

"What Makes Smart Buildings Smart?"

biix White Paper - 15 May 2014

Introduction

In a sense, buildings have been smart since the introduction of the PC and direct digital building control systems of the early 1980s. While the term "Smart Building" wasn't popular at that time, the technology of the 1980s helped shape our current definitions of the term.

The classic definition of a smart building centers around intelligent, distributed control systems. These systems are typically designed to help reduce a building's energy and maintenance costs. Intelligent control systems both make decisions on their own, and help the user troubleshoot wasteful or poor performing areas of operation.

In the early 21st-century, a sudden explosion of additional technology began to enter buildings. It was no longer simply the HVAC system being controlled by computers. Computers were now controlling elevators, lighting, water systems, sprinkler systems, fire and life safety systems, building security systems and much more. And more importantly, these systems were beginning to integrate with each other.

Two problems started to emerge. First, the integration of systems became a problem. The question of the day was 'How do we get one proprietary system to 'talk' to another?' Second, the sheer volume of information began to grow exponentially. In nearly every case, the information remained locked in silos, or locked in dusty notebooks, binders and blue prints stashed in basement janitor closets.

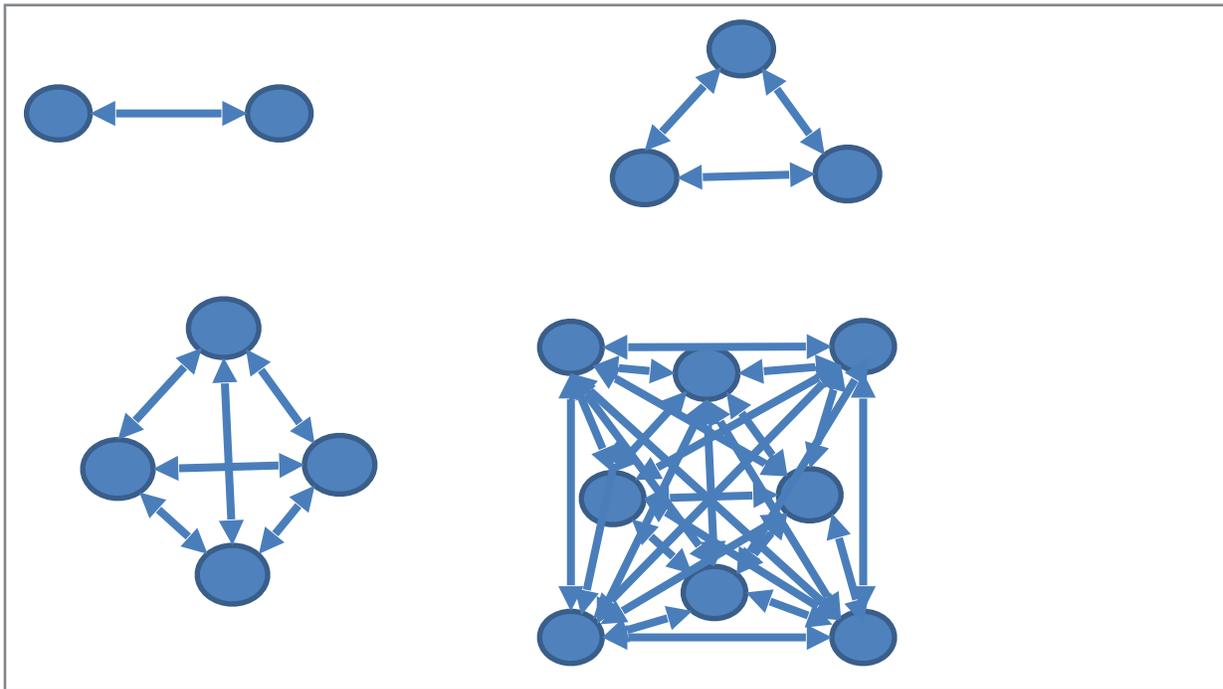
Integration was limited by the lack of standards, and made more difficult by the lack of willingness of many manufacturers to subscribe to common, open standards.

The result has been that while buildings are becoming smarter and smarter, they're smart within individual silos. They're the smart guy standing in the corner of the classroom talking to an empty room.

The Integration Challenge

“Without a standard information model, the integrations needed for smart buildings, smart energy, or even smart operations, are expensive. The data is expensive to gather. It must be gathered anew for each additional integration. The expense of each additional integration increases, as each additional system must be integrated with more existing systems. No additional value is garnered from the initial data gathering; each project starts from scratch in a systems environment of growing complexity.” - Toby Considine, biix CTO [1]

Something as simple as collecting nameplate information gives us a clear example of the inefficiency of duplication. When a building is under design, the design engineer creates schedules depicting the basic requirements of equipment, including size, performance and electrical characteristics. This is the beginning of nameplate data, and the beginning of a baseline for commissioning. As the construction/installation process evolves, various parties independently collect the same information, including the start-up technicians, the balancing (TAB) contractor and the commissioning authority. At the end of the project, all this information is independently put in separate PDF reports or three-ring binders and handed over to the owner. The owner, however, typically deploys their own personnel to hand-collect the data once again. In a large or complex facility, this could cost tens of thousands of dollars.



The Growing Complexity of Ad Hoc Integration
Getting one or two systems to communicate is relatively feasible. Getting many systems to ‘talk’ becomes extremely difficult.

Under Lock and Key

With the emergence of cloud-based computing, storage and services, opportunities began to open that never existed before. People could access building information remotely. While limited information had been available since the 1980s, there was now an extensive crush of information available. The sheer volume of data was increasing and it was becoming inhibiting.

As the trend of more and more complex data continues to grow, it leaves us with a growing set of problems:

- Information is not centrally organized, i.e., information is not organized according to a universal standard.
- The lack of communication standardization continues to create a serious barrier to accessing useful integration and having the benefits of a standardized information exchange. The result is information that remains locked in buildings. It may be locked in a database, in an Excel spreadsheet on someone's laptop, on a huge set of PDFs stored on a set of DVDs in the drawer of someone's desk, found in files on a BMS workstation, or lost in a large set of blueprints and notebooks stuffed in a basement mechanical room.
- We have collectively and consistently placed ROI ahead of human interaction. We are designing systems so complex that people don't understand them. Energy-saving initiatives focus solely on the bottom line, completely ignoring the ability of executives, employees and vendors to keep up with the growing complexity of buildings. And all of this is occurring against a backdrop of downsizing our workforces while simultaneously demanding increases in productivity.
- When we hand people the tools to help overcome all this complexity, the tools are often useless: they are awkward, counterintuitive and overly complicated. They are not designed for consumers, but are designed for engineers. So, they end up serving the needs of their designers, instead of serving the needs of their end-users.

Models to Learn From

What makes a smart building smart? Integration. We have plenty of models to exemplify this.

The human body is a set of systems that are highly integrated. They do not operate stand-alone. Someone may possess the greatest set of kidneys in the world, but they mean nothing without the other systems that go along with the kidneys. Yet this is how we are operating many smart buildings. We may have the greatest building control systems in the world, but they mean nothing if they're not fully integrated into the heart and soul of the building. And this includes the users.

Part of what makes a building smart includes more comprehensively integrating people into the equation, giving people the opportunity to be smarter and smarter. Buildings and people are not mutually exclusive. They are highly interdependent. While on the one hand we already know this, on the other hand we have forgotten some essentials. What has been created with the technology in buildings is an ability to control processes and to create floods of information. What has not been created, however, are simple and easy ways to make information sensible, practical and usable. Until biix.

Humans do not exist independent of each other. Our world wouldn't work very well if there was no way to translate between Spanish, French, Japanese, German, and English. We would live in a global Tower of Babel. Paradoxically, what we have today, in many ways, are rising Buildings of Babel. Inaccessible and incomprehensible to their users.

The martial arts masters teach us to "move the body as a unit, not as isolated parts." Yet, what we have today are buildings that are often isolated units. A "complete body model" has yet to be introduced to the built environment.

Why isn't this happening? Certainly not because people don't want it or aren't looking for it. And certainly not because of the lack of need. Actually, the need and the market are great.

Overcoming Gravity

Many of us believe these improvements are not occurring because an open standard model has not yet emerged that has the support of key and critical players. But is that truly the case? Ask Autodesk, Bentley, the US Army Corp. of Engineers, GSA, the American Institute of Architects BuildingSmart Korea or BuildingSmart UK and Ireland - all of whom have adopted the National BIM Standard and COBie.

Biix is not re-inventing the wheel. We incorporate well-known and prevalent existing open standards. But there is a key difference in our manner of adoption: we are adapting standards in a way that makes them practical, intuitive and easy-to-use. We are creating software for building consumers - for everyday technicians, operators, commissioning teams, CFOs and end users. Leave the clunky interfaces and single-minded applications to their designers. Give the everyday users what they want and need - what they will actually use, enjoy and benefit from. Give them integrative, collaborative tools that will help them redefine and improve what it means to be an energy-efficient, sustainable building.

With simple-to-use tools, the built environment will undergo a massive transformation.

Buildings Already Have a Brain

There are many groups deeply interested in changing this landscape. They are seeking major paradigm shifts.

In early 2014, the CleanTech Group hosted a conference in San Francisco called "Buildings Get A Brain". The summit was sponsored by Johnson Controls, Jones Lang LaSalle, and Navitas Capital. A white paper, "Buildings Get a Brain: Why M2M communication still needs P2P collaboration", was issued as a followup to the conference.

Biix believes that buildings already have a brain. But our contention is that the brains aren't really talking to each other that well. They're not sharing their experiences. They're not growing together socially. They are not adequately exchanging information and contributing to the growth and advancement of both humans and buildings. The interrelationship between buildings and other buildings, and the interrelationship between buildings and humans has not advanced sufficiently.

It's Supposed to Be Simple and Easy

In our zeal to save energy in buildings, the industry's highly technical approach has not been without cost - we have often left out the 'soft arts' of human interaction. While we have had undeniable success finding the 'low hanging fruit' of improving building's energy efficiency, we have failed to improve our own efficiencies with respect to how we interact with buildings, including the many systems in buildings and the oppressive amounts of data they produce. How do we simplify? How do we make our interactions with buildings simple and easy?

Huge Untapped Opportunities

The technology to integrate and analyze building energy information is largely available, evident by the influx of building energy management systems and performance modeling software services into the market. Though plenty of technology options are available, the industry still lacks the one element that will tie everything together. According to Summit participants, the lack of communication across the building ecosystem—that is, an inadequate dialogue between architects, building operators, and others—is stifling the adoption of intelligent building efficiency practices. While entrepreneurs may have developed innovative machines that speak to one another, the ability to collaborate in human terms will determine the success of the building efficiency movement, and presents itself as one of the largest untapped opportunities within the sector. [2]

The Truly Smart Building

How do we make our interactions with buildings simple and easy? Our definition of what makes a building smart needs to expand.

Emerging Definitions of the Smart Building

Standards-based. The Smart Buildings Institute (a new Texas non-profit that's developed a smart building certification process, describes a certified smart building as one that, "1. Provides actionable information regarding the performance of building systems and facilities; 2. Proactively monitors and detects errors or deficiencies in building systems; 3. Integrates systems to an enterprise business level for real-time reporting and management utilization of operations, energy and occupant comfort; 4. Incorporates the tools, technologies, resources and practices to contribute to energy conservation and environmental sustainability."

According to the European Commission: "Smart buildings means buildings empowered by ICT (information and communication technologies) in the context of the merging Ubiquitous Computing and the Internet of Things: the generalization in instrumenting buildings with sensors, actuators, micro-chips, micro- and nano-embedded systems will allow to collect, filter and produce more and more information locally, to be further consolidated and managed globally according to business functions and services."

The Human Touch: "Technology alone won't do it. The GSA realizes that the smartest part

of smart buildings is people and wants to engage them. Providing feedback and information through a dashboard is a good start. With smart technology, we can learn anything we want about a building and optimize its performance. But real performance means happier, more productive tenants. And that requires insights into the hearts and minds of the people inside. What a dashboard can really do is enable better decisions, inspire participation, spread knowledge and best practices, communicate at a human scale and propagate new norms in how we use our buildings." [3]

The Need For Standards

More than anything else, project stakeholders crave the ability to understand how physical assets perform on relative bases. The ability to cross-reference building performance metrics with geographical locations (towns, states, countries), markets (residential, commercial, and industrial), and organizations (competitors and partners) will significantly enhance overall building efficiency, as well as increase competition amongst service providers to deliver higher efficiency gains. While market opacity can be a boon for entrepreneurs scrambling to capture market share, real estate managers are faced with a largely untested, nascent industry that has few standards and lacks a guidebook. [2]

NOTE: The biix technical and scientific leadership team members are internationally recognized as the leaders in building standard, including BIM, OBIX, COBie/COBie Lite, the National Smart Grid Roadmap, EMIX and the National Institute of Building Sciences.

[3] http://www.greenbang.com/from-inspired-to-awful-8-definitions-of-smart-buildings_18078.html

Summing Up

Building users are desperate for interoperability and ease-of-use. They need intuitive tools and software interfaces that require little to no training. They need products that make their lives easier, that lower their stress levels, that ease their frustrations. They need tools that empower their creativity and imagination. The open standards to make this happen are in place. The qualified Subject Matter Experts (SME) are in place. The vision and product are in place.

We cannot afford to not do this. The building sector consumes an astonishing 40% of all energy in the United States. We take for granted how much buildings dominate our lives. And they are only getting more and more complicated. As they do, our designers, builders, contractors and owners are on an increasingly desperate and harried hunt to find tools to make things easier, to make their own lives easier.

Let's make buildings even smarter and easier to integrate with by paying more attention to people. The risks of ignoring this issue are high. But through enabling transformation tremendous opportunity arises, along with what should be welcome and warmly received disruption.

[1] Source: biix White Paper "Commissioning First", Toby Considine, 22April 2014

[2] "Buildings Get a Brain: Why M2M communication still needs P2P collaboration", 2014, CleanTech Group, Authors: Volpe, Berenshteyn, Prill

[3] http://www.greenbang.com/from-inspired-to-awful-8-definitions-of-smart-buildings_18078.html