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The Realization of Intelligent Buildings

Integrated building systems streamline operations, add long-term value to property, and enable better service delivery to end-users

By Jana J. Madsen

Ten years ago, conversations about intelligent buildings included phrases like "what if" and "in the future." Today, the same excitement permeates, but talk of intelligent buildings is no longer about the potential - it's about the reality.

Thanks to a few courageous building owners and developers in North America and overseas, the real estate industry is beginning to catch a glimpse of what's to come. Ask the pioneers involved in these projects to provide a firsthand account of their experiences and you'll hear how the design, construction, and operation of intelligent buildings requires a new approach, innovative strategy, and a team with different players.

Widespread adoption of intelligent technologies can mean only one thing for the real estate industry: transformation.

Defining Intelligent Buildings

Not even Google can give you a straightforward answer to the question, "What is an intelligent building?" While no standard, agreed-upon definition exists, most attempts have several things in common. Intelligent buildings:
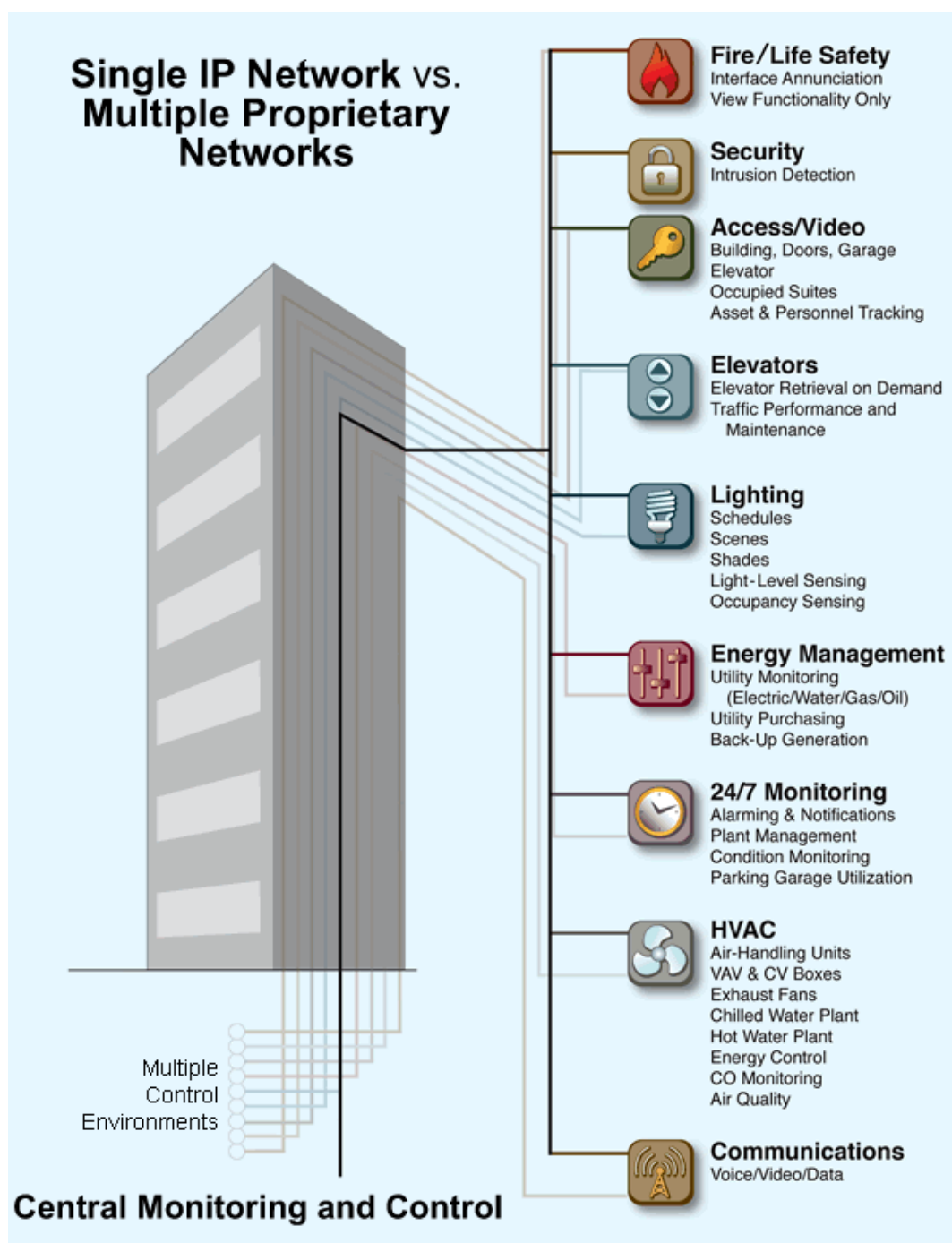
- Integrate disparate building systems so they can be controlled by a centralized common user interface.
- Use a shared network for all building-system communications.
- Are high-performance buildings that provide significant benefits to building owners, property/facility management professionals, and end-users.
- Maximize building performance and efficiency by integrating building systems such as lighting, HVAC, safety, power management, security (access control, video surveillance, and visitor management), etc.
- Use technology and strategies that add long-term, sustainable value to the property.

PHOTOS: EMPORIS

One America Plaza, San Diego
The standardized broadband infrastructure at San Diego's One America Plaza reduces costs by aggregating bandwidth, integrating building systems, automating IT, and providing Wi-Fi to tenants. A Web-based tenant services system, along with building engineers who are equipped with tablet PCs and PDAs, provides higher-quality service to tenants.

Single IP Network vs. Multiple Proprietary Networks

Fire/Life Safety
Interface Annunciation
View Functionality Only

Security
Intrusion Detection

Access/Video
Building, Doors, Garage
Elevator
Occupied Suites
Asset & Personnel Tracking

Elevators
Elevator Retrieval on Demand
Traffic Performance and
 Maintenance

Lighting
Schedules
Scenes
Shades
Light-Level Sensing
Occupancy Sensing

Energy Management
Utility Monitoring
 (Electric/Water/Gas/Oil)
Utility Purchasing
Back-Up Generation

24/7 Monitoring
Alarming & Notifications
Plant Management
Condition Monitoring
Parking Garage Utilization

HVAC
Air-Handling Units
VAV & CV Boxes
Exhaust Fans
Chilled Water Plant
Hot Water Plant
Energy Control
CO Monitoring
Air Quality

Communications
Voice/Video/Data

Multiple Control Environments

Central Monitoring and Control

SOURCE: BPG PROPERTIES LTD.

"People have different levels of intelligence; so do buildings," says Ronald J. Zimmer, president and CEO, Continental Automated Buildings Association (CABA), Ottawa. Not every building system has to be integrated to make an intelligent building; however, the more systems that are connected, the greater the benefits. Tom Shircliff, who cofounded Charlotte, NC-based IntelligentBuildings® with Rob Murchison, agrees: "It is important to note that each owner and manager should only seek a level of integration that makes sense for him or her. This is not all or nothing, which is frequently the perception."

Intelligent buildings successfully merge building management and IT systems to optimize system performance and simplify facility operations. Integration greatly reduces the expense and frustration associated with installing and operating multiple autonomous building systems.

Ballantyne Village, Charlotte, NC
Customers at Ballantyne Village in Charlotte, NC, can use touch screens to locate retailers and discover what's on sale. These preferences are tracked, and the responses to what shoppers see onscreen are monitored via IPenabled video surveillance. Smart bathroom fi xtures automatically communicate to facility managers when soap, toilet paper, and paper towels are empty. PHOTOS COURTESY OF BALLANTYNE VILLAGE

How They Work

Integration begins with conduit convergence (i.e. the cabling infrastructure for every system is shared). In traditional buildings, disparate systems (such as HVAC, lighting, and security) each have their own controls and, in many cases, use a different method of cabling. "The first step," says Paul Ehrlich, president, Building Intelligence Group LLC, St. Paul, MN, "is that everything comes onto a common network infrastructure."

Once disparate building systems are integrated onto one IP or Ethernet network using routers and switches in the core of the building, they are converted into IP by a centralized control system. After that translation is complete, the data gets delivered to the network of switches and gateways, and eventually to a central monitoring application. At this point, it is accessible via a secure Web browser.

The days of using four or five different computer systems to support security, HVAC, and other building systems are long gone. "Anything you can do in a building now, you can do all from one interface," says Cory Hildebrand, director of IT, BPG Properties Ltd., Philadelphia. At Ave Maria University in Naples, FL, the network operating center in the engineering office consists of a 6-foot by 8-foot video wall of LCD TVs. When the center is not manned, the system is accessible via the Internet, ensuring 24/7 monitoring.

Specifying open-standards-based building systems (e.g. LonWorks® and BACnet®) is advantageous. Murchison explains why: "Interoperability between building systems is more efficiently enabled by an open protocol because, every time that we connect applications, we don't have to go through a manufacturer's service people or a software gateway."

Selecting open systems gave Bryan Mehaffey, vice president for technology and systems engineering at Ave Maria University, assurance that the university would be able to bid out future intelligent-building projects without increased costs. "I wanted a protocol that we could manage in an open platform and that would work across multiple vendors, and I don't just mean three or four - but hundreds. Our construction scope over the next 25 years is 129 buildings, and I can't afford to be tied to one contractor. We need to be able to keep it open for competitive bidding. Also, as construction goes, I may wind up having two or three contractors working out here at one time, and they all have to be able to communicate. I have to have a common protocol set that they all can work on together, no matter who the contractor is."

To see open systems at work, look no further than your home entertainment system. The DVD player, TV, stereo receiver, CD player, speakers, and digital video recorder (DVR) - irrespective of brand - operate using a standard communication protocol that allows them to work together. "When you go out and buy a DVD player, you're not buying it based on the fact that you own a Toshiba TV. You're buying it based on pricing, features, warranty, service, looks, and, potentially, the brand. You never think 'I have a Toshiba TV, so I have to buy a Toshiba DVD player,' " says Zimmer.

Ave Maria University, Naples, FL
Integrating a sophisticated human resources database with security makes access control easier to manage on Ave Maria University's Naples, FL, campus. Students use wireless smart cards to buy lunch, make copies, gain access to the dormitory, check out books from the library, etc. PHOTOS: MARK STRONG

Benefits and Capabilities

Because we are only at the onset of implementation, it's impossible to know all the ways in which intelligent buildings will benefit owners, property/facility management professionals, and end-users. The experiences of early adopters, however, have uncovered the following advantages.

Tenant attraction and retention. A significant benefit to the building owner is the expectation that intelligent buildings will get above-market rents, have lower vacancy rates, and reduce turnover.

Lower operating costs. Because integrated buildings are also efficient buildings, operating costs are significantly lower. More accurate monitoring and control of energy-intensive systems like HVAC and lighting help keep costs in check. At the entirely new, 500,000-square-foot campus of Ave Maria University, during the design phase, consultants overshot the estimate for the cost of operations (including staff and building costs) by $600,000 per year. "I'm operating at about $3.15 per square foot for utilities across the board. The estimated cost was between $3.60 and $4.25, based on our architecture. That's including the outside utilities as well," says Mehaffey. Here, integrated systems made a bankable difference.

Energy metering. "It's very, very common in buildings to have no information, other than the electric bill, on electrical distribution and electrical metering," says Ehrlich. This is an area where intelligent buildings really shine. Integrated systems can track and automatically invoice tenants for their energy use. At Ballantyne Village, a mixed-use (retail, office, entertainment) facility in Charlotte, NC, intelligent-building systems enable energy sub-metering, and tenants are re-billed for the precise amount of energy they use - all without the need for the power company to install and monitor individual meters.

Fast and effective service. Intelligent building technologies give building management professionals the tools they need to better serve tenants, occupants, and users. Accessing building systems via the Internet makes it easier for facilities professionals to answer questions and monitor building performance off-site. Problems are identified early and solved immediately. "It's a really fabulous tenant relations/property management tool," explains Nancy Cleveland, senior vice president and director of sustainability, BPG Properties Ltd.

Tenants can file work orders in a Web-based tenant services system. The Irvine Co., owner of One America Plaza in San Diego, is using its building-owned wired and wireless network to better service tenants in its 600,000-square-foot, multi-tenant skyscraper. Engineers carry Web tablets and pocket PCs to eliminate much of the paperwork typically associated with work orders, and to accelerate their response time.

Simplified property management. At Ave Maria University, maintenance crews don't take pressure readings or adjust valves by hand. Adjustments are made from the network operations center with a few simple keystrokes. The result is a leaner facility management operation. Support for the university's optical transport backbone, the voice/data network, two data centers with approximately 75 servers, a $23 million chiller plant, access control, audiovisual, cable television, and power management is managed by a team of eight, including Mehaffey. Only two of those people are exclusively responsible for the facilities-related systems.

Enhanced life safety and security. A fire situation is perhaps the most commonly cited example of how integrated systems are beneficial. The alarms sound and other building systems begin to react: Exhaust dampers open, the IP paging and intercom system issues instructions to occupants, the access-control system unlocks doors for evacuation, and CCTV cameras provide emergency responders with a view of the fire.

Intelligent buildings offer life-safety enhancements in other emergencies as well. An earthquake sensor or signal from the national geological service can be connected with building systems for facilities in seismic zones. "In the event of an earthquake, an integrated building can automatically shut off gas lines, shut down computers, and automatically notify occupants of the earthquake," Ehrlich says.

Security becomes mobile in intelligent buildings. Wireless surveillance cameras and a Web-enabled security system at One America Plaza allow guards to view live video from a laptop or pocket PC.

Anticipation of future technology. While no one can foresee where the future of technology is going, experts predict that a building with an IP backbone will be ready to support almost anything that comes onto the market. And, with tenant needs changing, it's important to have a building flexible enough to adapt quickly.

1000 Continental, a 200,000- square-foot, Class-A office building in King of Prussia, PA, was built by BPG Properties Ltd. with an enhanced IP core and shell. In that building, adding services for a tenant is simple. Assuming that a space is already built out, a tenant can move into 1000 Continental and have voice, data, and communication systems up and running almost immediately - forget waiting 30 to 45 days for a telecomm provider.

Additional revenue. Intelligent buildings can offer tenants wired and wireless high-speed Internet, and other communications services that will maximize the building's revenue per square foot. One America Plaza provides free Wi-Fi as an amenity to all tenants and visitors, and offers bandwidth as a fourth utility. The facility's Building Optical Network enables tenants to purchase bandwidth of up to 100 megabits per second (60-times faster than a typical T1 connection). Wi-Fi, integrated paging, Bluetooth, digital signage, and rich media communications can be made available for a fee (or free) to differentiate the building.

Single point of contact for requests. Since the technology and systems engineering department at Ave Maria University handles both IT and facility-related services, students and faculty aren't confused about who addresses their problems. "If they need their ID [smart] card fixed or their laptop repaired, they go to the same shop. If they're locked out of their rooms or can't get on the Internet, they come to the same place to get support," explains Mehaffey. "That's created a quality of life for students that has been extremely well received."

Environmentally friendly. Careful measurement and monitoring of energy use for the purpose of reducing consumption is a hallmark of green and intelligent buildings. While it's possible to have a green building that isn't intelligent (e.g. using recycled carpet, low-VOC products, etc.), because of the efficiencies that smart technologies provide, all intelligent buildings are some shade of green. For example, at 1000 Continental, a daylight-harvesting system could work in concert through the IT backbone with interior lights and occupancy sensors to provide optimum light levels and save energy use.

Barbizon/63, New York City
During the renovation of Barbizon/63 in New York City, integrated building controls were installed in the luxury condominium. Tenants use their IP phones to adjust room temperature and other building systems by using the phone's touch-screen display. A single redundant backbone makes the luxury condominium a standout to possible tenants. This building offers tenants music on demand, e-concierge services, Wi-Fi, video intercom, the ability to check lighting and climate controls via the Internet, and more. PHOTOS: ADRIAN WILSON

Rethinking Design and Construction

Intelligent buildings require integration of more than just building systems: They demand a new approach to design and construction. "The divisional construction process makes it really difficult to structurally put together a converged building," Murchison explains. Instead of an architect handing off responsibility for the design of electrical, mechanical, and structural systems to various engineers, intelligent buildings must be designed considering the interaction of these and other systems from the onset (instead of autonomous operation). "In many cases, these different consultants and design team members may not even meet, and may not even coordinate or work together. Alignment of all the stakeholders in the process can create a lot of common-sense efficiencies," he says.

As soon as the decision is made to employ intelligent-building technologies, the benefits of integrated systems and project goals should be communicated. Without understanding, support will be scarce. Get all parties (finance, design, construction, marketing, HR, legal, and facility management) to rally around the idea. "A few simple meetings can start this ball rolling. This is not about disrupting schedules, relationships, and budgets; rather, you can paint the picture for the team of a more efficient use of capital and significantly lower energy and operating expenses, and then have design decisions filtered that way," Shircliff explains.

Stick to your convictions. "Architects, engineers, and contractors make their margins and their money by repeating what they've done before. That's where they're the most comfortable. When you bring something to them that is unique and out of their comfort zone, they're very resistant to looking at those ideas with an open mind," says Mehaffey. "Don't let other people come in and try to change your mind. Until this type of application becomes mainstream, you're going to be swimming against the current."

Careful selection of the project team can alleviate headaches later. Consider seeking out a general contractor with experience in sustainable building projects. "Generally, the more LEED experience a contractor or a consultant has, the more open-minded they are about incorporating new things into the building design and construction," Cleveland explains.

"The general contractor (GC) absolutely has to understand the requirements for all of those diverse and various systems to connect into the central backbone that's being designed by the IT consultant. It's very important to have a lot of that dialogue

happening upfront," she says. Success is more likely when communication flows freely between the GC and IT consultant.

The desired outcome of integrated building systems requires an integrated design team/approach with lots of upfront discussion, team members who are progressive, buy-in from all stakeholders, and a steadfast commitment from the owner/developer to refute naysayers' claims that it can't be done.

1000 Continental, King of Prussia, PA
Both intelligent and green, the core and shell of 1000 Continental in King of Prussia, PA, enables tenants to cost-effectively achieve LEED-CI in their build-outs by tying in to the intelligent-building system to reduce energy. PHOTOS: ROB IKELER

Saving Costs, Building Value

Because intelligent buildings are far from the norm, it can be difficult to secure project funding without proof of their value. Cost savings reaped at the project's inception and during building operation can help paint a clearer picture of life-cycle costs. CABA's Life Cycle Cost Analysis tool can help. It constructs a detailed cost model and life-cycle analysis, and calculates the value of integrated buildings by showing the net savings when smart technologies are employed.

"Don't listen to anybody who's telling you that you can't do it, that it's not going to work, or that it's going to cost you a lot of extra money," says Mehaffey, who has proof: By installing fewer standalone systems, he estimates that Ave Maria University saved $1 million when compared to a traditional design. And, because the system enables fewer operations staff, an additional annual savings of $350,000 is projected.

Intelligent buildings eliminate redundant technology, saving money in the process. Shircliff estimates that owners can start saving immediately: The consolidation of the basic cable and pathway infrastructure, along with similar efficiencies in other trades, may save developers as much as $2 per square foot. "Intelligent buildings use technology for increased asset utilization and better use of capital, like using a video server with IP security cameras instead of having several DVRs in multiple locations. We've eliminated some hardware and appliances through software and other technology," Murchison says.

Now that price points have dropped, open protocols are more common, and IP has matured, intelligent buildings may soon become the norm instead of the exception. Escalating energy costs, interest in green buildings, and a slowing real estate market (causing increased competition for tenants) are all catalysts for widespread adoption.

If you listen to the buzz, you'll still hear "what if" and "in the future." The difference is that people are no longer asking *if* intelligent buildings are feasible, but are instead discussing *how* the industry will be impacted by the proliferation of smart technologies. With most of the obstacles to creating an intelligent building resolved, the only question is this: Are you ready to embrace the changes required to achieve integration?

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