

Web Services for Building Automation



The introduction of web services for building automation systems (BASs) enables users to monitor building conditions, run energy-trending reports, alter schedules and temperature setpoints, and respond to system alarms from any location with Internet access. These interfaces also enable the networking of BASs for multiple buildings so that they can be controlled from one location. Web-based systems first appeared on the market in the mid-1990s but only became widespread in new and existing BAS installations in the early 2000s. Today, the majority of new installations are web-based systems.

There are a couple of benefits provided by web services that may enable BASs to more broadly serve the commercial building market. One ideal application for web-service controls is in small commercial buildings with no facility manager onsite to operate a BAS. Further, the use of web services makes it easier to link the BAS to business-enterprise software—accounting and business scheduling programs, for example—which increases potential savings.

Why Use Web Services?

The convergence of information technology and web-based control software is driving major changes in the building-controls industry. Conventional BASs feature a central computer linked to controllers embedded in lighting, HVAC, and security equipment within a building. Web services are developed by connecting multiple buildings to the Internet through gateways, which convert the building's control communications protocol to Internet-based communications protocol (**Figure 1**). These systems allow access to multiple buildings from a single location and also provide more flexibility and accessibility than conventional BASs—all of which could help increase the market for BASs.

Good Fits for Web Services

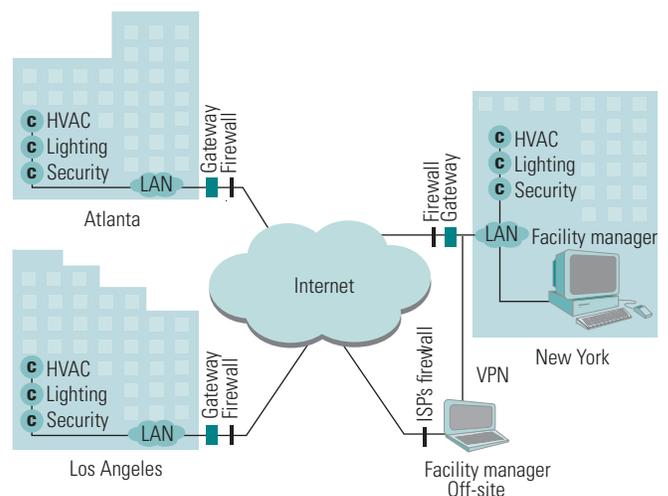
Web-based BASs have the potential to make BASs more accessible and affordable for commercial building applications. Several national retail stores, restaurant chains, and large corporations, including PETCO and Home Depot, are already using web services to exercise building-control operations from a central location.

In large corporate applications, the ability to collect and process building data coming from several sites has the benefit of lowering the cost of BASs per building for two reasons:

- Because software applications and computer servers are shared among several buildings, each individual building-control system will be less expensive; and

FIGURE 1: The operation of web-service BAS systems

Web services allow building automation systems (BASs) to be connected through the Internet. Because these systems offer remote-control capabilities, facility managers can monitor and control the environment of their buildings from any location with a web connection. They can also manage multiple sites simultaneously or aggregate them for load control.



Notes: c = controller; ISP = Internet service provider; LAN = local area network; VPN = virtual private network.

Courtesy: Platts

- Centralized monitoring allows corporations to hire one energy manager to analyze several buildings remotely rather than hiring one facility manager for each building. For example, Home Depot, a nationwide retail chain, has successfully outfitted 36 stores in New York State with web-based BASs, enabling one facility manager to monitor multiple sites.

Web services also have the potential to bring BAS capabilities to the small commercial building market. Small buildings have historically avoided such systems because they require additional, trained personnel to operate the systems. Web services allow BASs in small commercial buildings to be managed by either a remote facility manager (for companies with multiple small buildings) or an outside firm that offers facility-management services for multiple clients. The initial costs for the system are also lower because each individual facility does not need to purchase the computer server required to operate the system.

More Accessibility

Because web services use a web browser as the user interface, the control system can be accessed remotely using any device with web-browser capabilities and a secure link to the Internet. With the emergence of portable electronics that have Internet access, such as personal digital assistant (PDA) devices and cell phones, building operators can respond to events and alarms even when they're not at their desks.

Demand Response

Facility managers operating multiple sites with web services can save a great deal on electricity bills by participating in utility demand-response programs. At times of peak demand, the local utility may ask for cooperation from large energy users, requesting that they turn off equipment or shut down production. Web-based BASs can aggregate small loads for significant load shedding.

XML Enables Web Services

The key enabler of web services for building automation is an Internet protocol called XML (Extensible Markup Language). XML has emerged as the standard protocol for data exchange in many business sectors and is being adopted by BAS manufacturers.

XML is similar to the more familiar HTML (Hypertext Markup Language), the language used to create the web pages that you see in your web browser. XML uses tags much like HTML data tags to record the relationships among the data elements in a file. The data in an XML file can associate a device, such as a controller, with numerous objects such as control points, messages, and alarms. A computer reading the file would be able to "understand" the physical capabilities of the objects and know how and when to communicate with them.

By supporting XML for building automation, manufacturers give their customers the flexibility to configure the system through their IT department, use a configuration package from another manufacturer, or use a third-party software package that supports XML as a file format. Examples of the latter include Microsoft Excel and Microsoft Access. Because Microsoft is freely distributing its XML software engine, it's much easier for manufacturers, software developers, or users to create custom applications that read and write XML data, possibly even reading proprietary configuration data files and exporting them in standard XML format.

The use of XML also allows BASs to seamlessly communicate with business-enterprise software compatible with XML, such as accounting and business scheduling (for example, Microsoft Outlook) packages. For example, an XML-based building automation system could be integrated with scheduling software to control HVAC and lighting equipment based on when individual building zones are

occupied. Or XML-based controls could be used in hotels—HVAC systems in a hotel room could be switched on through the reservation system when a guest checks in.

In 2007, ASHRAE published an extension to the BACnet standard—a data-communications protocol standard for BASs—that defines how BACnet protocol information can be communicated using XML and web services. Most BAS manufacturers have adopted the BACnet standard or have gateway devices that can convert the BACnet protocol to their proprietary communications protocol.

Concurrently, an organization known as CABA (Continental Automated Building Association), which is comprised of nearly 400 manufacturers, utilities, and government agencies in North America, has developed a building automation-oriented protocol called oBIX (Open Building Information eXchange) that also utilizes XML. As these new standards see wider use, web services for BASs will become more common.

Costs and Security

Despite the potential benefits of web-based controls, concerns about cost and security have slowed their adoption. However, a closer look shows that those concerns may be exaggerated.

Costs. Although web services do not have to add to the physical cost of a BAS, some manufacturers charge more for the features that web services enable. For example, one manufacturer quoted that a system with remote-access capabilities via PDAs and cell phones would add 20 to 25 percent to the initial cost of a basic system.

However, even if these features add to the upfront cost of the system, they can be less expensive in the long run because roughly 80 percent of the BAS lifecycle costs are incurred after the installation of the system. Web-based controls can reduce lifecycle operating costs by:

- *Reducing data entry.* Before the advent of web services or XML, a facility manager who wanted to compare data from a BAS with data from another business information system would have to either do so manually or build an expensive program to tie the two systems together. Controllers that incorporate the XML protocol eliminate the need for human intervention, thus lowering labor costs.
- *Reducing staff costs.* Because networked building controls allow many buildings to be controlled from a single computer terminal, only one facility manager is needed.
- *Reducing training.* Users who are familiar with the Internet should have little difficulty learning how to use a well-designed web-based BAS. The software design makes it easy to monitor control and sensor status and to set report parameters, no matter how many buildings have been networked together.

The lifecycle cost savings will vary depending on the application. A study at Ave Maria University in Florida found that the school could reduce its maintenance staff from 24 to 7 people by installing a web-based control system in 10 campus buildings. This reduction saves the university approximately \$350,000 per year.

Security. Although there have been concerns about security with these web-based systems in the past, industry experts assert that the systems are now as secure as non-web-based systems. IT professionals have been working closely with building managers to improve the security of web-service systems by employing the same types of firewalls and encrypted data used in regular IT infrastructure. Firewalls are used to isolate a system from the public. Most building-control vendors have experience dealing with the security of these systems. For example, WebGen, a BAS manufacturer, has successfully connected numerous Bank of America buildings using web services protected by encrypted data and firewalls.

Collaborating with IT Staff

At the beginning of a web-based BAS project, it's recommended that the facility manager collaborate with the IT department because IT support can ensure the success of a project. IT staff can be responsible for handling software upgrades, network connections, and any computers that manage the BAS. Also, determine whether the IT department can employ security using firewalls. IT personnel are often willing to host BAS software on the corporate servers so that they can ensure security for the enterprise network, using appropriate firewalls and encrypted data transfer. They can also help with handling software upgrades, network connections, and any computers that manage the BAS.

Future Developments

As demand response and smart-grid technologies—technologies that offer consumers unprecedented flexibility and information regarding their electricity consumption—continue to grow in popularity, it is likely that manufacturers will work to integrate web-based BASs with real-time utility pricing tools. This trend could ultimately lead to automated energy procurement based on price—allowing businesses to reduce operating costs, which adds value to their bottom line.

Two current projects are leading the way. The first involves automated demand-response (autoDR) systems, integrated with a BAS, which use web-based electricity-pricing and event notifications to automatically initiate preprogrammed control strategies. When electricity prices are high or when the grid is nearing full

capacity, these control strategies reduce electricity loads. Lawrence Berkeley National Laboratory researchers have begun to examine which demand-response strategies can be automated in facilities. Additionally, work is underway on a tool that can help determine what strategies and peak savings are feasible for an existing facility.

Another real-time-pricing project for building controls is called the NewEnergy Alliance, an organization founded by Constellation NewEnergy, an energy service provider that includes equipment manufacturers, building automation companies, system integrators, and software businesses. This group is working to develop BAS technologies that are integrated with real-time energy-market information and pricing signals. As of October 2008, no products had been released, although NewEnergy Alliance hopes to commercialize products by the end of 2008.

Resources

BACnet, www.bacnet.org

Continental Automated Buildings Association, www.caba.org/

Open Building Information Xchange, www.obix.org

Lawrence Berkeley National Laboratory, Automated Facility Demand Response, <http://drcc.lbl.gov/drcc-1.html>

Automated Demand Response Cuts Commercial Building Energy Use and Peak Demand, CEC-TB-31, http://www.esource.com/esource/getpub/public/pdf/cec/CEC-TB-31_AutoDR.pdf