ISSN 2191-7825

www.bacnetinternational.org

# BACnet International JOURNAL

Issue 15

## This Issue

Continued Growth of BACnet

Global Testing of the Global Standard

# BTL CERTIFICATION

## Your Best Path to BACnet Interoperability

If you are involved with building controls and automation, rely on the BTL Certification program to make sure the products you buy have been rigorously tested for compliance to the BACnet standard. BACnet is the world's standard for building interoperable solutions but it only works when products are correctly implemented. When you buy products that are not correctly implemented it can cost you a lot in terms of system integration time and money.

The BTL Certification program is operated by the BACnet Testing Laboratories (BTL), which is overseen by BACnet International. BTL was established more than 15 years ago to lead compliance testing and host interoperability events. To achieve certification, BACnet products must successfully undergo rigorous industry-standard testing conducted by recognized, independent testing organizations.

Users can identify tested products through the BTL Listing Service which is available to users globally at no cost. The service supports searching for specific products as well as browsing through products with different capabilities. In addition, the listing service provides detailed information on the specific tested capabilities of each product.

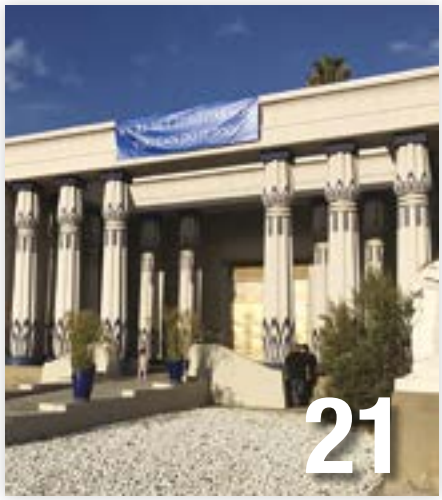
Accelerate your system integration and avoid unnecessary integration costs. Require all BACnet products in your system be fully tested. Ensure every product displays the BTL Mark or is verified through the BTL Listing Service.

There are over 800 products in the BTL Listing Service with more being added every month. **Find tested products to fit your needs at www.bacnetlabs.org.**

**BACnet Testing Laboratories**
**bacnetlabs.org**
**btl-coordinator@bacnetinternational.org**
**+1-770-971-6003**

© Blue Ridge Technologies

© BACnet International



© Comfort International




# Content

## Issue 15 | April 2018

Cover picture:

Rosicrucian Egyptian Museum, San Jose, CA

© Comfort International

All issues can be downloaded from http://www.bacnetinternational.org/journal

# Letter from the President

## Welcome to the Latest Issue of the BACnet International Journal!

It is an exciting time to be a part of the BACnet community. BACnet today is an interesting juxtaposition of old and new. Old in the sense that BACnet has decades of history in the market, achieving over 60% global market share according to the latest market research. At the same time the BACnet standard is being extended with new capabilities that will bring the benefits of open systems to a broader segment of the building automation market. The stability and extensive history of BACnet provide a powerful foundation for its new capabilities.

Under the auspices of ASHRAE (American Society of Heating, Refrigerating and Air-conditioning Engineers) through its SSPC 135 Committee, BACnet has continually evolved, with an extensive application services model, enterprise integration, and network security. Recent extensions simplify sophisticated lighting control and bring elevators and other vertical lift equipment into the BACnet solution space. And, moving forward the standard is being extended to provide more robust support for Internet of Things (IoT) integration and data analytics. With these new capabilities BACnet will play a critical role in leveraging data sharing and cloud-based applications to achieve more efficient and cost-effective building operations.

As the BACnet standard has grown and matured, so has the BACnet community. For many years it was difficult to answer the simple question "Where can I go to get started in understanding BACnet?" Now we can direct people to The BACnet Institute where they can take an online, self-paced BACnet Basics course or browse over 100 curated and tagged multimedia resources. And if that is not enough, they can participate in collaborative forums to learn more or get their specific questions answered.

Along with growing the pool of educational resources, the community itself continues to grow. Every BACnet manufacturer is required to have a unique ID and during 2017 the list of issued IDs rose to over 1000 … and the number keeps growing. The BACnet user communities in North America and Europe continue to expand with new members in both BACnet International and BACnet Interest Group – Europe (BIG-EU). We are also seeing increasing BACnet community activity in China and India.

The global BTL testing and certification program for BACnet products has also grown with the addition of several internationally recognized test facilities in Europe, with more in process. To further push the boundaries of BACnet testing and certification, we are organizing an International BACnet Testing Symposium in October of this year. Look for information and registration details on the BACnet International website.

In this issue of the BACnet International Journal, you will find articles touching on most of these topics … which naturally leads to our theme for this issue, BACnet and Beyond.

Enjoy!

© McMillan

**Andy McMillan**
President and Managing Director | BACnet International
andym@bacnetinternational.org | www.bacnetinternational.org

**ABOUT THE AUTHOR**

Andy McMillan is President and Managing Director of BACnet International, where he works with users and suppliers to expand and enhance the BACnet community. Previously he served as President of a building automation and energy management business unit of Philips Lighting.

# BACnet and Total Environmental Control: Shining a Light on BAS Controls

Does your Building Automation System (BAS) provide your occupants with total environmental control? Traditionally BAS providers have focused on temperature, humidity, and indoor air quality to address comfort and environmental control. Unfortunately, that only accounts for a portion of the picture in today's facilities. The overlooked element in environmental comfort and control (that has been surrounding us the whole time) is the impact of lighting intensity and color. As our buildings have evolved towards modern computer-based work and learning facilities, we have begun to realize the large impact that light quality, intensity, and color usage play when providing total environmental control and the need for the control of lighting.

It is interesting to note that due to the inverse relationship between cost and comfort in HVAC systems, very limited occupant input has conventionally been offered in BAS (i.e. very limited setpoint adjustment or placebo thermostats that have been installed to give the appearance of occupant control). Conversely, lighting in a computer-based facility tends to have a direct correlation to energy savings because most occupants will generally choose a lighting level that is less than full intensity. This desire to have local control is pushing BAS strategies to include everything from circadian rhythms to adaptable occupant centric strategies and the maximization of daylight. This combination of new requirements and a demand for more occupant choice presents both opportunities and challenges in BAS design and implementation moving forward.

Fortunately, BACnet-based open systems are helping take advantage of these opportunities by unifying once discrete building systems to provide greater comfort, productivity, and energy efficiency. This unified building control concept provides occupants with Total Environmental Control (TEC) by approaching each zone in a holistic manner. These intelligent systems, combined with the exponential growth of smart phone usage, and our growing preference to use the phone as the primary system interface, are creating an expectation of instantaneous personal control. Concurrently, the emerging dominance of LED lighting along with its inherent control capabilities (intensity and color) and the advancement of national energy codes have converged to expand the requirements of environmental

»

Occupant centric controls for the modern commercial office space

control to include the lighting domain and more. To parody an old commercial, "BACnet, it's not just for HVAC anymore."

While the adoption of dimming capabilities to control light intensity is obvious, the need to control the color of light is much more subtle. Current studies show that we now spend upwards of 87% of our day indoors, and along with that comes the realization that a lack of natural light is affecting our health, productivity and happiness. Although we do not consciously think about it, our bodies are conditioned to respond to a set natural cycle. Each day our mornings start out with warm reddish light while the sun rises in the east. As the day progresses, light slowly transitions to a cooler more blueish color, and then begins to warm back up when the sun sets for the night. This natural progression contributes to our circadian rhythm, or twenty-four hour biological process, that controls our rest-activity cycle while also influencing our immune system. Warm (reddish) and longer wavelength light provides a calming effect and begins our night cycle, while cooler (blueish) and shorter wavelength light decreases melatonin and increases alertness.

Various studies are beginning to tackle this lack of natural light by not only mimicking the progression of natural light indoors but also using specific color spectrums of light to promote particular behaviors. Companies have always been looking for ways to ensure their employees are productive, but modern employment trends have shifted this thinking to include the requirement to promote happy and healthy employees. The growing demand for TEC systems is being driven less by energy savings and more so by the comfort and productivity of the occupants. Many companies are specifically using unified strategies (control of both HVAC and lighting in a single system) to create a differential advantage in recruiting and retention. Other companies are implementing sequences that enable more occupant centric control. A few examples of these sequences or strategies can be found in the following vertical markets, but more are being researched, tested, and implemented.

## K-12 Market

In the field of education, a number of case studies have focused on researching the benefits of color tuning or changing the color spectrum of light in a classroom. Specifically, providing a warmer color light promotes a sense of calm and comfort. Usage of this strategy has shown particular promise in special needs classes, as well as being beneficial to at risk students. In addition, sequences of operations have been designed around using various light colors throughout the day to maximize the amount of time students are in "learning mode." Cool, blueish light in the morning increases alertness to get students quickly into a learning zone, while a warmer light in the afternoon can help to calm students down after recess to bring them back into focus.

## Commercial Office Spaces

The modern commercial office space is also a great example of an environment that is beginning to focus on the quality and color of light

Enhancing the learning zone

in various types of spaces when applying the BAS. The first zone that many people look at as an opportunity to apply TEC is the ubiquitous conference room. Conference rooms are a space that requires a high level of adaptability, and while that was traditionally resolved through simple switching, modern conference rooms are implementing sequences that combine temperature, audiovisual equipment, light level and color to maximize the usefulness of the entire zone. Specifically, a very balanced light color in the middle of color spectrum is utilized to create a welcoming environment while still promoting alertness. Conversely, other zones are looking to utilize the far end of the color spectrum, where colder more blueish light is used in brainstorming rooms to promote maximum alertness and productivity. Finally, on the opposite side of the spectrum, warmer light that is used for break rooms and the modern relaxation room.

## Correctional Facilities

How do you account for natural circadian rhythms when your occupants are allowed only a very limited amount of time outside and where natural light is overshadowed by security concerns? Sequences designed to mimic the natural progression of sun light have showed benefits to both physical and mental health in prison populations, while other studies look at the effect of both color and choice. In the same way color is used for its calming effects in education, correctional facilities can also benefit from this application. Studies show that light color can lower incidents of violence. In addition, simply allowing for occupant choice can produce beneficial outcomes in this industry. In a world where most, if not all, choices are made for you, the ability to have some control over your environment leads to healthier and happier occupants.

## Healthcare Industry

The final vertical market that I wanted to highlight is the healthcare industry. Research has shown that healthy circadian rhythm cycles can increase recovery rates and immune system strength. Strategies designed to take advantage of this research include daylight harvesting to maximize natural light exposure, the implementation of daily circadian lighting scenes, and the reduction of harsh light during nighttime hours. All of these sequences are designed to promote the mental and physical comfort of both employees and patients, and will become even more critical as health care cost trends continue to trend upwards.

## Moving Forward

As we continue to research the effects of decreased natural light, it will become increasingly important for the building automation system industry (design and implementation) to move beyond the traditional approach of focusing on only HVAC in each zone and adopt a TEC mindset. Occupant demand for buildings that are adaptable and holistic in approach is rapidly growing and is best served by a unified system. Unified systems are already being delivered through BACnet-based open control systems on an exception basis and need to become the standard. Moving forward, buildings with proprietary controls systems that inhibit interoperability, serviceability and choice will no longer be acceptable. Then, the true promise of the Building Automation System will be realized: A single automated system that maximizes the health and wellbeing of occupants in the most energy efficient way possible.

### ABOUT THE AUTHOR

Dennis Swoboda is the Vice President of Sales and Marketing for Blue Ridge Technologies, a manufacturer of Native BACnet lighting control solutions designed for open communication with most Building Automation Systems. In his role, Dennis oversees global sales and marketing initiatives for the sale and installation of Blue Ridge Technologies lighting control systems. In addition, he works with Engineers, End Users, Owners and Controls Contractors to help lower life cycle costs, increase energy savings, and reduce carbon emissions by taking control of the largest energy loads in a building. Dennis has over 20 years of lighting control experience, and gives frequent talks and presentations on energy codes, lighting, and BACnet. He has been a member of BACnet International for almost a decade, and has previously served as the BACnet International Marketing Committee Chair. Dennis currently serves as an active member of the BACnet International Board of Directors.

© Swoboda

**Dennis Swoboda**
Vice President of Sales & Marketing | Blue Ridge Technologies
dswoboda@blueridgetechnologies.com | www.blueridgetechnologies.com

# Using VPN Bridges with BACnet for Easy Remote Access and Commissioning

Remote access to devices is an increasingly common requirement for Building Management Systems (BMS). Remote access is used for commissioning, making changes to the operating parameters, monitoring or running diagnostics. Keeping buildings running more efficiently results in considerable savings and has given rise to Energy Management as its own trade. With the increased demand for remote access, it is necessary to implement secure solutions. VPN bridges with BACnet provide secure remote access and commissioning.

According to a latest market research study conducted by BSRIA, BACnet has a global market share over 60%. BACnet/IP is based on the popular IP protocol and allows a distributed architecture via the use of the Internet. BACnet/IP devices inside a building are on their own subnet and are accessible to each other. A BACnet/IP to BACnet/MSTP router can easily connect the MS/TP devices up to the IP subnet. A PC or a controller running a head-end software can send a Who-Is message and get a response from all the devices in a building. The Who-Is message is a broadcast message and traverses on the same subnet to all devices, which subsequently respond with an I-Am message. Once the discovery process is completed, normal communication can occur using directed messages. Accessing a BMS system remotely involves the use of different subnets and these subnets are connected via IP routers. The broadcast messages that easily traverse on a single subnet are blocked by the IP routers, restricting the BACnet device discovery process to the subnet of the device that sent the Who-Is message.

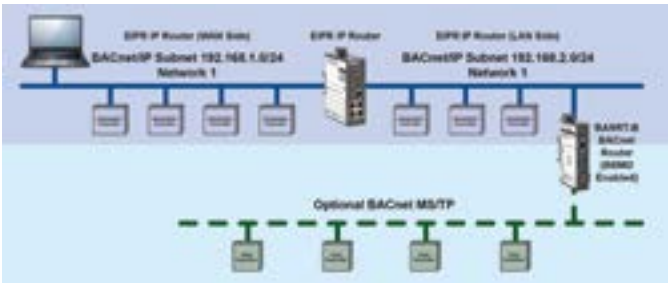



Figure 1: BBMD Functionality with IP Firewall Disabled
© Contemporary Controls

## BACnet Communication Across Subnets using BBMD and FDR

BACnet solves this issue of blocked broadcast messages across subnets by utilizing a BACnet/IP Broadcast Management Device (BBMD). For BACnet/IP communication to occur over two subnets, a BBMD device must exist on each subnet. Each BBMD device is configured with the IP address of its partner BBMD device. This is called the BBMD's Broadcast Distribution Table (BDT). On receiving a broadcast message, the BBMD device sends a unicast or directed message to its partner BBMD device with the original broadcast message as its payload. The partner BBMD device receives the message, decodes it and then sends a broadcast message on its own local subnet. The local BACnet devices respond and this is again sent back by the BBMD device to its partner BBMD device on the first subnet via a directed message. The original BBMD device follows the same process and distributes the remote subnet response via a broadcast message on the local subnet. This completes the discovery process.

BACnet also supports the concept of Foreign Device Registration (FDR). If a workstation or controller needs to access BACnet devices on a remote subnet and there are no other BACnet devices on its subnet, it does not need to support the full BBMD functionality. The device supporting FDR functionality registers with a BBMD device on the remote subnet and can send directed messages to the remote BBMD device and the remote BBMD device will send directed responses to the FDR device along with the other BBMD devices in its BDT table. At least one BBMD device is required on one of the subnets where the FDR devices can register.

In the setup shown in Figure 1, the BACnet router rovides the BBM functionality and can also support Foreign Device Registration. The PC running the application and all the BACnet/IP Controller on the 192.168.1.0/24 subnet support Foreign Device Registration and register with the BBMD device. The controllers on the 192.168.2.0/24 are on the same subnet and do not need to register with the BBMD device. Optionally, a BBMD device on 192.168.1.0/24 subnet can be used eliminating the need to setup FDR entries on the PC and the BACnet/IP controllers.

## BACnet Communication Across Sites using Internet

Setting up BBMD entries and FDR can sometimes become challenging and cumbersome. Most IP routers or firewalls connected to the internet block the incoming traffic. Special rules must be setup to allow any traffic to pass the firewall and this involves setting up Port Forwarding for the BACnet UDP port in use (by default 47808 or 0xBAC0). The IP router receives the BACnet traffic intended for the specified BACnet UDP port and forwards it to the device specified in the Port Forwarding entry. For a remote BBMD or FDR device, it will have to use the address of the Firewall device instead of the real BBMD device behind the firewall. Furthermore, the BBMD device has an additional setting where the Firewall address must be setup as its Public IP address. Complicating things further, this setup only allows access to the BBMD device. If additional BACnet/IP devices exist on

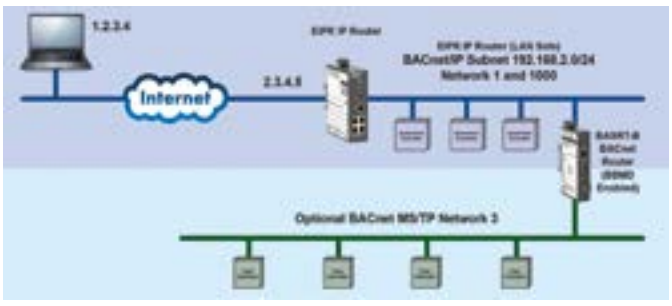



Figure 2: Remote Access to BACnet Network © Contemporary Controls

behind the firewall, an additional UDP port is required. The BACnet/IP devices besides the BBMD device use this second UDP port and the BBMD device also needs to support the BACnet/IP routing from one UDP port to another.

In the setup shown in Figure 2, a BACnet Network on subnet 192.168.2.0/24 exists with controllers and a BACnet/IP router utilizing the default BACnet UDP port of 47808. If a PC application needs to access this from a remote location, BBMD and FDR are enabled on the BACnet router and a port forwarding entry is added to the IP router. Since UDP port 47808 is already being used on the local subnet, another UDP port, 47809, must be used for this port forwarding entry and a second network number is also setup. The BACnet router is configured to have a secondary port of 47809 and specified to use this UDP port for BBMD. Although this is all on the same subnet of 192.168.2.0/24, BACnet treats them differently because of varying UDP port and network numbers. After a successful FDR by the PC application with the BACnet router, the discovery process occurs using port 47809, which the BBMD BACnet router forwards to the local subnet on port 47808, getting responses on the same default port and routing the responses back to the PC on port 47809. The BBMD device has the IP address of 2.3.4.5 setup as the Public IP address and the PC also has to direct all the communication to this IP address of 2.3.4.5 instead of the actual subnet of 192.168.2.0/24.

## BACnet Communication Across VPN Bridges

Setting up Port Forwarding in the firewall, configuring Public IP address on the BBMD device and setting up the BACnet/IP devices for the correct UDP ports can be confusing. What if you could access the BACnet system remotely and securely as if the PC running your software was part of the local subnet? IP routers can provide a feature called Virtual Private Networks (VPNs) allowing you to connect two separate networks securely over the internet. There are multiple VPN options available but Virtual Private Networks (VPNs) can be setup for bridge mode for secure remote access and easy BACnet Broadcast Message traversal. Ethernet Bridges work on Layer 2 of the OSI layer and transparently pass messages, including broadcast messages. Once broadcast messages can be passed, there is no need for setting up BBMDs, FDRs or multiple BACnet UDP ports. There may be need to setup Port Forwarding if the VPN routers are behind a firewall but no additional setting is required. VPNs are also secure since they are based on the Transport Layer Security (TLS) protocol where the data is encrypted.

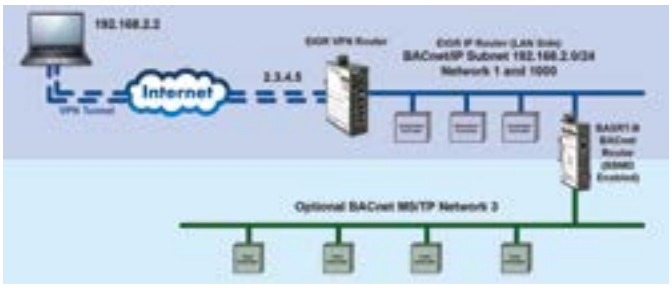



Figure3: Remote Access to BACnet Network using VPN Bridge
© Contemporary Controls

VPN bridges can be setup between two VPN routers. This can be used to connect two subnets in two separate buildings across the internet. BACnet/IP communication can occur without additional setup for BBMD or FDR. The IP addresses on the LAN subnets of the VPN routers are on the same subnet but are segmented to avoid any overlapping. This can be a permanent setup to connect two remote buildings securely. VPN bridges can also be setup where one IP router runs as the server and a PC can run as the VPN client. Once the VPN connection is established, the VPN router assigns the PC an IP addresses belonging to its LAN subnet. This is the same subnet where all the other BACnet/IP devices exists. The VPN client PC then communicates over the VPN bridge interface and all the communication occurs transparently. This setup can be used for remote diagnostics when a need arises for troubleshooting. The VPN bridge can also provide an option where different PCs can connect simultaneously or one at a time. This can be useful in a scenario where a technician performs a maintenance task and then an engineer can verify it, each logging to the device remotely without having to drive to the actual site.

In the setup shown in Figure 3, a VPN router supporting bridging is used. The PC running the VPN client software connects to the VPN router establishing a secure VPN tunnel between the PC and the router. The PC is assigned an additional virtual interface with an IP address belonging to the 192.168.2.0/24 subnet, which is the same subnet as the existing BACnet network. Since all communication now occurs over the same subnet and VPN bridges pass all traffic through them, it greatly simplifies the setup by eliminating the use of BBMD.

The cost of IP infrastructure devices like IP routers that provide VPN capabilities has come down significantly and is not a limiting factor anymore. All the advances in the IT field lend itself well to protocols based on IP, like BACnet/IP. VPN bridges can be used to speed up commissioning and save on equipment cost. A PC running a workstation or specific BACnet application can be setup to connect to different sites as required to perform maintenance, thereby getting rid of the need to setup dedicated equipment. VPNs have the added advantage of encrypted communication and easily restricting remote access to authorized personnel. With the increasing demand for remote access, using VPN bridges with BACnet provide the secure solution.

© Parmar

**Harpartap Parmar**
Senior Product Manager | Contemporary Controls
hparmar@ccontrols.com | www.ccontrols.com

### ABOUT THE AUTHOR

Harpartap Parmar is a Senior Product Manager at Contemporary Controls, which designs and manufactures BACnet building controls and networking equipment. Harpartap focuses on industrial automation, information security and IP routers. He has more than 17 years of experience at Contemporary Controls developing and testing a range of networking, control and communication products.

# Cyber Security for BACnet Systems

For today's building automation systems, BACnet-based or not, cyber security should always be a concern. You should take the same precautions for building systems that you would for all of your other valuable assets that you want to keep safe and secure.

## Securing Today's BACnet Systems

The BACnet network security published in 2010 as Clause 24 of the BACnet Standard was never substantially available in the market place. While there were implementations developed to verify the concepts there were only a few, niche products publicly offered supporting Clause 24.

So how do you properly secure the network over which BACnet is running? This is more than just protecting the communication while in transit; it is also about securing the access points of the system. The Ethernet wall jack in the cafeteria should not allow a connection to the BACnet system on campus. The two keys to security of BACnet systems today are network separation and access control.

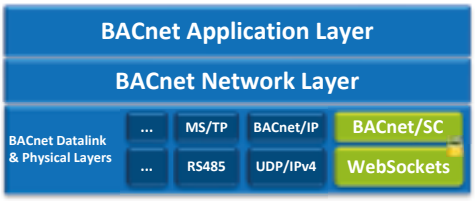



Figure 1: BACnet Secure Connect

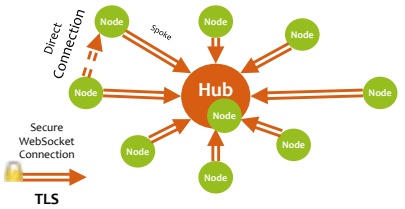
The current typical practice for securing BACnet/IP and BACnet/IPv6 networks is through virtual separation. Various technologies out of the IP world are used for virtually separating the IP networks and LANs for BACnet. Standard IP networking equipment may be used in cases where particular Virtual Private Network (VPN) or Virtual LAN (VLAN) technologies are not inherently supported by the BACnet/IP devices. Firewalls can be used to control access to external network devices, such as PCs on the office network.

For other BACnet datalink options, such as BACnet/MSTP, again, physical separation is providing the security. However, there may be network segments with devices exposed to the public space where physical MSTP connectivity may be possible with low efforts, yet some special equipment would still be required. For isolating such exposed networks, BACnet network products, such as advanced BACnet routers or BACnet application proxies with firewall functions can provide the required separation of the exposed BACnet network.

Access to the BACnet system may also be provided through a web services server, which may implement all sorts of security measures, including HTTPS and authorization schemes. BACnet includes the standardized RESTful web services interface in Annex W that has both network security and authorization concepts based on TLS and OAuth2.0, which may be used for this purpose.

In the most extreme case, only user interfaces are exposed to the outside of the BACnet system, such as web pages that are served by a web server which is controlling access to the BACnet system.

Far more details about how to do such separation and access control can be found in an article written by Carl Neilson, past-Chair of the BACnet Committee, in ASHRAE Journal's BACnet Today supplement of November 2013.




© BACnet International

## BACnet Secure Connect

With the increase of requirements on convergence and coexistence in IT managed IP networks, along with supporting banking grade cyber security to address upcoming regulations and threats, the BACnet committee developed BACnet Secure Connect, or BACnet/SC. This is a new data link layer option in the BACnet stack that maintains compatibility with BACnet devices on any of the other current and future datalink options.

This new datalink option makes use of secure WebSockets in a virtual hub-and-spoke model. (See Figure 1) The WebSockets protocol is an Internet standard (RFC 6455) and very common in today's web applications. As WebSockets can be secured with Transport Layer Security (TLS), and with BACnet/SC requiring the use of secure WebSockets with TLS version 1.2 at a minimum at all times, strong cyber security protection is possible. The strength of this protection is similar to what you have when accessing your e-banking account or using your favorite chat app through the Internet.

With BACnet/SC using TLS for secure WebSockets, the means for cyber security is in place. This also means that there can now be control over access to the system. This includes managing keys and privileges over the entire life-cycle of the system.

It may well have been that when Clause 24 was released, the building automation industry was just not ready to adopt it. It would have meant learning a whole new technology domain for most organizations to become capable of managing cyber security. Now, however, the BACnet/SC will be the platform for cyber security in BACnet devices and there is no way around it. Cyber security will be implemented at the system level, rather than within some limited set of devices, so it will have to be managed at the system level. However, manufacturers and vendors will need to design services, products and tools enabling non-IT experts to manage the cyber security components, but to be effective designers will have to keep the complexity under the

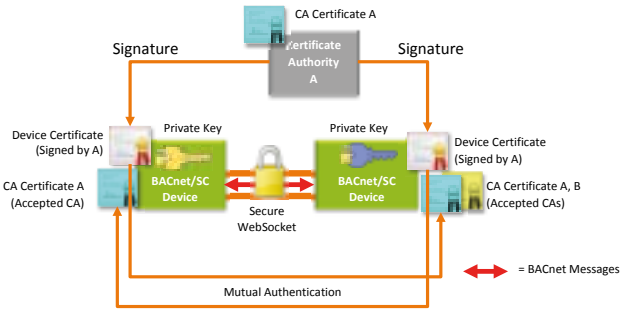



Figure 2: BACnet/SC Device Configuration for Secure WebSockets
© BACnet International

hood. Before reviewing some aspects of managing the security for the BACnet/SC networks, a more detailed look at the required configuration and infrastructure is helpful.

## Security Infrastructure and Configuration

TLS uses a standard Public Key Infrastructure (PKI) supporting asymmetric public and private keys, X.509 public key certificates, and signing Certificate Authorities (CAs). IT departments often have such infrastructure already in place for managing their servers and client computers. Along with infrastructure, the proper certificates and keys for TLS are also required.

As with any other communication that is based on TLS, a BACnet/SC device will require the following configuration:

- an X.509 public key device certificate signed by one of the accepted CAs,
- a corresponding unique and secret private key for the device, and
- one or more CA certificates of accepted CAs used for authenticating the device certificates of WebSocket connection peers.

The set of these elements is collectively called credentials. For a WebSocket peer to be accepted, the peer's device certificate must be signed by one of the CAs for which a CA certificate is configured locally. With the operational credentials, this authentication check is performed mutually by each peer. (See Figure 2)

In order to support the workflows and keep the communication secure at all times, BACnet/SC relies on two kinds of credentials. The manufacturer credentials (left in Figure 3) are configured by the manufacturer at production and are used to establish BACnet/SC connectivity with devices fresh from the factory, or those that have been factory reset, and so are in factory default condition. The operational credentials (right in Figure 3) are configured for the installation, and are used in the operative phase when a device is configured as part of a BACnet system connected through BACnet/SC.

The Manufacturer CA is used to sign the manufacturer credentials, which are configured into the devices at the factory. When configuring »

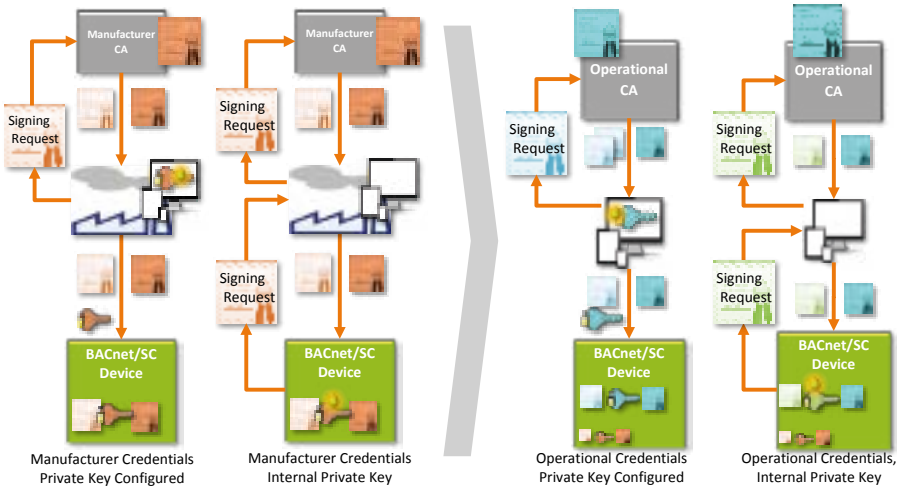



Figure 3: Configuration Flows

a device for an installation, an Operational CA designated for that installation is used to sign the operational credentials for the devices. The installation tools will generate certificate signing requests to the CA and then configure the operational credentials into the devices. For both kinds of credentials, if the device is generating the key pair by itself, and the private key is internal and never leaving the device, the device must support a Certificate Signing Request (CSR). This occurs so the tool or agent can pick it up and the CA can sign the device certificate whose public key now matches the internally generated and secret private key.

## Beyond the Public Key Infrastructure

Even though BACnet/SC is used for securing the BACnet system and the required CA and tools are in place, both of which are required, this is not the entire cyber security solution. Managing this process securely is critical and it has an impact on many organizational aspects, both for manufacturers and for installations. The entire life cycle of an installed BACnet system must be considered, including all entities that may interact with the system and its parts over that time. You want to keep control over the keys to your BACnet system at all times. This organizational part of the security solution is perhaps more complex and demanding than just implementing the required TLS technology into the products.

## Security Support by Manufacturers

From a manufacturer's perspective, there are a number of activities that are required in order to continuously communicate securely with the BACnet/SC devices, starting after the devices have been produced. Obviously, the manufacturers are implementing the required TLS and BACnet/SC functionality into devices. For securely connecting with the device over BACnet/SC when in factory defaults mode, the manufacturers are imprinting the manufacturer credentials into their products before they leave the factory.

Also, for continued support of security, manufacturers should include some means to update the device's software or firmware while it is installed. Being capable of updating software is good practice in general, but now that BACnet/SC includes TLS and can support strong IT security, it is an even more important feature.

## Managing Security for an Installed BACnet System

Every device that is part of a BACnet/SC network in operational security configuration requires the operational credentials. Engineering tools or automated agents will be used for creating, signing and configuring the operational credentials into devices.

The CAs to be used for the system must be determined and activated so that they support signing the device certificates for the devices. These CAs may support online signing services and therefore should support standard certificate management protocols from the IT world for certificate signing requests. This helps the interoperable and independent setup of operational credentials by engineering tools and agents.

The interoperable configuration of the operational credentials in BACnet/SC devices will be fully supported through respective BACnet/SC and WebSocket configuration properties of the Network Port object. This includes the presentation of certificate signing requests matching the internal private key if the keys are generated by the device.

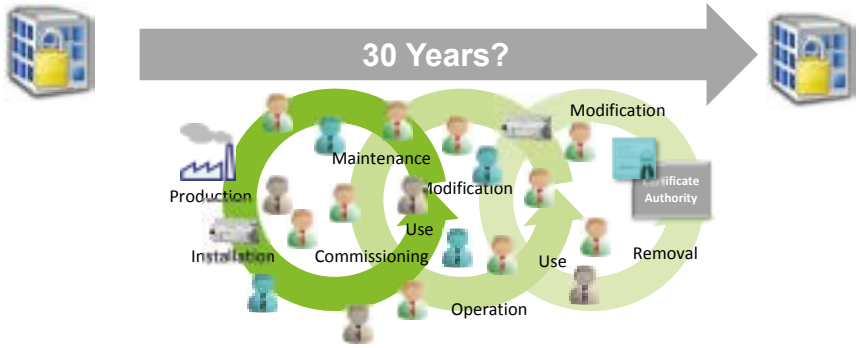



Figure 4: Life Cycle Aspects © BACnet International

## Organizational Aspects

In order to engineer, build, install, commission, maintain, operate and do all the other tasks of a BACnet installation, or use all its features, many parties are involved. Each of these parties will need some access to the BACnet system over time, especially when you consider the entire life cycle of a building automation system. Which can easily be 30 years and more. (See Figure 4)

The CA services being used for the BACnet system need to be available over time. If possible, you should be able to create and sign certificates at any time. Any sort of device certificate updates must be possible at almost all times as well.

All persons interacting with the system and connecting to the network, along with their tools, are required to be granted some access to the system. New devices, replacements and removals need to be considered. There are a lot of questions to be answered. Who is determining and granting access? Who is controlling the CAs in order to only sign particular devices' certificates granting them access to the system? Who is supervising CA services designated for the system? And, there are many other questions!

We are moving into a new era in building automation. Not only is there convergence with the IT world, but we are also starting to share the ubiquitous and global IP networks and thus need strong cyber security. This also comes with a requirement for managing the keys. It will help if you have a plan regarding the cyber security setup of the BACnet system, including all operational aspects, and with a system lifecycle perspective.

**ABOUT THE AUTHOR**

Bernhard Isler is an ASHRAE member and chairman of the ASHRAE SSPC 135 BACnet Committee. He works for Siemens Switzerland Ltd., Building Technologies Division, located in Zug, Switzerland, bernhard.isler@siemens.com

© Isler

SIEMENS

**Bernhard Isler**
Building Technologies Division | Siemens Switzerland Ltd
bernhard.isler@siemens.com | www.siemens.com

# BACnet and the IoT

The Internet of Things (IoT) is the buzz today in both the home and building automation sectors. But what exactly does IoT mean? It depends on who you are asking. Some immediately think this is all about how to connect physical things to the Internet, and ultimately to controls and other services hosted in the cloud and accessible through web browsers and apps. This is illustrated on the left in Figure 1. This cloud-centric view of IoT is typically presented by cloud services companies. In this view, the controls functionality is hosted in the cloud and interaction between devices is thus through the cloud. Those that are very familiar with building automation systems for commercial buildings may envision IoT helping things get connected to a common and shared IP network infrastructure, and letting them interact with each other directly as illustrated on the right in Figure 1. And, of course, this includes optional cloud services used for non-critical functionality, such as remote access, data propagation, analytics applications, user interfaces and foreign applications access.

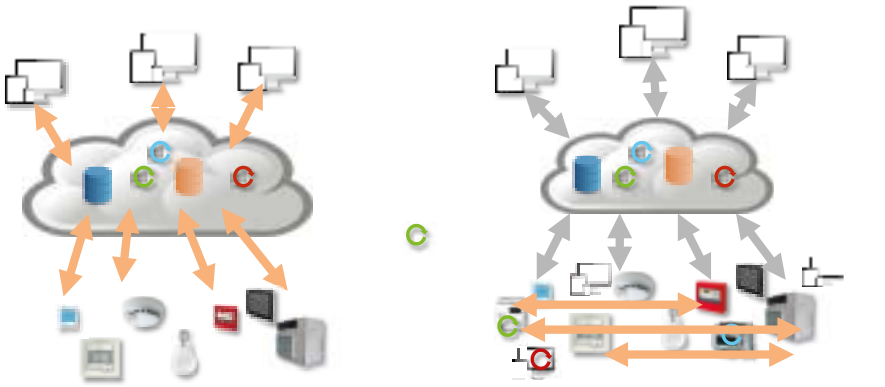


Figure 1: IoT Topologies



To increase the confusion, there is a myriad of organizations, consortia and companies that come up with their own IoT solutions and specifications. Most of those solutions are typically designed with the home and residential market in mind. What seems common to them is that they are all using almost the same underlying technologies and so are interoperable to some protocol level, e.g. up to the exchange of JavaScript Object Notation (JSON) serialized data, and accessible in a Representational State Transfer (REST) style across HTTP(S). When it comes to application concept representations and application data modeling, the solutions are non-interoperable so gateway functions are required for integration. While this might work in smaller systems with a single point of integration, like a cloud service or a smart speaker, it can create reliability issues. In addition, it will definitely not be easy to manage all the gateway functions in larger installations, such as in commercial buildings. And, it makes overarching applications and device to device direct interactions difficult.

While IP technologies are becoming a ubiquitous networking model throughout consumer and commercial systems, today's consumer IoT world is something of a "reset" in terms of interoperability at the application level. Like commercial building systems 20 years ago, many of today's IoT consumer solutions use proprietary approaches which lock-in owners to a particular supplier's platform. As a result, solutions may be limited and there may not be an open market with a broad and competitive offering. The many automation protocols, both standard and proprietary, that were in the commercial building automation market in the 1980's and 1990's have given way to a few standard protocols that have been broadly adopted. This has enabled a dependable and open eco-system that in turn has created a competitive market place and broad offerings.

## The IoT for Building Automation

It is very clear that building automation systems support and use all sorts of cloud services for accessing and working with building data and the building automation system. However, building automation systems will keep using direct communication between the devices, with no agent or service in the cloud or smart speaker making the bridge. Direct communication is particularly needed in commercial buildings and at large scale. While HVAC control might not be very sensitive to latency and availability, lighting can have large amounts of luminaires that need to go on or off all together within a few ten milliseconds. Other application domains are too time critical or constrained by regulation to allow a dependence on the Internet or some cloud service. Instead, these domains will continue to require local control. They need to have direct and reliable connectivity to sensors and direct control over actuators. And, since the IP infrastructure may be shared, cyber security becomes a very important aspect in building automation communication.

So the question is, does the consumer IoT world have a solution to these domain needs? Many of the existing IoT approaches are designed to serve the needs of the consumer and residential markets. The needs of commercial building applications are not specifically addressed and not well supported, at least not yet. Various consortia are now working on technologies and standards to support scaling and direct communication of such applications. In the technology stack, there is still work going on at IETF and other groups to come up with robust cyber security that also covers group communication. These features will be required to make the technology stack ready for commercial building automation. Overall, there seems to be some convergence to two IP technology stacks, one for the constrained devices and networks based on CoAP, and one for non-constrained devices and networks based on HTTP, both covering up to and including access methods and data serializations, as illustrated in Figure 2.

However, the application level of such communication is an important element and addressed by most of the many IoT players in a way that it becomes very specific to them. The application level normally specifies the basic data model, the application models, the services, and also the descriptive data concepts used to represent the building and the automation system digitally. Specifying these aspects individually is creating interoperability issues when integration into an overall multi-vendor system is required.

So for direct interaction, is every device required to know and understand a multitude of models and how to access them? At first glance it would be a "Yes". But here, the converged technology stacks come to the rescue. Modern IoT implementations follow the Representational State Transfer (REST) principles. In this approach, there is only an opaque address, usually a Universal Resource Identifier (URI), needed to address some data value. The URI complexity is irrelevant as is the complexity of the data model and structure where the value exactly exists.

While interoperability would be maximized by having a single standardized and comprehensive ontology and one model for all building automation domains used in all products, systems, installations, and applications globally, it will never be the reality. So it will be important that products and systems support and can cope with multiple ontologies. For the reduction of the number of ontologies needed, ASHRAE's BACnet committee, together with Project Haystack and the Brick Schema organizations, has started work on the new proposed ASHRAE standard 223P for the designation of semantic tags for building data.

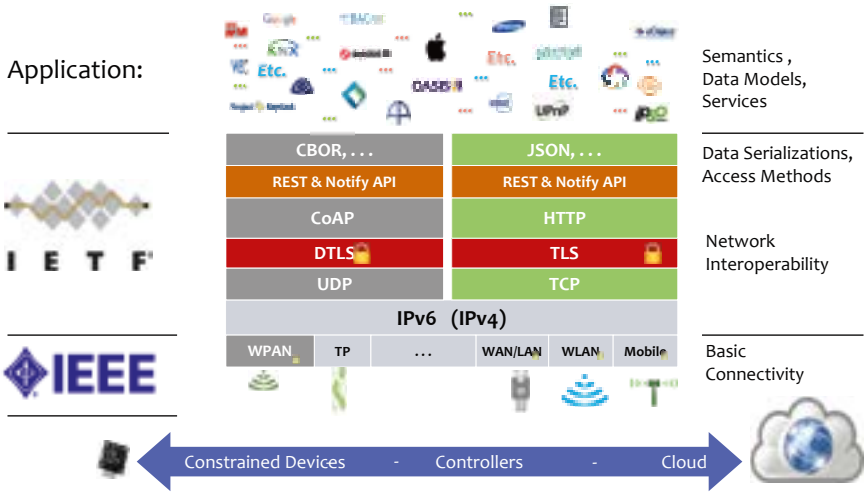



Fig 2: Typical IoT Technology Stacks © BACnet International

The work lays in setting up the URIs addressing the data. For doing this setup, the availability of machine-readable descriptions for the data, describing the application models, structure and semantics of the data, is central. Software can do the discovery and identification for determining these URIs based on such descriptions. Devices may contain this functionality themselves, but for small devices such determinations may be offloaded to a tool or agent that configures the small device with the URIs that it will use to access data in other devices.

Thus, interoperability will depend on understanding the descriptive information, which can now include semantic tags and ontologies. On this level, some consortia pull towards the use of the Resource Description Framework (RDF) based ontology representations. But even on this technological base, a multitude of domain ontologies already exist, or are in development. And each is representing some view and abstraction of the concepts relevant in building automation. Fortunately, there are mechanisms in RDF allowing ontologies to be bridged and be related to each other so that machines can derive concepts they know. These bridging ontologies will help machines become capable of achieving common understanding and interoperability among different ontologies.

## BACnet and the IoT

As it is interesting to see how the IoT technologies are evolving towards being usable for the commercial building applications, there are a number of issues that still require solutions. BACnet is the currently available solution for commercial building applications. And, BACnet includes a semantic model at the application level that got extended and refined over the years, and has proven to be useful. The recent developments of the BACnet standard added even more descriptive capabilities through standardized device description formats and semantic tags on objects and relations.

So what is the future of BACnet in the context of the IoT? This question deserves a more detailed discussion. BACnet as we know it today, serves as the core of commercial building automation. As it gets developed further, it will continue to serve as the core far into the future. There is a robust eco-system around it, and the offered solutions are broad and comprehensive, including a certification program that rigorously tests conformance. Generic connectivity solutions for BACnet systems to cloud services, including standard BACnet RESTful web service interface implementations on JSON and HTTP, are available in the market.

However, there will be demand for support of the constrained environment IoT technologies in building automation. In the non-constrained environment, the demand for web services' access to building automation systems drove the development of the BACnet RESTful Web Services (in Annex W of the BACnet standard), including a standardized and lossless representation of BACnet devices and objects. So there is already a standardized way for accessing BACnet through the non-constrained IoT technology stack. For connection with, and support of, the constrained environment IoT technology stack, a standard BACnet RESTful web services API based on CBOR and CoAP will be needed, including a standardized representation of BACnet devices and objects.

In both IoT technology stacks, the application model of BACnet, on which the major part of investments in implementing and applying BACnet are made, will remain a valid application model. Standardizing the representation of the BACnet application model in the constrained IoT technology stack will preserve these investments, and will enable a seamless and smooth path forward into utilization and support of the constrained environment IoT technology stack. This will complement BACnet for the IoT, by supporting small device direct connectivity and ensure interoperability among devices and services in IoT environments and with installed BACnet systems.

**ABOUT THE AUTHOR**

Bernhard Isler is an ASHRAE member and chairman of the ASHRAE SSPC 135 BACnet Committee. He works for Siemens Switzerland Ltd., Building Technologies Division, located in Zug, Switzerland, bernhard.isler@siemens.com

© Isler

SIEMENS

**Bernhard Isler**
Building Technologies Division | Siemens Switzerland Ltd
bernhard.isler@siemens.com | www.siemens.com

# Smart VFDs for a Smart BACnet Network

A building automation system (BAS) is only as smart as the devices that are connected to it. It should come as no surprise that when providing comfort in a building, a variable frequency drive, or VFD, has kept pace. This comes in the form of connecting to a BACnet network and providing the plethora of information that it contains over the network. Whether the information is transferred over an Ethernet connection, BACnet/IP, or serially, BACnet MSTP, it can be easily passed along.

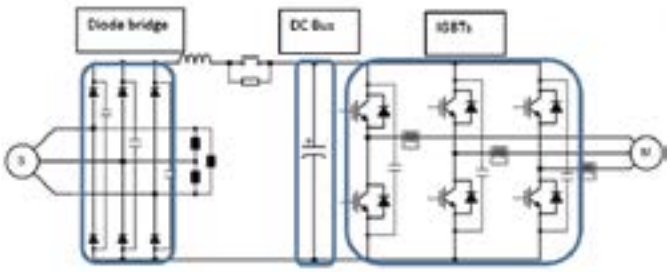
Yaskawa Z1000 VFD ©Yaskawa

At its core, a VFD provides the ability to adjust the speed of a motor, resulting in the ability to vary the speed of the fan that is attached to the motor. When compared to the older traditional methods of air flow regulation, e.g. dampers, a VFD can provide more energy savings. The keys to its energy savings capability revolve around its topology and ability to take advantage of the affinity curves for fans.

A VFD is constructed of three main parts – 1) input diode bridge, or sometimes referred to as a converter, 2) DC bus, and 3) output IGBTs (insulated gate bipolar transistors) or sometimes referred to as inverters. The diode bridge takes the incoming AC voltage and rectifies, or converts, it into DC. The rectified DC voltage from the diode bridge charges up the capacitors that make up the DC bus and stages it for the IGBTs. Through pulse-width modulation, PWM, the IGBTs create a simulate AC waveform to the motor, or inverting the DC back to AC. This construction and power flow gives a VFD the motor control capability to vary the speed motor and take full advantage of the affinity curves. What this ultimately means is that when operating at a reduced fan speed less power is required from the utility, e.g. 50% fan speed equals 12.5% power.

With the interoperability nature of BACnet, many VFDs with BACnet capability can easily become part of an existing or new BACnet network. VFDs provide information through various different objects that they support. The most common object types that a VFD supports that supply valuable information are analog output, analog value, binary output, and binary value. But, in addition to being able to provide information, a VFD can also be controlled over a BACnet network through the use of an analog input, analog value, binary input, and binary value object types. The wonderful part about BACnet is that the supported objects have properties that can be read over the network and help define the data point that is being read back. Take AV2, analog value 2, as an example. Without being able to look up what this represents in the correct reference, AV2 would mean nothing. However, using the ReadProperty service in BACnet, you can get descriptive information that would define AV2. In this example, it would let you know that AV2 is a Frequency Command that has a resolution of X.XX in Hz. This capability of BACnet cannot only help with determining what objects and information a VFD can provide, but help ease the integration of the VFD into a BACnet network by eliminating the need to cross reference a manual and determine the information.

One thing to remember is that even though a VFD can provide a plethora of information over BACnet, a VFD is still only a cog in the machine called a building automation system. There are many other cogs like occupancy sensors, lights, temperature sensors, and access card readers that make up this machine. Using BACnet as the backbone to obtain information and send commands to devices that make up the machine provides the foundation for a very well run machine. The coordination could provide the right amount of comfort at the right time. You can reduce energy usage by not regulating an unoccupied area to comfortable level. Or you can predictively prepare a currently unoccupied space based on various sensor inputs. The possibilities are endless; it's all a matter of taking advantage of the devices that are wired onto a BACnet network.




VFD topology ©Yaskawa

**ABOUT THE AUTHOR**

Edward Tom started from the ground up with his career. After graduating, he began as a field engineer getting his feet wet before moving on to become an application engineer and applying his degree with what he had learned in the field. This has provided him the ability to be an effective product manager at one of the largest VFD manufacturers in the world.

© Tom

**Edward Tom**
Product Manager, Drives | Yaskawa America, Inc.
edward_tom@yaskawa.com | www.yaskawa.com

# Is My Building Smart?

If you look online for the definition of a Smart Building, you'll probably walk away with more questions than answers. Definitions are loose and they frequently differ from each other. Some criteria are common. A smart building should be interconnected. Systems should work together to deliver operational information to the building's occupants and building managers. Efficiency is often mentioned, but none of the definitions are overtly tangible. At what point is my building smart? Are there buildings that are automated that aren't smart? Is every label for smart building self-defined with its own set of standards and guidelines?

One point seems to occur in most definitions, though. The systems that inform or improve occupant experience need to work together. Even if you're not chasing definitions such as smart building, you can still pursue better operational efficiency, reduced energy costs or a better experience for the people in your building. Members of the Building Automation System (BAS) industry have worked on all of these criteria for years. We create buildings with better temperature accuracy and better energy reporting efficiency. But lately, we've been pushing the boundaries of what our BAS can do. We incorporate more data than we ever have in the past. We're doing that by integrating more equipment and more systems.

System integration isn't a new concept. We've been pulling lighting, access and HVAC together into systems that administrators can operate from a single seat or through a single piece of software for quite some time. The issue is that system integration is often seen as a time consuming and costly process. Integration is quick and efficient when you're bringing devices together using the same network protocols. Protocols like BACnet were created expressly for this purpose. But what happens when we want to take an automated building and create a smart building? What do we do when we see more integration opportunities in buildings that can lead to even more energy savings or a better occupant experience but those devices aren't on our common protocols?

System level integration using gateways has been the answer for quite some time. Gateways convert the data from one protocol to another. These gateways need to be powerful and they take a significant amount of effort to develop, leading to a high per unit cost. Once you've factored that cost into your project you then need to allocate time to map over points from each device on the network. Each device from a network contains multiple data points. Each one of those points that need to be accessed must be mapped from its network onto the gateway. Then the main system needs to access the data from the gateway. If you need to issue commands across networks rather than just read information, then more point mapping needs to be done. All this leads to a costly amount of engineering time. This means that only the clients that can afford the cost, take advantage of the integration opportunities offered by these devices. For many clients, this cost is prohibitive. The opportunities to save on energy use and operating costs are lost.

Sensor hub, © Delta Controls

As technology develops, integration is shifting from a top-down approach. For some facilities chasing the smart building concept, the answer is smaller gateways intended to integrate devices directly without another network or gateway in between. This is done via room integration using micro-gateways. For example, if a hotel wants the access and lighting for each room integrated into their HVAC system, they may need to employ large gateways. This retrofit will be expensive using system integration. With room integration, a micro-gateway connects directly to door contacts, locks and light switches. This can even be achieved wirelessly. It's as simple as adding a device directly to the original network. The workload of the integration is all but eliminated and because of the reduced cost, more options are available to the building owner.

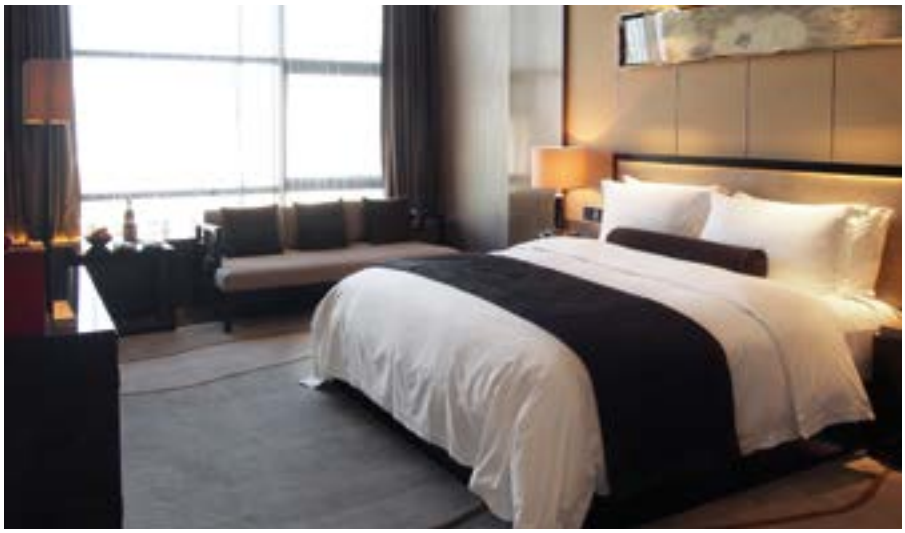
There are times when system-level integration can be economical. For large groups of energy sensors or gas detection sensors, it may be easy to add the device information. In these cases, system integration is less complex. The devices are uniform and the data only needs to run one direction. When devices are diverse or information needs to flow both ways, system integration is less attractive. So what type of integration should you use? The answer for many facilities is leveraging both types of integration.

So if you agree that a smart building is an integrated building, you need to think about integration happening on multiple levels of your system. When integration becomes simple and cost-effective, more building operators can take advantage of the benefits. Although, this hasn't led to a firm definition of smart buildings. The definition eludes us because we're always chasing more. In the example of the hotel, when a guest uses their access card to enter the room, the access request is instantly passed to the main system. The main system sends the command to turn on the entry light for the guest and the HVAC system comes on to keep the guest comfortable. But what if the needs of an occupant in the space are more complex?

For example, a meeting room or boardroom simply needs to be a comfortable, well-lit environment for people to share thoughts and ideas but keeping the space well-lit is costly. If electronic blind control is integrated into the system, daylight can be used in place of electronic lighting. Light detection sensors can be added to determine when there is enough daylight for »

the space. This is fine for face to face meetings, but for presentations the light will interfere with televisions and projectors. What seemed like an intelligent room in a smart building starts to feel less impressive.

How do we create a better occupant experience? How does the building become smart? Integration creates opportunities for better environments, but the building needs to be able to know what occupants want to do in the space. What if you could dim the lights, close the blinds, cool the space and turn on the projector with one button press? Would we then be closer to the definition of a smart building? As an industry, we'll likely need to delve further to find a succinct definition. But with multiple levels of integration, buildings are looking smarter every day.



Hotel room





**Shane Murphy**
Delta Controls, Inc. | Marketing Manager
smurphy@deltacontrols.com | www.deltacontrols.com

Delta CONTROLS
A Delta Group Company

**ABOUT THE AUTHOR**

Working in the controls field for over 15 years, Shane Murphy works as the Marketing Manager for Delta Controls. Shane uses his years spent as a field technician and an engineer to bring value to his role in marketing. He oversees marketing for Delta Controls as well as producing video, digital and print media.

# The BIG-EU Looks Back on 20 Successful Years

For 20 years, the BACnet Interest Group Europe (BIG-EU) has been a cornerstone of building automation. Founded on May 14th, 1998, it looks back on 20 years of success. During this time, with its power of integration, it has gathered over 130 members and has become the mouthpiece of providers, as well as planners, integrators and operators of open building management systems. The common standardization and dissemination of uniform device communication through the BACnet protocol (ISO 16484-5) was and still is a success that is second to none.

"The strong interest in BACnet has never subsided," reports BIG-EU President Klaus Wächter, Siemens Switzerland AG, "in fact, the demand for training continues to increase." This growing demand throughout Europe led to the founding of the BACnet Academy in 2009. From Birmingham to Warsaw, Stockholm to Madrid, the academy teaches the fundamentals of BACnet first-hand.

The BACnet Standard has achieved a global market share of over 60 percent, according to the latest analysis by the British research firm, BSRIA, which also forecasts further growth for the next five years. The BIG-EU and its 130 members, who come from 20 different European countries and North America, are promoters of this development. Following a wave of internationalization of its own direction, the BIG-EU has launched regional BACnet groups in France, Italy, the Netherlands, and Scandinavia. It has also supported the BACnet application in Asia with BACnet conferences in Beijing, Shanghai and Hong Kong.

## Entry into Independence, Expandability, and Investment Security

A groundbreaking moment for the use of BACnet in Europe was when the German Reichstag and government district were outfitted with interoperable building technology. As numerous as the participating manufacturers were, the device communication was uniform thanks to BACnet. This made the planners, integrators and building operators sit up and take notice. After the time of proprietary systems, BACnet signaled to them the entry into independence, expandability, and investment security.

The BIG-EU founded a joint working group with the AMEV, the working group for mechanical engineering and electrical engineering of state and local administrations, which is now part of the Federal Environment Ministry. Their objective is to provide neutral public information on the use of BACnet in administrative and educational buildings as well as cultural institutions. The BACnet recommendation of the AMEV appeared in 2017 in its second edition.

A BACnet forum of the BIG-EU in Berlin also triggered engagement between BACnet and the Austrian army. The Military Real Estate Management Center initiated its own BACnet conference on secure and interoperable building automation in shared properties. The BIG-EU was also asked for support from Switzerland. Again it was about neutral information for state building planners and operators. In 2017, the 88-page "Recommendations for BACnet application" of the Swiss Confederation was published. The publisher was the KBOB, the coordination conference of the construction and real estate bodies of the public builders of Switzerland.

"As an organization, the BIG-EU has become both a meeting place for building automation specialists and an information forum," stated Wächter. Summarizing the association's history he said, "operators are increasingly choosing to become a member of the BIG-EU." It is they who particularly benefit from the open exchange. Strabag, Fraport AG, Deutsche Bundesbank are all companies that have already decided on a membership in the BIG-EU.

© BIG-EU

At the Deutsche Bundesbank in Frankfurt, representatives of the BIG-EU and the working group for mechanical and electrical engineering of state and municipal administrations (AMEV) met. From the joint working group "BACnet in German-speaking markets", the BACnet recommendations for public buildings were created.

# BACnet Interest Group – China and Asia Upcoming Events

The BACnet Interest Group – China and Asia (BIG-CA) is currently planning two events: Plugfest and Golden Week.

The Plugfest event will be June 11 – 13, 2018 at ITEI's new lab in Yi Zhuang Jing Economic Develop Zone Beijing, China where vendors can bring their BACnet devices together for testing. There will also be a presentation by Bernhard Isler, Chair of the ASHRAE SSPC 135 Committee.

BIG-CA's Golden Week will be held November 12 – 15, 2018 at the Wuxi institute of Fudan University, in Wuxi, Jiangsu Province, China. The BACnet Golden Week is typically comprised of an international conference, developer training and a Plugfest event. Sponsors include BIG-CA, BACnet International, BACnet Interest Group – Europe, and Fudan University.

For more information about either of these events, please contact Natalie Nardone at natalie@bacnetinternational.org.

# Energy Efficient Solutions in the Argon Building

The complex building management system (BMS) of the Argon building in Gdansk was developed primarily on the basis of iSMA solutions proposed by Global Control 5 – a Polish producer of building automation equipment.

Argon building (387,500 sq.ft.), erected as part of the 3rd stage of Alchemia – a multi-purpose business complex located in Gdansk - was developed by Torus. Argon, delivered at the end of August last year, is currently recognized as an office showpiece of Gdansk. It has 14 above-ground stories with a total area of 409,000 sq. ft., of which 387,500 sq. ft. is intended for offices.

LEED® Platinum Certificate for Argon Business complex © GC 5

Argon received the highest LEED Platinum Certificate. It is the third "platinum" certificate for the Alchemia complex. In the final evaluation, the building scored 88, which ranks it 5th in the country and equal to a few other projects.


What does it mean in practice? All the materials used inside the Argon building have a VOC content (volatile organic compounds) that meets the LEED standard. Additionally, with the higher efficiency of mechanical ventilation and special filters, the air quality in the building is much higher than is required by Polish law. In more crowded rooms, $CO_2$ sensors (iSMA-B-LP-C) were installed. An employee can control the temperature in their surroundings and they can open a window as well. Systems implemented in the building allow a total of 45% reduction in non-drinking water use. Water efficient toilet and urinal equipment also contributes to the reduced use of water by at least 50%. The buildings façade provides high-level protection against heat energy loss thanks to materials with high thermal properties and a specially designed structure of aluminum profiles and accessories.

Numerous energy efficient solutions were implemented: energy efficient light fittings, presence sensors, efficient building equipment and systems, as well as an HVAC system. With the BMS system, meters and submeters, it is possible to monitor the current utility consumption and capture the "sources" of higher consumption of electricity, water or heat. As the building was under construction, the developers implemented an erosion and sedimentation plan to prevent the spread of pollution to the neighboring land plots, as well as an air quality management plan. Construction waste segregation allowed reusing more than 75% of waste.

The Argon building has been equipped with

- 1,200 iSMA-B-FCU-HL controllers for all the Fan Coil Unitsin the building, which are intended for maintaining room comfort
- 660 fully personalized iSMA-B-LP wall panels
- 2,200 iSMA-TE-DP temperature sensors for ongoing monitoring of room temperature
- 60 iSMA-B-AAC20 freely programmable DDC controllers for controlling various building systems
- 320 iSMA-B-MIX and iSMA-B-MINI distributed I/O modules for monitoring the HVAC, electrical, and lighting systems.

Argon contains 50,000 automation points, visualized and managed as a homogeneous system. The entire facility is managed by the Niagara 4 BMS software and 20 network controllers working in the Niagara 4 environment.

**Global Control 5**
gc5.pl

# Egyptian Museum Achieves Net Zero Carbon

It is 2018. A facility built in 1966 has just reached net zero carbon status and has done so without replacing the aged HVAC system or buying carbon credits. It took an owner with vision, two service providers, and BACnet control.

The Rosicrucian Egyptian Museum calls San Jose, California home. It sits on a larger campus belonging to The Rosicrucian Order, AMORC (Ancient Mystical Order Rosae Crucis). Today, the Museum displays over 4,000 artifacts and hosts more than 100,000 guests per year, including 26,000 school children.

The building itself is noteworthy in several respects. First, it was architecturally inspired by the Temple of Amon at Karnak. Second, it houses the largest collection of Egyptian artifacts on exhibit in western North America. Third, it has two stories of display space with an area of about 24,000 square feet.

## An Opportunity

However, it also hosted an inefficient HVAC system that required nearly constant maintenance and created continuous comfort issues. In fact, the system had so many refrigerant leaks that at least three dozen jugs of surplus refrigerant were kept onsite at all times.

Quotes to replace the aging system and ductwork were in excess of one million dollars. These proposals were nearly ready to go to permit when the owners consulted with Comfort International, Inc. (CI, www.comfortintl.com). According to CI president, Alan Pong, "Through our Efficient Energy Management Systems (EEMS) study we were able to find a solution that was over $700K less expensive and reduced their energy usage by over 48%."

This study revealed several areas where improvements could be made. For example, the audit found that the basic HVAC system could provide high quality service, surpassing even modern VAV Reheat efficiency, by upgrading its basic multi-zone layout to optimal variable flow zone control. Electrical consumption at the building was high because the existing HVAC system was too simple. Modernizing its design with variable speed fans, smart dampers, variable compressors, and digital open control programming, would bring about state-of-the art efficiency.

The Rosicrucian Egyptian Museum in San Jose, CA was architecturally inspired by the Temple of Amon at Karnak.

With updated BACnet control, the museum can now reliably protect the antiquities with proper temperature and humidity while saving energy.



The study also indicated the need for free cooling through greater use of cool, outside air. Variability could also be introduced in duct static pressure and airflow to accommodate the varying needs of the building.

## Working the Plan

The planned work then moved forward, including a new, highly variable refrigerant cooling system, better outside air usage, variable airflow, elimination of hot-cold mixing, and various optimization strategies and measures. Comfort International worked with another chosen service provider, Mynt Systems (http://myntsystems.com), who handled lighting and solar upgrades.

Better monitoring and alarming led to improved humidity control and boosted ventilation to adequate levels when occupancy demanded it. The facility is now able to hold proper temperature and humidity that provide for both visitor comfort and aid in the preservation of the ancient artifacts.

## Reaping the Rewards

Before the system upgrades, annual electric usage at the museum was at a moderate rate of 10.2 kWh per square foot. Now, annualized usage is around 5.2 kWh per square foot. In addition to these cost savings, the upgrade reduced $CO_2$ (greenhouse gas) emissions by about 58,400 pounds every year. That is equivalent to permanently removing five average cars from the road. Reduced consumption also allowed for a smaller solar array than was originally planned.

BACnet controllers and expansion I/O modules, from the Conquest line of KMC Controls, Inc., were used along with KMC actuators and third party wireless zone temperature sensors. The real magic occurred in the custom programming performed by Comfort International. The resulting control of the HVAC system is so incredibly efficient that ultra-low static pressures (typically under 0.10 inches of water column) are possible resulting in whisper quiet performance.

Julie Scott, Executive Director of the museum, remarked, “For years, experts told us it was not possible, with our historic buildings, to make Rosicrucian Park Net Zero Carbon. Together with Comfort International and Mynt Systems we did it!” Conveniently, these site improvements were made without disrupting normal operations for this popular, public museum.

While simple payback for the upgrades is long (about 15 years), the upgrades negated the need for the much costlier system change-out that had been planned. On this basis, the payback can be considered instantaneous.

BACnet control was provided by the Conquest line by KMC Controls, Inc. 

**Comfort International**
www.comfortintl.com

# New to the BACnet International Family

Member of BACnet International

BACnet International is the global organization that encourages the successful application of BACnet through interoperability testing, educational programs and promotional activities. BACnet International complements the work of other BACnet-related groups whose charters limit their commercial activities.

BACnet International community membership includes a who's who list of top tier companies and industry professionals involved in the design, manufacturing, installation, commissioning and maintenance of control and other equipment that use BACnet for communication.

We are proud to welcome the following new members to BACnet International.

## Silver Member

CREE

**Cree**

Cree is a market-leading innovator of lighting-class LEDs, LED lighting, and semiconductor solutions for wireless and power applications. It is uniquely positioned to innovate new ways in which lighting will serve as a platform for emerging technologies and capabilities that will enrich lives, improve society, and safeguard the planet.

4600 Silicon Drive
Durham, North Carolina, 27703
United States

HUBBELL Lighting

**Hubbell Lighting**

Hubbell Lighting is elevating the lighting experience. Empowered by lighting solutions that integrate seamlessly into their environment, save energy, provide improved quality of light, deliver return on investment and armed with Hubbell's unflinching support, its customers are able to think differently about how, where, and when they can use light. As one of the largest lighting fixture manufacturers in North America, it features a suite of brands that provide a full range of indoor and outdoor lighting products serving the commercial, industrial, institutional, and residential markets.

701 Millennium Blvd. (133.91 mi)
Greenville, South Carolina 29607
United States

KONE

**Kone**

As a global leader in the elevator and escalator industry, KONE provides elevators, escalators and automatic building doors, as well as solutions for maintenance and modernization, which add value to the life cycle of any building. Their products service the residential, office and retail, as well as public transportation and airport market segment. In addition, KONE serves hospitals, leisure centers, hotels and industrial properties.

Keilasatama 3
P.O. Box 7
02150 Espoo
Finland

Lenze

**Lenze**

Lenze specializes in developing motion control solutions that help their customers meet ambitious performance and productivity goals. Their complete line features ultra-efficient general-purpose inverters, an innovative amplifier servo line, sophisticated servo automation systems and robustly engineered gear motors and mechanical components.

Lenze solutions are used worldwide in many industries, including automotive, packaging, material handling and logistics, robotics, and commercial equipment (pumps/fans).

630 Douglas Street
Uxbridge, MA 01569
United States

MACURCO GAS DETECTION AERIONICS

**Aerionics (Macurco)**

Aerionics, Inc. manufactures the Macurco Gas Detection product lines. They strive to provide the highest quality gas detection, safety and security solutions to customers worldwide.

Celebrating 45 years of gas detection, the Macurco product line offers

equipment for residential, commercial and industrial applications. Since 1972 Macurco has been providing detection options for a number of different gases including carbon monoxide (CO), nitrogen dioxide ($NO_2$), hydrogen (H2), propane (LP) and methane (natural gas).

3601 North St. Paul Avenue
Sioux Falls, SD 57104
United States

Resource
Data Management

**Resource Data Management**
Resource Data Management is a global energy and building controls specialist, trusted by the world's leading retailers and blue chip companies to deliver sustainable control and remote monitoring solutions.
Taking a cohesive approach to energy management, their products deliver end-to-end solutions for the commercial, leisure, retail and public sectors that give users the ability to operate across open protocols and maximize existing control and monitoring assets.

80 Johnstone Avenue
Hillington Industrial Estate
G52 4NZ
Glasgow, UK

**Shanghai Sunfull Automation**
Shanghai Sunfull Automation is a leading manufacturer of protocol gateways, HMI, PLC and protocol transfer software in China. They focus on know providing the most competitive pricing and good quality with the best possible delivery time.

A466, N.O. 2588
Jinhai Road
Pudong, Shanghai 201209
China

**Swegon**
Swegon is a leader in the application engineering, design and supply of commercial indoor climate and ventilation solutions. They focus on creating comfortable indoor environments by providing their customers with complete, energy-efficient HVAC solutions. By focusing on system design, rather than product features, they provide the ultimate value to their customers by acting as an extension of their design team.

JA Wettergrens gata 7
SE-421 30 Västra Frölunda
Sweden

# Member News

Member of BACnet International

BACnet International would like to congratulate the following companies on their strengthened commitment to the BACnet protocol and increasing involvement in the BACnet community. As part of these actions they have moved their membership to the Gold tier. We thank them for their continued support and look forward to many more years of collaboration.

## Silver to Gold

ONICON
FLOW AND ENERGY MEASUREMENT

**Onicon**
ONICON designs and manufactures a full line of highly accurate flow meters and energy measurement systems. Their wide range of products includes turbine, vortex, electromagnetic, thermal mass, and clamp-on ultrasonic meters as well as BTU meters and display modules.

As a worldwide leader in HVAC flow and energy measurement solutions, their engineered solutions are specifically tailored to their customers' unique needs. Every product is individually wet-calibrated, and all products are delivered fully programmed for their customers' applications and ready to use right out of the box. This attention to detail simplifies installation and maximizes performance.

11451 Belcher Road South
Largo, FL 33773
United States

QUANTUM AUTOMATION

**Quantum Automation**
Quantum Automation is a networking and controls distributor comprised of talented Electrical and Mechanical Engineers dedicated to understanding and delivering exactly what customers need. Founded in 1991, Quantum Automation is the largest of four Value Added Resellers for AutomationDirect in America. They are also the largest distributor of Moxa networking products in America.

They have been recognized for outstanding customer service, quality products, hands-on training, competitive prices, and over 50,000 part numbers to choose from.

18 Kaki Bukit Road 3 #4-1/2/3
Entrepreneur Business Centre
Singapore 415978

# Network Controls Implementation – from a Facility Manager's Perspective

With more and more HVAC, lighting, fire alarm, metering and other equipment now coming with BACnet objects and services on board, it is becoming increasingly common for new construction and renovations to have Networked Controls incorporated into the design and specifications. In the past, these devices either used hard-wired or aux contacts to provide start/stop control and provide a common alarm. With Networked Controls, devices can be controlled over the BACnet network, allowing for a wide range of alarm and status points that can precisely report problems with a device. Hard-wired control and monitoring can still be done for safety reasons; however, it is not mandatory. When implemented properly, a BACnet-based building automation system (BAS) can be an effective tool for increased energy conservation, comfort of the occupants, and overall sustainability of a building.

The design intent of the BACnet-based Networked Controls model is expressed in the specifications and implemented during procurement, construction and commissioning. Once the job is completed, the operation and maintenance of the BAS is handed over to the Facility Manager (FM); therefore, it is critical that the FM maintains involvement throughout the design and construction process in order to ensure the system meets his requirements.

Historically, the FM has not been involved throughout the design, procurement, construction and commissioning process, resulting in systems that don't meet FM needs. In order to ensure that his operational requirements are met, he must work closely with key project team members. A close coordination effort with the Construction Manager (CM), who is responsible for designing and building the project, is required. In addition, since many Networked Controls devices use BACnet/IP, the FM must work closely with the IT department both during construction and long before the building is handed over to the owner. Likewise, with the advent of real-time pricing and greater interaction with utilities (the SmartGrid), the FM should work closely with the Utility Manager (UM) throughout the design process to ensure utility requirements are incorporated. This will allow the UM and the FM to optimize utility costs. By instilling a collaborative environment with key project team members through the design and construction process, the FM will have a better understanding of the system and a stronger support system during the operational stage of the building life.

BACnet International has created a course, titled The Facility Manager's Guide to Building Automation Systems, designed specifically for FM, CM and UM staff to help them understand how they can play a role throughout the procurement, construction and commissioning process of a Networked Controls implementation. The goal of the course is to enable the FM to operate the system in a way that maximizes benefits for the owner and enables the FM, the UM and CM to work smarter, not harder!

© Wichenko

**Grant Wichenko**
President | Appin Associates
appin@appin.com | www.appin.com

## New Course Available Soon on The BACnet Institute

© The BACnet Institute

A new course titled "The Facility Manager's Guide to Building Automation Systems" will soon be released on The BACnet Institute e-learning site.

This new course provides insight on how Facility Managers can effectively participate in and contribute to a BACnet-based BAS integration. While the course is positioned from a Facility Manager's perspective, it is still a valuable resource for other key professionals in the BAS integration process, including Building Owners, Contractors, Project Consultants, and even IT professionals.

What you will gain from this course:

- understanding of the key principles of BACnet-based BAS design and procurement
- importance of collaboration between Facility Management and IT
- knowledge of how the Networked Controls BAS design model enables streamlined facilities management

REGISTER FOR FREE at www.thebacnetinstitute.org to access this course and many other resources.

# Transition to BTL Certification Program Complete

Transition to the BTL Certification Program has been completed! A BTL Certification includes a Certificate of Conformance, a BTL Listing and the right to use the BTL Mark. It is the indicator that a product has successfully passed rigorous verification by testing and demonstrates that it correctly implements rules and interoperability of the BACnet protocol.

More and more product specifiers are requiring BACnet as a "must-have" for system requirements. There are now 171 distinct manufacturers with BTL-Listed or BTL-Certified products, with a total of 858 BTL-Listed or BTL-Certified products. Specification of BACnet as the protocol and requiring BTL Certification is becoming THE benchmark for project specifications to ensure interoperable installations.

The BTL Mark may be displayed only on products that have successfully passed BTL Testing. Testing ensures that the device correctly implements all of the BACnet functionality it contains as governed by ASHRAE standard 135.1. The BTL Working Group defines the BTL Test Plan and governs the testing.

## Testing Process

Suppliers can have their products tested at various global BTL Recognized Testing Organizations. These locations can be found on the Device Testing page of the BACnet Testing Laboratories website.

For those wanting to test at the BTL Lab, please submit the following three forms to btl-coordinator@BACnetinternational.org: BTL Checklist, BTL Lab Testing Application, and BTL Lab Testing Agreement. These forms may be found by selecting **BTL Lab Testing Forms** on the Device Testing Page indicated above. Information concerning the entire BTL Testing process may be found under the BTL Test Package v15.0 link at bacnetlabs.org/page/test_documentation under the heading Current Test Package.

The signed BTL Lab Testing Agreement and the $750 Application Fee are required to secure a place in the BTL Lab testing queue. The testing queue is currently one to two months but may vary depending on the number of applicants at any given time. The BTL Checklist and BTL Lab Testing Application determine the testing that will be performed. An Application Acceptance letter will be supplied that includes a formal estimate for the amount and time of testing and a test entry date. Fees are billed at the conclusion of testing.

BACnet International member companies with Silver level or higher memberships receive a discount on testing fees. (The Testing Application fee is the same for all applicants.) Participants may apply for Testing and BTL Certification of a family of devices that share underlying BACnet software in order to minimize testing costs.

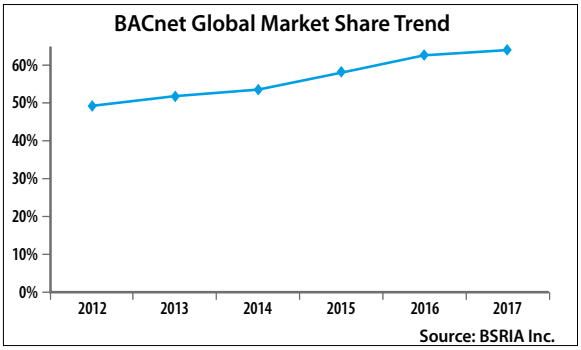
© Hayes

**Emily Hayes**
BTL Coordinator and BTL Working Group Chair
btl-coordinator@bacnetinternational.org

# BACnet Market Adoption Report Available

For more than 20 years BACnet adoption has grown dramatically, both in terms of absolute size and as a share of the total building automation market. At this point most people involved in building automation know that BACnet is the leading data communications solution for building automation systems. What most people do not know is just how far BACnet has penetrated the building automation market around the world. Until recently there has not been good market research data on this topic. However, a new multi-protocol, global market penetration report published by industry analysts at BSRIA in the U.K. addresses this question. It says, "BACnet is currently the leading protocol with 64% market share globally with demand for this protocol growing in every country worldwide."

The BSRIA report covers a number of building automation protocols so BACnet International has extracted relevant information to create a BACnet-specific report for its members. Along with global market share information it also provides BACnet market share data for various regions of the world and outlines some of the drivers that will lead to continued growth. To give some context for current market share data, the report includes historical market share by region for the last five years, projections for the next five years and some information on the percentage of project specifications that require BACnet. The report, "BACnet Market Adoption" is available at no charge to BACnet International corporate members by contacting David Nardone at david@bacnetinternational.org. Non-members or those interested in market share information on other building automation protocols can purchase the BSRIA report by contacting sales@BSRIA.com and referencing the "Market Penetration of Communication Protocols – Global" report.




For the 5 year period from 2012 to 2017, BACnet has had strong upward market share trend as more and more users and suppliers adopt it. © BACnet International

# NEW BTL-LISTED PRODUCTS

| Manufacturer | Product Name | Model |
|---|---|---|
| ABB | HVAC Drive | ACH580 |
| Avelon Cetex AG | Alcedo | 7 |
| Comfy | Comfy Gateway | TR-3 |
| Contemporary Controls | BASrouter | BASRT-B |
| Danfoss | VLTÂ® HVAC Drive | FC-102 |
| Delta Controls | O<sub>3</sub> | O3-DIN-CPU |
| Dent Instruments | PowerScout 48HD | PS48HD |
| DEOS AG | OPENweb | DS-OWB |
| Dwyer | Series IEF | EFX1X2-X3-COM X4 where X1 is H or S<br>X2 is N or B X3 is CND, PG or 10<br>X4 is none or more of the following: -LCD, -CC, -FC and -NIST |
| EasyIO Holdings Pte. Ltd. | EasyIO FS Controller | FS-32 |
| EasyIO Holdings Pte. Ltd. | EasyIO FW Controller | FW-14, FW-08, FW-08V |
| EATON | PowerXL DH1 | PowerXL DH1 |
| Eurotherm by Schneider Electric | nanodac | nanodac |
| Ges Teknik A.S. | AW-WSHP-Gateway | SMC-GT-BAC2K15 |
| Global Control 5 Sp. z o.o. | MINI-Series | iSMA-B-8U, iSMA-B-8U-IP, iSMA-B-8I, iSMA-B-8I-IP, iSMA-B-4I4O-H, iSMA-B-4I4O-H-IP, iSMA-B-4U4O-H, iSMA-B-4U4O-H-IP, iSMA-B-4U4A-H, iSMA-B-4U4A-H-IP, iSMA-B-4O-H,iSMA-B-4O-H-IP, iSMA-B-4TO-H, iSMA-B-4TO-H-IP |
| Global Control 5 Sp. z o.o. | MINI-Series | iSMA-B-8U, iSMA-B-8U-IP, iSMA-B-8I,<br>iSMA-B-8I-IP, iSMA-B-4I4O-H, iSMA-B-4I4O-H-IP,<br>iSMA-B-4U4O-H, iSMA-B-4U4O-H-IP,<br>iSMA-B-4U4A-H, iSMA-B-4U4A-H-IP,<br>iSMA-B-4O-H, iSMA-B-4O-H-IP,<br>iSMA-B-4TO-H, iSMA-B-4TO-H-IP |
| Global Control 5 Sp. z o.o. | MIX-Series | iSMA-B-MIX18; iSMA-B-MIX38,iSMA-B-MIX18-IP;<br>iSMA-B-MIX38-IP |
| Global Control 5 Sp. z o.o. | MIX-Series | iSMA-B-MIX18; iSMA-B-MIX38, iSMA-B-MIX18-IP;<br>iSMA-B-MIX38-IP |
| IMI Hydronic Engineering | TA-Slider 1250 Plus BACnet/IP | 322227-16210, 322227-46210,<br>322227-16219, 322227-46219 |
| IMI Hydronic Engineering | TA-Slider 750 Plus BACnet/IP | 322226-16210, 322226-46210,<br>322226-16219, 322226-46219 |
| ISOIL Industria | MV311-ISONRG | MV311 |
| Johnson Controls | IOM2723 | MS-IOM2723-0 |
| Johnson Controls | IOM3723 | MS-IOM3723-0 |
| Johnson Controls | IOM3733 | MS-IOM3733-0 |
| Johnson Controls | PCX2723 | CH-PCX2723-0 |
| Johnson Controls | PCX3723 | CH-PCX3723-0 |
| Johnson Controls | PCX3733 | CH-PCX3733-0 |
| Johnson Controls | VRF Smart Gateway | SI-VRFCBN02-x1x2x3<br>where x1 is 0 x2 is S or K<br>x3 is E, C or J |
| Johnson Controls | VRF Smart Gateway | SI-VRFCBN02-x1x2x3<br>where x1 is 0 x2 is S or K<br>x3 is E, C or J |
| Matrix iControl Sdn. Bhd. | EasyIO30P series : 30 I/O Controller | IO-30S-BM, IO-30P-BN |
| MBS GmbH | Universal Gateway - UGW | UGW Standard, UGW Profinet,<br>UGW LON, UGW KNX,<br>UGW x-link, UGW M-Bus,<br>UGW DALI |
| OJ Electronics | OJ-Air2 | OJ-Air2Master x-Air2Master<br>where x is AD, AL, HA, MA,<br>OJ, PE, PI, RH or TX EX-Master |
| Powers | IntelliStation | 109601 |
| Priva | Priva Blue ID S10 Controller | S10 |

| | | |
|---|---|---|
| Saia-Burgess Controls AG | Saia PCD1 / PCD2 Line | PCD1.M2110R1 (PCD1.Room), PCD1.M2120, PCD1.M2160, PCD1.M2220_C15, PCD2.M4160, PCD2.M4560 |
| Saia-Burgess Controls AG | Saia PCD3 Line | PCD3.M3160, PCD3.M3360, PCD3.M5560, PCD3.M5360, PCD3.M6860, PCD3.M6880 |
| Samsung Electronics Co., Ltd. | DMS BACnet Gateway | A(M)IM- B17* |
| SAUTER | EY-modulo 5 Building Controller | EY-AS525F001 |
| SAUTER | EY-modulo 5 Room Automation Controller | EY-RC504Fxxx1 where xx1 is 001, 011, 021, 041 or 101 |
| SAUTER | EY-modulo 5 Room Automation Controller | EY-RC505Fxxx2 where xxx2 is 031, 051, 061, 071, 081, 091, 0A1 or 0B1 |
| Siemens | Desigo DXR2 Automation Stations | DXR2.E09, DXR2.E09T, DXR2.E10, DXR2.E12P, DXR2.E12PX, DXR2.E18, DXR2.E17C, DXR2.E17CX, DXR2.M09, DXR2.M09T, DXR2.M10, DXR2.M11, DXR2.M12P, DXR2.M12PX, DXR2.M18 |
| Siemens | Desigo PXC3 Automation Stations | PXC3.E16A-100A, PXC3.E72-100A,PXC3.E72A-100A, PXC3.E75-100A, PXC3.E75A-100A |
| Siemens | TXB3 Bus Interface Module | TXB3.M |
| Trend Control Systems | IQ4 | IQ411, IQ412, IQ422, IQ4E, IQ4NC |
| Tridium | Niagara 4 BACnet Advanced Workstation, Niagara 4 BACnet Operator Workstation | DR-S-BAC-AWS,DR-S-BAC-OWS with DR-S-BAC-AWS-UP |
| Tridium | Niagara 4 BACnet Advanced Workstation, Niagara 4 BACnet Operator Workstation | DR-S-BAC-AWS,DR-S-BAC-OWS with DR-S-BAC-AWS-UP |
| WattMaster | Daikin DDC Controller | OE377-26B-00001-1 |
| WattMaster | VCCX2 Controller | OE338-26B-VCCX2 |
| Zumtobel Lighting GmbH | LITECOM INF BACNET | 22169635, 22169636, 22169637, 22169638, 22169639, 22169640,22169641, 22169642, 22169643, 22169644 |

# First International Symposium on BACnet Testing


BACnet Testing Laboratories (BTL) and The University of New Hampshire's InterOperability Lab (UNH-IOL) are hosting an International BACnet Testing Symposium, October 6 - 7, 2018, at the UNH-IOL facility in Durham, NH.

The symposium will bring together thought leaders from around the world to discuss first hand experiences and best practices for BACnet testing and test tool development. Potential topics include current test tools and methods, IoT testing readiness, future test requirements and architectures, and others.

It will be a perfect opportunity to discuss, network and dig deeper into BACnet testing solutions and how they align with the growth of the industry. The symposium will include 1 1/2 days of presentations along with a dinner networking event.

This event will interest test tool developers, labs, QA engineers and product developers. For more information on the Testing Symposium, please contact Natalie Nardone at natalie@bacnetinternational.org.

# Two BACnet Days at Frankfurt Airport

## Frankfurt Airport is the venue of the BACnet Airport Conference 2018 that will take place on September 27th and 28th.

The conference, which is being organized by the BACnet Interest Group Europe (BIG-EU), is primarily geared towards facility managers, airport managers and building planners of airports of all sizes. The event will address the use of the BACnet protocol at airports – from the design through to tender, right up to implementation.

The conference is combined with an exhibition showing the reliable operation of buildings at airports. A guided tour behind the scenes of Fraport will give the participants visiting the site an idea of how BACnet helps to operate buildings reliably and efficiently at airports.

Particularly at airports, BACnet is regarded as an enabler for investment security and reliable building operation. Fraport AG is building its new Terminal 3 with building automation based on BACnet communication.

### Rapid Growth

BACnet plays a key role in airport management, as the communication standard contributes significantly to solving the specific tasks at the airport. In many cases, however, decision-makers lack neutral sources of information and a platform for exchanging experiences.

With the Airport Conference, the BIG-EU provides an information event that addresses the specific needs of airports. The conference takes into account the complexity, efficiency and rapid growth of airports from a technical, economic and environmental perspective.

More about BACnet in the growth market of aviation: www.airportconference.org

# Calendar of BACnet International Events

| Dates 2018 | | |
|---|---|---|
| May 8 – 10, 2018 | LIGHTFAIR International | Chicago, IL |
| May 16 – 18, 2018 | European BACnet Plugfest | Luedenscheid, Germany |
| June 11 – 13, 2018 | BIG-CA Plugfest | Beijing, China |
| June 21, 2018 | BTL (WG) Meeting | Houston, TX |
| June 23 – 27, 2018 | ASHRAE Annual Conference, SSPC 135 Meetings | Houston, TX |
| September 27 – 28, 2018 | BACnet Airport Conference and Exhibition | Frankfurt, Germany |
| October 6 – 7, 2018 | International BACnet Testing Symposium | Durham, NH |
| October 8, 2018 | BTL Working Group (WG) Meeting | Durham, NH |
| October 9 – 11, 2018 | Plugfest Interoperability Event | Durham, NH |
| November 12 – 15, 2018 | BIG-CA Golden Week | Shanghai, China |

**Subject to change. For more information, contact David Nardone, BACnet International, david@bacnetinternational.org or visit www.bacnetinternational.org**


## BACnet International Journal 15

The BACnet International Journal is a global magazine for building automation based on BACnet technology. Experts, practitioners and professionals show the way in applying and developing the BACnet standard – from building automation trends to devices and application projects; from qualification and training to testing and certification; from who's who in the BACnet community to useful information on events and publications. Special attention is given to members and activities of BACnet International.

**Distribution**
This Journal can be ordered free of charge by BACnet users as well as partners, members, media representatives and friends of BACnet International.
Order the BACnet International Journal by e-mail at info@bacnetinternational.org.

**Online Distribution**
The BACnet International Journal is posted to www.bacnetinternational.org.

**Editor**
MarDirect Marketing Direct GbR
Bruno Kloubert
Responsible according to the press law
Droste-Hülshoff-Straße 1
44141 Dortmund, Germany
Phone: +49-2 31 42 78 67 31
Fax: +49-2 31 42 78 67 32
URL: www.bacnetjournal.org

**Board of Directors**
Andy McMillan, President and Managing Director, BACnet International
Brad Hill, Honeywell International
Raj Jayaraman, Vice-Chair, Burton Medical
Erica Johnson, UNH, Interoperability Lab
Trevor Palmer, Acuity Brand
Raymond Rae, Delta Controls
Nancy Stein, Siemens
Dennis Swoboda, Blue Ridge Technologies
Michael R. Wilson, Chair, Automated Logic

**Publisher**
BACnet International
1827 Powers Ferry Road
Building 14, Suite 100
Atlanta, GA 30339
Phone: 770-971-6003
Fax: 678-229-2777
info@bacnetinternational.org

**Advertising**
MarDirect Marketing Direct GbR
Phone: +49-2 31-42 78 67 31
Fax: +49-2 31-42 78 67 32
E-mail: vonhelden@mardirect.de

**Picture Credits**
BACnet International, MarDirect and specified companies




**ISSN 2191-7825**

# MACH-ProView™ LCD

## NOW with TRENDview


TRENDview

SPACEview

LISTview


STATview

Better by design™

Reliable Controls unveils the new MACH-ProView™ LCD with TRENDview. This freely programmable, combination BACnet® Building Controller (B-BC) and BACnet Operator Display (B-OD) resides on Ethernet, Power over Ethernet, Wi-Fi or EIA-485 networks. Backed by an industry-recognized 5 year warranty and a nation-wide network of certified Authorized Dealers, the new MACH-ProView will empower you to stay in touch with your building's performance.

Member of BACnet International

www.reliablecontrols.com/MPV

Reliable controls

# BACnet International

## Continually Raising Building Standards

BACnet International is an industry association that facilitates the successful use of the BACnet protocol in building automation and control systems through interoperability testing, educational programs and promotional activities.

ASHRAE BACnet™

**BACnet is leading the world in Building Protocol Standard:** It plays a significant role in building automation projects worldwide.

BACnet® BTL TESTING LABORATORIES

**Achieving the Mark of Distinction:** The BACnet Testing Laboratories (BTL) Mark provides users with assurance that a product has passed the industry standard BACnet conformance tests conducted by a recognized, independent testing organization. The BTL Mark is a mark of distinction, achieved by more than 800 products, that many building owners and control system designers look for as a must-have in order to be eligible for a project.

Discover More Today: **www.bacnetinternational.org**