How Intelligent Are These Buildings?

Chances are, not very. But some engineers say the timing is right for a decades-old concept to achieve widespread implementation. Can the obstacles be overcome?

BY EVA KAPLAN-LEISERSON

A *New York Times* article describes a new type of building that seems to think for itself. As a man comes into work on Saturday to catch up, his access card sets into motion a series of events. The door not only opens, but the elevator arrives, the heating or air conditioning turns on in his office, and his computer starts up. When he reaches his office, a sensor controlled by his body heat turns on the lights. Futuristic scenario described in last week's paper? Actually, this article ran on May 13, 1984.

As the article demonstrates, the idea of a smart building is not new. Although the concept has been discussed since the 1980s, a true intelligent building with integrated, automated systems is hard to find. That may soon change, say some experts. They believe a confluence of forces are working together to enable the concept to finally gain widespread adoption, but they admit that there are still obstacles to overcome.

Intelligent buildings entered the public consciousness in the early to mid-1980s. Ira Goldschmidt, P.E., integration engineer for the Building Intelligence Group LLC, and owner of Goldschmidt Engineering Solutions, explains that large building controls companies such as Honeywell, Johnson Controls, Siemens, and United Technologies (now Carrier) started the push to sell connected systems.

The premise was that by purchasing building control, fire alarm, lighting control, security, and elevator systems all from the same company, the systems could be connected and offer added capabilities, he says. However, in the pre-Internet era, there were many competing and uninteroperable data networks. That hindered information sharing between disparate systems, and the promises of intelligent buildings never materialized, he explains.

Now that Ethernet TCP/IP has become the standard networking protocol, information sharing is much simpler, says Paul Ehrlich, P.E., Building Intelligence Group

founder and president. In addition, costs for connecting a device to that network have fallen, Ehrlich says, from $1,000 to $1,500 five years ago to pennies today.

Ehrlich, whose company recently was part of the design team for a new laboratory building project that sounds almost identical to the *New York Times* description, believes that technology and economics are coming together to enable intelligent buildings to finally take off.

He says implementing an intelligent building could add, on average, $1–$3 per square foot onto the regular building cost. In some cases, he says, by reducing redundant networks, there may be no additional

cost. And when his company does economic evaluations for owners, he finds that the systems pay for themselves in six months to three years.

Some of that payback, according to Ehrlich, is due to another factor that makes the concept more economically viable today: rising energy costs. Intelligent buildings, which can turn building systems off and on according to the actual needs of occupants rather than on a standard time schedule, can make their occupants not only more comfortable and effective, but also save energy and, thus, money.

This reduced energy usage also helps to create more sustainable buildings. As the green building movement grows,

interest in intelligent building technology and processes is increasing as well, Ehrlich says.

Tom Hartman, P.E., principal of the Hartman Company, which provides technology to the building construction industry to enhance building comfort and energy efficiency, says that in the past, technology was seen as antithetical to green building. In this last decade, however, people have come to realize that technology has a role to play in creating sustainable structures. That's an important development for the intelligent building industry, he says.

Still, the reality is that the numbers of buildings that have fully automated, integrated systems are "in the handfuls to the tens to maybe the low double digits," says Ehrlich. "It's very economically viable. It's just not being done."

Hartman puts it another way. "You can look at it as a cup 1/16th full or you can look at it as 15/16ths of an opportunity," he says. "But the fact of the matter is, we're still trying to get traction on [intelligent buildings] to become a mainstream issue."

The Continental Automated Buildings Association, a nonprofit industry organization founded in 1998 that promotes advanced technologies for the automation of buildings in North America, hopes to make intelligent buildings an industry standard. The organization commissioned Ehrlich's

company to answer the question, What is holding back the widespread acceptance of intelligent buildings?

Ehrlich's Building Intelligence Group interviewed about 100 facilities directors in various markets: schools, universities, hospitals, and commercial office buildings. The resulting document, the Intelligent Buildings Roadmap, was released in July.

According to the report, the primary challenges are not with products, technologies, or standards. Instead, the main obstacles heard in focus groups were those of people and processes, Ehrlich says. Facilities directors discussed a lack of coordination among the parties involved in projects, difficulty finding qualified consultants and suppliers, and the challenge of proving the value of an intelligent building to get project funding.

Ehrlich places the responsibility for the first two issues close to home: "As consulting engineers, we don't quite have our act together," he says.

Current building design, he explains, lacks a systemic approach. The architect hands off the design of systems to individual engineers, such as mechanical or electrical engineers. Those systems are then built by individual contractors. "At the end of the day, you have a building with a whole series of discrete but largely nonintegrated systems," he says. There is no one person or group who designs and oversees the whole.

The industry, he says, needs building systems architects or systems integration engineers—people who are generalists and can tie systems together. And the design process needs to enable that kind of perspective as well.

It's unclear at this point whether the generalist should be an engineer. Ken Sinclair, owner and editor of the online magazine automatedbuildings.com, says there's a short supply of people who can implement intelligent building projects because the industry crosses over so many disciplines.

Is the right person a mechanical consulting engineer? An IT professional? Or someone from another technical background, such as HVAC? "It's difficult to even decide who that person should be," Sinclair says.

Hartman believes that engineers may need to let go of elements of technology they

usually deal with—which they are hesitant to do—and turn them over to someone who looks at the bigger picture.

"Imagine if you refuse to buy a PC off the shelf," he says, "and you want to put your own chip in, buy the keyboard from this [other] person. Imagine how long it would take you, how much it would cost, and how effective computers would be today."

Goldschmidt agrees. Engineers who work in building systems need to pick their expertise, he says. Will they focus on true mechanical or electrical design, or get involved in the integration of systems?

If it's the latter, he says, they might need some IT expertise. Goldschmidt, for example, has a dual degree in computer science and mechanical engineering. "It's the only way I'm able to hold my own in this business," he says. If engineers don't want to learn about system integration, he adds, they need to hire an expert.

Goldschmidt points out another difficulty related to the third major challenge brought up by focus groups of facilities directors: proving the value of projects. While the economics of intelligent buildings make sense over the long run, he says, most buildings are built on first cost. "Nobody does the life cycle cost analysis," he says.

Ehrlich says proving the business case is a critical step. "Often we think of a building as a structure," he says. "In reality it is often an extension of a owner's business." Engineers who want to do intelligent buildings

curve that Ehrlich expected to see, everyone responded with either an 8, 9, or 10 on a 10-point scale. There weren't even any outlying groups, Ehrlich says. "We would expect even one group saying, 'No, this is just junk; we're not going to do this.' But we saw very strong support across all the groups.'"

The conclusion, he says, is that there's great opportunity. Buyers seem to want intelligent buildings, but the industry isn't very well organized, he explains. The Building Intelligence Group, however, is working with CABA to make improvements.

"We've determined there definitely is a technological chasm between the early adopters of the technology—the enthusiasts, the visionaries—versus

concept of what intelligent buildings are. Even within the industry, each expert seems to have a slightly different definition. King explains that CABA wants to clearly define the product, the target market, and the marketing strategy.

Some of the tools that have the potential to drive the industry are already under development. CABA's Life Cycle Cost tool will demonstrate to building owners and operators how much they can save over the lifetime of a building if they install intelligent-building technologies at inception.

The Building Intelligence Quotient, an online survey that allows building owners, operators, managers, and designers to assess the intelligence in their existing buildings and determine what technology would make them smarter, is being expanded to include a validation procedure. Ultimately, professional engineers could get training from CABA, King says, to learn how do a site visit to validate the responses given by the online survey. Additionally, an overall industry certification and training program, he explains, would ensure that people hired to implement intelligent buildings understand how to work across all the different systems.

CABA is also looking into launching a rating system similar to the U.S. Green Building Council's LEED program. And the organization is in talks with the USGBC about using the Building Intelligence Quotient as a means of scoring for LEED innovation credits, which are a kind of extra credit given for exemplary performance.

Interoperability of standards is another area in which CABA wants to make progress. Many standards have been developed for the industry, but King says CABA is "technology agnostic" and just wants to make sure that standards will be interoperable. Ideally those interoperable standards would be Internet-based, he says.

CABA's Intelligent Building Taskforce is working on an in-depth business plan for the organization based on the Intelligent Buildings Roadmap. The plan includes defining the term intelligent buildings and determining the costs and resources needed to move forward on the recommended efforts. The business plan was expected to be completed at the end of August and then forwarded to the board of directors for review and approval. **PE**

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need to be more aware of how the owner will use the building and its systems, he says, then educate them about the benefits of their solutions and what they will get for their money.

The surprising findings of Building Intelligence Group's focus groups was that, despite the challenges expressed, facilities directors said they recognized the importance of implementing intelligent buildings in reducing their costs, improving building efficiency, and extending the capability of their operations staff.

When asked "How likely are you to add new intelligent building technology in the next one to two years," instead of the bell

the majority," says Rawlson King, CABA communications director. "We want to figure out, how do we cross that chasm. How do we get mass market buy-in to the notion of intelligent buildings?"

Building Intelligence Group's roadmap identifies a series of possible steps, including marketing programs, industry branding, and advertising; tool development; building awards; education programs; certifications; knowledge building and best practices; and market research. And it calls for an expanded charter and mission for CABA to deliver these programs.

Marketing and branding is key, King says, because people don't have a clear