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Leveraging Cloud-based Building Management Systems for Multi-site Facilities

by Shoumi Sen and Simon Leblond

Executive summary

Until recently, enterprise building management of multiple, distributed facilities has been beyond the budget of most organizations. New advances in Cloud technology are now enabling enterprises to centrally monitor, control and manage their medium and smaller sized facilities at an affordable cost. The benefits of the cloud facility management approach have helped to create more productive environments for workers and customers and also facilitated better executive decision-making at the corporate level.

Introduction

In a perfect world, facilities managers would always choose to optimize building performance. Consuming less energy, improving occupant comfort and productivity, reducing equipment failures and repair emergencies—these are all ideal goals.

But in the real world, especially for enterprises with multiple distributed facilities, building optimization can seem like a pipe dream. Resources and budgets are already stretched to the limit just keeping buildings in operation. Most organizations have a large stock of older buildings with varying degrees of building automation controls, or often only simple thermostats. Growth, mergers, and acquisitions create even more headaches.

In this environment, activities like managing the big picture, sharing best practices, and proactively fine-tuning building systems have simply been impractical, if not impossible, for most organizations.

Recently, the development of the Cloud and other technologies has created a new opportunity for facilities managers to take control of operations on a large scale. By using the Cloud—which provides connectivity, data storage, and applications without major investments—it is now possible and cost-effective for companies of all sizes to view and manage their facilities landscape in a consistent, centralized way.

This paper explains how enterprises with distributed facilities can use the Cloud cost-effectively for improved building management that reduces energy and maintenance costs, improves efficiency and asset management, and provides greater occupant comfort and productivity.

Drivers for change

Optimizing building operations—which means creating environmentally friendly, high-performance spaces that are efficient and sustainable—is good business in many ways.

Without optimization of operations, facilities managers are forced to operate in reactive mode, when everything that goes wrong is more expensive and has greater impact on operations. Typical problems include:

- Increased wear on existing equipment
- Components break or fall out of calibration
- Higher overall energy costs
- Reduced overall operational efficiency

There is also the missed opportunity to use energy more efficiently, such as running HVAC and lighting only when needed. It's been estimated that as much as 30% of the energy consumed by commercial office buildings is wasted.[1] This does not even include the cost of inefficient use of maintenance resources, which can be substantial (think emergency calls to fix a boiler in the middle of winter).

In addition to these direct costs, there can be a significant loss of human and organizational performance. Poorly performing HVAC and lighting systems can lead to indoor air-quality problems and uncomfortable environments, impacting a company far beyond the maintenance department.

Research shows that the productivity and comfort of building occupants is closely tied to the temperature and overall environmental conditions of their building. The World Green Building Council has found that "81% of workers find it difficult to concentrate if the office temperature is higher than the norm" and 62% "take up to 25% longer than usual to

[1] EnergyStar (http://www.energystar.gov/ia/partners/publications/pubdocs/C+I_brochure.pdf?0b55-1475)

complete a task" if they are too hot.[2] Customers are affected too. Poor lighting in a clothing store can reduce sales. A restaurant that is too hot or too cold will lose business.

With so much to be gained by improving building systems, why don't more organizations invest in better systems?

Managing multiple facilities

Most facilities managers understand the value of automated and optimized building systems. Building Management Systems (BMS), which use HVAC and lighting controls to visualize and manage a facility's operations, are widely used across many industries. But enterprises with many distributed facilities face significant obstacles.

A major challenge is the diverse stock of buildings that must be managed. Most are likely existing facilities that may or may not have building control systems, so facilities managers must make do with whatever systems are in place. Such systems may range from simple thermostats to local building control systems. While these controls may help locally, they operate as silos and do not provide any visibility or control at the enterprise level, leaving corporate management with no way to be proactive, share best practices, or make informed energy-related decisions. As a result, corporate views of facilities performance typically can be obtained only in occasional static reports.

It is possible to upgrade local systems and then link them through a private network to create centralized management capabilities. While this approach can produce positive ROI, it is not always practical, as it can require substantial investments in purchasing, installing, integrating, and maintaining the necessary systems. Many spaces are likely to be rented, offering facilities managers little control over what can be installed or retrofitted.

A well-instrumented building, logging data at regular intervals, can produce huge amounts of data within a short period of time. Across an enterprise, this can quickly fill storage capacity and greatly tax a company's processing capabilities.

The cost of addressing all these challenges, whether assisted by a third-party integrator or by using internal IT resources, has historically been beyond the reach of most companies.

Cloud technology offers a solution

In recent years, the development of the Cloud has made possible a more cost-effective approach to enterprise facilities management. By using the Cloud, medium and smaller sized facilities can be viewed and managed in a consistent, centralized way.

The Cloud is a general term for the technology that allows organizations to outsource data storage, communication, and/or processing (see **Table 1**). IDC defines it as "Consumer and business products, services, and solutions delivered and consumed in real time over a network (most often the Internet)."[3]

The idea is simple: instead of purchasing and maintaining vast IT centers, companies can use the Cloud to strategically outsource portions of their operations. Using the Cloud enables a more agile IT strategy and often provides maximum bang for the buck. A well architected Cloud solution can solve data storage, processing, and management problems, as well as many other inherent security and networking challenges at significantly less cost than building and operating your own server farm.[4]

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[2] "Research Note: Thermal Comfort," World Green Building Council, 2003 (http://www.worldgbc.org/files/6714/1372/1194/140918_Research_note_-_Thermal_comfort.pdf)

[3] "The Impact of Cloud Computing on the Development of Intelligent Buildings," Casey Talon, IDC Energy Insights, Jan 2013

[4] "How I Learned To Stop Worrying and Love Building Data," AutomatedBuildings.com, Aug 2012

Table 1
"The Cloud" is generally defined as off-premises data storage and processing.

Cloud terminology	Definition
Public cloud	This refers to a "multi-tenant" environment, where the computer resources used are shared with other tenants. The Public Cloud is lower cost than a Private Cloud, but gives the user no control over the actual systems.
Private cloud	This is defined as "single-tenant environment" in which each client has systems and hardware dedicated to their applications. This costs more than the Public Cloud, but provides greater control over the technology used, ownership of security, and compliance with regulations such as Sarbanes Oxley and HIPAA.
Hybrid cloud	This refers to uses where both Public and Private Cloud resources are combined, with the Private Cloud portion reserved for sensitive data and applications, and the Public Cloud portion used where possible to reduce costs.

Cloud-based solutions are:

- Easy to deploy because the technology is outsourced
- Able to collect and process data from anywhere at anytime
- Delivered to any user platform (computer, phone, tablet)
- Easily scalable; can expand (or shrink) use at any time

These advantages make the Cloud an ideal platform for enterprise facilities management. HVAC, lighting, and energy use data can be read from the various buildings at regular intervals (from every 5 minutes to every few hours, depending on criticality). This data is then sent to the Cloud, where it is collected, aggregated, and delivered via reporting applications to both local and corporate decision makers. Any number of remote locations can be linked via the Cloud; more can be easily added as growth occurs, and the large amount of data generated by facilities becomes easily manageable.

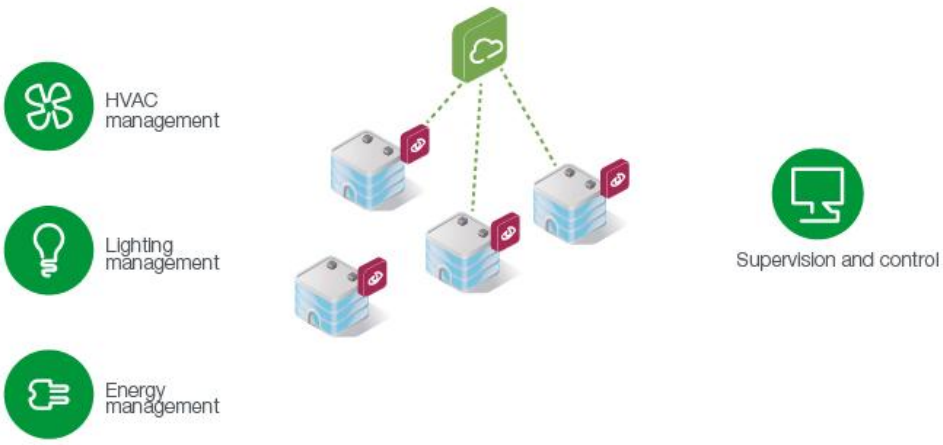

Figure 1
Sample diagram of how enterprise interfaces with the Cloud

Enterprise visibility

The old adage “You can’t fix what you can’t see” certainly applies to building management. The typical enterprise has almost no visibility into remote building performance. A Cloud-based solution changes this dramatically. Everyone from the CFO to the corporate facilities manager and maintenance director can have near real-time visibility into energy use and occupant comfort across the enterprise.

Visibility can include:

- Live monitoring and control of HVAC, lighting and metering devices across all locations
- Visualization dashboards to view building performance metrics, spot trends, and gather insights
- Graphs, charts, and conversions (e.g., kW to dollar cost, or kW to carbon footprint) to help decision-makers understand the information

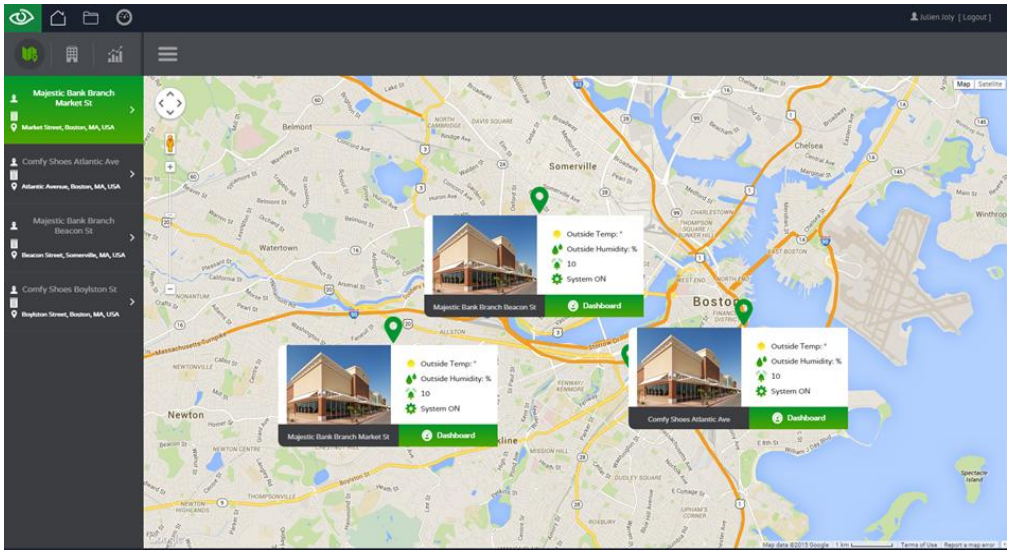

Figure 2
Example of multi-site management dashboard from cloud software

A Cloud-based solution provides most of the key capabilities that could be obtained from a custom-built solution, such as:

Continuous improvement - Facilities managers can see into individual or overall building operations, evaluate energy use and costs, and compare performance across sites to drive continuous improvement.

Proactive maintenance - Problems can be identified before they become serious—for example, declining performance in a chiller can indicate failing equipment, and maintenance can be dispatched before a crisis occurs.

Occupant comfort - Local conditions can be continuously monitored to ensure the comfort of workers and/or customers at all times, in all facilities.

Real-time alerts - Unexpected events and out-of-spec conditions can trigger automatic alerts, enabling swift action and problem resolution.

Crowd sourcing - The Cloud makes it easy for people to share information, enabling an enterprise to take advantage of crowd sourcing, or “bottom-up” solutions. Reusable assets can be stored in the Cloud and accessed anywhere. For example, a control program written for a local system can be uploaded to a central library where it can be shared, avoiding the need to “reinvent the wheel.”

Improved services - Overall building services can be improved by making more information available to the right people, from local maintenance to corporate planners.

Control capability

While visibility is valuable in itself, Cloud-based solutions can go further. Some centralized applications can also offer control capability, allowing remote adjustment of local environmental settings. This requires a common BMS (Building Management System) platform to be installed at all or most of the sites, but the investment can be worth it. This can be done in stages on an "as-needed" basis, starting with the most critical or poorly-performing facilities first, helping to ensure a cost-effective approach.

By adding control capability to a Cloud-based solution, enterprises can manage their entire facilities landscape almost as if it were a single structure. Executives can not only monitor all sites, but can also make adjustments to local HVAC and lighting whenever necessary, from any location on any device.

Global scheduling is also possible, enabling centralized management of schedules for any number of buildings across the enterprise.

BMS data for analytics

Another option (that can be added at initial deployment or later on) is the ability to perform analytics on the big data captured from across the enterprise and stored in the Cloud.

Again, this capability does not have to be purchased or internally maintained; analytics can be "rented" through SaaS (Software as a Service) where the application is accessed through the Cloud, or MSaaS (Managed SaaS) where all the work is outsourced and users are provided with the results and reports they need.

Analytics software sifts through the mountains of data generated over time from all buildings, and searches for correlations, trends, and anomalies that might be significant and useful for facilities management. Analytics enable decision makers to:

- Discover trends in energy and equipment use, identify faults, perform root-cause analysis, and prioritize opportunities for improvement based on cost, comfort, and maintenance impact
- Complement dashboards by interpreting the underlying data—showing not just where inefficiencies occur, but why
- Understand why a building is operating efficiently (or not), leading to more permanent solutions
- Convert intelligence into "actionable information" for troubleshooting and preventative maintenance, as well as for solving more complicated operational challenges
- Augment building management staff, helping to fill knowledge and resource gaps
- Enable facility managers to proactively optimize and commission building operations more effectively than with a dashboard alone

More on building analytics can be found in the Schneider Electric white paper entitled "Optimizing Buildings Using Analytics and Engineering Expertise."

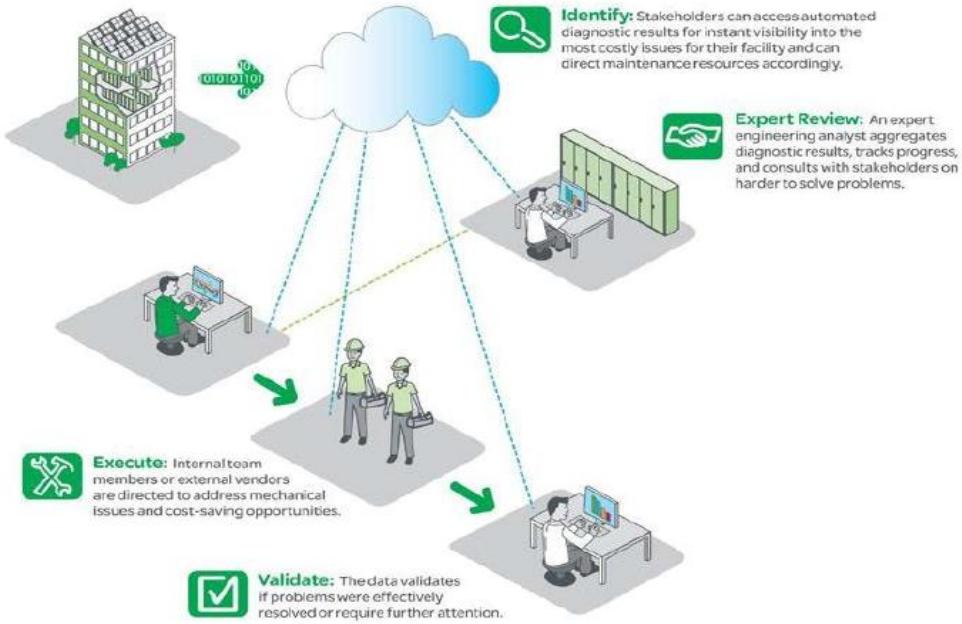

Figure 3
Information flows from data to results. Analytics reduce facility operating costs over time by targeting maintenance efforts.

Getting started

Most enterprises will need to make an initial investment in local building controls so that HVAC, lighting, and sensors can be standardized and linked to the Cloud. Once a basic local infrastructure is in place, enterprises can then tap into the Cloud to take advantage of all the centralized reporting and analysis capabilities described in this paper.

Typical controls to consider include:

- Smart AC and heating controls to allow advanced scheduling (and remote Cloud-based operation if desired)
- Door and motion sensors that trigger lighting and AC when a room becomes occupied
- Lighting control that can be as simple as scheduled on/off, to providing a range of light intensity based on time of day or actual sunlight.
- Window sensors that can detect when a window is open and trigger new HVAC settings or security alarms

More information regarding building controls can be found in the Schneider Electric white paper, "Improving Office Energy Costs and Worker Productivity with Integrated Room Controllers."

Working within budget

A Cloud-based facilities management system can be installed in stages, or modified to fit different situations. Organizations can start with key facilities and then deploy to other locations as needed or desired. There is also the option to use existing control technology (if it's sufficiently 'smart') and linking disparate systems through custom programming, although it is usually more sensible and cost-effective to standardize. Standardization will make it easier to add BMS and analytics capabilities later on, possibly as part of a staged implementation.

Upgrading local controls is made easier and more cost-effective with the use of wireless communications technology, which is available for most building control instruments. Wireless controls can be easily installed by a local electrician in minutes without disrupting business. In a typical building, the various controls communicate wirelessly to a gateway, which then forwards the data to the Cloud. Because of this ease of installation, wireless controls are widely used in legacy buildings.

An example of avoidable costs is illustrated in **Figure 4**. Actual data will vary according to region and specific facility conditions.

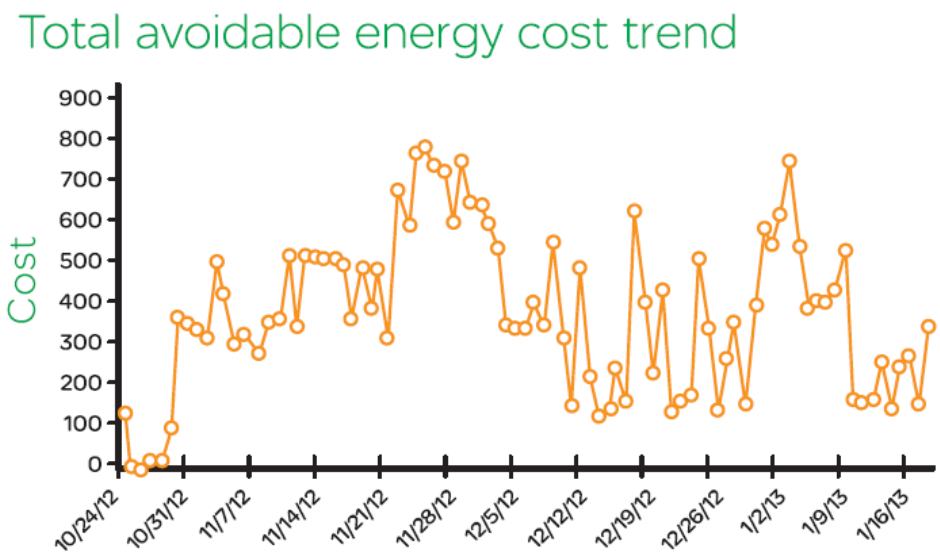

Figure 4
Sample building analytics chart derived from weekly reports.

This level of investment is easy to cost-justify for most facilities. If we assume a savings of 30% in energy costs (which is frequently achieved in real installations), full ROI can usually be realized within six months to two years.

Enabling security in the cloud

Security is an important concern in every enterprise. Contrary to some popular views, Cloud computing can provide an environment that is more secure and less costly than most internal IT systems, due to centralized data storage, governance, and control. In fact some Cloud services offer the same technology as that used by secure banking.

As described earlier, there are public Clouds that use the open Internet and share resources among clients, and there are private Clouds that provide dedicated resources for each client. Both public and private Clouds can be highly secure, depending on what is offered by the provider. The main advantage of a private Cloud is that it gives users more control over the technology and security systems that are employed, making it easier to standardize security processes and maintain accountability.

Although personal information is not transferred in building management applications, some building information, such as security status or occupancy, could be considered sensitive. In choosing a Cloud provider, organizations should evaluate their own security concerns, and carefully examine the security capabilities offered by potential providers whether public or private.

Conclusion

Historically, enterprises with multiple facilities have been challenged to manage their buildings effectively, especially at the corporate level. Even where building controls are in place locally, achieving a corporate view and control of facilities has been impractical for most organizations.

The emergence of the Cloud has made possible a more cost-effective approach to enterprise facility management. With a relatively small investment in local building controls, organizations can then use data storage and applications in the Cloud to monitor and even control remote facilities from a centralized location. This enables facilities managers to achieve reduced costs, improved occupant comfort, and overall enhanced building performance across the enterprise.

Readers ready to pursue Cloud-based facilities management may find these segment-specific white papers helpful:

- Four Ways that the Cloud Benefits Federal Energy Management
- Four Ways the Cloud Benefits Higher Education Energy Management

An industry expert, such as Schneider Electric, can help assess the readiness of your remote locations and determine the upgrades that would be necessary to enable Cloud-based management, as well as advise on solutions for centralizing control and implementing big data analysis.

About the authors

Simon Leblond - As director of global business development & marketing for Schneider Electric Small Building Systems, Mr. Leblond defines paths to market, core messages, and IP approach. He also represents the company with key customers in North America and Europe, developing partnerships and sales channels, and providing input to the development group on industry trends and needs. Mr. Leblond has co-authored a number of patents for healthcare and building automation technology, and has authored articles for industry publications. He holds a Bachelor of Science and a Master of Science in Economics from the University of Montreal, Canada.

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