

# UNIFYING LIGHTING CONTROL & BUILDING AUTOMATION

TO CREATE A FACILITY AUTOMATION SYSTEM



The Nationwide and Cardinal Health facilities in Columbus, Ohio, have experienced a significant decrease in building occupancy due to remote work. They report going from an average capacity of 80% before 2020 to a total as low as 20% on any given day in 2021. This reduction has caused entire floors of people to disappear and the building owners' rent revenues to shrink drastically.

The change in how people work post-pandemic and the 57-year average age of commercial buildings drive a need to retrofit buildings. The lack of electricity supply-side growth will drive a more comprehensive implementation of stricter energy codes. These future codes will require features like automatic demand response and will not be limited to states such as California and Washington. The building owners realized they had a massive issue and looked to Jim Burch and the team at Convergent for ideas and solutions to reduce energy and operating costs.

Both buildings have existing Blue Ridge lighting control systems (LCS). These systems are integrated/unified with the BAS via BACnet and utilize dual-technology occupancy sensors. The Nationwide system has been installed for over three years, and the Cardinal system was installed in early 2023.

The Convergent Team proposed using the existing Blue Ridge LCS system to leverage its occupancy sensors and BACnet network capabilities to determine real-time operating requirements (occupancy level) in conjunction with the building automation system (BAS) to turn off unneeded lights and to setback or turn off nonessential HVAC equipment. Implementing this strategy drastically reduced operating costs and made these facilities more energy efficient.

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DO WHAT YOU CAN  
WITH WHAT YOU HAVE,  
WHERE YOU ARE.  
- THEODORE ROOSEVELT

## PROBLEMS:

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This trend in reduced occupancy occurs not only at Cardinal Health and Nationwide but at most commercial facilities worldwide. In November of 2022, Forbes reported that the daily occupancy in the world's office buildings ranges from about 20% to 70%, considered low compared to pre-pandemic numbers, where the average was around 80%. Nationwide and Cardinal Health realized hybrid work was here to stay post-pandemic. They also understood the need to keep the office space open for people to gather and collaborate. Creativity was needed in this new world of less-than-optimal occupancy to solve the overcapacity problem and resulting financial inefficiencies. The problems most building owners face are reducing energy costs while providing a comfortable and productive environment for spaces with constant variability in use (Load). In this case, going back to basics and understanding what their current/installed systems offered individually and what is possible when approached from a facility perspective was vital to developing a go-forward strategy.

For decades, it has been the same old story. The sequence of operations is designed and implemented based on individual control system processes, i.e., lighting control (LCS) by the electrical division and temperature controls (BAS) by the mechanical division. This lack of a facility perspective and minimal interoperability regularly fails to deliver a coordinated, comprehensive facility control system that building owners think/assume they are getting. This unfortunate assumption that BAS equates to interoperability as a facility management system consistently when the reality is that BAS, as most often implemented, equates to temperature control consistently and interoperability occasionally on an exception basis disappointing owners and needs to be addressed.

Facility Managers have broader requirements and a more comprehensive focus than any individual controls subsystem can provide but prefer a single user interface to provide a complete picture of the facility, driving the need for systems integration and engaging system integrators.





Systems integration presents two challenges, the first being networking/protocol and the second providing individual process knowledge, i.e., temperature, lighting, security sequence design, and implementation. Generally, the broad adoption of ASHRAE's BACnet Standard has solved the Networking and protocol issues.

From a communications perspective, BAS systems integrators have the experience and requisite skill to successfully integrate multiple control subsystems and unify them under a single user interface (front end). Interoperability between subsystems and effective sequential control must be consistently and effectively delivered. Effective delivery mainly depends on the product manufacturers' feature offering and system integrators' process expertise. The consequence of not delivering the best solution or practice for a process means the time to recoup the investment in an integrated facility management system is extended, and many times, promised benefits are not fully realized.

The lack of understanding by contractors and system integrators of the facility manager's operating requirements significantly contributes to the cost of system delivery.

As a systems consultant and commissioning agent, Jim has commonly seen physical installation issues due to a lack of trade responsibility coordination delay projects and drive additional costs (change orders). He also points out that the contracting chain looks to the BAS systems integrator as a process expert for all subsystems.

The BAS systems integrator usually has the requisite networking skills and at least a familiarity with temperature controls but not a clue about lighting controls in general or advanced lighting controls specifically creating gaps. This expertise gap creates an unnecessary and costly dependence on lighting control manufacturers for "factory" startup and commissioning services.

Manufacturers are not generally in the contracting chain and, therefore, do not benefit from knowledge provided at job meetings (regular communication) and contract document transmittals, creating gaps in requirements and trust.

The lack of process expertise and gaps in the scope of work balloon to a point where progress stops and frustration builds. This leads to the classic scene of all parties sitting around a conference room table, pointing fingers, and losing money. At the same time, the facility/project still operates inefficiently or falls further behind schedule.

## SOLUTIONS:

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Nationwide and Cardinal Health recognized Jim Burch's experience with systems integration and deep control subsystem knowledge. They engaged him to find a cost-effective solution to address the excess capacity issue. They also asked him to identify potential improvements beyond energy savings in other areas, such as maintenance and housekeeping services.

He audited the Nationwide facility and found that the Blue Ridge lighting control system included dual technology occupancy sensors monitoring a 36-square-foot perimeter in open office zones for automatic on/off control. He thought he could leverage the Blue Ridge system to inform the building automation system when one of these zones is occupied.

He developed a software tool within the BAS to monitor and collect the occupancy sensor data from the LCS and determine the total time the zones are occupied/used. Utilizing what was already available in the LCS and leveraging the existing integration to the BAS, He created a facility-based approach to the excess capacity issue based on real-time data (Space Usage by Zone/Area). Using the space usage data, he also reduced operating costs through a usage-driven maintenance program, allowing the facility managers to be more strategic with their spending on general maintenance. Specifically, they can increase maintenance frequency in high-traffic areas and reduce the frequency in low-traffic areas, resulting in a cleaner building (productivity) at a lower cost. He then utilized the usage data to drive cleaning crew deployment. For example, if a common area required cleaning after 250 hours of use, he could precisely target the areas that met the total time used. Utilizing a facility management system approach with data-driven action allows the facility managers to spend less money. They can strategically target by zone/area when and where cleaning is required rather than scheduling an entire floor for cleaning.

He also developed a facility-based sequence that utilizes the LCS occupancy sensing (motion) and security/access system via the BAS to authenticate approved space use in unoccupied modes. This sequence reduces false alarms and unnecessary patrols in a building. This allows for a more automated approach to physical security, increasing safety and productivity.



Understanding space usage on a more granular level also enables the building owners to make better decisions on future renovations regarding actual space requirements and better accommodate the occupants who utilize the space. This information also informs the best choice for furniture purchase decisions, such as future floor plan designs and placing collaboration spaces in the best location inside their buildings.

Understanding usage in real time helps create better work environments (Comfort) that motivate people to want to come to the office and enjoy the experience. For building owners, creating preferred environments/spaces leads to more demand and renovation projects for contractors.

The next planned event-driven strategy is environmental zone control. Occupancy sensing will control the light level in space and adjust (reset) the HVAC space temperature setpoint based on actual occupancy within a predetermined range established by the facility managers. This strategy will pay for the Blue Ridge LCS in less than six months.

## T A K E A W A Y S :

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In facilities where a BACnet-based LCS and BAS are already networked, all a facility needs to implement these strategies is to use the occupancy sensor data and simple facility control sequences driven by space occupancy and usage. Other considerations in space usage-driven strategies/sequences are determining the ideal size of a monitored zone, sensor density, and input requirements. In practice, average LCS occupancy sensor density can establish reasonable estimates of space usage. To leverage the true power of the space usage data, the facility manager must determine (gather requirements) initiation criteria (parameters) for these sequences to automate actions. It is also essential to remember that the facilities-based approach is not just limited to large facilities or mission-critical facilities with budgets for feature-rich systems that can be expensive.

BACnet-based networking is a standard feature in today's commercial control devices/systems and is regularly installed in buildings from 5,000 square/feet and up, enabling interoperability between subsystems.



## S U M M A R Y :

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It is exciting to realize that the needed technology and infrastructure are already in place at many facilities. With a simple change in perspective from individual subsystems to a facility-based theory of operation, all interested parties will achieve better results, foster more creativity in the future, and finally deliver on the many marketing promises made since the early 1990s.

Congratulations to Nationwide and Jim Burch for their investment in recognizing and testing the facility-based theory of operation, proving that increased comfort, productivity, and efficiency can be delivered by turning disparate subsystems into a facility automation system.

The offices at both Nationwide and Cardinal Health that were once walled cubicle farms are now becoming a space where people want to be because it is inviting (space layout and furniture selection), well maintained (housekeeping based on use rather than schedule), and safer (understanding from a security/access actual location of people) increasing both the value of the space and efficiency. Collaboration thrives when people find an inviting and comfortable space, and productivity and retention increase significantly.

The facility automation system measuring and acting on actual needs in real-time lowers operating costs and increases value and service to tenants (customers). The ability to use sensor data from the LCS explicitly installed to meet code and share it with the BAS through a shared BACnet network, where the data is repurposed for both temperature control and facility operations, can genuinely improve the experience of all interested parties with just a modest investment in time and money.

