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Controlling Your Environment

The BACnet Manufacturers Association (BMA) explores the history and future of BACnet protocol.

By Jim Lee

In the beginning, there were no heating or cooling systems other than those provided by Mother Nature. At first, man discovered fire, which was followed by a series of evolutions such as the fireplace and the Franklin stove. At some point, it occurred to man that lighting a fire and opening and closing windows was a primitive way to control his environment. Then came central heating and central cooling. In the early part of the last century, pneumatic controls were introduced into building environment systems. These control systems used compressed air and a series of regulators and actuators to control steam lines or air-handlers. This technology became standardized, and several different companies manufactured interchangeable pieces of equipment to control buildings' internal environments. The market expanded rapidly as the idea of temperature control was widely embraced. The HVAC industry was born.

When the energy crisis of 1973 arrived, a new way of thinking about controls evolved. By not wasting heating and cooling, one could save an enormous amount of money on energy. These potential savings were so great that engineers were inspired to find new ways of managing energy consumption through the use of computers. Minicomputers were connected to pneumatic control systems and even more money was saved. But these computer systems were not interchangeable or standardized as the pneumatic components had been, and a new business model was developed - locking the customer into proprietary technology systems that added value for the customer and job security for the controls company. As the microprocessor and computer revolution unfurled in the early 1980s, the newly fledged building automation industry embraced a concept called direct digital control (DDC). These DDC systems were all proprietary - only one manufacturer supplied the components to each system. DDC was less expensive to operate and allowed even greater cost savings than pneumatic systems, and so customers continued to tolerate this model based on these benefits.

During the DDC revolution, market conditions were changing. The cost of energy was dropping and the number of manufacturers providing building automation systems (BAS) was growing. Over time, the business model changed from BAS companies selling control products to these companies servicing installed systems. The initial costs were reduced, but instead the BAS manufacturers used service contracts and upgrades to derive healthy profits from this new business plan.

Today, many contemporary building automation equipment manufacturers provide proprietary systems that aim to integrate all of a building's controls - as long as all of the building's controls use the same proprietary approach. While at first this model may have appeared economical to building owners, it soon led to the dominance of a single contractor in a facility and prevented building managers from using competitive and more cost-effective systems - simply because these other systems did not fit into the original manufacturer's technology.

As a result, building owners have often become locked into products from a single manufacturer and have not been able to take advantage of innovative new technologies or cost-saving opportunities. Up until now, when a new technology was deployed that used another communication technology (protocol), an additional, compatible workstation was also required.

This tangle of different proprietary systems and the inability of customers to choose or switch BAS suppliers led to a market full of dissatisfied customers - many of them large users, such as the

government, universities, and large corporations.

A Standard is Born

In 1987, these large users banded together under the auspices of the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE), Atlanta, to develop a standard communication protocol called BACnet® (Building Automation and Control network). BACnet was developed to combat the proprietary-system business model and to keep users from being locked into a single supplier. The flexibility offered by a standard protocol also helps combat planned obsolescence and high prices.

No single company owns BACnet - it is an open, consensus-based standard developed by a committee comprised of end- users, consulting engineers, manufacturers, the government, and the academic community. After three public review drafts and extensive industry debate, BACnet was approved as an ASHRAE/ANSI standard in 1995. BACnet is being considered at the management and automation level as a European standard CEN 247 and is being adopted worldwide. BACnet products are now available from almost all building automation companies. At least 5,000 BACnet-based jobs have been installed in the United States and extensive deployment is under way globally. Examples of BACnet projects around the world include: the German Parliament Building (the Reichstag) and numerous hospitals in the European community; in Asia, installations in Japan, Korea, Singapore, and China; and installations in Australia. In the United States, BACnet is featured in a number of high-profile buildings, such as at 450 Golden Gate in San Francisco. It is also currently under review for use in the United States Capitol in Washington, D.C.

BACnet makes the communication portion of each building, control, and monitoring device use a standard set of communication rules - in other words, a common language. That means all salient aspects of each device have the same appearance on the communication channel. Devices do not have to all be the same, nor even to work the same, but they must all send their information across the communication channel in the same way in order to communicate.

One of the major reasons for the development of this standard protocol was to alleviate the inefficiency of having a multiplicity of different workstations, each controlling a specific piece of hardware or system in a building with automation and control equipment from multiple manufacturers. Large users, including universities; local, state, and federal government agencies; large corporations; and distributed organizations, such as chain stores, hotel chains, and real estate investment trusts, would otherwise be unable to support the proliferation of disparate proprietary technology. With BACnet, however, these concerns are a thing of the past.

BACnet has been chosen by most manufacturers as the interface of choice to integrate different types of building systems including HVAC, lighting, fire alarms, security systems, and elevators. For instance, BACnet is the leading choice in the world today for connecting HVAC control systems to fire alarm systems for smoke control applications. It is also the leader in connecting lighting, HVAC, and security systems for occupancy control.

Benefits of BACnet

As a building owner or manager, BACnet can help you by breaking the proprietary technology lock of controls companies. This will allow you flexibility in negotiating service contracts and expansion projects and allow the integration of previously disparate systems. By specifying BACnet, you will be able to control your building's functions from a central location through the use of an integrated workstation.

Many engineering firms and architects treat building controls as an afterthought. After all, they are not the ones who have to live with the consequences of proprietary systems and their high cost - you are. In fact, many building automation specifications are actually written by controls manufacturers in their own best interests, and end up finding their way into bid packages. Insist on BACnet technology from your engineering firm or contractor. Your best interest as a building owner or manager to save life-cycle cost might not be consistent with those of your engineer and contractor. It is worth it to specify a BACnet system, and there are many places to help you to acquire those specs: See ASHRAE GPC-13 and NIST sample documents as starting points. BACnet, by its nature, accommodates a wide variety of IT infrastructure.

It's time to stop thinking about the sophisticated computer infrastructure that controls your building as "Climate Control" and start thinking about it as IT infrastructure. If your consulting engineer is unfamiliar with BACnet, consider working with a building automation IT consulting firm or a consulting engineering

firm that specializes in BACnet. If you are working with a performance contractor, make sure your performance contractor installs BACnet-based systems. Without BACnet, measuring enterprise-wide efficiency can become its own technology nightmare. Many performance contracts have guarantees with the performance contractor monitoring the results. By specifying BACnet, you can be sure that the open public data definitions will allow you to monitor the data collected by the performance contractor.

BACnet Questions
The large building automation system manufacturers are in a tough position. Their primary revenue stream is made up of service contracts for existing customers. By offering BACnet products, they will quickly degrade their ability to hold these customers captive. Instead, they will need to earn your loyalty by providing superior service. This said, the people who run these controls companies have examples from the computer industry to follow. Companies which have sold proprietary closed systems (e.g., Apple Computer, Digital Equipment) have fared much worse in the marketplace than companies which have pursued open systems (e.g., Microsoft, Sun Microsystems). These companies need to trade off opening their systems while balancing the transition of their organizations to compete on service. Almost all of these companies have BACnet products. It is to your benefit to insist on these products in your facilities.

Manufacturers Unite
There are places to turn to get assistance in incorporating BACnet into your facilities (see sidebars, pages 90 and 94). The BACnet Manufacturers Association is a new organization that encourages the successful use of BACnet in building automation and control systems through interoperability testing, educational programs, and promotional activities. BMA members include companies involved in the design, manufacturing, installation, commissioning, and maintenance of control equipment that uses BACnet for communication.

The Future: NBS
Besides allowing building managers and owners greater freedom of choice in building controls systems, BACnet opens up great new possibilities for even more sophisticated and efficient applications for the future. Over the next 10 years, building control companies, equipment and systems manufacturers, energy providers, utilities, and design engineers will face increasing pressure to improve performance and reduce costs. These pressures will drive the development, adoption, and use of network building systems (NBS). NBS is a combination of hardware and software systems that allows for communication within a building's systems (e.g., heating, ventilation, and air-conditioning, fire alarm, lighting control, security systems, etc.) and/or communication across multiple building systems into one central location, and applications to improve facilities' operations.

BACnet is the enabling technology for NBS because it not only supports multivendor interoperability, but also supports most existing networking/wiring infrastructures. BACnet has also been designed to easily adapt to future networking technologies.

The convergence of the enterprise-wide management paradigm, the Internet, and open systems in building automation (BACnet) now allow for the deployment of Networked Building Systems. A typical NBS consists of several components, including:

- Existing and/or upgraded building controls.
- Routers/gateways which connect various building controls.
- A wide area network (WAN), which may be Internet - or intranet-based.
- A central management workstation(s) with applications.
- Interface to energy providers and information services (weather, real time pricing).
- An interface with existing corporate level information technology systems.

While the implementation of NBS will benefit building owners and managers, utilities and energy providers will realize the greatest benefit. In the short-term, building owners and managers will be the first to realize several very important benefits providing an immediate increase in value - chief among them being:

- Lower Energy Costs. Access to and analysis of energy usage data will deliver cost savings due to better controls, an ability to aggregate multiple buildings' energy usage to negotiate lower electricity rates, and optimization of real-time pricing.

- Lower Operations and Maintenance Costs. More efficient allocation/deployment and shorter duration of on-site manpower resources will result in reduced overtime expenses, reconfigured and/or reduced operations and maintenance staff functions, and the use of third-party operations and maintenance contractors.
- Lower Repair and Replacement Costs. The use of NBS will allow systems and equipment to operate under nearly optimal conditions for extended periods. In addition, equipment and component malfunctions will be diagnosed and remedied before catastrophic failure occurs. As a result, equipment life will be extended, fewer replacements will be required, and replacement costs will decline. Furthermore, better diagnostic tools will enable support staff to more quickly and effectively repair equipment and components.
- Increased Occupant Productivity. NBS should result in improved occupant comfort from enhanced operating performance of HVAC and lighting systems. Maintaining temperature, humidity, and air quality will give the building operations staff the information to provide a more consistent environment and quicker response time when change is necessary. Improvements on comfort and control have major impacts on worker productivity and tenant loyalty.
- Integration with Information Technology Systems. NBS will permit easy and cost-effective integration of enterprise-wide facility data into existing information technology systems, providing more centralized control for operational, purchasing, and financial management.

Think BACnet
Open system control technologies are clearly the way of the future. BACnet has been adopted as the dominant open communication protocol worldwide. By demanding BACnet systems, you protect yourself from expensive expansions and service contracts as well as pave the way for enterprise-wide Networked Building Systems, providing greater efficiency and preparing you for the utility deregulation of the future. Organizations such as the BMA are out there to educate the market on BACnet and building automation.

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