How Can a Building be Intelligent if it has Nothing to Say?

The Need for Business Systems in Today's Buildings

By Interval Data Systems, Inc.

So, you have an intelligent building. Congratulations. Web-enabled. Operational systems connected on a shared IP backbone. All the coolest technologies—Web services, SOAP/XML, etc. You can sit on your couch, connect wirelessly to your control systems and… accomplish nothing that you couldn't before.

What? Everything is connected—it has to be better.

Your building might be "intelligent," but all too often it has nothing to say.

It's Not About Technology Standards

In all the discussion about Building-IT convergence, it seems that everyone forgot about the "I" and focused on the "T." After all, get a bunch of technologists together and the conversation is bound be become about technology. Only problem is, the buyers (building owners, facilities executives, CEOs, CFOs) don't really care. They care about business value—operational and financial information, productivity, verifiable savings, accountability—not technology standards.

The IT world has repeatedly demonstrated, through both its successes and failures, that technology without a clear business purposes is a complete waste. The buildings world needs to heed that lesson, not repeat the mistakes.

Let's take the focus off IP, except as an enabling technology and implementation standard. IP itself is not the answer, at least not to any question a CEO ever asked (John Chambers excluded, of course).

Value is in the Information

The business value of Building-IT convergence comes from information. More specifically, from being able to extract actionable information from operational data. No data, no information—no information, no business value. All the technology infrastructure in the world won't change that. IP connectivity without data is like a superhighway without on ramps.

If you're thinking to yourself, "I can get any data I want out of my building automation system—what's the big deal?" then start considering these questions:

- Can you collect *all* the data, simultaneously, from every point in your building systems, or from just a few dozen (or perhaps a few hundred) points?
- Could you view the operational data for the past year, for any piece of equipment in a building or the physical plant, if you needed it right now?
- Is the data from all operational systems (BASs, meters, utility data, fire and safety, etc.) available in one place, time synchronized for easy comparisons?

- Is the operational data integrated with other business systems, such as space planning systems and CMMS?
- Does everyone who could benefit from the information—inside and outside facilities—have access, and is it organized to meet each user's individual needs?
- Are the IT applications (designed for the business of running a facility) in place to achieve the productivity gains, cost savings, and other business benefits possible?

If you answer "no" to most of these, you're not alone. After talking to well over 300 facilities people in the past two years, less than two percent are doing anything to address the need for data. But those two percent are reaping the rewards.

Massive Productivity Gains

It is often said that if you can raise the productivity of the entire workforce by just one percent that the benefits far outweigh energy/operational costs to make that happen. While conceptually interesting, these arguments typically have enough holes in them to vent a boiler room. Not what we're talking about.

Instead let's look at making dozens of people across facilities and maintenance organizations more productive by 70, 80, even 90%. Take a senior engineer for example…

A Web-based interface to the control system means the engineer can operate from anywhere. What's the value? Well, it means they can override a setpoint from their living room while watching "24" and wondering why Chloe has schematics to every facility in existence, but they still can't get "as built" drawings for their latest building. Convenient? Yes. Did it change what they could do, or their productivity? Only a little—there is some value to not having to return to the control room for everything.

What did that same engineer do all day? They spent four hours trying to collect data from various sources to do some analysis. They took spotty data from control systems, data loggers, and threw in some estimates, combining six spreadsheets so that the timestamps matched and they could finally do the analysis. Then they did 20 minutes of actual engineering. This, unfortunately, is the norm.

Stop Wasting Time

Whether it's internal staff or a contracted engineering firm, engineers spend 4 – 12 minutes collecting data for every minute of actual engineering. It is such an accepted way of life that organizations don't even realize how much time is wasted. If the building had something to say, it reverses that ratio, improving our engineer's productivity by as much as 90%.

That's just the tip of the iceberg. There are dozens of commonly performed tasks, ranging from simple equipment information requests and performance measures to complex financial analysis and energy audits, where the productivity gains can be multiple orders of magnitude in scope when all the data is available.

New Value from Old Data

A permanent record of facilities operations is an asset, just as the physical structures are. Its value is not just in having history, but in how it can be used. When all the data is available, the building has a lot to tell about past, present, and future operations.

First, a simple case. For diagnostic purposes, the data values at the time of equipment malfunction, or after the hot/cold call came in, is of minimal value. The historical data leading to the problem is where the information lives to identify and fix the root cause. The old data delivers new value by way of solving today's operational problems.

But there is more that you can do. One great thing about collecting building data into an IT application is that you can do things with it without interfering with ongoing operations. You're not limited to just mining the data, you can add to it. You can build calculations on top of the raw data. Instead of building models based on engineering assumptions and design specs, run those same equations against actual operational data. Want to change the model? Go ahead and run it again. Compare the two results. Manage cost, consumption, comfort. Normalize for weather or inflation. The beauty of having a complete operational record in a data warehouse is that you're not limited to analysis or modeling going forward, but you can also apply them to the past. With the data, buildings have an endless supply of information to tell you.

Ensuring Your Buildings have Something to Say

Unfortunately, it is still hard and/or expensive to get data out of the underlying building systems and accessible through IT applications. There are proprietary systems still shipping today. Concepts like "proprietary BACnet" exist. Remember, the data belongs to the building owner, not the systems vendor.

Even open systems don't necessarily allow an IT application to collect all building system data. Architectures were developed for control, not information access (a reasonable decision given that control is the system's primary function), which sometimes results in the case where you can collect data from any point, but not from all points. Don't forget, most existing buildings aren't equipped with the latest open technologies; they have systems that are a decade old.

While overall this situation is slowly getting better, there are vendors doing the open systems Moonwalk—taking steps with the illusion of going forward while actually moving backwards—making data harder to collect. To cover up their shortcomings, some manufacturers will question why you need the data or disparage the cost of collecting and storing data (today's cost of storage is insignificant). Don't be fooled.

Any versus All

We hear it frequently—especially with newer, open control systems—you can access any point in the system or trend any point in the system. Actually, that's been mostly true for a while. Most DDC systems can view or trend any point, even those systems we now refer to as legacy. That works OK for control systems, but falls totally flat when it comes to building information systems.

Compare "access to any data" with possessing all the data, all the time, for every point. The historical record of how systems operate, how they interact, how they respond to various external conditions such as weather and occupancy, creates the foundation for a facilities business system.

Think about other business systems. What would a sales information system be like without all the sales data? Could you run a retail business with only today's sales data? How about historical data, but from only two percent of the stores? These fit the "access to any point" or "trend any point" information model, but it's absurd to

imagine running a $50 million retail business this way. So why run a $50 million facilities operation with "any" data?

In contrast, look at a sales system with all the data. You can trend and analyze sales in any dimension, look at correlations with weather, see how different stores perform compared to each other or to industry benchmarks, identify the impact of exemplary (or poor) performance. In short, you can make informed business decisions and ensure that stores are run the way you intended. Now, change "sales" to "operations" and "stores" to "buildings," and the same is true for running a facilities business.

Separate Representations, Separate Data

Now that we've established the business need for *all* the data, does that mean you should turn on trending for every point in your building systems? No. Odds are that will bring the control function to its knees. Instead, what is needed is an information system that extracts data from the control system into a separate data warehouse—an IT representation of the building. By doing so you take the burden for data collection and data management off the control system, which isn't designed for it in the first place, and create the basis for a facilities business system.

This approach is necessary even for the few control and metering systems that are capable of logging all the data into their own database. Metering systems are used to trending a lot of meter points, but can you afford to meter everything—every fan, pump, cooling coil, etc.—not a chance. But it's not just a cost issue. There are several other advantages to separately collecting data for business applications:

- Many control systems only keep data for a few days or a few months. This way you can keep the data forever, creating a historical record of how your facilities operated.
- All prior data is available, no matter when you need it or what you need it for.
- You can combine and correlate data from many different building systems, or even other business operational systems, for analysis.
- The data warehouse architecture is not tied to the needs of the building systems, enabling a different set of business applications.
- An unlimited amount of modeling and analysis is possible using actual past operational data to improve future operations, designs, and financial performance.
- The data becomes accessible by a wide variety of users across the enterprise and external contractors, instead of limited to control system users, increasing the knowledge base of the entire facilities organization.

Using IT to Add Business Value

The advantages of a separate building representation, collected into its own data warehouse are examples of how an information technology (IT) system adds business value. They are built around the business needs of their users, supporting the way you run your business, but also facilitating the transformation from service delivery to operating as a multi-million dollar business.

Don't assume the word "business" only refers to finances. Managing a facilities operations business requires tackling many issues—service-level agreements (explicit or implied) for comfort, health and safety, utilities services, building maintenance,

and several hundred employees to manage. There are new construction projects, renovations, and qualitative issues such as accountability and credibility. And of course, there is the financial side of managing utility costs, budget cycles, capital requests, etc.

IT systems can completely change how you approach every one of these business challenges. The data collection discussed above is just the first step—a critical step, but only the first of many. The IT system must organize data to make it easy for end-users to extract actionable information. The organization must be flexible to enable many different views, as diverse users have unique needs. These organizational requirements inform the data representation, which conversely allows or limits the flexibility of information organization and presentation.

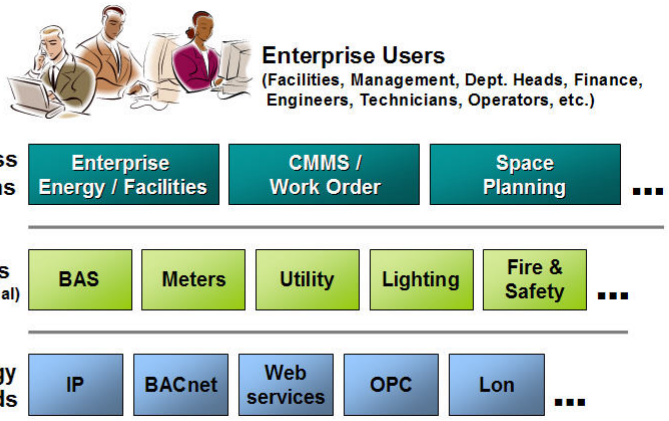

Figure 1: Business systems exist at a level above the engineering- and operations-oriented building systems. They serve different users and functions, and require separate technology architectures to deliver their intended business value.

In the end, the business value from an IT-based building system comes from the ability to make better decisions, increase productivity, improve customer service, and other business improvements. The IT representation needs to translate these high-level benefits into detailed implementation decisions. For example, how data trees are constructed, what reports exist (and what data feeds them), the level of interactivity for ad hoc analysis, the ability to layer calculations on top of raw data, are all defined by varying users and uses of the information system.

The information to transform your facilities operation into a business is not possible with today's control systems, metering systems, or other engineering-level applications. This is why you need to collect all the operational data separately—to build a business-level system (see Figure 1) capable of delivering entirely new levels of value.

Real-World Examples

Enough with the theory. Let's look at some typical examples where the world changes if you have an information system in place.

Hot/Cold Calls

You get a hot or cold call. What happens? In most cases the technician that responds will check the current conditions, adjust a thermostat or override a setpoint, and that's about it. If the room has habitual problems, perhaps there are a few trend logs running, but what data is available?

An information system provides operational details for every room (or zone) in the building. The technician not only sees current conditions, but also knows how long the space has been uncomfortable, how well the air handler is running, how the terminal box is operating, cooling and reheat valve behavior, etc. In most cases, it only takes five minutes to determine the real cause of the comfort problem so that the proper correction is made the first time.

Taken a step further, facilities has the information to show its customers what happened. Historical data showing the space becoming uncomfortable, the extent of which is measured in a comfort index (calculated from the captured data) that non-engineers can easily understand. The information is there to show when the call was logged, the corrective action taken, and exactly how long it took to become comfortable again.

The IT system helps the business of meeting the comfort obligation, providing fast and accurate customer service, and communicating with the customer in a way that they understand.

Business Metrics

Facilities leaders and executives have entirely different information needs. They need to understand how the business is running—how current operations stack up against last month, last year, industry standards, and organizational goals. Utility bills are a terrible way to manage the business. Too few data points that are far removed from the time they account for.

A big advantage of separating the collected operational data from the control systems is the additional processing that IT systems can perform. Take a supply fan, for example. Most control systems can tell you if the fan is on or off, and the percent of full-load amps. That is all you need to calculate the kWh for the fan. The manufacturer's specifications will supply horsepower, motor efficiency, and any other necessary parameters. Add utility rate information and you can report the cost in dollars/hour at any point in time.

Similar capabilities exist to measure the energy consumption of pumps, heating and cooling units, exhaust fans, or any other mechanical systems. These are the building blocks that most facilities executives only dream about. With them you can produce reports that show the metrics of your choice for the building, broken down by air handler and each piece of equipment, or broken down by floor, zone, or room. Metrics that normalize across multiple buildings, such as MBtu/SqFt become simple. Accounting for weather is similarly easy. The information is there to see what's running well and what isn't, what's improving and what's not.

The ability to set and meet concrete goals, measure successes and document issues, and prioritize work are just some of the real-world advantages a true information system provides that control systems cannot.

Growing Staff Knowledge

Some facilities organizations perceive adding an information system as yet another thing to do. Who has time to look at the information? The short answer—almost everyone.

A major goal of IT systems is to deliver the right information to the right users, and do it fast. Instead of spending four hours in spreadsheet hell, you can spend 40 seconds

pulling together the information you need. You can, that is, if the underlying data is complete and the system was designed to meet users' requirements. You're not likely to train 100+ users to use the control system. Even if that were easy, you wouldn't want to. IT systems are designed to handle hundreds, even thousands, of different users' information needs.

When more people start using information to understand how the buildings and systems they work with daily actually function, good things happen. Issues are caught before they become problems. Communications improve. Learning happens. Staff can see the impact of their work. The total knowledge base of facilities team rises. Growing the staff's knowledge is good business as tomorrow's challenges will be greater than today's.

Conclusions

How can a building be intelligent if it has nothing to say? It can't.

How does this happen, that buildings thought to be intelligent sit there quietly, saying nothing? By focusing solely on the technology. By forgetting that it's the information that provides business value. By assuming that the data is always available.

Intelligent buildings must talk. The business value is only achieved when they share what they know, communicating between building systems and with their owners. They do this through data. Without the data you limit the building's intelligence and you limit what you can accomplish. Technology infrastructure doesn't change that.

Architects say that form follows function. The IT equivalent is that technology follows business function. Otherwise, you get technology in search of an actual problem to solve. This has happened many times in the past and unfortunately, is doomed to repeat itself. In the end, it's always the same result—no business value equals eventual failure.

Building control systems exist at the engineering or operational level. They are not designed as business systems, nor should they try to be as their primary function is of critical importance. The control system representation of a building is different from an IT representation at both the technical and end-user level.

IT systems, when done properly, have changed the way businesses function. Every other function in a company/institution has changed over the past 25 years due to the availability of information—finance, administration, sales, customer service, marketing, manufacturing, R&D, distribution, you name it.

Only facilities operations has yet to take this step. It's a step that requires a business mentality and a new approach in both technology and management.

References

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