to converge BAS with the IT systems for several years. With the new IP network in place, he felt that a quality network was now ready to more effectively manage tasks such as metering and building automation. In addition, the opportunity was available for the BAS to provide a wider and more concurrent scope of data to help ensure more effective operation of the buildings, especially from an energy and environmental sustainability point of view.

With Boyce's vision leading the way, in 2010 Carleton began the construction of two new buildings, which would be the first to take advantage of the new network. The Canal and River Building projects represented an unprecedented fusion of the university's facilities management and IT department from development through to construction and deployment.

"This initiative represents an entirely different process in construction," says Boyce. "With a traditional IT network such as data and telephones, the general contractor's job is substantially finished before the switches and network are put in place. With this new methodology, the network has to be in much earlier and has to be implemented while the building is under construction, so the BAS can be brought on line and be operational before overall construction is completed. There was a tremendous opportunity for a new level of convergence, not just with regards to technology but also the way the two departments within the university collaborated."

SOLUTION

Carleton turned to Cisco and building control solutions provider Delta Controls Inc. to aid in developing an overall strategy and plan for the project. In conjunction with the university, the team developed a strategic solution, driven by network convergence, the leadership position of Cisco in Power over Ethernet (PoE), and Delta's strength in delivering an IP/PoE-based automation platform.

"BAS requires a tremendous amount of data to be pulled out of the system on a regular basis in order to get an accurate picture of what's happening within the building," says Shane Murphy, Canadian business development manager, Delta Controls Inc. "A stronger, more robust network allows you to pull more data from the system worry-free, without the concern of congesting or overstressing the network. Industry leaders like Cisco provide the backbone for the networks and allow us to forge ahead and explore solutions within our own industry."

Delta decided to harness the potential afforded by PoE. Using Cisco Catalyst® Switches, Delta designed a unique interface small enough to provide power to the entire BAS architecture integrated onto the network.

"The new PoE controller allows the entire architecture to be established over PoE and for more devices to be connected to the IP network than traditionally seen," says Colin Harraway, technical account representative, Delta Controls Inc. "It broadens the pipeline substantially and allows for greater data transfer. It also 'future-proofs' the building. Instead of the standard two-wire network seen in most buildings for the past 25 years, PoE allows us to keep pace with other industries, such as the computer industry, and ensure this deployment will remain valid and at the top of its class for many years."

The innovative switching solution also benefits from Cisco EnergyWise™ technology to measure, report, and reduce the energy consumption of IP devices such as phones, laptops, and access points. This achievement is in line with Carleton's determination that the new buildings are as energy efficient as possible with the utmost in indoor environmental quality. Boyce's overall goal was to apply Canada's Green Globes and the new ASHRAE 189.1 standard to the initiative to create a healthier environment for students and faculty through reduced carbon dioxide and increased fresh air in buildings.

"ASHRAE 189.1 is the new, improved standard, but it's not actually a compliance standard yet, that remains 90.1," says Harraway. "However, Carleton was adamant this was the standard they wanted to deploy. It has 30 percent higher energy efficiency and is focused more heavily on sustainability, a reduced carbon footprint, and the life cycle costing of a building through operations and maintenance. It's another example of our refusal to be content with industry standards and our drive to push the envelope. We want to be able to implement the best technologies in these buildings and within the industry."

RESULTS

Construction of both buildings finished in 2012. The Canal Building is now fully up and running and is completely integrated onto the new converged IP network. The convergence of BAS with IT has led to a more cost-effective business method as well as a simpler operational process. All the building automation end devices are on the IP network and are controlled by a management system residing in the campus' data center under the support of the IT department. Facilities management staff also has remote access to the infrastructure and are able to easily access and control or troubleshoot individual devices such as temperature controls or lighting.

The new IP network allows for a more efficient transfer of data between automation systems, which has led to the creation of new sequences of operations that result in additional energy savings. For example, the new Delta IEQ BACstats placed in the building can measure the indoor environmental quality (IEQ) and feed data pertaining to lighting level, temperature, humidity, and carbon dioxide across the network. This data is recorded at regular intervals and transferred to the necessary operating system to help ensure conditions are always maintained at the appropriate level.

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– **Darryl Boyce**
Assistant Vice President,
Facilities Management
Carleton University

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> "The effective operation and management of a building's system, whether it's temperature, ventilation, humidity, or air quality ultimately leads to a better working and learning environment," says Boyce. "Professors teach better, and students are more receptive to learning. Our ultimate goal is to create conditions that foster innovation and the highest level of productivity."

The Canal Building has also become a key focus of engineering students. "The Canal Building allows students to access some of the building's data they can evaluate for their studies," says Levesque. "It's a great opportunity for engineering students to have the ability to hook into the building network and work with building data collection systems and metering systems, in effect turning the building into a 'living lab.' Imagine medical students with the opportunity to examine a live body as they learn. It's another example of BAS data being used in innovative ways now that it's a part of the overall IT network."

NEXT STEPS

The strategies and methodologies used in the construction of the Canal and River Buildings proved to be a resounding success and now serve as the template for future building projects at Carleton. The university now considers convergence to be the key enabler for driving energy optimization, sustainability, and high-performance building value.

"The collaboration of all participants across the departments and our suppliers really drove this project," says Boyce. "Cisco and Delta shared the university's vision to devise a solution that would not be merely 'good enough' but could also act as an industry standard. By coming together, we accomplished our goal. In fact, this template was so successful it has not only become the standard for future construction projects but also for the retro-fitting of existing buildings."

PRODUCT LIST

Switches
- Cisco® Catalyst 6500 Virtual Switching System
- Cisco Catalyst 2960 Series Switches
- Cisco EnergyWise Technology

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For more about Cisco Smart+Connected Communities, visit:
http://www.cisco.com/web/CA/solutions/strategy/smart_connected_communities.html

For more about Delta Controls, visit: http://www.deltacontrols.com/

To find out more about Carleton University, visit: http://www.carleton.ca/

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