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Issue 06

This Issue

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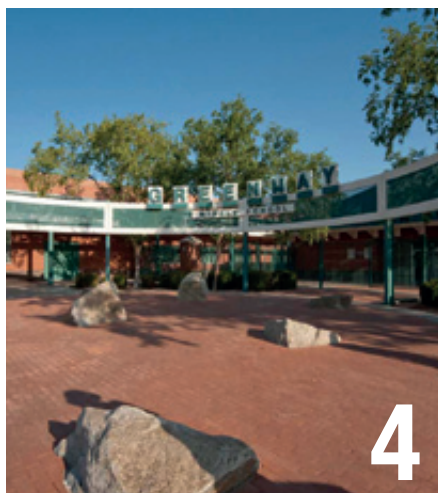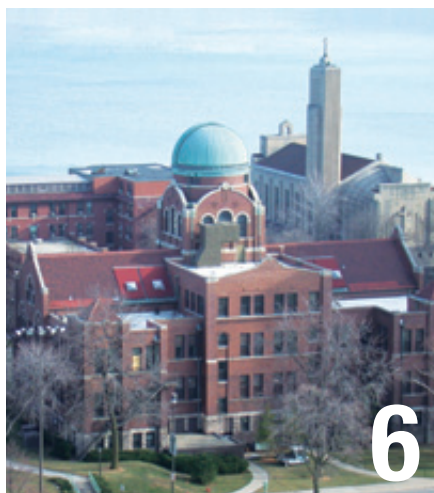*Tools show the resources available for posting and the user permissions, and with a drag, drop and click, the Web operator interface is complete.*

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Cover picture

Loyola University - Lake Shore Campus
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Greenway Middle School Phoenix, AZ

Greenway Middle School has a proud history dating back to 1912. What began as a one room schoolhouse in northeast Phoenix has evolved into a district serving 33,000+ students in grades K-12. Originally named Sunnyside School, it was the first within what is now known as the Paradise Valley School District. The middle school is recognized as one of the top educational institutions in the nation and serves as a model for other secondary schools across North America.

Located on the corner of 30th Street and Greenway Road, the school is home to approximately 580, 7th and 8th grade students. The campus features a highly flexible gymnasium, a weight room, a tennis court, a running track, a full-sized field, and contemporary science labs. The ultra-modern facilities provide students with a comfortable atmosphere and an extraordinary learning environment.

Like many other schools in its district, Greenway faced a number of energy challenges in 2008. In dealing with both rising energy costs and increased budget constraints, the school also had an inefficient energy management system. Personnel struggled with inconsistent cooling and poor ventilation, inadequate and insufficient lighting, as well as the lack of centralized control.

Determined to find a way to reduce energy consumption and costs, as well as improve serviceability to schools throughout the district, officials established an energy management program. The program was designed specifically to analyze the performance of the current system and identify where improvements need to be made. As an outcome of the program, Greenway Middle School was directed $1.1 million for a mechanical systems overhaul. As part of the overhaul facility personnel requested lighting upgrades and a custom tailored, web-based energy management and control system.

In search of a solution that was in touch with their needs, school officials turned to Urban Energy Solutions, a KMC Controls® authorized partner, to design and implement a system that would meet the district's aggressive energy reduction goals. "We chose to partner with Urban Energy Solutions because of their high level of expertise and unrivaled customer service," commented Daniel Rinker, EMS/HVAC Technician for the northeast Phoenix district.

Work began in June of 2009 and by August the school had two new water-cooled chillers, two new gas boilers, new fan coil units, and upgraded air handlers with demand and occupancy-based control ventilation. In addition, new high-efficiency lighting with occupancy-based controls and power monitoring equipment was installed. All of these control systems and equip-ment were integrated and managed with KMC BACnet Advanced Application Controllers. The controllers provided an open interoperable system that seamlessly communicates with the Niagara AX JACE front end.

Since the installation, district officials have been extremely impressed with the performance and results the digital system provides. "After comparing Greenway's monthly energy use in December of 2009 to the same period in 2008, energy consumption was down nearly 50 percent," noted Joe LaRovere, Energy Management Division Manager at Urban Energy Solutions, Inc. "This reduction in energy consumption is vital to the district schools. Faced with a one-two punch of decreased funding and rising utility costs, they simply cannot survive long term without an energy management program in place," he added.

Because of the reduction in power demand, Greenway has received the ENERGY STAR award as well as over a $100,000 donation from Arizona Power Service.

Through the efforts of Urban Energy Solutions and the rest of the project team, Greenway will continue to serve as the benchmark to other school systems across the nation. ◼

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Princess Noura University, Saudi Arabia

Princess Noura University is the world's largest women's university. Located in Riyadh, Saudi Arabia, the university is composed of 32 campuses in a self-contained higher education city, which can accommodate 40,000 students and 12,000 employees. The total built up area is around 3 million square meters. The university includes administration buildings, 13 faculties, a 700-bed student hospital, an 11.5 km automated metro and a residential area that includes accommodation for students and staff.

Not only was the sheer size of this site impressive with 30,000 BACnet controllers from various manufacturers, but the hectic schedule to beat the 25-month deadline of construction was equally challenging. The installation required 18,000 Neptronic BACnet fan coil controllers, which were pre-configured to control 4 pipes of cooling and heating with a 3-speed fan. The Neptronic fan coil controllers were also fully integrated with a Johnson Controls system. With so many controllers one of the biggest challenges was to save time and reduce costs. Neptronic provided pre-configured controllers for the required applications, which saved time and reduced costs related to system configuration. Neptronic also offered the solution of using RJ45 connectors on the thermostats and controllers, which saved time and reduced the cost of installation related to the wiring between the thermostats and controllers.
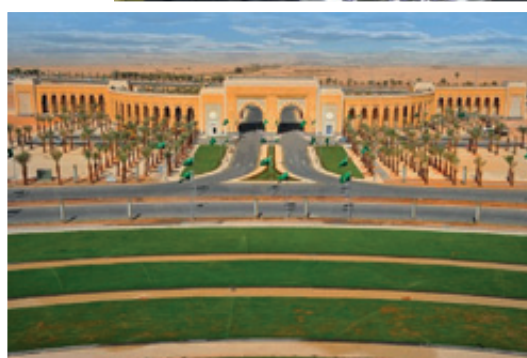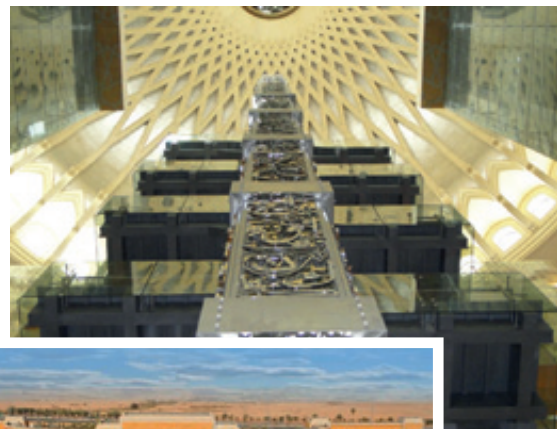
Neptronic was a part of this immense collaboration due to its open platform, proven integration, reliable BACnet communication, user friendly operation and its customized solutions as per the project requirements. ■

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Loyola University Chicago, IL

Loyola University's Lake Shore campus is home to 8,000 undergraduate students and consists of 44 buildings spread over 100 acres. The Jesuit campus is home to the College of Arts and Sciences, the Institute for Environmental Studies, the Niehoff School of Nursing, the School of Education and Graduate School. The campus also includes the main libraries and sports centers.

The Loyola campus is more than 100 years old and as such they have just about every type and variation of HVAC on campus, many of which were aging or failing. With 44 buildings spread over 100 acres, the university faced excessive energy operating costs and poor comfort control in many buildings, especially in the summer. In addition to energy and maintenance efficiencies, the management team was looking to establish control system standards with an easy-to-use graphical interface.

Buildings around campus were not getting adequate chilled water to satisfy comfort needs due to poor distribution control. Delta Controls revised the chilled water piping configuration from a 3-way to a 2-way valve design, eliminating the secondary distribution pumps in all buildings on campus. The revised central chilled water plant configuration is a "Vari-Prime" design for variable chilled water flow through the chillers as well as throughout the campus via variable frequency pump operation. The University's existing Ethernet Wide Area Network was used as a backbone to integrate the system campus wide.

Chuck Jenkins, Campus Automation Specialist, remarked that the first summer of operation was the smoothest summer he could ever remember in terms of customer satisfaction. Plant efficiency improved dramatically, with chiller plant differential increasing on average 8 to 9 degrees F. Comfort complaints virtually disappeared. Staff can respond to service requests from anywhere on or off campus via any PC with Web access or from their wireless PDAs. So far, Delta Controls has been used in 30 buildings on campus.

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BACnet Web Services Too

BACnet's foray into the wonderful world of XML started with BACnet Web Services. BACnet was then extended with the Control System Modeling Language, or CSML. Now, the committee has voted out for public review the ability to use CSML to interoperably describe devices and objects. And into the mix, we have provided the ability to semantically tag data. The committee is also on the cusp of releasing the second version of BACnet Web Services. And to top it all off, the new web services are being investigated as the foundation for BACnet's Smart Grid support.

In 2006, the first BACnet web services were launched. At the time the committee was focused on providing a solution that was simple to use. The web services were designed to easily integrate into applications such as MS Excel allowing users to extract data from the control system and provide comprehensive reporting. The goal was to allow simple enterprise integration. At the time, most web services were based on SOAP, but RESTful services were on the rise. The committee went with the tried and true and based the BACnet web services on SOAP.

The initial web services provided access to simple data from a control system; individual pieces of data in contrast to complex structured data. It is important to note that one of the goals was protocol neutrality. BACnet Web Services abstract out the control system protocol and allow access to the data regardless of the underlying system. To achieve that goal in a simple manner, the committee forwent the ability to access complex BACnet data recognizing that most of the useful data was held in simple objects (Analog, Binary, and Multi-state objects).

But the committee always planned to extend the web services to provide full access to all data from a control system. In order to provide that access, first there must be the ability to represent the data in XML. This need focused the committee on the continued development of CSML. Keeping in mind the goal of protocol neutrality, CSML was designed to handle any control system data, not just BACnet data. So in 2010, the committee completed the CSML specification and once again started looking at web services.

Starting from the position that CSML would form the basis of the BACnet Web Services update, the committee then examined the rest of the current BACnet Web Services framework to determine other pressing issues that should be addressed. During the development, the committee considered a number of standard web services technologies including atom publishing and pubsubhubbub. In the end, a direction that reduced implementation complexity was chosen over adoption of some of the mainstream technologies.

As the committee advanced down the path of reworking BACnet Web Services, it became clear that the correct path forward for BACnet Web Services was a RESTful model. SOAP had started its downward slide with more and more implementations dropping it in favor of a RESTful approach. The move to a RESTful set of web services became one of the goals of the rework.

As the development of the BACnet Web Services update progressed, some milestone events occurred in the real world of control systems. In Iran, the Stuxnet attack grabbed a lot of media attention as one of the most advanced attacks on a control system, later to be followed by the troubles of security breaches of the Tridium Niagara framework. These events underlined the need for strong, state-of-the-art security and authorization for control systems connected to the Internet. To address this, BACnet Web Services employs OAuth 2.0, TLS, and PKI certificate management.

Early implementers of BACnet Web Services were asking for very specific additions to the model. One of the features most asked for was the ability to subscribe for notifications. In the new BACnet Web Services, clients will be able to subscribe for changes to data allowing subscriptions for changes of value, alarm log and trend log updates. Subscriptions are managed by allowing clients to register callback URIs. When the server needs to notify the subscribed device, it posts a notification record to the registered callback URI.

Another interesting feature requested was the ability to allow a resource (a piece of data), to mirror data from another BACnet Web Services resource. This allows an server which collects data from other servers, either to provide a common place for convenience, or to pro-

```
GET /.bacnet/1234/event-enmrollment,2/Event_Parameters@value


200 OK
Content-Type: application/xml

<?xml version='1.0' encoding='utf-8'?>
<Choice xmlns="http://bacnet.org/csml/1.1" name="out-of-range" />
    <Unsigned name="time-delay" value="60" />
    <Real name="low-limit" value="15.0" />
    <Real name="high-limit" value="25.0" />
    <Real name="deadband" value="0.5" />
</Choice>
```
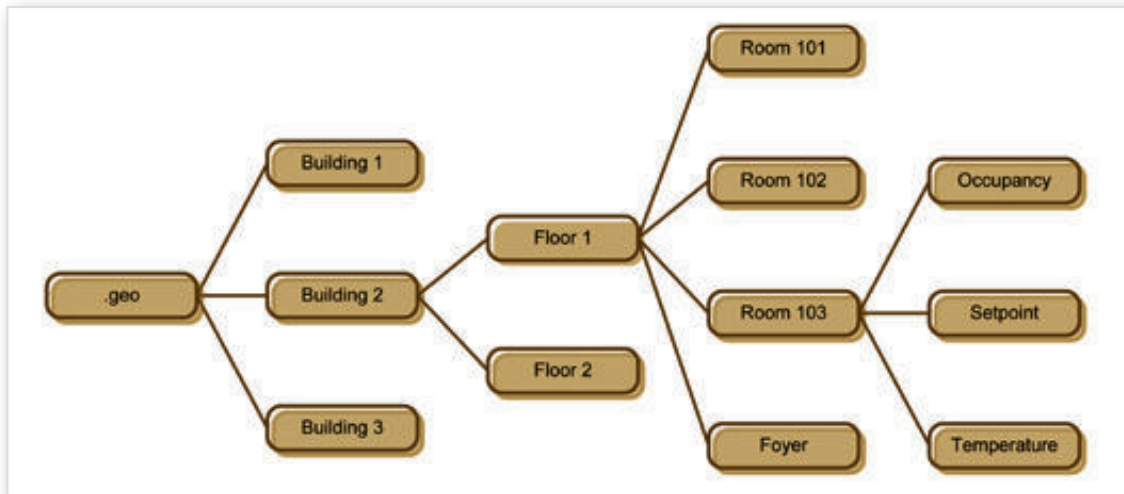
Retrieving a complex data item with the new web services

An example logical (geographical) tree.

vide archiving services for trends or alarms, to advertize the original source of the data being aggregated. This is done with two new attributes: "sourceId" and "via". The "via" attribute contains the dereferenceable URI of the source data and "source-id" contains the non-dereferenceable globally unique identifier of the data.

In BACnet Web Services, the data is organized into logical trees. In the logical trees, data is normalized into simple data values allowing easier integration with other non-control system software. The update continues with the same logical trees, but also adds in physical trees that provide access to the data in its original form. In the physical trees, the data is accessible in the form it is found in the control system. A physical tree may be present for each of the protocols that are accessed via the web services server. While any protocol can be represented, the BACnet standard provides the standard form for BACnet data; the form for other protocols is left to either other standards organizations or implementers of web servers services that interface to them.

To improve access to data in the web services data tree, the new BACnet web services provide the ability for annotating data with semantic tags, and the ability for clients to search and filter on data value or semantic tag values. This is achieved by allowing a client to request a complete data tree along with a filter so that only data items matching the filter are returned. This feature facilitates queries such as retrieving all values that are in alarm, or all which have the substring "Zone Temp" in their name, or which have the semantic tags 'boiler' and 'temperature'.

Other interesting additions to BACnet Web Services include:

- The ability to create and delete nodes in the data model tree. While this functionality provides the basis for the subscription feature, it is also useful in other ways including the creation of new logical views of the control system data.
- Improved access to trend log data, allowing clients to access the raw trend log entries; the entries which form the basis for the periodic trend log entries returned in the original trend log web services.
- Allow servers to return only as much data as they can handle and providing a new URL which the client can use to retrieve the next set of data.
- Allow access to multiple data items in a single request though the use of the new 'multi' attribute, which is a single addressable data item whose content is a collection of other data items.

While not complete at the time of this writing, the committee expects the specification to be completed and voted out for a public review by the time of publication of this article.

The BACnet Committee has other task items which are building off of the BACnet Web Services and CSML work. The Applications Working Group is actively developing standardized interfaces to equipment and systems. The new web services provide for access to these interfaces through the use of the search and filter functionality. Once the standardized interfaces are available, clients will be able to query by interface making it simpler find all AHU, VAVs, and to find the specific data of interest for each piece of equipment, such as related zone temperatures.

The Smart Grid Working Group is examining the potential for the new web services to provide the initial basis for complex smart grid data models in BACnet. The concept has an initial implementation which would be completely based on web services, and future extensions which allow for smart grid data in the non-web services BACnet devices.

To help promote a deep technical review of the new web services, a number of companies have committed to developing prototype implementations of BACnet Web Services clients and servers during the public review period. The goal is to hold a plugfest for these prototypes to test and improve the specifications and the implementations. Anyone interested in participating in the plugfest can contact Carl Neilson (cneilson@deltacontrols.com) for more information. ■

```
GET /.sysdata/objects?filter=
@tags/temperature and @tags/
boiler
```

An example filter query which retrieves all objects with the semantic tags 'temperature' and 'boiler'.

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Delta
CONTROLS

New BACnet Standard Published With Significant Improvements To Alarm Handling

ATLANTA – Changes to the newly published BACnet standard from ASHRAE will encourage smart lighting controls and other building automation controls systems. ANSI/ASHRAE Standard 135-2012, BACnet, allows building equipment and systems manufactured by different companies to work together. It is the only open, consensus-developed standard in the building controls industry.

The new standard is being published ahead of schedule due to the wide-reaching changes in alarming functionality made by addendum af to Standard 135-2010. This edition of the standard also includes recently adopted changes for the lighting industry. Addendum af provides significant improvements to the alarm handling in BACnet including: improved fault handling, temporary alarm recipient subscriptions, improvements in scalability of alarm distribution and simplifications in alarm distribution to support less complex products, according to Carl Neilson, Chair of the Standard 135 Committee.

"For building owners/integrators these changes allow improvements in interoperability between lighting control products and other building automation systems," he said. "Hopefully, this facilitates more deployment and integration of smart lighting controls, such as lights that turn on/off when occupants enter/leave rooms; lights that come on based on the same schedules as climate control; and opportunities to reduce lighting based on energy usage during demand/response events. With the changes in alarming, we also hope to see alarming support in 'smaller' devices, which should provide more alarm and fault detection with a lower engineering cost."

Addendum af contains 32 parts. Changes include:

- Removal of Annex C and Annex D
- Clarification of optionality of properties related to intrinsic event reporting; optionality of properties related to change of value reporting; priority_array and relinquish_default; segmentation related properties; virtual terminal related properties; time synchronization interval properties, backup and restore properties; active_COV_subscriptions property; slave proxy properties; restart related properties; log_deviceobjectproperty; clock aligning properties; and occupancy counting properties are allowed to be present
- Ensures that pulse_rate and limit_monitoring_interval are always together and that that event notifications are not ignored due to character set issues
- Adds the ability to configure event message text; event detection enable/disable property; dynamically suppress event detection; specify a different time delay for to-normal transitions; inhibit the evaluation of fault conditions; for some objects type to send only fault notifications; a notification forwarder object type; an alert enrollment object type
- Separates the detection of fault conditions from intrinsic reporting

- Makes the event reporting property descriptions consistent
- Identifies the property in each object that is monitored by intrinsic reporting
- Changes the description of the reliability property
- Improves fault detection in event enrollment objects and the specification of event reporting
- Reduces the requirements on notification-servers

This version of the standard also includes the addition of support for lighting control through the new lighting output object, the channel object and the WriteGroup service.

The cost of ANSI/ASHRAE Standard 135-2012, BACnet – A Data Communication Protocol for Building Automation and Control Networks, is $170 ($140, ASHRAE members).

To order, contact ASHRAE Customer Contact Center at 1-800-527-4723 (United States and Canada) or 404-636-8400 (worldwide), fax 678-539-2129, or visit www.ashrae.org/bookstore.

Energy Harvesting Wireless Sensors in BACnet Networks

Automation control should achieve the reduction of energy requirements in buildings in a simple and substantial way. In most projects, this purpose cannot be covered by one technology. Therefore, the most feasible approach for a modern building automation today, is the integration of several established standards to a solution that combines the benefits and compensates the weaknesses. A very practicable example for this is the integration of EnOcean energy harvesting wireless into BACnet-based wired networks.

Building space is often rearranged according to tenants' changing needs. Wireless systems provide the flexibility that allows interior architects to base a system on the BACnet standard, and still discover new possibilities of design and installation presented by wireless systems. Switches and sensors are no longer tied to the location of electric wires. They can be optimally placed for convenience or ergonomic terms. Furthermore, the specific features of energy harvesting wireless products, being wireless and batteryless, free the user from the burden of changing batteries in hundreds or thousands of devices in a regular period of time. This allows system planners and users to place sensors just about anywhere (e.g., on glass, furniture, windows, brick walls, ceilings) and control them centrally via BACnet.

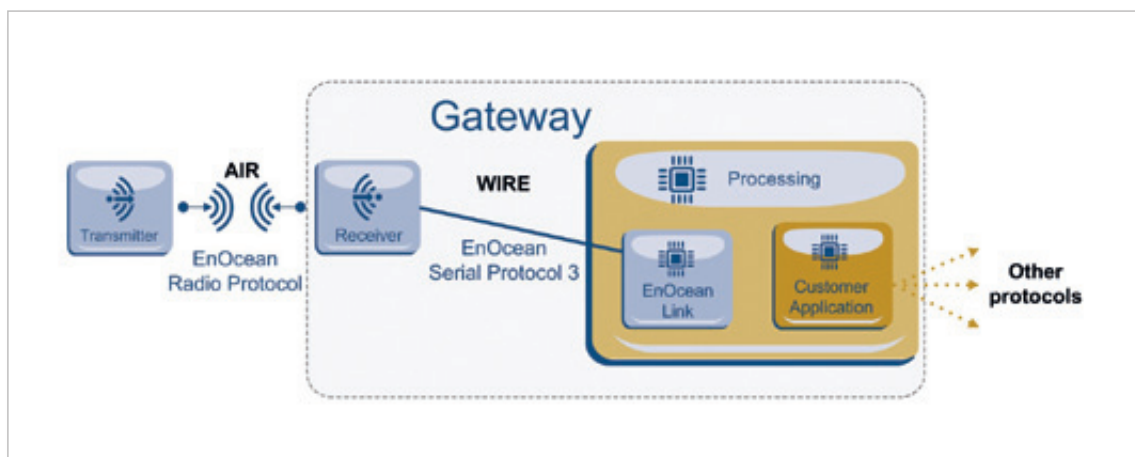## Energy harvesting wireless devices

Energy harvesting devices are particular in being able to generate their own power. They do not need power supplies or batteries to function. They harvest ambient light, motion or temperature differences to perform their daily tasks. Instead of batteries, miniature solar cells, electro-mechanical converters and thermal converters provide the necessary energy. Maintenance work such as regularly changing the batteries is no longer needed, as the technology is energy-autonomous. Based on the international wireless standard ISO/IEC 14543-3-10, the technology can also be easily connected to all systems that communicate over WiFi, as well as over Ethernet/IP, KNX, BACnet or LON via gateways.

Interoperability

Building professionals have voiced the need for interoperable devices from one company be able to talk to an intelligent controller from another. BACnet ensures interoperability between devices of different manufacturers when participants in a project agree on certain BACnet Interoperability Building Blocks (BIBBs) defined by the BACnet community. Interoperability between EnOcean devices is driven by the standardized EnOcean Equipment Profiles (EEPs) from the EnOcean Alliance. More than 100 product profiles are available, for different energy harvesting wireless solutions for building and industrial automation as well as smart home systems.

Connecting EnOcean to BACnet

Based on the energy harvesting wireless technology, a wide range of energy-autonomous applications is available for the connected building, including batteryless switches, intelligent window handles, temperature, moisture and light sensors, as well as presence sensors, relay receivers and control centers. All these battery-

less devices can be easily installed and integrated to BACnet. The Albert at Bay Hotel in Ottawa shows how such a system can be built for an HVAC retrofit project.

The control solution chosen for the project combined a BACnet management system, CAN2GO wired and wireless controllers from Schneider Electric, and a wide-variety of end-devices communicating over EnOcean and other communication protocols like Modbus.

In each suite, a CAN2GO controller is connected directly to the local heat pump. The controller is also connected to a Modbus thermostat and two EnOcean wireless sensors: a motion sensor and a temperature sensor. Multi-protocol conversion to BACnet is performed by the controllers, which have embedded gateway functionalities. Networking between controllers is achieved using the existing telecom risers. One CAN2GO unit per riser is connected to LAN, making all the aforementioned points available for management using the hotel's BACnet system.

Easy Commissioning

The process of integrating EnOcean devices into the BACnet system via the CAN2GO controllers takes a few seconds and can be done in two ways. Each EnOcean device has a unique ID. It can be learned by a CAN2GO unit:

1) Enter the ID manually while connected to the controller's web interface (direct Ethernet connection, or via LAN);
2) Learn the ID by clicking the physical learn button on the EnOcean device and the virtual learn button of the controller's web interface.

EnOcean points are automatically converted to BACnet points by the CAN2GO in-node processor. A large portion of the commissioning can be done before deployment. System integrators can associate EnOcean devices to their respective controllers beforehand to streamline deployment even more.

The control sequences of the system modulate the hotel's heating, air conditioning and ventilation according to room occupancy and precise local sensing data. The overall result is reduced energy consumption with increased occupancy comfort. Because wireless devices were used, inventory downtime was minimized and wiring costs were greatly reduced.

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BACnet in Korea

BACnet was first introduced in Korea in 1998 by Prof. Seung Ho Hong in Hanyang University who led the project of translating ANSI/ASHRAE 135-1995 BACnet specification to Korean language and adopting it as Korea Standard (KS X 6909) in 1999. Later, KS X 6909 was changed to KS F ISO 16484-5 to harmonize with ISO 16484-5 as BACnet was adopted by International Standard.

Since BACnet was adopted as KS, BACnet market began to grow in Korea. In the beginning, the Korean market was governed by foreign manufacturers such as Cimetrics, Alerton, Automated Logic and Delta Controls, etc. As the interest in BACnet was growing in Korean market, some pioneering local companies began to develop their own BACnet-based products. In 2007, the Korean version of modified NISTIR 6392: GSA Guide to Specifying Interoperable Building Automation and Control Systems Using ANSI/ASHRAE Standard 135-1995, BACnet was accepted as KS F 1791.

Since 2009, Korean government has driven a big enterprise for smart grid in order to efficiently manage national electricity resource. Including home and industries, buildings are one of the main entities that consume a large amount of electric energy in Korea. It is widely recognized in Korea that BACnet should be the infrastructure for implementing smart grids in buildings because (1) BACnet already provides basic functions for smart grid, and it is expected that more sophisticated functions will be developed in the Smart Grid Working Group of ASHRAE SSPC 135 Committee in the future, and (2) BACnet is already adopted as KS. Since then, many medium to large size companies are involved in developing BACnet-based products for building automation and building energy management devices and systems. Table I gives a list of the BACnet products currently manufactured by Korean companies.

As the standardization of smart grid in buildings and facilities becomes paramount, Prof. Seung Ho Hong and Mr. Yu-Chul Kim, CEO of Nestfield Co. Ltd. which is the leading company in Korea for BACnet based smart grid in buildings, decided to participate standardization activities of smart grid in buildings, and attended 2013 ASHRAE winter conference in Dallas. Both Prof. Hong and Mr. Kim will continue to attend ASHRAE SSPC 135 and SPC 201P committee meetings to contribute to the development of standards and introduce new technologies and standards related to BACnet to Korean society. ■

Manufacturer	Device Profiles								
	B-AWS	B-OWS	B-OD	B-BC	B-AAC	B-ASC	B-SS	B-SA	B-Oth
iControls				√		√			
Korea Digital Control	√			√					
LG Electronics		√		√		√			
Nara Controls Inc	√			√	√	√			
Samsung SDS	√			√		√			
Samsung Techwin				√	√	√			
Nestfield				√					

Prof. Seung Ho Hong
Hanyang University

Yu-Chul Kim
CEO of Nestfield Co, Ltd

BACnet: The Global Standard for Building Automation and Control Networks

Book by H. Michael Newman

If you are reading this article, or the BACnet Journal for that matter, you apparently know what BACnet is. But how much do you know? I recently had the privilege of speaking to H. Michael Newman the "Father of BACnet", on his upcoming book "BACnet: The Global Standard for Building Automation" and his life experiences which helped the standard evolve into what we know it as today.

In speaking with Michael, it was interesting to hear of BACnet's history, as well as his own journey which prompted the development of BACnet. The evolution of the Standard began as a single idea back in 1981. Controls companies began offering their own DDC equipment, the problem being none of the products, although very similar, could communicate to each other. Most didn't see this as a problem, but for Michael it was. He felt a standard needed to be implemented to make this happen. From there it took 6 long years for him to get people to understand the issues, and form the initial committee that would drive the development of what we know as BACnet. In the beginning, many did not believe a standard would be possible, let alone in ASHRAE, but Michael, with the help of Steve Bushby of NIST, continued on with perseverance and determination. Once the committee was set in motion, BACnet came to fruition after another 8 ½ years of hard work. The history of BACnet is quite interesting and is told in detail within the book, but there is much more to the book than the back story itself.
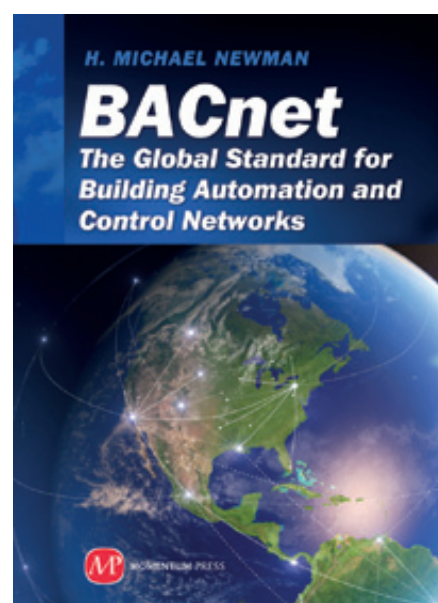
Michael is no stranger to writing. His first book "Direct Digital Control of Building Systems" was published back in 1994. When I asked Michael why he felt the need to write a book devoted to BACnet, his answer was simple. There was no book written in English that explained what BACnet was. In 2005, Hans Kranz wrote the first and only book devoted solely to BACnet in Germany. Michael decided that an English version was necessary, and there was no one better to write it than the "Father" himself.

In his words "When you write a standard you aren't allowed to explain it. The Standard has almost no explanatory material in it." Simply stated the only explanation you received was: "in order to conform to the Standard you will do this." Michael felt that the BACnet community needed more. A history, a background, fundamentals, applications, processes and procedures, where BACnet has been and where it is going. The book explains why things are the way they are, and lends itself to be the see all and know all of everything BACnet.

I had the opportunity to browse the book and it truly encompasses everything BACnet. Whether you are a novice just beginning to work with and learn about the BACnet Standard, or an expert who has worked with it for years possibly even helping with the development of BACnet, I assure you there is something that you will find both informative, and interesting. Based on the most recent BACnet 2012 Standard the book brings you up to date with everything in the current edition.

The last chapter is devoted to what is on the horizon for BACnet in terms of Future Directions. He gives brief descriptions of seven main focuses the BACnet committee is currently working on. This includes Network Port Objects, Support for IPv6, and MS/TP Extended Frames to name a few. BACnet is ever changing and growing and this last chapter is an example of how true this is.

For further information on this and other subjects that Michael covers in detail throughout the book, you can purchase it on Amazon and through the ASHRAE bookstore. "BACnet: The Global Standard for Building Automation" will be released by the end of the summer. The book can be purchased as either a hard copy or eBook.

If you are a fan of H. Michael Newman, you will also be pleased to know that he is going to return to his aviation roots and will be penning another book on that subject in the near future. I would like to thank Mr. Newman for his time and expertise, not only during the interview, but in writing such a collaborative resource for our industry.

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Understanding Building Automation and Control Systems

BAS Terms

A Building Automation System (BAS) is a centralized, interlinked, network of hardware and software, which monitors and controls the environment in commercial, industrial, and institutional facilities. While managing various building systems, the automation system ensures the operational performance of the facility as well as the comfort and safety of building occupants. Typically, such control systems are installed in new buildings or as part of a renovation where they replace an outdated control system.

You may hear any of the following terms to describe the control or automation of buildings:
- Controls – this term is appropriate in describing discrete devices that control particular pieces of equipment or processes.
- Direct Digital Control (DDC) – describes the communication method used in modern devices (hardware and software). Collectively, DDC products control various building systems and form the automation system.
- Building Automation and Control Systems (BACS), Building Control System (BCS), and/or Building Management System (BMS) – same as Building Automation System.
- Energy Management System (EMS) or Energy Management and Control System (EMCS) – generally understood to be the same as a Building Automation System but may have special emphasis on energy metering/monitoring.
- Smart (Intelligent) Building – a building equipped with a data-rich BAS.

What is Controlled

Generally, building automation begins with control of mechanical, electrical, and plumbing (MEP) systems. For instance, the heating, ventilating, and air-conditioning (HVAC) system is almost always controlled and includes control of its various pieces of equipment such as:

- Chillers
- Boilers
- Air Handling Units (AHUs)
- Roof Top Units (RTUs)
- Fan Coil Units (FCUs)
- Heat Pump Units (HPUs)
- Variable Air Volume (VAV) boxes

Lighting control is, likewise, low-hanging fruit for optimizing building performance.

Other systems that are often controlled and/or brought under a complete automation system include:
- Power monitoring
- Security
- Close Circuit Television (CCTV)
- Card and keypad access
- Smoke control and fire alarm system
- Elevators/escalators
- Plumbing and water monitoring

Types of Control Systems

Early control systems were pneumatic (using tubes filled with compressed air) and were generally restricted to controlling various aspects of the HVAC system. Common pneumatic devices include controllers, sensors, actuators, valves, positioners, and regulators. Since the communication "protocol" was air, pneumatic devices comprised the original interoperable "open" control system, allowing products from different manufacturers to be used together as well as in place of each other. Due to their large base of installation throughout the 1960s and 1970s, pneumatic control systems are still in place in a majority of existing buildings, especially in established metropolitan areas.

Analog electronic control devices (operating from low-voltage DC analog signals) became popular throughout the 1980s. They provided faster response and higher precision than pneumatics.

However, it was not until microprocessor-based digital control or DDC (Direct Digital Control)

devices arrived in the 1990s that a true automation system was possible, and DDC provided the tools needed for the modern generation of efficient, sustainable "green" buildings. Since there were no established standards for DDC communication in the early 1990s, various manufacturers created their own (proprietary) communication methods. Proprietary DDC systems provided powerful functionality but were not interoperable. Thus, a given building or portfolio could be "locked" into a specific manufacturer. This was not necessarily a problem unless the relationship with the associated service provider later soured or that provider went out of business.

By the late 1990s and especially into the 2000s, movements were afoot to standardize on "open" communication systems. The American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) developed the BACnet (Building Automation and Control Networks) communication protocol, which became ASHRAE/ANSI Standard 135 in 1995 and eventually became the industry open standard. BACnet is the only communications protocol that was designed for open system interoperability and specifically intended for building systems. BACnet International provides various ways to help ensure that interoperable BAS products from different manufacturers can communicate with each other, work together, and facilitate easier upgrades from older systems. The concept of "future-proofed" interoperability blends well with the long-term perspective and integrated project design of green building practices.

What a BAS Looks Like

Most of the automation system is behind the scenes as hardware devices mounted to equipment or hidden underfloor or in the ceiling. Some personalized control can be made available through thermostat-like devices. From a central management perspective, the BAS resides as software on an operator workstation (computer) or is available as a web page.
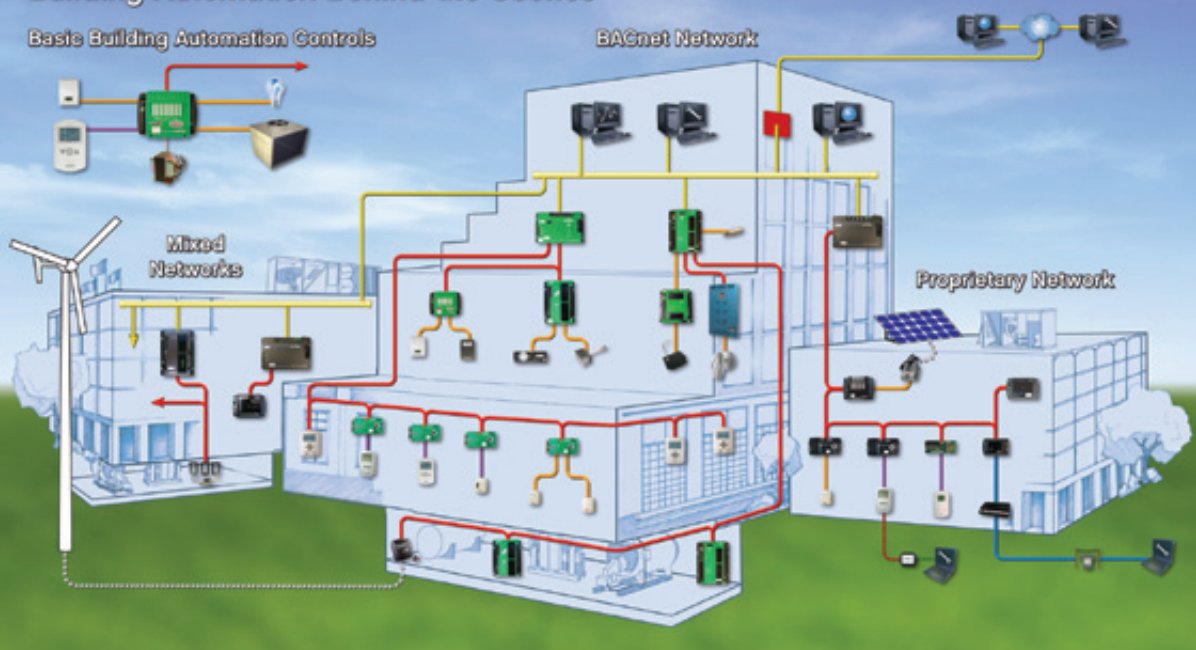
A generalized view of a BAS

Various types of "controllers" manage equipment and portions of the network. Temperature, humidity, pressure, and other types of sensors provide environmental input to the controllers. Output devices, which provide physical manipulation of the environment, include damper actuators, valves, relays, and variable frequency drives.

Who Installs or Services a BAS

A properly trained in-house staff can manage the operation and, sometimes, the maintenance of the BAS. However, system design and initial installation is almost always accomplished by controls professionals such as dedicated controls contractors or system integrators. In practice, the controls contractor is a sub-contractor to the mechanical contractor. Sometimes, the mechanical contractor will have a dedicated controls division. Electrical contractors with controls teams are also common, and multi-functional system integrators are becoming more common for today's complex facilities. These controls professionals can provide on-going service or train in-house staff to self-perform service.

BAS and Green Buildings

The automation system can also offer a huge amount of data related to building performance, and with this data in hand, building owners can make more intelligent decisions. Better, more informed decisions lead not only to lower energy usage and operating/mainte-

nance costs but also to higher occupant comfort and productivity.

When building green (whether retrofit or new construction), an automation system can contribute greatly to the ability to earn certification such as in the EPA's ENERGY STAR or the USGBC's (U.S. Green Building Council) LEED (Leadership in Energy and Environmental Design) rating systems.

Today's BAS Trends

Some current trends influencing building automation include:

- Wireless technology is beginning to replace traditionally wired BAS infrastructure. Thus far, however, the wireless technology is limited to sensor-type devices and suffers from issues including a lack of clear wireless standard, short battery life, and communication challenges through various types of building structures and materials.
- Enterprise-level initiatives are making the communication protocol of the BAS less important.

- While it is quite common to replace an old pneumatic control system with a new DDC system, pneumatic-to-DDC bridging strategies also exist.
- Before coming to the construction site, more controls are being pre-mounted by the factory to equipment.
- Hardware and software continues to be augmented by energy-related visuals.
- There has been tremendous consolidation among BAS manufacturers, leaving relatively few independent players.

For more information, see resources such as these:
Wikipedia: Building Automation
(http://en.wikipedia.org/wiki/Building_automation)
KMC Controls: Benefits of Controls in Green Buildings (http://www.kmccontrols.com/products/Benefits_of_Controls_in_Green_Buildings.aspx)
XINCA: Key Elements in Intelligent Buildings
(http://xinca.com/elements-intelligent-buildings-2734.html)
High Performance HVAC: DDC Systems or Direct Digital Controls (http://highperformancehvac.com/ddc-systems-direct-digital-controls/)

Ben H. Dorsey III
Sr. VP of Marketing
KMC Controls
info@kmccontrols.com

ASHRAE SSPC 135 Meetings – BACnet Proceedings

Bernhard Isler[1]

In May, the ASHRAE SSPC 135 BACnet Committee met in San Francisco at the Pacific Energy Center, a venue belonging to PG&E. The meeting room sponsored by PG&E, was a good fit, as it usually serves as a training classroom for HVAC controls. In June, as part of the ASHRAE Annual Conference, the committee met again in Denver, CO.

While the committee assembled in San Francisco, the public review of a number of addenda was still ongoing. Thus, many working groups were focusing on the preparation of addenda for public review that did not make it into the spring review cycle. Apart from this, a lot of work was done to catch up with test specifications for functionality recently added to the BACnet standard.

The work on enhanced support of web and Internet technologies was ongoing in San Francisco in several working groups. The hot topics being worked on are the new RESTful BACnet web services, the extended BACnet data model (BACnet XD), and Internet application protocol based transport bindings. The plan was to ship the RESTful Web Services for public review in Denver. Along with this, the committee started planning on a respective web services plugfest. A call for companies that would be willing to participate with early implementations was placed.

In Denver, a lot of work was involved on comment resolution and revision of addenda drafts that were in public review this spring. Most of these addenda were prepared for the next review or publication. The work on the RESTful Web Services (Addendum 135-2012*am*) was ongoing, but it was clear that the time available was insufficient to bring this forward for public review in Denver. The Data Modelling Working Group concentrated on the proposal for enabling BACnet XD for classic devices. This proposal was finally approved for public review as Addendum 135-2012*ba*. It is, together with 135-2012*am*, part of a series of addenda which will bring BACnet forward into the world of IT, Web and Internet technologies and the Internet of Things. The RESTful Web Services addendum will be brought forward off-meeting, in tele-conferences. It is planned to make it ready for public review sometime later this summer.

RESTful Web Services Plugfest

As noted earlier, the committee plans for a plugfest for the new RESTful BACnet web services. In Denver, a larger number of smaller and bigger BACnet companies announced their support and participation with early implementations based on the upcoming public review draft addendum 135-2012*am*. The plugfest will not only serve to verify inter-operation of implementations, but will also help to increase public attention of the very powerful and comprehensive RESTful web services and the web-accessible extended data model for building automation and control systems. These new features will significantly facilitate and simplify the integration of building automation in building management, enterprise and Smart Grid applications.

Addenda Completed

In the recent meetings, a number of addenda were completed. Some did not receive comments at all in the public review, while others received comments that required editorial changes only. The following addenda will undergo ASHRAE approval and publication in the next few months:

- Addendum 135-2012*al*
  Gateway Best Practices, New BIBBs and Device Profiles
- Addendum 135-2012*at*
  Interface_Value Property for Input and Output Objects
- Addendum 135-2012*au*
  Clarifications of Authentication Factor Encodings, and of Coercion Requirements for WriteGroup Service
- Addendum 135-2012*av*
  Server-side GetAlarmSummary and GetEnrollmentSummary Service Support Relaxations

The protocol revision that these addenda will make up will be determined, but will likely be a revision higher than 15.

Also worthy of notice is that Addendum 135-2012*ar*, Miscellaneous Changes, was finally published shortly after the Denver meeting. It was also announced that the test standard addenda 135.1-2011*l* and -*n* are on their way to being published correctly as addenda to 135.1-2011.

Addenda Approved for Public Review

In San Francisco and Denver, a number of addenda to 135-2012 were approved for initial or subsequent public review, although the poll had to be completed by a continuation letter ballot after the meeting. The addenda approved for public review were:

- Addendum 135-2012*an*   PPR1
  MSTP Large Frames
- Addendum 135-2012*aq*   PPR2
  Elevator Monitoring, COV Multiple
  Reporting
- Addendum 135-2012*aw*   PPR2
  Alarming Revision Complements
- Addendum 135-2012*ax*   PPR1
  Miscellaneous Changes
- Addendum 135-2012*ay*   PPR1
  Timer Object Type
- Addendum 135-2012*az*   PPR1
  Binary Lighting Object Type
- Addendum 135-2012*ba*   PPR1
  BACnet XD for Classic Devices

Addendum 135-2012*an* adds large frames to MS/TP and enables MS/TP to transport foreign messages, such as IPv6 frames. Addendum 135-2012*aq*, Elevator Monitoring in BACnet and COV Multiple Reporting, received a larger overhaul after its first public review, and was made ready by the Objects & Services Working Group for its second public review. Addendum 135-2012*aw*, after its first public review, was extended to allow the new fault algorithm Fault-Out-Of-Range to be applied to all numeric value objects.

The first three addenda of the above list had already been seen by the public in a previous review. The last four addenda in the list are new addenda and will be out for public review for the first time. Addendum 135-2012*ax* proposes a number of smaller changes and clarifications. Addendum 135-2012*ay* proposes a new Timer object type. A Timer object represents a count-down timer, which may produce event notifications and perform write operations on changes of its status. It will support various applications that have a need for network visible time count-down, respective status change indication and notification, as well

as configurable write operations on change of status. This complements the Schedule object with write operations at times relative to the current time. Addendum 135-2012*az* introduces a new Binary Lighting Output object type. This new object type is derived from the Binary Output object, but selectively enhanced to represent functionality and features of a binary lamp, including support for a blink warning mechanism. Addendum 135-2012*ba*, as mentioned before, enables classic BACnet devices to contain or refer to a static description in XML of its capabilities. Theses descriptions are enabled to use some concepts of BACnet XD even.

The test standard addendum 135.1-2011*o* was approved a while ago for its first public review, but the public review was delayed since it adds tests related to extensions specified in addendum 135-2012*ar*. That addendum is now published, so 135.1-2011*o* can go into its first public review now.

- Addendum 135.1-2011*o*   PPR1
  SubscribeCOVProperty Error Tests

Other Addenda in the Works

Addendum 135-2012*ai*, Network Port object type, was in another public review early this year. Work is ongoing by the Internet Protocol Working Group to address information security concerns raised by commenters.

Addendum 135-2012*aj*, Support of IPv6, has also undergone several public reviews. Its functionality is currently being completed and the changes to the Network Port object required for IPv6 are being defined. Also, comments brought up by Swisscom, a leading IPv6 ISP and IT company in Switzerland, will be incorporated.

Addendum 135-2012*am*, BACnet RESTful Web services, is in work by the Data Modelling Working Group. More details on this were noted previously in this article.

Addendum 135-2012*ap*, Application Interfaces methodology and infrastructure, is currently on hold. The Applications Working Group is awaiting directions from the BACnet XD discussion before preparing a draft for the next public review.

Addendum 135-2012*as*, Command Source Information, went through the first public review this spring. This addendum will undergo some substantial changes, related to coordination and alignment with an audit log model proposal in work at the Network Security Working Group. The Institute of Electrical Installation Engineers of Japan (IEIEJ), which is the original proposer of this addendum, is currently reviewing the proposed changes.

To stay up-to-date on public reviews, standards publications, as well as interim meeting announcements, you can subscribe to the weekly ASHRAE Standards Actions electronic newsletter, or read it, at the ASHRAE website http://www.ashrae.org/standards-research--technology/standards-actions. ◼

2013: A Great Year for BTL Listed Products

Nearly 375 products have now obtained the BTL Listing. We look forward to more milestones in the years to come! This year through testing, the following vendors' devices have earned the right to display the BTL Mark.

The BTL Listing is a testimonial that the product was subjected to rigorous verification by testing, demonstrating that it correctly implements interoperable BACnet. That requirement is steadily becoming the benchmark stated in project specifications, to avoid sub-standard implementations. The BTL Mark is permitted to be displayed on devices which have passed BTL Testing. Testing ensures that a device correctly implements all of the BACnet functionality that it contains. ASHRAE standard 135.1–2011 and the BTL Test Plan governs the testing. There are three documents required to be filled out and mailed/emailed to <btl-manager@BACnetinternational.org> in order to make application for testing and commence the testing process. Fillable forms and instructions describing the entire testing process are in the 12.0 test package, at www.BACnetinternational.org/associations/8066/files/BTL_Test_Package_12.0.final.zip The BTL Checklist and BTL Testing Application determine the testing which will be performed.

Every device is different, but a schedule estimate and testcase can be created from those two documents. A signed BTL Testing Agrmt and US $1,000 deposit secures a place in the test queue. BACnet International member companies at Silver level or higher receive a discount on testing fees. It is common for testing and a Listing to apply to a family of devices that share underlying BACnet software. We test only the BACnet functionality. If the same firmware is used in common amongst devices, one testing and one Listing can apply to the family. If you have any further questions please do not hesitate to ask. I look forward to seeing your application for BTL testing.

Duffy O'Craven
Manager of the BACnet Testing Laboratories (BTL)
btlmanager@bacnetinternational.org

AB Regin
- Regio Room Controllers

Acutherm
- EF-B

ALC
- LGR Line
- SE Line
- Room Controller
- ZN341v
- WebZone

Azbil
- Inflex™ VC VAV Controller with Actuator

Carrier
- AppController
- Fan Coil Open
- i-Vu Open Router
- i-Vu Open Link
- RTU Open
- RTU-MP
- UC Open Controller
- UC Open XP
- UPC Open
- Unit Vent Open
- VAV Single Duct
- VAV Fan Terminal
- VVT Bypass
- VVT Zone Controller
- WSHP Open
- WSHPW2WM Open

Continental Control Systems
- WattNode BACnet

Cristal Controls Ltd.
- CCLP-BACnet

Danfoss
- FC 102

Delta Controls
- Application Controller DAC-633PoE
- Application Controller DVC-V322PoE
- enteliZone
- ORCAview 3.40

E-Mon
- BAS Meter

Honeywell
- 961 series BACnet Thermostat Driver
- ComfortPointTM Open Compact VAV
- ComfortPointTM Open Digital I/O Controller

Johnson Controls
- Advanced Application Controller
- Advanced Programmable Application Controller
- Metasys
- VAV Modular Assemblies
- VMA 1630

Korea Digital Control
- SCAFA ezHMI

LG Electronics
- PQNFB17C1

MR Engineering
- eBCON
- ORCAview

Obvius
- AcquiSuite

OEMCtrl
- I/O Zone 560, 483
- I/O Zone 8112
- OEMPrtl Pro

Price
- Healthcare Controls

Samsung SDS
- I/O Extension Modules

Samsung Techwin
- Network Gateway Controller SAG-B1280A

Schneider Electric
- I/A Series® MicroNet™ Unitary Controller
- iEM3000 Series Energy Meter
- SERPBC600
- StruxureWare Building Operation Automation Server
- StruxureWare Building Operation Enterprise Server
- StruxureWare Building Automation Operation Server
- StruxureWare Building Automation Enterprise Server

Siemens
- DESIGO INSIGHT
- Strato
- BACwALL
- BACzone

Swegon
- GOLD IQnomic

Tekmar
- Mixed Plant Boiler Stager

Trend
- IQeco

Tridium
- 961 series BACnet Thermostat Driver
- JACE-2, JACE-6, JACE-7
- JACE-NXT

Wattmaster
- VCGX Controller
- VCBX Controller
- PCIM Controller

Yaskawa
- SI-B3
- Z1000

Plugfest Berlin 2013 – Building Operators Profit from Smooth Interoperability

At the 7th annual European BACnet Interoperability Workshop manufacturers and developers from 10 countries tested BACnet communication of their devices. The so called Plugfest was held in Berlin, Germany from May 21-23 by the BACnet Interest Group Europe (BIG-EU).

BIG-EU Plugfest 2013

Building operators profit from smooth interoperability of BACnet devices. To keep it that way or even increase quality of BACnet communication BACnet International and the BACnet Interest Group Europe (BIG-EU) regularly host plug fests. This secures that new systems and updated devices perfectly communicate with each other, and acceleration of commisioning.

In Berlin, 23 teams of manufacturers from 10 countries were busy with eight individual pairing sessions. Additionally two round tables and one all-inn session were conducted. The group of almost 50 engineers was supported by Frank Schubert, Graham Whiting, Gerhard Bahr and Christoph Böttger.

The location at the HTW University of Applied Sciences for Engineering and Economy and the City of Berlin contributed to the success. The 8th European BACnet Plugfest will take place on May 21-23, 2014 in Switzerland.

New to the BACnet International Family

Member of

BACnet International

BACnet International is the international 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 pleased to congratulate Nara and LG for upgrading their membership level to Gold.

We are also proud to have welcomed the following new members to our ranks in 2013:

AB Regin

The goal of AB Regin is to be a significant supplier of solutions in building automation and water & sewage. Through competence, simplicity and commitment, together with their partners, they develop products and solutions that contribute to efficient energy consumption and sustainable development. Their goal is to make Regin a leading supplier of solutions that contribute to improved energy consumption and sustainable development

AB Regin
Sweden
Corporate Affiliate Member
of BACnet International
www.regin.se

Accutrol LLC.

Accutrol LLC is a manufacturer of world class air flow measurement and control products used in critical environments and other specialized applications. Accutrol offers engineered airflow control solutions designed to meet the demands for 21st century sustainable design. The flagship product is the low pressure drop AccuValve® air flow control valve incorporating high accuracy airflow sensing with a revolutionary design based upon proven technologies. The design characteristics of the AccuValve enabled the product to receive the 2008 AHR Innovation award.

Accutrol LLC.
United States
Silver Member of BACnet International
www.accutrolllc.com/

Chipkin Automation Systems

Chipkin Automation Systems (CAS) are building and industrial automation protocol experts. We sell, support, develop, install, configure protocol converters/gateways, data loggers, remote monitoring and control applications. Founded in October 2000, CAS focuses on machine to machine data communications and remote monitoring.

Chipkin Automation Systems
Canada
Silver Member of BACnet International
www.chipkin.com/

Continental Control Systems

Continental Control Systems, LLC is a privately owned Colorado limited liability company that began operations in 1995 as a product development and manufacturing company. CCS specializes in electric power metering and monitoring equipment for use by the energy services industry. Our mission is to create and provide the technology and equipment that enables the efficient use of electricity throughout the world. We are staffed by a team of highly qualified design engineers, software and firmware engineers, applications engineers, production technicians and sales and support specialists all with a common objective: To supply our customers with reliable and accurate products at a reasonable cost, with the highest level of professional service and attention to customer needs.

Continental Control Systems
United States
Silver Member of BACnet International
www.ccontrolsys.com

Dwyer Instruments, Inc.

Since the company was founded in 1931, customers have come to recognize Dwyer Instruments to stand for quality, reliability, and readily available low cost products. As a leading manufacturer in the controls and instrumentation industry, we continue to grow and serve major markets including, but not limited to HVAC, chemical, food, oil and gas, and pollution control. New applications are discovered daily through a cooperative effort between Dwyer and its customers.

Dwyer Instruments, Inc.
United States
Silver Member of BACnet International
www.dwyer-inst.com/

Gentec

Since its foundation in 1959, Gentec designs, produces and markets custom solutions that exceed the industry's quality and design requirements. These solutions end up in applications as diversified as electric power conversion and power consumption management, from the military to banking institutions, to name only a few. The products developed and produced throughout the years by Gentec have always been a notch above the rest. Thanks to the commitment of its personnel to keep ahead of technological advances and to exceed the industry's quality standards on both development and the production aspects.

Gentec
Canada
Silver Member of BACnet International
www.gentec.ca

Measurlogic, Inc.

Enabling Energy Efficiency has been the motivation for the team at Measurlogic for developing an advanced technological selection of Smart Revenue Grade Electrical Energy Sub-Meters and Practical

Electrical Data Acquisition Systems. Measurlogic is an American manufacturer and distributor based in Centennial, Colorado. The company was founded in 2000 on over 30 years of experience in the design, manufacture, sales and support of precision instrumentation, energy mitigation products, electrical monitoring meters and energy management systems. Measurlogic serves the commercial and industrial markets, both domestic and international. ◼

Measurlogic, Inc.
United States
Silver Member
of BACnet International
www.measurlogic.com

Pegasus Automation International

Pegasus IBMS products for intelligent buildings have been installed in Malaysia since 2000. Owing to the flexibility of the Pegasus product in customization, platform independence (open platform) and being the pioneer in communication protocol object application (POA). POA is the advance drive object-oriented technology which allows any 3rd party devices to integrate seamlessly with either Pegasus Front End Human Machine Interface (HMI) SCADA software, Pegasus Network Control Unit or Pegasus Fully Self Contained Controller into the Pegasus I/O database directly with full control, monitoring and management function capabilities.

With the implementation of POA, all Pegasus IBMS installed at site have at least one or more seamless integration links to 3rd party devices. At present, more than 200 copies of Pegasus IBMS have been installed at sites such as data centers, universities, hospitals, etc. in Malaysia alone. ◼

Pegasus Automation International
United States
Silver Member
of BACnet International
www.pegasus-automation.com

tekmar Control Systems

With over 28 years of experience tekmar Control Systems understands the comfort of the occupants in a building depends on the performance of its heating, ventilation & air conditioning (HVAC) system. Since 1984, tekmar has developed affordable heating & cooling control solutions designed to get the best performance from the mechanical equipment and system. In anticipation of the needs of tomorrow, they continue to innovate and pioneer new technologies, following their motto "Better Design. Better Control. Better Systems." ◼

tekmar Control Systems
Canada
Silver Member
of BACnet International
www.tekmarcontrols.com

Triatek

TRIATEK founded in 1985, is a growing, privately held company based in Norcross, Georgia. TRIATEK manufactures a complete line of building control products that seamlessly integrate with most building automation systems on the market including but not limited to Johnson Controls Metasys™, Siemens System 600 Apogee™, Automated Logic Webctrl™, Andover Controls, Teletrol, Alerton Technologies, and many others. ◼

Triatek
United States
Silver Member
of BACnet International
www.triatek.com

EnOcean with BACnet – simplify your building automation
No Wires. No Batteries. No Limits.

BACnet Gateway/ BMS

Batteryless wireless **Light sensor** automatically matches lighting to daylight

Batteryless wireless **Occupancy sensor** adjusts temperature and turns off lights when a room is not in use

ENERGY SAVINGS & FLEXIBILITY

Batteryless wireless **Switches** control lighting and shading

Wireless **Plug-in switch module** to control lighting and consumer appliances

Batteryless wireless **Position sensors** setback HVAC when windows or balcony doors are left opened

Batteryless wireless **Room temperature sensor** for minimal energy consumption and maximum comfort

Benefits of EnOcean –
The Energy Harvesting Wireless Standard

- ◼ Installed in over 250,000 buildings worldwide
- ◼ Over 1,100 interoperable EnOcean enabled products
- ◼ Over 300 members in the EnOcean eco-system

enocean Wireless Standard
ISO/IEC 14543-3-10

www.enocean-alliance.org/products

Calendar of BACnet Events

Date	Location	Event	Highlights
2013			
September 17-18, 2013	Las Vegas, NV	NFMTVegas/ BACnet Internatio-nal Educational Conference Vegas	BACnet International booth, education sessions, awards ceremony and reception
November 19-21, 2013	Atlanta, GA	PlugFest	Hosted by BACnet International, includes interoperability testing, roundtable testing, education sessions
November 20-22, 2013	Philadelphia, PA	Greenbuild	BACnet International booth
January 21-23, 2014	New York, NY	AHR Expo	BACnet International booth (member product showcase display) and education track
March 4-6, 2014	Baltimore, MD	NFMT	BACnet International booth
June 1-5, 2014	Las Vegas, NV	LightFair International	BACnet International booth
Fall 2014	Las Vegas, NV	NFMTVegas	BACnet International booth, education sessions, awards ceremony and reception
Fall 2014	New Orleans, LA	Greenbuild	BACnet International booth

Information about all Events:

Natalie Nardone, CAE, CMP, BACnet International Office,
natalie@bacnetinternational.org

»Efficient Technology with BACnet

» Room Operating Unit
  WRF08

» Energy-efficient

» Interoperable

» For various applications
  (rH, CO2, temperature, room operation...)

» Surface Room Sensors,
  including wireless EasySens types

» Room Operating Unit
  WRF04

» Room Humidity Sensor
  FTW04LCD

» Room CO2 Sensor
  WRF04CO2

» www.thermokon.de

thermokon®

Keep in touch with the future

Building Better with BACnet International

2013 BACnet International Sessions at NFMT Vegas:

Session Title	Presenter	Date/Time
Building Sustainability through Building Automation	Ben Dorsey KMC Controls, Inc.	Tuesday 8:00 AM - 8:50 AM
Automation Armageddon	Andy McMillan BACnet International	Tuesday 9:00 AM - 9:50 AM
The Lighting Controls Evolution: From Yesterday's Energy Codes to Tomorrow's High Performance Buildings	Pete Baselici WattStopper	Tuesday 10:00 AM - 10:50 AM
Wireless Direct Digital Control	Jim Kohl Trane	Tuesday 11:00 AM - 11:50 AM
Using BACnet to Obtain Free LEED Credits	Tim Skell ABB, Inc.	Wednesday 9:00 AM - 9:50 AM
How Facility Managers, Specifiers and Equipment Suppliers can use BACnet Effectively	Grant Wichenko Appin Associates	Wednesday 10:00 AM - 10:50 AM
VFD Communications - Which Objects Should I Monitor and Why?	Mike Olson ABB, Inc.	Wednesday 2:10 PM - 3:00 PM

Connect with us online at www.BACnetInternational.org

Visit us in Booth 412

ABB

AMERICAN AUTO-MATRIX®
Smart Building Solutions

BACnet International

BLUE RIDGE TECHNOLOGIES

KMC CONTROLS
In touch.

MEASURLOGIC

TRANE®

VICONICS
Beyond Comfort

WattStopper®