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*Photo 1: The City Centre complex in the Toronto greater metropolitan area uses a Web-based BAS.*

# BACnet® Goes Green

**By Steve Tom, Ph.D., P.E., Member ASHRAE**

**W**hat do you do if you're one of Canada's largest integrated real estate firms, you own an 18 acre (7.3 ha) signature site with 800,000 ft<sup>2</sup> (74 322 m<sup>2</sup>) of leasable area in one of the strongest office markets in Canada, and you want to provide existing tenants (including your own headquarters) and prospective clients with the most efficient, comfortable, and desirable work environment possible? You "Go Green," of course. And you do it with BACnet®.

The Go Green program was developed by the Building Owners and Managers Association of Canada (BOMA Canada) to recognize existing commercial buildings, which are using the best environmental practices in five key areas:

- Resource consumption (energy and water use);
- Waste reduction and recycling;
- Building materials;

- Interior environment; and
- Tenant awareness.

Within these five areas 10 minimum requirements exist, and a building must meet or exceed all 10 requirements to be certified as a Go Green building. With its emphasis on energy audits and best practices in existing buildings the Go Green program is roughly equivalent to LEED®-EB certification. An additional

requirement of the Go Green program is that the certification process includes an on-site visitation by BOMA.

Morguard Investments wanted to Go Green with their City Centre complex. Located in Mississauga, Ontario, part of the greater Toronto metropolitan area, the complex consisted of four major office buildings with planned future construction of retail, office, and amphitheatre buildings. When it came to building automation, they realized that having multiple disconnected stand-alone systems would hardly qualify as best practice. Their goal was to integrate control of the HVAC, lighting, fire, access control, and security systems. "I've always had a dream of driving into a parking lot, swiping my security card, and having it automati-

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## About the Author

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cally turn on my office lights and air conditioning” said Paul Bayliss, operations manager for Morguard Investments. “Our existing systems had reached the end of their life. The fire alarm system was so old there were only two people in all of Canada who were capable of working on it. We needed new systems that would be more energy efficient, and more cost effective to maintain and operate.” Since these systems come from different manufacturers, BACnet was the logical choice for the protocol to tie them all together.

“We knew we needed a nonproprietary protocol” said Bayliss. “We wanted one protocol to talk to different pieces of equipment. Our consulting engineers looked at competing protocols and advised us that BACnet was the best choice.” Other features that were high on Morguard’s priority list were energy management capabilities, a user-friendly graphical interface, and a Web-based system. This last feature was important because of the flexibility it provided for their technicians and because it would allow them to give tenants access to appropriate building automation system (BAS) functions in the future.

Morguard chose a Web-based BACnet control system made by an HVAC controls company to form the core of their BAS. This made sense because the roughly 5,500 HVAC control points comprised the largest single system in the building and because the user interface requirements were more sophisticated than the other systems. The lighting was controlled by another native BACnet system, and the 650 lighting points were easily integrated into the BAS using BACnet. Zone lighting and HVAC are normally controlled off the same basic occupancy schedule, which eases the scheduling workload, and they can also operate independently for security lighting, HVAC freeze protection, and other special circumstances.

The fire system is, by code, an independent stand-alone system that does not require use of the BAS for any life-safety warning or control actions. It does, however, communicate with the BAS via a BACnet gateway. This allows the building operators to monitor the status of approximately 2,700 fire system points such as smoke detectors and pull stations through the BAS graphics. The BAS also receives alarms from the fire system, notifies appropriate people of the alarm, and records alarms in the BAS log.

The security system is also a stand-alone system, but in this case it is integrated into the BAS using a high-level XML/SOAP interface, essentially a subset of the recently defined BACnet Web services. Like the fire system, this enables system operators to monitor the status of approximately 1,050 security points such as door switches, card access readers, and security cameras. The BAS similarly records and alerts people to security alarms. The integration goes beyond that of the fire system; however, as the

security system can also trigger the HVAC and lighting systems to take certain actions, such as fulfilling Bayliss’ dream of turning on the lights and HVAC. Also, the security system includes closed-circuit TV cameras (CCTV) that are used to monitor areas of particular interest. The cameras generate a standard image signal that is easily displayed on a Web page, the graphics for the web-based BAS include links the user can click to display the CCTV image in a pop-up window.

Figure 1 shows a typical floor plan summary, providing the user with an easy to read overview of the status of the HVAC, lighting, fire, and security systems within one building. The column of floor plans on the left indicates the thermal comfort (temperature deviation from setpoint) of the zones on each floor of the building. Green zones mean the temperature is between the heating and cooling setpoints. Yellow and orange zones indicate progressively warmer temperatures, and light and dark blue indicate cooler zones. Light grey indicates the zone is unoccupied. The middle column of floor plans shows the status of the lighting controls. White zones show where the lights are on, and light grey indicates the lights are off. The rightmost column summarizes the status of the fire and security systems, with white indicating everything is operating normally. A red zone in any column indicates an alarm condition.

Figure 2 shows a combined fire and security floor plan for a single floor. This detailed view shows the status of individual door switches and other sensors. It also indicates the location of the CCTV cameras. Clicking on one of camera icons will display the CCTV image in a separate window like the one shown in Figure 2. When this screen shot was taken a smoke detector and a heat sensor were placed in a simulated alarm state, causing them to appear in red on the floor plan. This also caused the alarm icon in the upper right-hand corner to turn red, indicating there are active alarms in the system. Clicking on this icon would display the alarm log. Additional alarm actions (pop-up window, printout, e-mail, etc.) are possible.

As with any project in an existing building, a prime concern was to disturb the existing occupants as little as possible. This required much of the work to be done after normal business hours, with careful phasing of work so equipment could be seamlessly transferred from the old independent systems to the new integrated system. “I haven’t had any complaints from the tenants about noise, interference, dirt found on their desks the next day, etc. That’s the biggest compliment I could give to the installation crew,” said Bayless. Occasionally, the installation crew run into problems where the actual installed equipment doesn’t match the as-built drawings, a situation that would not surprise anyone who has worked on a retrofit project before, but the problems are solved as they arise.

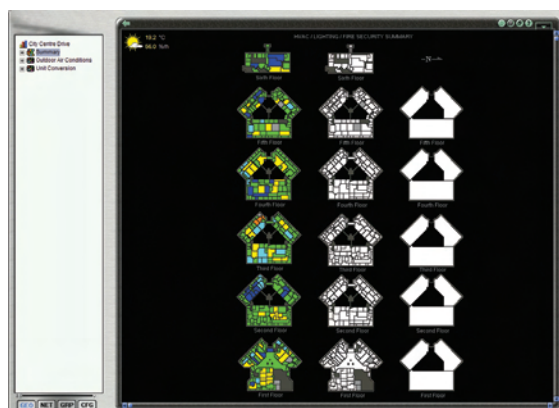
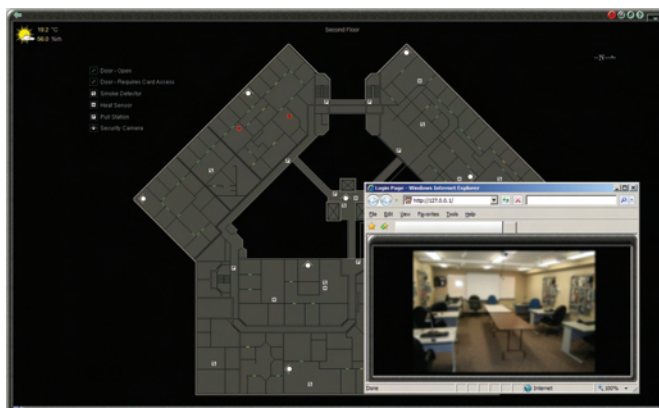


Figure 1: Integrated floor plan provides systems overview.



*Figure 2 (left): Fire and security floor plan with CCTV image. Photo 2 (right): Facility managers have more than enough computer screens to monitor already. They don't need separate screens for every building subsystem.*

The hub of the integrated system is a Web server located in one of the four buildings. Dedicated fiber optic cables connect this server to the two nearest buildings, with a leased fiber optic connection to the furthest building. "Using our own dedicated lines provides huge cost savings for the short runs," explained Bayless, "but it didn't make sense for the distant building. We're running fire system communications over this cable, so wireless wasn't an option."

The four buildings have received their Go Green certification, and Bayless is pleased with the project. "We relied upon analysis by consulting engineers in selecting our contractor for this project. They had worked with them on previous integration projects and felt they offered the most cost effective solution in the long run. Having one single contractor as the prime makes things easier. Integration works with this model." ●

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