

# DDC—The Attention Is on Communication

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Open systems, connectivity, integration, interoperability and standards—in the last couple of years the marketing activity in the building control industry has focused on **communication**. At issue is the ability of different building control systems to communicate using standards and in turn talk with each other, a situation that clearly provides significant benefits for the owners of buildings. Since this has been an issue for more than a decade, what caused this increase in marketing expenditures and more importantly, a focused effort on product development?

Many would point to the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) effort to develop a communication protocol that resulted in a standard. Although the release of the BACnet standard was a watershed event, some credit should also be given to the rise of another communication protocol. The Echelon Corporation's LonWorks technology has provided LonTalk, an alternative communication protocol that led to LonMark interoperability standards.

If you are not involved with buildings, or the systems employed in the control of buildings, you may have never heard of BACnet or LonMark. Even if you are involved in the control or management of buildings, you may not have had a chance to get beyond all the messages to understand the importance of the details of how different systems talk to each other. The world is constantly changing and the building control industry is no different.

This article presents the current industry status and manufacturers' approaches to this change. While protocols are important, the purchaser of a building management system should remember the reasons for having a system. Protocols, whether proprietary or open, are just tools for accomplishing building control and management. Communi-

ation is an issue that requires a lot of attention, but not at the expense of the goals established for control and management. Here's my vision of the future.

## CARING ABOUT COMMUNICATION IN BMS

Why should anyone care about the way building management systems from different manufacturers talk to each other? First there are the reasons that prompted the BACnet effort. These benefits have been stated a number of times in a number of different articles. They include the ability to be vendor independent, the potential of having a single seat user interface, the prospect of process interaction, and the ability to share communication media.

**Vendor independence** is the first and most important benefit for a building owner. In the past, a building owner was tied to a manufacturer whose equipment was installed in a building. The proprietary nature of the communication protocols used provided little choice for the owner when it was time to upgrade or expand an existing building control system. The owner only had three choices: noncompetitive bidding, the installation and operation of multiple systems, or complete system replacement.

If all the intelligent systems in a building can talk to each other it creates the opportunity to have a **single seat user interface**. This is the second benefit of standards. At one location, the systems in a building can be commanded or viewed for operational status. The ability to command points or check the status of systems and diagnose problems from one single location increases productivity. Having just one consistent method to command and view various systems in a building reduces the training burden on the building management staff. It also increases the likelihood that systems will be used to their full potential.

The communication between systems that results in some kind of action is referred to as **process interaction**. This is the third main benefit of standard protocols. This concept is about as old as Direct Digital Controls. If you stop to think about it there are a lot of different intelligent systems in the average building today. Most of the efforts in developing standard protocols have been directed at the control systems for the Heating Ventilation and Air-conditioning (HVAC) but a building might have any number of subsystems. Systems you might find in a building

include lighting control, access control, power monitoring, elevators, fire protection systems, and others.

The classic example of process interaction has always been a person gaining access to a building using a card. The event of the card being read by the access control system activates the lights and HVAC in that person's office. In addition an elevator might be directed to the first floor and a security camera might pan toward the door to record the event.

Finally the use of any type of standard has the potential to reduce installation costs. A big opportunity for control systems is to take advantage of the standards in the computer industry. For instance a building control system should be able to **share existing network communication media** in a building such as an Ethernet Local Area Network. Why not use this same media infrastructure to transmit building control information? The caveat is that there needs to be enough room on this network for the additional communication traffic.

## INDUSTRY RESPONSE TO STANDARD PROTOCOLS

Standards are now available and the benefits to building owners have been clearly established. Manufacturers motivated by profit want to supply what customers say they want. The more customers request standard protocols in the products they purchase, the greater is the desire of suppliers to deliver these products.

However, contrary to the proclamations about the wide spread acceptance of standard communication protocols, the majority of products for the building industry still use vendor specific protocols. The good news is this situation is changing. But, the implementation of these standards is not consistent among manufacturers.

Companies are responding differently to the market need for standard or open protocols. Some manufacturers are meeting the call for standard protocols by providing a gateway. The gateway is a communication link between a system using a proprietary protocol and a standard or open protocol. This approach is most common to manufacturers with a significant number of installed systems. The use of a gateway can be a final solution or just a migration step toward the introduction of new products.

Another strategy is to implement a single protocol across an entire product line. This strategy seems simple and clean but the use of a

single protocol throughout a building management system can come at a price. First of all, protocols are like people. They have particular strengths and weaknesses that are part of their personality. A single protocol may work very well in some applications but have limitations operating in others. This single protocol strategy could also backfire on a company if the chosen protocol does not end up in common use within the industry.

The single protocol strategy is typical of some small- to mid-sized firms in the industry. A couple of these companies are clear leaders having been first to the market with product lines and systems using either the BACnet or LonMark protocol. These small firms have used their size to their advantage to get to the market quickly with product.

In order to pick protocols that are appropriate for the different applications in a building management system, some manufacturers have indicated that they will provide a multiple protocol approach. One protocol may be used for high-speed communication, the type of communication is used for monitoring and control by building operators. Another protocol would be implemented at the field device level. The intent of this strategy is to take advantage of each protocol's particular strengths. It also provides the manufacturer with some flexibility if one of the protocol choices turns out to be unpopular. This approach creates additional effort for the manufacturer since the manufacturer using this strategy will have to develop a product that will act as a translator between the different protocols.

Manufacturers who represent a large percentage of the market share for building control systems have embraced the multiple protocol approach. Many of these firms have stated their intent to use the BACnet protocol at the upper level in system architecture where high-speed networks are used. Typically this implementation uses Ethernet, a media and data standard for computer networks that is an option in the BACnet standard. These same providers have declared LonMark to be the protocol of choice for field devices. These are the devices that perform most of the monitoring and control in a building.

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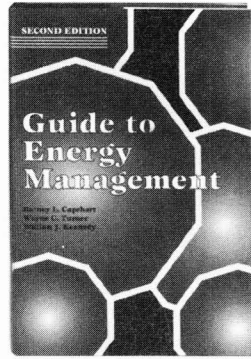
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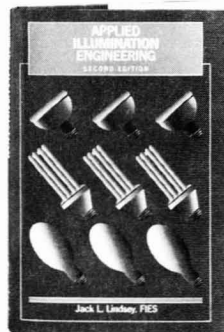
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tion issues will be worked out and there will be some level of consistency among products. But that date is still far in the future. The transition period we are in now requires that building owners and managers pay attention to the specific communication goals for a building control system. This transition period opens up the possibility to make mistakes based on misconceptions of what can be acquired or achieved with standard protocols. These mistakes show up either at bid time or may become visible sometime in the future when an existing system must be upgraded or expanded.

Right now there are only a few companies offering a complete system using a standard protocol. Some companies offer a limited selection of these products including communication gateways. And there are different approaches to the application of protocols within a system. As stated before, company specific protocols are still in wide use.

Building owners want specifications that attract a fair number of bidders. They also want to have a system that meets current operational goals along with future requirements. Without a clear set of operational goals and an understanding of the products available it may be difficult to get competitive bidding and get a system that meets operation requirements. Plus, without a clear understanding of the application of protocols within a system, an owner may find it difficult to upgrade or expand a system in the future. This would cancel out one of the key benefits sought from the use of standards.

## KEEP PUSHING

It is also important for building owners to be informed so that they can get the system that they want. By being informed they can also direct the industry in the development of products. In order to drive the industry it is important to have to some level of understanding about protocols. Unfortunately, the experts in communication protocols tend to be the manufacturers themselves. Building owners might know and understand the benefits they want but are not usually versed in the specifics of technology. Gaining this knowledge is important if owners want to drive the industry in the direction that will provide the most benefit.

It is also helpful to understand the different messages in the mar-

ket. Some organizations have an interest in the success of a protocol. They want their particular protocol choice to survive this transition period and ultimately be the protocol in common use. The choices made by customers and vendors will determine the outcome of this period. The natural reaction for these groups is to promote a particular protocol in order to improve the chances for final success.

Articles and advertisements continue to appear in trade magazines that imply that the market has already accepted a protocol. There are claims about the number of products in which a protocol has been used. These are meant to convince the reader that products using a particular protocol are plentiful. Usually when numbers are quoted about the number of products using a protocol, not all the products address the same industry or application.

Sometimes there are claims about the number of buildings in which a protocol is used. Many of the buildings identified as having systems that use a protocol may only have a product or two installed. As is very often the case, most of the products in these buildings use different and usually company-specific protocols.

Industry promotions can be a little misleading, although they do help to educate. Manufacturers will respond to customer demands. These demands can be based on the perceptions created by industry promotions or they can be based on actual customer needs. Both building owners and manufacturers will benefit in the long run if these demands are based on need and not perception. It is also important for customers to keep demanding the open system solutions to keep the industry moving forward.

## WHAT TO DO

It should be remembered that protocols are just tools, but they are important tools to achieve the benefits discussed. One protocol is not necessarily better than another protocol. Different protocols have particular strengths and weaknesses depending upon their application. In some cases proprietary protocols may still be the best solution.

Manufacturers are promising products, offering gateways, and providing products. Many building control systems still use company specific protocols. Some companies are cooperating to make sure devices actually work together. You have a building that needs a control



system and cannot wait for a shake out in the industry. What should you do? Like most situations, it depends. What you do will be dictated by the type of building you have, the number of facilities that you must operate, your present facility management goals, and your future needs.

As stated before, the key to getting what you need is to establish goals for the system you want in your building. It is possible to focus so much on the communications used by a system that the original purpose for a control system can be lost. When the debate about communication protocols is over a system purchase will revolve around system features, applications, product quality, company strengths, and company reputations.

The main focus should be the value a system provides. One of the key benefits of using a standard protocol is that it allows an owner to have a system that is independent of a single manufacturer. But this should be the second consideration after system features, applications, product quality, company strengths and company reputations.

If you are responsible for a campus of facilities your focus should be on the communications that exists between different buildings. Achieving communication between the buildings will allow monitoring and control from a single location. Each building may have a different manufacturer's system and use different protocols. In this situation the protocols used within a building are not as critical as the ability to link buildings together.

Very often this type of integration has been referred to as "islands of integration" or "system-to-system integration." In order to achieve this campus-wide communication the systems installed in these buildings must be able to communicate using the same protocol. A purchaser of a system for a campus should seek manufacturers that provide either a gateway or use that common protocol in the products that connect the campus-wide network.

The same consideration may be true for the manager of a large building that expects to expand a system due to the addition of a wing sometime in the future. It is important to make sure the original system has the ability to use a standard protocol. Again, this can be accomplished with a gateway or by systems that use the common protocol for higher speed communication. In both examples, to achieve this system-to-system integration most manufacturers would agree on the BACnet protocol operating over Ethernet. A minority of other manu-

facturers would suggest using LonMark.

If a building owner is not expecting to expand a system in the future, the focus should be on a choosing a common protocol for all the field devices (such as Variable Air Volume (VAV) controllers). In this case the owner wants to be able to purchase field controllers from a number of sources and use them interchangeably. Many manufacturers are producing products or have stated an intent to develop products using LonMark protocols. However, others would still suggest using BACnet for these controllers.

There is movement towards the use of standards in subsystems like lighting control, access control, power monitoring, elevators, and fire protection systems, but progress is much slower. As part of the development of goals for a building management system the purchaser should consider the integration of these other systems.

This requires a closer examination of each manufacturer's ability to connect to these other systems. Most of these intelligent subsystems continue to use proprietary protocols. Integration of these individual subsystems is usually accomplished through the use of standardized gateways. While gateways may not be as efficient as the use of a standard protocol they can provide benefits such as having a single seat interface and process interaction. The building owner must determine which of these possible subsystem integrations provide the most the value.

A standard, like the BACnet protocol, includes different options for implementation. It is not enough to say that a product should comply with a protocol. Many times the details about the implementation of a protocol are needed to assure that current and future goals can be met. You should consider the services of a consulting engineer in order to get a system that meets your current and future goals. A consultant can help establish the implementation details of a protocol to meet your goals.

## CONTINUING ACTIVITIES

In North America there are a number of associations pushing forward open and standard protocols. Many manufacturers are involved with one or more of these organizations. First of all there is the Standing Standard Committee for BACnet within ASHRAE. This group is

tasked with answering questions of interpretation and maintaining the standard. This includes following a process to make changes to the BACnet standard. Another group in ASHRAE is GPC-13. This group is developing guidelines for engineering consultants to specify building control systems.

There is also an organization called the BACnet Consortium for Interoperability. This organization is independent of ASHRAE. The purpose of the group is to deal with BACnet implementation issues that may prevent products from actually talking to each other.

There is a different organization that looks to expand the use of LonMark. The LonMark Interoperability Association is broken up into different groups based on application. One group deals with HVAC issues. Other applications groups include lighting, refrigeration, fire, and security.

There is also considerable activity outside of North America dealing with BACnet and LonMark. Some groups are associated with professional organizations looking to develop European standards. Others are pure industry groups that deal with education, implementation and promotion of a protocol.

Outside of these organizations companies are directly cooperating with each other. These cooperative events typically focus on testing and improving communication between BACnet products. The BACnet standard can be implemented in different ways that may prevent products from effectively communicating. Companies that are committed to the success of BACnet want to make sure that BACnet products can talk. Since there is no independent testing organization for BACnet products, these motivated companies have taken the responsibility to make sure products work together.

The same effort has not been necessary for LonMark products since the LonMark Interoperability Association acts to assure compliance by providing LonMark certification for products.

## THE FUTURE

In response to customer demands companies are providing more and more products everyday. The protocols mentioned in this article are going to change as well. LonMark continues to add application definitions. This will expand the use of this protocol into different ar-

eas. BACnet will evolve. This evolution is necessary in order to meet increasing demands for the communication of information. These changes create a moving target for the industry. Fortunately the changes are not likely to be so great that they cause a new round of product transition in the industry.

It is clear that standard and open protocols are in the future for intelligent systems in a building. The change in systems that control HVAC may take as long as five years. Other subsystems are likely to take longer. Manufacturers will arrive at this future at different times.

Large companies have a large base of installed systems. It takes some effort for these companies to develop a migration path. The move to standards must be well conceived and carefully delivered. To believe these companies are trying to deny the trend to open systems would be to assume that these companies are naive. There are too many examples in the pages of business history to ignore the consequences suffered by companies that have tried to stake out a position different from the rest of an industry. Most manufacturers are expending considerable resources to be involved in activities that forward the cause of open and standard protocols.

However it is unlikely that there will only be one protocol for all building systems. At first this may seem like a failure of the entire effort to develop standards. A significant number of companies are indicating support for both BACnet and LonMark. The reason is that manufacturers are applying protocols based on their strengths in different communication applications.

There are two points to remember. The protocols that do come into prominent use will be available to all. This greatly improves the opportunity for products to talk and provide building owners with the benefits that have been discussed. And even with two or three commonly used protocols it will be a much smaller number than all the proprietary protocols that can be found in a building today.

Most of the recent industry focus has been on the communication protocols that are used in the HVAC control products. I pointed out early in the article that there are a lot of other subsystems in a building. These include lighting control, access control, power monitoring, elevators, fire protection systems, and others.

The progress toward standards in these systems is not as far along as the accomplishments in HVAC control. This means that integration issues will continue to occupy the attention of building owners

and consulting engineers far into the future. Interoperability, connectivity, and integration will continue to be discussed because of the benefits to be gained from integrating these other subsystems.

## CONCLUSION

During this period of change it is wise for the owners of buildings to develop the goals that are to be met by building management systems. While communication protocols are an important point to consider, they should not be the only issue driving the selection of a building management system. Product features, system applications, product quality, and company reputation are as important as they ever were.

Owners should also understand the purpose and intent of all the messages in the marketplace. The key is to look closely at what is available in the industry at any given time. It does little good to request features and protocols that can not be provided by any supplier.

It can be worse to demand a set of features and protocol implementations that can only be met by a single company. Competitive bidding suffers, defeating the stated purpose of the drive toward standard protocols. Alternately, building owners still need to push manufacturers to come out with more products using standard protocols.

Don't forget to look for more opportunities to improve productivity. A key area ripe for productivity improvement involves the integration of systems other than HVAC. The benefits of a single seat interface and process interaction exist with these other systems. Market pressure needs to be applied in these other areas so that products for lighting control, access control, power monitoring, elevators, and fire protection systems conform to certain communication protocols. Just as gateways provide a solution or migration path to get to LonMark or BACnet, gateways can also be used to accomplish integration with these other building subsystems.

One final thought: do not discount the value that continues to be provided by company specific protocols. Some of these protocols are open to the world. Company-specific protocols may not be able to deliver vendor independence, but they have been an important tool for many systems in providing energy savings and increased productivity. Some are able to provide single seat interfaces and process interaction for the

subsystems in a building. The move is clearly away from company-specific protocols toward new open and standard communication. But it will be some time before systems have these standards and provide the rich and robust information environments that many building owners require.

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#### ABOUT THE AUTHOR

**Brian K. Kammers, P.E.**, is the program manager for Facility Management Systems at Johnson Controls, Inc. His responsibilities include the global marketing of the Metasys Facility Management System and the expansion of the Metasys Compatible Product list. In addition he is responsible for several co-marketing relationships and the promotion of Intelligent Building Systems.

Mr. Kammers has 17 years of industry experience. He received his bachelor's degree in engineering materials and industrial engineering from the University of Wisconsin, Milwaukee. He earned his masters degree in business management from Vanderbilt University.

He is a member of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., and serves on the Society's Technical Committee for Computer Applications. He is also a member of the Association of Energy Engineers and holds a professional engineer license in Wisconsin.

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#### RE OPEN PROTOCOLS—AN INTERNATIONAL VIEW

"My company has me traveling from Europe to Asia teaching network integrators how to use the new technologies. I'm really excited about the technologies and how the building controls paradigm is shifting across the planet. In fact, it appears that the movement toward open protocol is stronger in the Euro and Asian markets than it is here in the USA, where it was conceived."

*A Controls Specialist*