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BACnet International Journal

The BACnet magazine for building automation in North America and the world

BACnet Knowledge is the Cornerstone of Success

NFMT – National Facilities Management & Technology
Baltimore, March 15th – 17th, 2011

BUILDING OPERATING MANAGEMENT'S NFMT National Facilities Management & Technology

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BACnet International Journal
The BACnet International Journal is the American 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.

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Chicago, Site of Numerous BACnet Solutions

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Everyone has Something to Teach – BACnet Education

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Knowledge is the foundation behind any success – be it individual success or corporate success. Here at BACnet International our goal is to make as much knowledge on the ASHRAE, SSPC 135 BACnet Standard as available as possible to ensure the success not only of our members, but of all practitioners in the BACnet community.

The BACnet Education Committee formed and began providing educational content on the BACnet International website in 2010 in an effort to help educate the BACnet user community. BACnet informational and educational presentations created for the Facility Decisions conference, BOM Webinar, and ASHRAE AHR are now posted on the BACnet website in a specifically dedicated Education portal, which you'll find on the far right side of the homepage. In 2011 the Education committee plans to create and make available additional materials for end-user operators, specifying engineers and consultants, system integrators, and product developers. Industry professionals utilizing BACnet are also invited to submit educational information and training materials, which the committee will review and post. We believe that everyone has something to teach.

The BACnet standard is now prevalent in the industry with over 50 manufacturers and OEM suppliers providing solutions in hundreds of products globally. Benefits of open system integration abound with high-performance buildings leveraging BACnet communications for not only basic monitoring and control, but also for more complex interoperability including client-side support of controller based alarming, trending with backfill capabilities, scheduling, and change-of-value (COV) reporting (as opposed to continuous polling).

Most recently, more than 35 companies participated in the 2010 BTL sponsored "Plugfest" interoperability test session event, and the BACnet client initiated "Back-up and Restore" functionality has been adopted in many distributed control products. The thorough BTL testing of listed products has bolstered confidence in the standard and the manufacturers' products proven to properly implement all of the functionality detailed in the manufacturer's Protocol Implementation Conformance Statement (PICs) that accompanies the product's listing on the BTL web site. For more information on BTL tested and listed products go to: www.bacnetinternational.net/btl/

To learn more about benefits of open system integration and interoperability made possible exclusively by the ASHRAE, SSPC 135 BACnet Standard or to volunteer for the BACnet International Education Committee, please visit: www.bacnetinternational.org

Roy A. Kolasa

Air Quality Control and Propulsion Unit Testing

A BACnet-based heating, ventilation and air conditioning (HVAC) system is offering ABB a double advantage by controlling the air quality within one of its factories in Finland, while simultaneously being used during the functional testing of its Azipod® marine propulsion units.

Power and productivity for a better world™

The BACnet-enabled ABB low voltage AC drives within the HVAC system provide the functionality needed for this dual application. The building automation system monitors the flow and temperature of air used by air-cooled propulsion units being tested, as well as the heating and air conditioning throughout the site.

The BACnet-based open building automation system enables the same operator work stations and operator interfaces to be used for the air conditioning of the factory and the acceptance testing.

Extending the scope is easy with BACnet

At the heart of the HVAC system is BACnet. Pumps and fans are controlled via 30 ABB standard drives for HVAC. The ABB drives with native BACnet MS/TP are connected to the building management system using BACnet/IP to MS/TP (Master-Slave/Token Passing) routers.

A benefit of BACnet is that functions not anticipated when the system was originally installed can be easily added. Because all data is available all the time, even if not required at the time of installation, there is no need to change any network or device configuration when adding new reports or alarms to the operator workstation.

Precise air handling control

The intelligence of the air handling system is located in the production area, where the air conditioning is split across two halls. One side is over-pressurized to maintain a clean environment, avoiding contamination from the other side. Air supply and exhaust are controlled separately to manage air pressure. The heat from all exhaust air is recovered to minimize energy losses.

BACnet-based HVAC system controls air quality at ABB's Vuosaari factory, while also assisting with functional testing of ABB's Azipod® marine propulsion units.

A BACnet-based heating, ventilation and air conditioning (HVAC) system, controls the air quality within one of its factories in Finland, while simultaneously testing the functional of Azipod® marine propulsion units.

Factory acceptance testing of Azipod® is governed by strict air handling guidelines. For example, the Azipod® air cooling system is located inside the building and must not affect or disturb the climate inside the production halls.

Fully remote access

The BACnet integration allows remote access to the system over local intranet and also to each individual drive. Even the inputs/outputs (I/Os) of the ABB standard drives for HVAC can be freely controlled from the building automation system.

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Bidirectional Wireless Control Integrated within BACnet Systems

Wireless building automation technologies have opened new possibilities for the industry. They can function as stand-alone solutions, but their full potential is only truly harnessed when integrated within centralized BACnet systems.

Are complete bidirectional control and integration of wireless technologies with BACnet feasible? Yes. In fact, it's been done already.

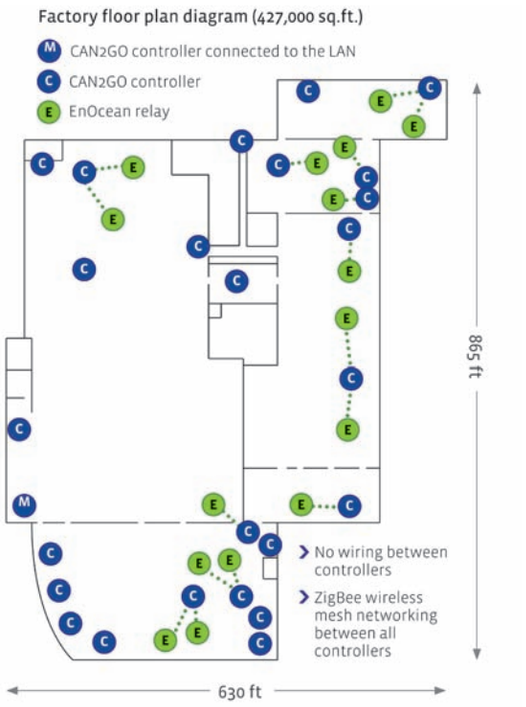
By embedding a BACnet IP gateway within a bi-directional wired and wireless controller, wireless to BACnet integration is done seamlessly. Resting on software innovation, as well as meticulous hardware combination, a controller can do much more than it used to. The controller can now be the gateway or router. It can even be the server.

EnOcean to BACnet bidirectional control and integration has already been done in several buildings; one of them a 427,000 sq.ft. cardboard factory. The factory has gas-fired unit heaters originally controlled by mechanical thermostats. The challenge was to integrate the heaters within the existing BACnet IP system of the factory.

Using EnOcean relays, controlled wirelessly by CAN2GO wired and wireless controllers, themselves equipped with embedded BACnet IP gateways, the mandated contractor was able to install the missing link between the heaters and the BACnet building management system – without extensive wiring costs or significant downtime.

16 heaters are controlled by EnOcean relays communicating with CAN2GO controllers. 9 others are hard wired directly to controllers. All controllers communicate wirelessly to each other using their ZigBee wireless mesh capabilities (the most robust wireless network type); limiting wiring to a minimum and allowing a robust mesh backhaul – even in a dynamic environment with large dense core paper reels. One controller is connected to the LAN, sending the wired and wireless end-devices as BACnet objects to the existing third party BACnet IP system – no gateway or software needed.

All controllers communicate wirelessly to each other using their ZigBee wireless mesh capabilities; wiring at a minimum, allowing a robust mesh backhaul – even in a dynamic environment with large dense core paper reels.



Schematic of factory floor diagram.

Putting all these installation and integration advantages together, the contractor estimated spending 40 % less time on the job then if it had been a completely wired retrofit. The total estimated savings reach $45,000... for a 25 controller project.

EnOcean to BACnet, and back again; complete bidirectional control and integration between two proven industry standards.

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School Renovation – Energy and Costs Saved

There are various reasons for renovating a building. Of course, a major reason is cutting the high cost of energy. Older buildings in particular are often veritable energy guzzlers because they have little or inadequate insulation. At St. Joseph elementary school in Lacolle, Quebec (Canada), the decision makers opted for EnOcean technology for the room temperature sensing devices. Energy costs were cut by 30 percent.

enocean® alliance
No Wires. No Batteries. No Limits.

Savings potential optimally tapped

Before its renovation, St. Joseph elementary school had no individual temperature regulation system but what could be called a dual-zone regulation for the entire school. As a result, it was often too cold in one half of the school and too warm in the other - depending on the intensity of sunshine. To cut the energy needed by heating and air-conditioning, and for extra comfort, the school decided in summer 2008 to install a system based on self-powered wireless technology from EnOcean. Sensors were put in place in 28 rooms, using light as their natural energy source and requiring neither batteries nor any external power supply. All room sensors are linked to a central BACnet system, controlling the temperature in individual rooms. The project was implemented by Regulvar, which served the school as consultant for the entire duration.

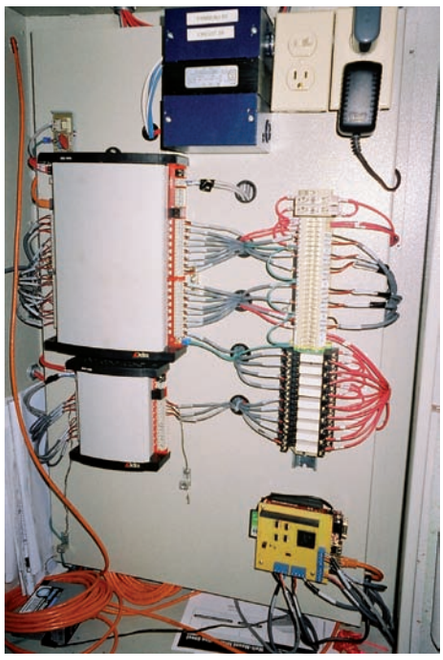
Convincing arguments

The room sensors have enabled the school to enhance comfort and substantially reduce its energy needs. Plus, the new system implemented by Regulvar now allows metering and remote monitoring of energy consumption via internet, e.g. on behalf of the education authority. A further key argument was that the entire installation could be carried out without interrupting the normal running of the school.

The entire installation could be carried out without interrupting the normal running of the school.

Speedy and simple implementation and a good investment

Installation of the whole system took just one week during October 2008 – including installation of the central control system for the monitoring and government of energy consumption. As everything had to be in place and operational before winter sets in, the simplicity and speed of installation was a huge bonus for the school. As it turned out, the biggest challenge was finding the right positioning of the room sensors because the school has thick walls of concrete and steel – normally a big challenge for wireless systems but no problem for the EnOcean devices. Choosing EnOcean's self-powered wireless technology saved the St. Joseph elementary school 20 percent in installation costs alone. The cost of implementing this wireless solution was 6000 Canadian dollars lower than for a comparable – but disruptive – cabled installation.



Choosing EnOcean's self-powered wireless technology saved the St. Joseph elementary school 20 percent in installation costs alone.

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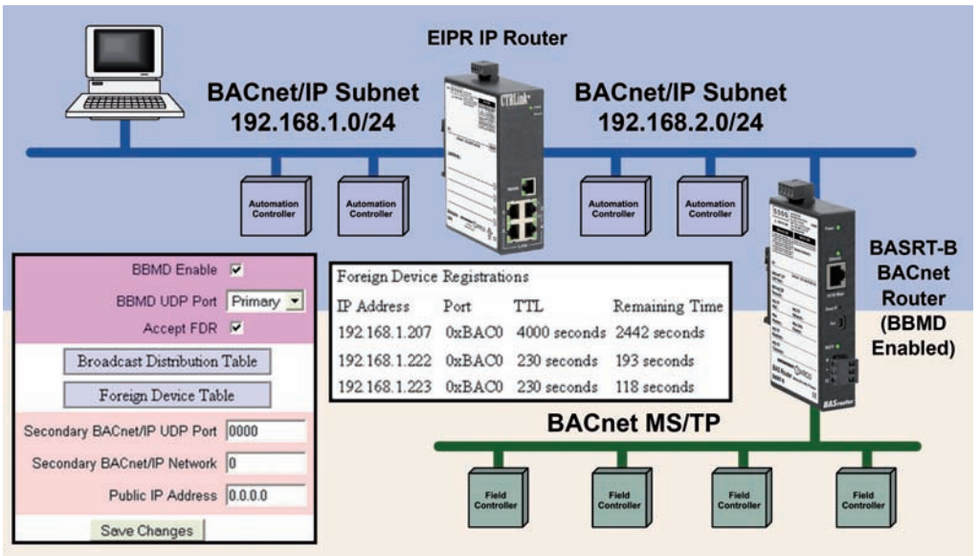
Achieve BBMD Support with the BAS Router

Attaching BACnet devices to IP networks gets complicated if the IP network is sub-netted with IP routers. Most IP routers will not pass broadcast messages which are crucial to BACnet operation. One solution is to install the BAS Router and use its BBMD (BACnet/IP Broadcast Management Device).

CONTEMPORARY CONTROLS

The BBMD takes a broadcast message from one subnet, encapsulates it into a directed message (which will pass through IP routers) and sends it to all subnets. The encapsulated message is received on the remote subnets by a BBMD that decodes and resends it on its local subnet as a broadcast. For this to work, you might think a BBMD must exist on each subnet, but this is not true if all the BACnet/IP devices support FDR (Foreign Device Registration). At least one subnet must have a BBMD to register all BACnet/IP devices from other subnets.



BBMD decodes and resends message on its local subnet as a broadcast.

In our example, two subnets are separated by an IP Router. The right subnet has a BAS Router attached to BACnet MS/TP devices. The BAS Router's onboard BBMD registers all BACnet/IP devices from the left subnet. But if a device on the left lacks FDR capability, an additional BBMD must be installed on the left subnet. The devices on the right need not register as foreign devices because the BBMD relays messages from the left subnet.

One solution is to install the BAS Router and use its BBMD (BACnet/IP Broadcast Management Device).

The BAS Router BBMD only functions by clicking the main page Advanced button, then enabling BBMD by checking a box (see left inset). All BACnet/IP devices must use the same port – typically BAC0. Normally, the BACnet/IP UDP Port matches that on the main page, but an alternate port can be chosen. An Accept FDR box (checked by default) allows foreign devices to register with the BBMD (if BBMD is enabled).

A button accesses the Broadcast Distribution Table (BDT) where up to five BBMDs can be specified by their IP addresses and subnet masks. In our example, there would be no entries because there is only one BBMD. If there were two, each BDT table would have one entry – the IP address of the other BBMD.

Another button accesses the Foreign Device Table (FDT) to display all foreign devices registered with the BBMD (see right inset). In this example there would be three entries – one for each BACnet/IP device in the left subnet.

NOTE: If the IP router has a firewall (as in our example), its port forwarding table must include BAC0 – otherwise, BACnet messages will not pass through the firewall.

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BACnet a Breath of Fresh Air in Classroom IAQ Monitoring

Research indicates that the environmental condition of a classroom plays a large role in a child's ability to stay alert and focused. Sadly, a number of studies show that classrooms are not ventilated at the recommended minimum rate of 15 – 20 cfm per person, causing an atmosphere of decreased productivity and learning.

Traditionally, classrooms are ventilated at a fixed rate based on an assumed occupancy or a set global time schedule. These methods allow an inrush of outside air, but do not ensure ventilation rates meet recommended guidelines. A fixed or set time method creates over and under ventilation. Over ventilation occurs when there is more fresh air introduced to a space than needed. This outcome causes exuberant amounts of energy to be used, greatly increasing a schools greenhouse gas emissions and energy costs. While under ventilation is caused when there is not enough outside air introduced to a space, causing an unstable indoor air quality (IAQ) making occupants drowsy and uncomfortable.

Fresh air monitoring at Byron-Bergens Elementary School – an important factor for children's ability to remain alert and focused.

The Challenge

Byron-Bergen is a small school district located in Upstate New York. A limited portion of the district was renovated in 2001, leaving the rest with structures and systems that dated back to 1957. An area of concentration in Byron-Bergen's capital project was upgrading and expanding the heating and ventilation (HVAC) control system. The district required a system that would adapt to growth, and easily connect and communicate with additional controls. Byron-Bergen chose to convert the existing system to a BACnet system. The Byron-Bergen District partnered with Packaged Air Systems Company (Pasco) for the controls system update. Pasco's solution was Demand Control Ventilation (DCV) using Veris Industries BACnet communicating CO_2 sensor.

The BACnet Solution

Byron-Bergen's facilities operated on variable air volume (VAV) systems. To achieve optimal regulation in indoor air quality Pasco looked to monitor CO2 and temperature in all spaces. The larger community areas throughout the schools required five to six sensors to implement DCV and adequately monitor the space. With standard sensors each component would need to be wired back to a controller. Unfortunately, most VAV's do not have inputs to support five to six CO_2 sensors and five to six temperature sensors. In order to properly install and monitor spaces like the gymnasium and library several additional large controllers would need to be purchased and mounted on the VAV boxes. Being a small district, Byron-Bergen's funds to complete the HVAC control system upgrade were limited. The budget did not have room for additional controllers. Pasco looked for an alternative solution and found it in Veris Industries CWLP BACnet communicating CO_2 Sensor with integrated temperature sensing.

Veris' CWLP with embedded BACnet communication protocol allowed Pasco to daisy chain the devices on one MSTP network, giving a direct connection to the upgraded Alerton BACnet controller. The CWLP eliminated the need for additional costly equipment and wiring.

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School Board Management: BACnet Gets an "A"

The Commission scolaire des Samares (the Des Samares school board) is located in Canada, in the province of Quebec, and has approximately 25,000 students and 5,000 employees. Its building inventory includes 91 buildings over a territory of 16,000 km^2. The buildings are on average 40 years old and together, they represent a total area of 320,000 m^2.

Maintaining building infrastructure is therefore a sizeable challenge, not only due to the number of buildings but also given the diversity, condition, age and specific needs of each one. Energy costs are considerable, as is the environmental impact. For example, in 2005, overall energy consumption reached over 240,000 gigajoules (66.6 million Kilowatt-hours) and as many as 5,700 tonnes of carbon dioxide were released into the atmosphere.

Aware that a significant reduction in energy consumption is based on control, centralization and optimization, school board officials did not hesitate to maximize the potential of building automation and they chose BACnet to ensure reliable and effective communication between the devices.

The school board and Regulvar have been working together for over 25 years. A building automation specialist, Regulvar provided its client with all the solutions it needed to integrate the HVAC, lighting and access control systems. With Regulvar's support, the school board provided all the algorithms required for predictive and energy control, managing peak electricity demand, following up on alarms, etc.

BACnet: the key to a successful integration

To carry out the integration, Regulvar used control devices developed by Delta Controls, including building and system controllers, as well as BACnet thermostats and lighting and access control devices. Six workstations equipped with the Delta Controls Orcaview software are designed to oversee operations as well as the management of over 20,000 input and output points. It is important to note that one of the workstations has a weather communication interface with Environment Canada, which helps determine predictions and identify periods during which the storage heaters need to be charged. Also of note was the innovative use of temperature sensors and self-powered wireless switches (EnOcean) that operate thanks to the Regulvar Universal BACnet Interface (RUBI) Gateway.

St-Roch-de-L'Achigan School with wind turbine.

Mechanical room at St-Roch-de-L'Achigan School.

Top marks for eco-responsible solutions

The strategies that were implemented, particularly the central control system, resulted in $1 million and 50,000 gigajoules in annual energy savings. The substantial reduction in greenhouse gas emissions (CO_2), i.e. 3,000 tonnes per year, represents a 440 % drop since 2005. These figures confirm the effectiveness of tools such as integration, automatic and centralized control and the BACnet protocol in the successful implementation of energy-efficient building solutions.

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[1] In Canada, school boards refer to elected boards that are responsible for decisions and policy concerning the schools in a given area.

Power in the Tower

The two airport towers in Frankfurt/Main and at the airport in Berlin Brandenburg International (BBI) are controlled by innovative building automation technology based on BACnet from DEOS AG. The high tech company makes sure there is "power in the tower" at all times.

Equipping an airport tower with modern and reliable building automation technology is always something special. The equipment and supervision of flight security concerns a highly sensitive area. The German Flight Security Agency ("Deutsche Flugsicherung GmbH (DFS)") ordered to control both new towers with DEOS technology and integrate it into the given airport infrastructure via BACnet.

New towers in Frankfurt/Main and Berlin

The new building of the tower became necessary, as the new runways on the south side of the airport were no longer observable. With 100 m², the new tower pulpit is 40 % bigger than the present one and provides room for 12 employees.

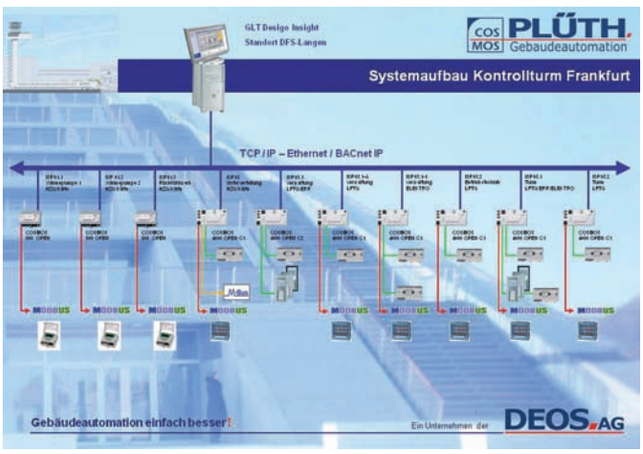
The 72 m high building is the landmark of the new BBI. Airport. The newly developed elliptical tower pulpit has room for 11 employees.

The technical standard

A very high technical standard was chosen for the building equipment. In both projects redundant ventilation systems were built. Even higher standards were applied to the controllers. They operate in Hot Standby mode to insure a seamless takeover of operation in case one system goes out of service. Altogether, 10 controllers of the COSMOS series from DEOS were installed to insure maximum comfort and safety.

In addition to HVAC, the craft Electro was integrated into the DEOS system. The compact size of the COSMOS I/O modules (automat profile) enabled them to be installed directly into the electrical distribution panels. The lighting and blind control was also integrated in the COSMOS BACnet controllers. With the COSMOS room control units, which were connected via high speed CAN-Bus, individual control is possible.

In January 2009, the foundation-stone was laid for the new airport tower for Frankfurt/Main.



System design of the control tower at the Frankfurt Airport.

Given the wide range of implemented protocols on the COSMOS 4000 OPEN controller from DEOS, further equipment of the tower was integrated via various protocols (Meters via M-Bus, heat pumps and UPS via MOD-Bus).

The compact size of the COSMOS IO modules allowed a decentralised placing in the rooms. Data exchange in the rooms can be done via BACnet network and also via CAN-Bus. In Frankfurt 2740 and in Berlin 2560 physical data points are controlled to insure optimal working conditions, highly sensitive for public safety. The use of the BACnet certified COSMOS controllers from DEOS, enabled the German Flight Security Agency to equip the new towers with the chosen BMS technology while integrating it seamlessly into the given airport infrastructure.

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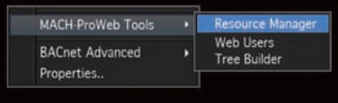
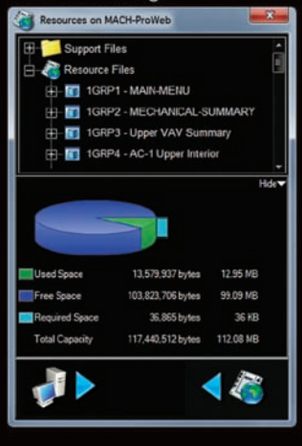
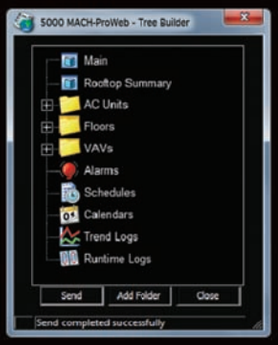
Tools



Resource Manager

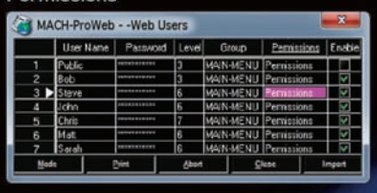


Tree Builder



The MACH-ProWeb™ Tools show the resources available for posting and the user permissions, and with a drag, drop and click, the Web operator interface including graphics, navigation and security, is complete.

Permissions



MACH-ProWeb™ Operator Interface

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ASHRAE SSPC-135 Meetings – BACnet Proceedings

Bernhard Isler [1]

The ASHRAE SSPC-135 BACnet Committee went through three very busy face-to-face meetings since the ASHRAE Winter Meeting in Orlando. Substantial work was performed during these meetings, yielding substantial developments for the BACnet standard and its companion test standard.

In May, the committee and its working groups assembled in Maryland for a one week interim meeting. This meeting was hosted by the Montgomery College on its Germantown campus, as it has for many years in spring.

The meeting took place right after the close of the public review of some addenda, so that the comments received could be discussed and resolution work be done. Addenda 135-2008*g* and -z were completed and prepared for approval and publication by ASHRAE. Comments on addendum 135-2008*ac* and addenda 135.1-2009*e*, *-f*, *-g* and *-h* were resolved and changes to these addenda considered for another public review. Work continued on comments and preparations for public review on lighting related addenda 135-2008*i* and *-aa*. A number of change proposals for clarifications and miscellaneous changes were voted out for inclusion into some future addenda and public review.

Alarming revision concepts completed

The Objects & Services Working Group (OS-WG) completed conceptual work on a comprehensive overhaul of the BACnet alarm and event mechanism. Over the recent years, the committee received various interpretation requests and change proposals on this matter, indicating inconsistencies and deficiencies in the standard. It was always clear that fixing this in a comprehensive way would be a major and substantial work to be done. This work was finally started in fall 2008, when an inaugural Alarm Summit meeting was held in Atlanta. After two other Alarm Summits, some OS-WG meetings and teleconferences, a broad consensus was reached in Germantown on the concepts and required first phase modifications and changes to the standard. Backward compatibility was a major concern, and was preserved to the largest extent possible. The first step revisions ultimately were compiled into addendum 135-2008af and went into its first public review in fall.

In June, the committee and its working groups met face-to-face in Albuquerque, New Mexico at ASHRAE's Annual Meeting 2010. Since Germantown, addenda revisions were prepared for public review, and new change proposals were compiled into addenda drafts for public review. A number of addenda were before the ASHRAE committees, and were approved for publication by the ASHRAE board of directors:

- Addendum 135-2008*g* Network Security
- Addendum 135-2008*p* Global Group Object
- Addendum 135-2008*z* Miscellaneous Changes
- Addendum 135.1-2009*d* COV Tests

New network security architecture released

With the approval and publication of Addendum 135-2008g, BACnet now has a state-of-the-art network security architecture. This includes mechanisms for data integrity and confidentiality as well as peer entity, data origin and operator authentication. This is supported on any BACnet networking technology, and is used in all relevant protocol layers, including the BACnet Network Layer and BACnet Virtual Link Layer of BACnet/IP. Currently, message encryption is using AES-128, and message authentication may use either MD5/HMAC or SHA-256. The architecture allows adding new algorithms in the future when needed. Aside from providing network security as such, the architecture enables server side operator authorization through its operator authentication mechanism.

During the plenary sessions, public review drafts of addenda were discussed and some got voted out for initial or a next public review in fall. Among those were addenda 135-2008*ac*, *-ad*, *-ae*, *-af*, *-ag* and -ah; and test standard addenda 135.1-2009*e*, *-f*, *-g*, *-h* and *-i*.

Foreign protocol mappings redirected

In the course of discussion of a change proposal that seeks to add a standardized mapping of ANSI/CEA 709 data to BACnet objects and properties, there was a spirited debate on usefulness of such mappings. It was pointed out that such mappings often do not really help interoperability. Applications today have difficulties in working with data in arbitrary aggregation or layout, may they appear in a third party vendor's product or some protocol mapping. Standardized interfaces to known functions would serve the applications much better. There were a number of attendees that strongly supported this idea. This group convinced the committee and the change proposal got tabled. It was made clear that this is not specifically on ANSI/CEA 709, but applies as well to other attempts for standard mappings. As a consequence, the committee may also reconsider those that are already part of the standard.

During the last week of October, the committee and working groups met in Atlanta, Georgia. Georgia Tech hosted the committee for the fifth time, providing excellent facilities for a productive week, as always.

Among others, the major activity during this meeting was to review and resolve public review comments that had been received on addenda that were out in public review. The working groups and the committee completed comment resolution on all these addenda. Approval of addenda drafts for public review was deferred to a letter ballot. A handful of addenda were made ready for ASHRAE approval for publication:

- Addendum 135-2008*ab* Additional MS/TP Baud Rates
- Addendum 135-2008*ac* Date and Time Usage
- Addendum 135-2008*ag* Miscellaneous Changes
- Addendum 135.1-2009*e* IP Test Revisions
- Addendum 135.1-2009*f* Miscellaneous new tests
- Addendum 135.1-2009*g* Many new Tests, Updates and Corrections
- Addendum 135.1-2009*h* Miscellaneous Test Changes
- Addendum 135.1-2009*i* New Tests, Updates and Corrections

Addenda made ready for public review approval, or had been in public review during the Atlanta meeting were:

- Addendum 135-2008*ad* Miscellaneous Changes
- Addendum 135-2008*ae* Access Control Amendments
- Addendum 135-2008*af* Alarming Revision
- Addendum 135-2008*ah* Deprecate ReadPropertyConditional
- Addendum 135-2008*ai* Network Port Object
- Addendum 135-2008*aj* BACnet Support for IPv6

BACnet to support IPv6

With the new addendum 135-2008aj going into public review, BACnet devices become able to be native IPv6 participants. The virtual MAC address approach chosen provides full backward compatibility with any existing BACnet device, enabling them to speak to BACnet/IPv6 devices, and vice-versa. Although BACnet/IPv6 uses inherent IPv6 multicast concepts, BACnet Broadcast Management Devices (IPv6 BBMDs) are still required. IPv6 BBMDs differ from the IPv4 BBMDs in that they are used to span multicast domain boundaries, may use DNS names to reach other BBMDs and Foreign Devices, and perform virtual MAC address resolution for devices that are outside the multicast domain.

[1] Bernhard Isler is the Secretary of the ASHRAE SSPC–135 and Producer Voting Member. He is convener of the Objects & Services Working Group of the committee. He is a member of Siemens Switzerland Ltd, Building Technologies Division, located in Zug, Switzerland, bernhard.isler@siemens.com

BACnet Protocol Analysis Using Wireshark

Frank Schubert [1]

In BACnet projects it is sometimes necessary to capture the network traffic for problem analysis. The free open-source software Wireshark helps to capture and analyze the network traffic.

Preparations

The first decision in network analysis is to clarify legal issues. This doesn't sound very technical (and indeed it is not), but might be essential. At first it may be necessary to ask the company's IT administrator to install Wireshark on a notebook, (this requires administrator access rights on the PC). Secondly it is always a good idea to inform IT-administrators in the project about network analysis and ask for allowance. Serious legal issues may be affected if an unauthorized analysis is performed, many companies have strict policies!

The second decision is to define the correct access point in the network. Network switches (as the name says) switch the unicast traffic to the designated devices, while broadcast messages are distributed to all devices in the network.

In a switched network environment three options may be used to capture all telegrams:

1) Hub:
Unlike a switch, a hub distributes all packets to all connected devices, so it works perfect to capture all packets, with one little exception. A hub is specified only for 10Mbit/s, so it reduces the bandwidth of the connection and no longer reflects the real situation if the actual connection is 100Mbit/s or higher.

2) TAP (Test Access Point):
This device is connected between the switch and one of the two devices to observe. The network sniffer is then connected to the third connection of the TAP, which passively listens to the conversation w/o actively participating in the network. The disadvantage of those devices is the high price though.

3) Switch w/ mirror-port:
Modern switches or IT routers may have an option to mirror the traffic from or to a device to another port on the switch. The network sniffer is connected to this port and listens to the traffic mirrored by the switch.

A good recommendation for analysis is option 3: Installing a network switch w/ mirror port capabilities in every technical equipment room connected to the IT backbone.

The third decision is the choice of the sniffer tool. Wireshark (formerly known as Ethereal) available under www.wireshark.org is an open-source freeware and one of the world's most popular sniffer. Due to a lot of valuable work by members of the BACnet community the decoding of BACnet telegrams is supported quite well.

The sniffing process

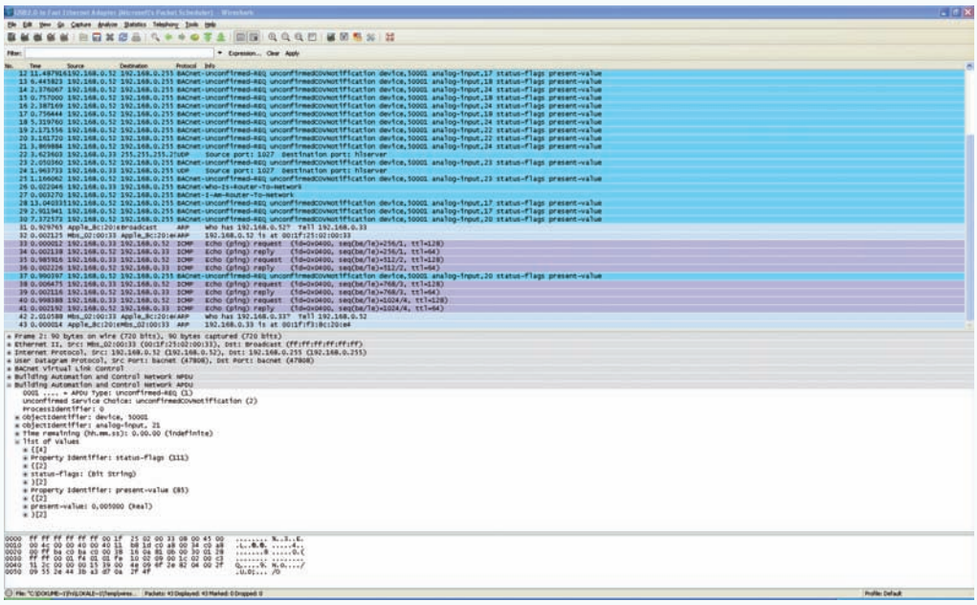
Capturing the traffic is started in Wireshark by selecting the network adapter. All network telegrams transported to/from this interface are shown in the main window. The capture process may be stopped or restarted at any time. Captured packets (so-called packet-logs) may be saved to the hard-drive for later analysis. The typical format is the pcap file format, which is understood by many network analyzers. (Pic. 1)

Capturing MS/TP

Unlike an Ethernet network interface most PCs don't support a direct connection to MS/TP (which is based on a EIA-485 serial interface). In this case an interface adapter is required to capture the data directly in the MS/TP network and provide it to Wireshark for analysis. There are a few companies on the market providing MS/TP interface solutions for Wireshark.

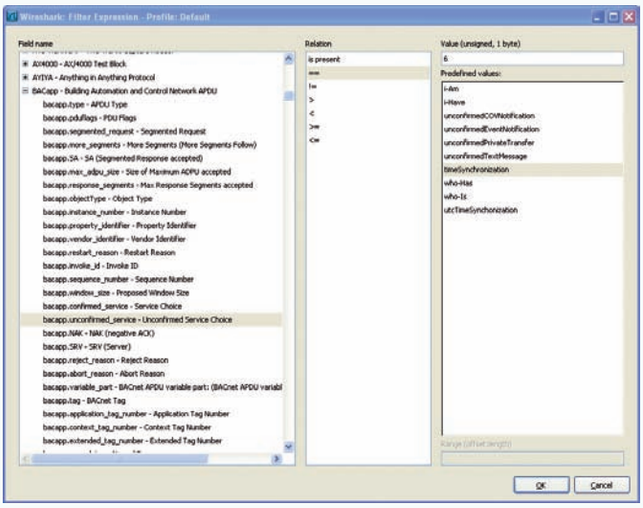
Filters

All telegrams (not only those for BACnet) are captured unless a capture filter is set. A great disadvantage is involved with capture filters though: Setting a capture filter does not reflect the

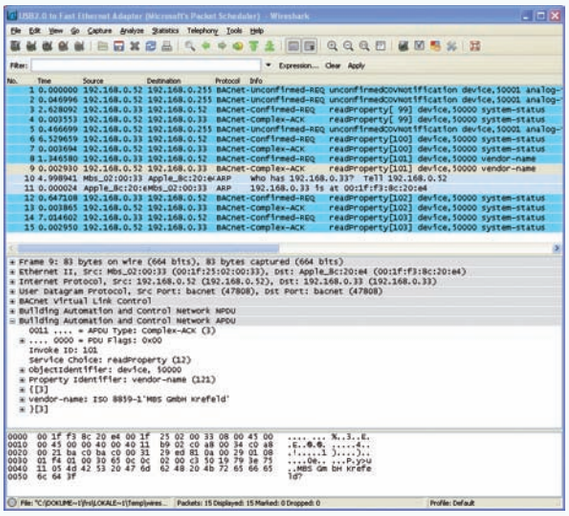


Picture 1

[1] Frank Schubert, MBS GmbH, is member of the ASHRAE SSPC-135, the Advisory Board and Working Group Technique of the BIG-EU as well as training-leader of the BACnet Interest Group Europe, frank.schubert@mbs-software.de.



Picture 2 shows an example to capture all time-synchronization messages.



Picture 3 shows an example telegram response to a ReadProperty/Vendor-Name.

whole traffic anymore, so other telegrams like ARP-requests (Address Resolution Protocol in IP) are no longer shown. Sometimes it becomes necessary to analyze the whole traffic not only the BACnet telegrams.

Display filters in Wireshark allow a higher flexibility. As the name says packets are only filtered to allow a certain view to the telegrams without modifying the packet log. BACnet telegrams can be selected by the filter with a total of four different options:

BACapp
This filter allows selecting telegrams by choosing parts of the application to match the filter (APDU filter), e.g. to show WriteProperty requests only.

BACnet
This filter allows selecting telegrams by their network layer content (NPDU filter), e.g. to select all telegrams which are designated to a specific BACnet network number.

BVLC
BACnet Virtual Link Control, this filter is specific to BACnet/IP and allows selecting telegrams by BACnet/IP related content, e.g. observing forwarded messages or BBMD (BACnet Broadcast Management Device) messages only.

BACnet MS/TP
This filter is specific to MS/TP and allows selecting telegrams by the MS/TP frame handling, e.g. to show PollForMaster requests only.

Display filters may be combined and general filters for specific IP-addresses or ports may be set as well.

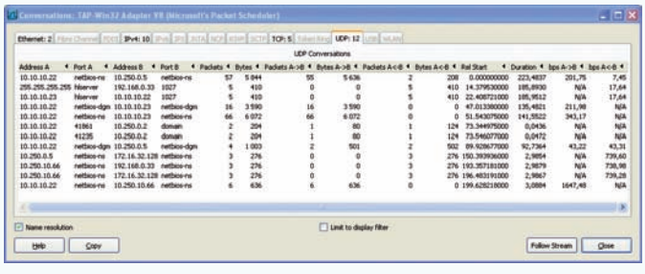
Analyzing the traffic
Analysis of packet logs may vary due to the problem to be investigated, so there are no general rules and this article allows only a short overview. Each single packet is decoded and presented in human readable text.

So the communication between two or more parties in the network is visible to the experienced user and may be interpreted as if listening to other people's talk. This requires good knowledge of the BACnet protocol though.

Statistics
Sometimes packet statistics are important as well. Questions like "which station sends the most telegrams" or "which two stations create the most traffic in conversations", etc. can be answered by the statistics in Wireshark.

Conclusion
Even if analysis may still be an engineer's task, capturing the traffic in a network and sending log-files for analysis is a good opportunity to get communication problems solved.

Wireshark is so powerful that this article only shows an overview. It is a good recommendation to download the tool and get familiar with it to be prepared in case there is a need to capture data in a project for analysis.



Picture 4 shows an example network statistic by IPv4/UDP conversations.

More Profiles for BACnet Workstations

Bill Swan [1]

BACnet has long had "Device Profiles" to describe, define, and specify different kinds of BACnet devices, ranging from the simple BACnet Smart Sensors (in short form written as B-SS) to the complex BACnet Building Controllers (B-BC), a well as the BACnet Operator Workstation (B-OWS).

But over the years it became clear that a single profile was not adequate to define the possible varieties of workstations. Sometimes the B-OWS requires capabilities well beyond what was needed for a simple device intended to display data, and sometimes its required capabilities were far less than what was implemented in an advanced system configuring workstation.

In June 2009 the BACnet committee published "Addendum 135-2008l" which included two new workstation profiles, the BACnet Operator Display (B-OD) and the BACnet Advanced Workstation (B-AWS), and their requirements. The resulting set of three workstation profiles are presented in Table 1.

There are many differences between the three profiles. The B-OD is essentially a data display device with far less capability than the other two. But the B-OWS and B-AWS are superficially similar enough that it is worth taking a look at their differences. This is best done in the context of BACnet's Clause 22 "interoperability areas," in particular Data Sharing, Alarm and Event Management, Scheduling, Trending (trend-logging), and Device and Network Management.

Data sharing

"Data sharing" is defined as the exchange of information between BACnet devices. There are two functions distinguishing the B-AWS from the B-OWS: retrieving values from devices and presenting them to the operator, and modifying settings presented in standard BACnet properties.

A B-OWS is required only to be able to display a basic set of properties from each of the standard object types, reflecting each object's core functionality. For an Analog Input object (which might represent a temperature sensor), these properties are the Object_Name (the name of the object, such as "Room 23 Temp"), Present_Value (temperature), Units (°C) and Status_Flags (its status).

A B-AWS must be able read and present all standard properties of all standard objects, except for Life Safety and Access Control objects. The B-AWS has additional requirements for presenting minimum ranges (for numeric values) and sizes (for character strings) that are not required for the B-OWS.

A similar situation exists for modifying (writing) values; the B-AWS has stricter requirements than the B-OWS.

Alarm and event management

In BACnet "alarm" and event" notifications are identical except for a flag that identifies whether the notification is to be considered an alarm or an event. In the Alarm and Event Management interoperability area, there are more stringent requirements on the B-AWS than on the B-OWS, as follows.

When presenting alarm notifications to the operator, the B-OWS is only required to identify the object that caused the notification, plus the time and the first 32 characters of a text message (if any) in the notification. The B-AWS is required to present many more parameters of the notification, including property values that resulted in the alarm (such as the temperature reading from a temperature sensor that went into alarm), plus up to 255 characters of the text message.

For modifying alarm configurations, the B-OWS is required only to present and modify a few specific properties of specific objects, including the high and low alarm limits of an Analog Input object. It is not required to configure alarms that are not based on analog values (such as a Binary Value object representing a circuit breaker's status).

The B-AWS has more stringent requirements placed on it, including a much larger set of objects and properties which it must be able to modify, and to configure all standard alarm types intended for operator notification.

Finally, the B-AWS is required to support Event Log objects (objects that record alarm histories) in other device, including the ability to display the objects' recorded alarm histories.

Scheduling

BACnet scheduling uses Calendar and Schedule objects. A Calendar object indicates whether today's date is in a list of dates within the object; such as holidays for example. A Schedule object contains a standard weekly schedule, with "exception schedules" to override a day's schedule completely or in part or completely; for example, scheduling a meeting for a conference room.

The B-OWS is required to present and modify the core properties of Calendar and Schedule objects, in particular lists of dates, weekly and exception schedules. It is only required to support three data types including analog and multistate values.

The B-AWS has additional requirements – including the ability to create and delete Calendar and Schedule objects – and a much larger set of properties which it is required to be able to modify.

Trending

BACnet trending (or trend-logging) is performed by two objects: the Trend Log object and the Trend Log Multiple object. Both objects collect and record time-stamp data, but the Trend Log object collects data from one property of one object in one device. The Trend Log Multiple object can trend multiple properties of multiple objects in multiple devices in the system.

The B-OWS is only required to gather and present trend data from Trend Log and Trend Log Multiple objects.

The B-AWS has a more comprehensive set of requirements, including the ability to create and delete Trend Log, Trend Log Multiple and Event Enrollment objects, and to modify a number of Trend Log and Trend Log Multiple data collection parameters.

BACnet Workstation profiles

Profile	Addendum l description
B-AWS	The B-AWS is the advanced operator's window into a BACnet system. It is primarily used to monitor the performance of a system and to modify parameters that affect the operation of a system. …
B-OWS	The B-OWS is an operator interface with limited capabilities relative to a B-AWS. The B-OWS is used for monitoring and basic control of a system, but differs from a B-AWS in that it does not support configuration activities, nor does it provide advanced troubleshooting capabilities.
B-OD	The B-OD is a basic operator interface with limited capabilities relative to a B-OWS. It is not intended to perform direct digital control. The B-OD profile could be used for wall-mounted LCD devices, displays affixed to BACnet devices, hand-held-terminals or other very simple user interfaces.

[1] Bill Swan is the Buildings Standards Initiatives Leader, Alerton, and a member of the BACnet committee. Bill.Swan@Honeywell.com.

Device and network management
BACnet defines the Device and Network Management interoperability area as "the exchange of data between BACnet devices concerning the operation and status of [the] devices." This includes a number of different types of operations. Although there are some common requirements for both the B-OWS and B-AWS, the B-AWS has additional requirements on it, as follows:

The B-AWS is required to be able to find and present a list of all BACnet devices – at least those that support BACnet's device location capability – currently connected to the BACnet system.

The B-AWS must be able to present a list of all objects in a particular device.

The B-AWS must be able to send the "DeviceCommunicationControl" command to another device to order it to stop sending messages for a specified time, or to restart sending.

The B-AWS must be able to create and delete objects in other devices.

The B-AWS must be able to order other devices to restart using the "ReinitializeDevice" command.

Finally, the B-AWS must be able to backup and restore the configuration of other devices using BACnet's "Backup and Restore" capability.

Summary
Superficially, B-OWS and B-AWS workstations offer relatively similar features, and many B-OWS will incorporate some of the additional capabilities of the B-AWS. But as described here there is actually a broad range between the two profiles, which should be considered when comparing and specifying B-AWS and B-OWS workstations.

BACnet: To Be is to Grow

David Fisher [1]

Fifteen years ago BACnet became an ASHRAE standard (135-1995) and shortly after also an ANSI standard (ANSI/ASHRAE 135-1995). Since that time BACnet has continued to evolve into an international standard (ISO 16484-5) and has seen widespread adoption by hundreds of companies. Millions of BACnet devices are in daily operation world-wide. Given that the adoption of BACnet is completely voluntary, this kind of progress in the evolution of BACnet in the marketplace is unprecedented in the building automation industry.

A year ago, I wrote for the ASHRAE Journal about the changing attitudes that affect how BACnet is used and applied. The number of products based on BACnet have significantly increased, especially from vendors already making BACnet products. There has also been an increasing number of new vendors, and an increasing rate of adoption by new vendors. In September 2009 there were over 380 vendors making BACnet products. Just a year later, nearly 100 vendors have been added to this list.

The unstoppable wave of new products include innovative applications for HVAC and building automation, but also significant expansion into allied areas of BACnet influence such as Lighting, Access Control and so forth. As more and more customers and consulting engineers realize the integration and interoperability potential for BACnet, products need to keep pace with increasing flexibility and sophistication. These pressures have pushed BACnet upward into more complex devices with more capability, downwards into smaller simpler devices, and outwards more deeply into complimentary areas of functionality. There are many factors that contribute to these pressures such as:

- Falling prices for technology components are enabling systems to bring more sophistication to designs that traditionally have been cost-constrained
- Rising energy prices are increasing pressure to find ways to interoperate more efficiently and to use increasingly complex strategies to coordinate and automate
- Rising labor prices are making the reduced training and maintenance cost of standards-based devices more attractive
- Rising costs for copper wire are encouraging designers to rethink how to distribute sensors and controls
- There is increasing demand for easy integration and interoperability as owners and managers want to squeeze more out of what they have, and get more out of new purchases

What is a standard anyway?
Our whole notion of a standard is often thought to be a document that describes what something is or should be. "To Be BACnet" has to be a destination, not a moving target. And yet in order to survive and embrace new ideas and technologies and applications, there also has to be a way for the standard to grow.

In ancient Sanskrit the verb "to be" shares the same root as the verb "to grow." As a published standard, BACnet is of course used as a reference point by many products, users and appliers. At the same time BACnet is managed under the doctrine of continuous maintenance. This means that the standard may be expanded, amended, revised and even rewritten more or less at any time. The ASHRAE SSPC-135 maintains BACnet through a consensus process of face-to-face meetings, email dialogs, teleconferences and public review. This represents over 3500 man hours per year of face-to-face meetings alone. So if the standard is finished and standing still, what is all this discussion about?

These deliberations review and discuss proposals for ways to make the existing standard clearer, and to address new areas that increase the scope of what BACnet can standardize and find consensus about as it relates to BACnet's central mission of interoperability between different building systems.

These discussions can take many forms but usually involve a four step process:

- Someone within the SSPC, or from an outside party, creates a draft proposal document. A draft proposal is then submitted to the convener of a responsible working group who puts the proposal in a queue of agenda

[1] David Fisher is president of PolarSoft® Inc., Pittsburgh, Pa. He was a charter voting member of ASHRAE's Standards Project Committee 135P and has been active in the development of the BACnet standard (ANSI/ASHRAE 135-1995, 2001, 2004 and 2008) since its inception. He served as a voting member on the Standing Standards Project Committee-135 until July 2000 where he is an active participant and contributing author. He has taught many courses about BACnet, networking and communications, and direct digital controls, including ASHRAE PDS and Short Courses.

items for future discussion. Eventually that working group reviews the proposal in a face-to-face meeting. Sometimes proposals like this have some pre-review in teleconferences when there is sufficient interest. Ultimately the proposal may be voted up to the SSPC for consideration if the working group consensus is that it has sufficient merit and its document(s) are reasonably complete.

- The SSPC chairman adds such documents to the agenda for future SSPC face-to-face meetings and eventually the working group-reviewed documents are reviewed again by the SSPC. This allows individuals, who have been unable to follow the working group, to review and express their opinions and may lead to revisions or another re-write/re-review by the working group. The SSPC may vote to hold a public review of any proposal in the form of proposed addenda to the standard. This is a required step for any proposal that represents a substantive change to the standard (as most proposals do).
- A public review is a period of time, typically 45 days or more, during which the proposed addendum is available on the ASHRAE website, and there is a formal review process where anyone may submit comments of a supportive or non-supportive nature.
- At the end of the pubic review, the SSPC reviews all comments and must reach a consensus on the appropriate response. Generally comments that are non-supportive are either accepted or rejected by the committee. In either case it may lead to changes in the addendum. Changes that are judged to be substantive require additional public reviews. The SSPC is not required to make changes when a comment is rejected, and some commenter may remain unresolved. Unresolved comments do not prevent publication of the addendum, but the SSPC policy is to make every effort to resolve comments.

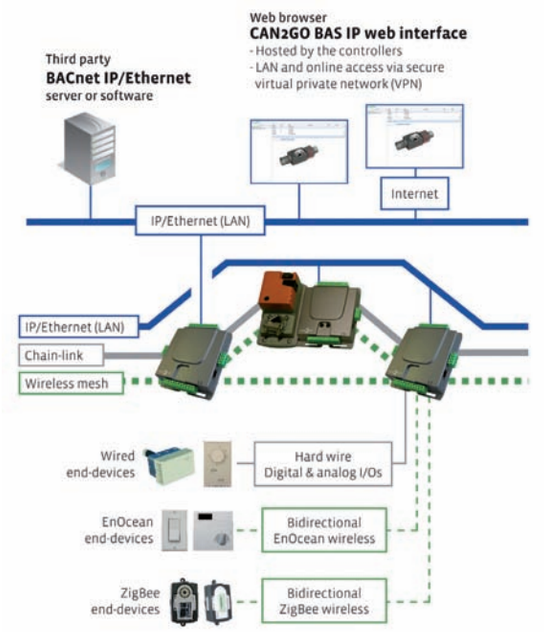
Recent changes to BACnet

Over and above minor fixes, errata and language clarifications, there have been a number of changes and additions to BACnet during the past year. Among these, Addendum q introduces the use of Zigbee as a wireless transport layer; Addendum o specifies a technique for using BACnet through NAT firewalls; Addendum j introduces the complete set of new Access Control objects that allow BACnet-based Access Control systems to be constructed with a very robust data model suitable for bank/military applications; Addendum l introduces new BIBBs that differentiate between three types of workstation devices from simple to complex. There are also a number of addenda that have completed their public reviews and will be ready for comment responses during the January ASHRAE meeting in Las Vegas. Among these is an addendum that makes sweeping improvements in BACnet's Alarm Model, mostly aimed at clarifying how the model should work. These changes will have a big impact on interoperability.

Managing change

With a rapidly expanding array of products from a large and growing number of manufacturers, BACnet is more than ever the leading choice for open and sustainable interoperability between devices from different vendors and across different disciplines. As the use of BACnet extends into more and more areas, the standard is being proactively expanded to embrace unique aspects in those areas through its proven consensus process. With a large following and the dedicated volunteer efforts of the SSPC, BACnet is managing both to be, and to grow.

Bidirectional Wired and Wireless Control and Embedded BACnet IP Gateway



Using EnOcean relays, controlled wirelessly by CAN2GO wired and wireless controllers, themselves equipped with embedded BACnet IP gateways, the mandated contractor was able to install the missing link between the heaters and the BACnet building management system.

The CAN2GO Variable Air Volume (VAV) controller offers simultaneous bidirectional control of wired and wireless (EnOcean, ZigBee) end-devices. It has embedded EnOcean and ZigBee transceivers, 6 inputs and 6 outputs, a flow sensor, an embedded BACnet IP gateway and an embedded BACnet IP server. The controllers can be programmed locally and support real-time response when scripting.

"The development of BAS gateways is an important milestone for the EnOcean community as well as for the building automation industry. Gateway controllers provide the missing link between wireless EnOcean devices and traditional building automation systems. Integrators everywhere can now manage EnOcean end-devices exactly as they manage wired end-devices," said Jim O'Callaghan, President of EnOcean, Inc.

CAN2GO VAV controllers offer three networking options: wireless ZigBee mesh, UDP (IP/Ethernet) and daisy chain. They can be integrated to third party BACnet IP systems or provide their own building automation IP web interface – accessible locally or online (via virtual private network).

SCL Elements Inc./CAN2GO
lnhamer@can2go.com
www.can2go.com

CETCI Receives BTL Certification for PET BACnet Gas Detection Transmitter

Critical Environment Technologies Canada Inc. (CETCI) is proud to receive the BACnet Testing Laboratories (BTL) certification for PET BACnet gas detection transmitter on October 15th, 2010.

PET BACnet gas detection transmitter has passed the BTL requirements for the BACnet Smart Sensor (B-SS) designation. PET is a "Parkade Emissions Transmitter" that communicates via BACnet protocol MS/TP and is available with one or two electrochemical or solid-state sensors and temperature sensor. Electrochemical sensor choices include ammonia (NH_3), chlorine (Cl_2), carbon monoxide (CO), ethylene(C_2H_4), formaldehyde (HCHO), hydrogen (H_2), hydrogen sulphide (H_2S), nitric oxide (NO), nitrogen dioxide (NO_2), oxygen (O_2), ozone (O_3), and sulphur dioxide (SO_2). Solid state sensor choices include combustibles and refrigerants R11, R12, R22, and R134A. PET features thermal resetting fuse, tri-color LED indicators for power and alarm, and an optional 4-digit LED display. In addition, PET includes a new sensor Calibration Extending Firmware (CEF) that takes into account the aging of the sensors so that less frequent calibrations are acceptable in non-critical applications. PET is ideal for use in non-hazardous vehicle exhaust environments, commercial HVAC and light industrial applications.

Critical Environment Technologies Canada Inc.
teresa@cetci.com
www.critical-environment.com

PET BACnet gas detection transmitter.

Reduce Consumption and Lower Costs with Customizable Energy Management Dashboards

enteliWEB™ is a Web-based, native BACnet application that combines the power of enterprise dashboards with easy-to-use facility management tools. Customizable Energy Management dashboards and powerful energy reports give managers the tools to reduce consumption and lower costs. Task-driven alarm management and system dashboards allow operators to quickly visualize and prioritize their work, keeping the facility running comfortably and efficiently.

Dashboard visualization
Walk in, sit down, and know everything! Dashboards provide at-a-glance summaries of your facility.

Enterprise Dashboards provide high-level information in graphical formats to help easily manage your facility's KPI's.

Personal Dashboards allow operators to customize their own dashboards so that the software can evolve with their needs and priorities.

Alarm management
Trend Logs of the monitored object are automatically found and displayed, pinpointing the time of the alarm.

System dashboards
System Dashboards make operating your facility easy by aggregating system graphics, alarm management, energy information and much more into a single dashboard screen.

Custom Navigation trees are designed to make browsing your facility simple.

Energy management
enteliWEB's intuitive and powerful energy management suite will help you to keep costs down and make your building Earthright™.

Energy Dashboards provide summaries of consumption, demand and energy profiles in detailed, easy-to-understand dashboard graphics.

Time is money
Multiple Sites with duplicate address ranges allow sites to be set up identically, saving engineering time and removing the worry of address conflicts.

Free to choose
Delta Controls' commitment to providing open standards and off-the-shelf software choices to building owners is at core of enteliWEB's design.

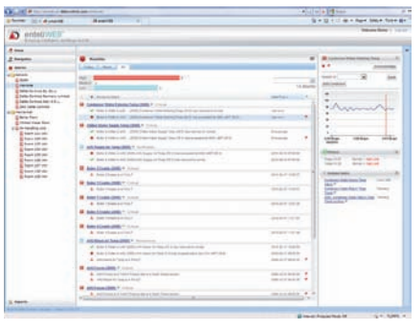
Native BACnet software allows you to use enteliWEB on any BACnet network.

Platform Independent Web software gives you a choice of operating systems on which to host enteliWEB. ■

Delta Controls Inc.
bdutt@deltacontrols.com

Personal Dashboard

Energy Dashboard



Alarms

Chiller Dashboard

Reporting

Keep in Touch with the New Thermokon Thanos

Thermokon Sensortechnik GmbH is currently presenting its new multifunctional room operating unit Thanos. With this, the German company is pursuing a new path towards intuitive and high design-oriented room control combined with high quality and engineering Made in Germany.

The Thanos type "S" stands for a smaller design unit. The rocking function is realized with a second menu level.

Thanks to the new Thermokon Thanos another top quality product will be available in the portfolio of room operating units by the end of 2010. Thanos is completing the range of the current series WRF04, WRF06, WRF07 and WRF08 especially convincing with its exceptional design. Under an overall glass front, a high-resolution 3.5"-TFT display is placed, so that an optical display of the executed functions is shown with every input made. Typical applications for room automation can be customized. The control of HVAC elements such as temperature set point adjustment, blind and light controls or fan stages can be easily realized by a simple touch. Combined with a common operating structure, the touch technology already enables an intuitive operation of the devices with its first use. Thanos has an integrated temperature / humidity sensor. The value is displayed directly.

The new operating unit Thanos is available in the basic colors black and white. With up to 12 buttons, a larger version called "Thanos L" is additionally available. The lower operating area is designed as a typical rocking function. This type is also available in landscape version, model "Thanos LQ". Type "S" stands for a smaller design unit. The rocking function is realized with a second menu level.

A brushed stainless steel clip is designed as touch sensitive presence button which realizes a typical switch function in the room.

Individual specifications are also an important object for the Thermokon Thanos. Therefore, several button fields can have a customized legend. Via a software application the devices can be easily configured with regards to operating functions, button symbols and display options.

The use of the standardized BACnet MS/TP protocol enables the connection to corresponding distant ends such as automation stations or BACnet operating working stations.

As an interface standard the digital data transmission RS-485 is used.

The device operates with the BACnet Application Specific Controller (B-ASC) device profile and places a number of BACnet objects at your disposal. The addressing of Thanos for identification in the network is made via an integrated DIP switch.

Optionally, the Thermokon Thanos BACnet can be extended with an EnOcean based transceiver module. Thereby, a gateway function of BACnet to an energy-optimized EnOcean based wireless system is realized. Furthermore, a direct and wireless communication to EnOcean based acutuators can be made. Possibilities and applications are unlimited.

The new multifunctional room operating unit Thanos once again emphasizes the high demand for design & technology by Thermokon.

Also available in a landscape version – Thanos LQ.

Thermokon
Sensortechnik GmbH
n.gotthardt@thermokon.de
www.thermokon.de

QuickServer and ProtoCessor ProtoNode BAS Gateways Awarded BTL Mark

FieldServer Technologies' QuickServer Building Automation gateway and the ProtoCessor ProtoNode gateway for OEM applications have received a BTL Mark under device profile B-ASC. This is the first fully-configurable building automation gateway to be BTL certified.

QuickServer utilizes the same proven technology that has made FieldServer the leading gateway in the building automation industry.

QuickServer utilizes the same proven technology that has made FieldServer the leading gateway in the building automation industry. This easy-to-use gateway can interface up to 250 points utilizing BACnet/IP, BACnet MS/TP, LonWorks, JCI Metasys N2, Modbus TCP, Modbus RTU and SNMP. Advantages of QuickServer are:

- Comprehensive FieldServer interface experience with thousands of devices using hundreds of proprietary and foreign protocols.
- DIP switches for fast installation: Sets MAC address, Node-ID, and Baud Rate on RS-485 port. Auto Baud is supported on BACnet MS/TP.

ProtoNode RER is designed for original equipment manufacturers needing a quick and easy path to enable their new and legacy devices to interface with Building and Energy Automation networks. Key advantages of ProtoNode are:

- One ProtoNode SKU can store multiple configuration files which are selectable via DIP switches. This feature allows OEMs with multiple different controllers to automatically support 1 or multiple protocols on 1 ProtoNode.
- BACnet COV support provides fast data communication while reducing the traffic over a BACnet network.
- The ProtoNode provide protocols translation between any of these protocols Modbus RTU, Modbus TCP, BACnet MS/TP, BACnet/IP, JCI Metasys N2, DNP3, and Allen Bradley EtherNet IP.
- Flash upgradable. ■

FieldServer Technologies
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"Young Wilds" Lift Off with BACnet

The presentation of technical news and innovative products needs a qualified attention if it will achieve some effect. For the DEOS control systems company the ISH trade fair is an excellent opportunity to present its developments in building automation" explains the CEO Stefan Plüth. Also next year in "who is who" in the building technology the DEOS AG will present a range of product novelties at the ISH fair in spring 2011 in Frankfurt am Main.

The DS-OPEN 600 can be used simultaneously as BACnet – Client and BACnet – Server.

OPEN 600

The "second generation" of the OPEN controller from the company DEOS AG starts with the COSMOS 600 OPEN (native BACnet). The "young wilds" want to know where it's at. The innovation can be used simultaneously as BACnet – Client and BACnet – Server. There are already 32 I/O´s integrated into the controller, optionally with manual control, as

well as the web-server for graphical visualization which is available on all COSMOS OPEN controllers. A maximum of up to 112 physical data points can be processed.

COSMOweb 7

Besides the Windows 7 compatibility the COSMOweb7 covers the introduction of work spaces as well as control panels as an alternative operation to Microsoft Internet Explorer. The software module logs parameter changes which are carried out via COSMOweb with date, time, old and new parameter value. In addition, User-logins and User-logouts are recorded with date, time and user name.

COSMOS SRU single room controller

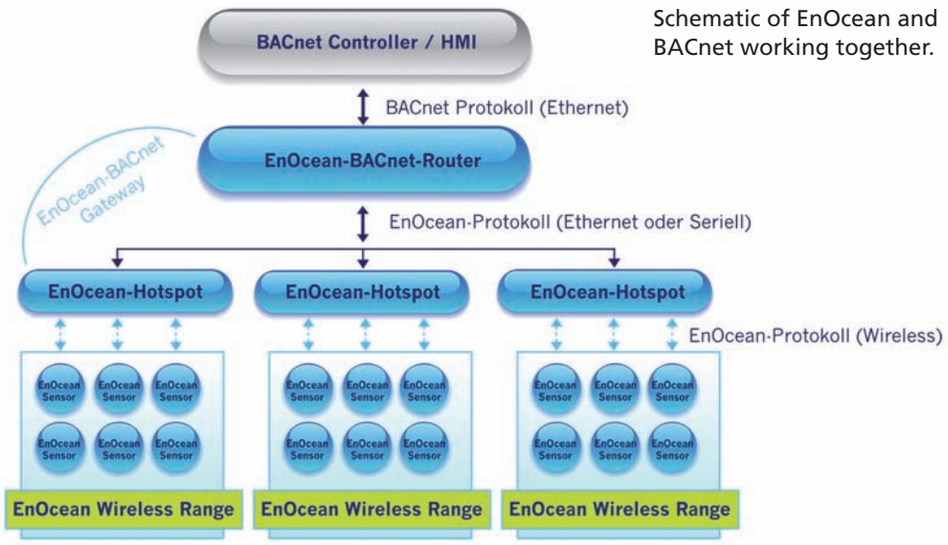
The COSMOS SRU (single room unit) is equipped with a BACnet MS/TP interface and can be connected to any BACnet controller or a BACnet GLT.

The operational areas of the COSMOS SRU single room controller are various. In particular the COSMOS SRU can be used for Fan-Coil-Units and room air cascade regulations, heating and cooling cascades as well as for simple heating element regulations. Thus the single room controllers are suitable for all kinds of HVAC regulations. Furthermore they can be used for light and shutter controls.

DEOS AG
Norbert.Kahle@deos-ag.com
www.DEOS-AG.com

EnOcean and BACnet – Ideal Solutions for Building Automation

The ASHRAE standard BACnet and batteryless technology from EnOcean complement one other ideally: The existing BACnet infrastructure can be extended seamlessly with wireless applications. This enables rapid upgrades of existing installations and brings the latest technology to areas of buildings that until now were beyond the scope of most solutions.



Schematic of EnOcean and BACnet working together.

Combining industry-wide deployment of BACnet with the versatility of EnOcean wireless technology can bring numerous benefits to building owners and facilities managers. By utilizing BACnet as a backbone, EnOcean switches, sensors and devices can cost-effectively penetrate the last mile of building infrastructure. This approach yields rapid upgrades of existing BAS installations and brings the latest technology to parts of buildings that until now were beyond the scope of most solutions. Being able to operate wirelessly and without a traditional power source are key strengths of EnOcean technology. Bringing those strengths into the BACnet world leads to innovative solutions and tremendous market potential. For this reason the S4 Group is currently developing a BACnet/EnOcean router and EnOcean hotspot, working together as a BACnet/EnOcean gateway, to bridge the gap between these two important segments of the building automation marketplace.

Application areas

The two standards can be implemented in a hotel for example, in which all existing services and functions – including HVAC, lighting, blinds – would be supervised and controlled by an EnOcean-enabled BAS. The hotel owners would be able to remotely monitor room status, override setpoints and occupancy status or precondition a room for guests so that it is comfortable by the time they arrive. After guests check in, room conditions can be controlled by the room occupancy status. To achieve this result, each room should be retrofitted with an EnOcean hotspot from S4 Group for example. One or more BACnet/EnOcean routers would monitor and manage the EnOcean hotspots and provide an EnOcean/BACnet gateway service. The BACnet gateway is fully bidirectional and supports all BACnet services and features allowing rooms to be integrated into a hotel management system and the primary building automation system. In this way the energy management of the building would be optimized, data for trend and historical analysis collected and occupant comfort maximized. Another application example is office buildings. A building constructed in the 1960s could be updated by a building automation system.

The S4 Group, Inc
www.thes4group.com
www.enocean-alliance.org

MS/TP Capture Device

In BACnet networks it is often necessary to capture telegrams for analysis. For BACnet/IP or Ethernet the free software Wireshark (formerly known as Ethereal) is used. But in MS/TP networks direct capture is difficult due to the critical timing and most PC don't have a MS/TP interface. For this MBS from Krefeld, Germany provides a low priced interface box, the BMI-CAP (BACnet MS/TP Interface Capture).

Connection
The BMI-CAP is locally connected to the MS/TP network and works completely transparent. The connection to the PC is established by the Ethernet network interface using a TCP connection to transport the MS/TP data to the PC. For this a crossover-cable is included in the package but additionally a connection through an existing network infrastructure for remote-analysis may be established as well.

Telegram capture
Telegrams are recorded using a receiver software running on Windows either stored in a pcap-file or piped into the operating system directly into Wireshark for online-analysis.

Additional benefit
The device integrates all functions of the BACnet router UBR-01 w/o extra costs and may alternatively be used in the operating mode acting as MS/TP, IP and Ethernet router. Additionally a DHCP server (dynamic address provision), an integrated web-server and 200 MB free storage space directly on the device are available. BBMD and FD functions may be used (even stand-alone without routing) and MS/TP slave proxy is supported as well.

BMI-CAP is additionally available in a small housing for cabinet mounting and as a supplement to the BACnet Test Framework (BMI-BTF). The devices are available from stock.

MBS GmbH
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www.mbs-software.de

Quo Vadis BACnet – Great Hope Worldwide

Individuals who are already using open and advanced automation technologies and who have no proprietary multi-vendor legacy will see no reason to invest time and money for BACnet in the planning phase, when then even more care and risks have to be taken for the acceptance protocol and start-up. For us as manufacturers who have a large network of independent system integrators, BACnet, means additional effort. What benefit is offset by this extra effort? Should we push BACnet or rather slow it down?

Saia Burgess Managing Director, Juergen Lauber (author) and Austin Wang at the BACnet Forum Shanghai.

Does a more than 20 year old „American" communication standard have a future? What good advice should we give to operators and designers who confide in us? In order to give a conclusive answer to this important question we must go beyond the borders of Germany or even Europe. During this week (18-22.10.2010) on site as CEO of Saia-Burgess Controls AG, I was able to observe what relevance BACnet has in China and elsewhere in the world.

New start versus refurbishment

There is a big difference between Europe and China: In Europe, more than 80 % of construction projects are in „old properties" which have a history and an expired life cycle. In China, there are more than 80 % of new projects with a Greenfield status.

Short-term thinking and acting

The decision-makers and the staff very often get a new employer. The problems belong to the successor, is the general mentality, and after only short periods of operation it is common for automation, measurement and control technology be taken over again by the usual care taker. This staff is inexpensive and abundantly available. Also, the major automation vendors have the majority of the projects as a technical joint venture and facility management companies in their own hands. The investor is not interested in what is being installed.

BACnet Forum 2010, BIG China and the rest of the world

The main focus in the title of the BACnet Forum in Shanghai was – Efficient System Integration for Green Buildings. In China and Asia the energy efficiency topic generally has a much higher and real significance than it does for us. Only 50 % of our operators name energy saving as the top priority.

In both India and China it's over 80 %. In China, designated local energy rates for properties are pre-assigned and going beyond this, the current is simply turned off. No legal recourse is permitted.

Thus, things that for us are „nice to have", become a must. Great hope rests on BACnet through the complete integration at all levels and in all major trades.

The interesting thing about the BIG China meeting was the discussions with the presidents of BIG International (USA) and BIG Australia. A fairly consistent picture comes into view for China, South East Asia and the United States. The pros and cons of BACnet were not discussed there, nor „whether" or „whether not". BACnet is simply a factual and normative power in these markets and no one can get around it.

BACnet will prevail throughout the world

The big difference between USA/Asia and Europe lies not in whether the BACnet is the standard building automation or not, but how this standard is practically implemented. Will BACnet be used interoperable and vendor-independently or not?

The difference is the cost and complexity in planning, commissioning and operation. The Chinese and the Americans will ultimately save themselves the extra trouble, and the Germans would rather seek 100 % of the potential benefits of the BACnet potential. This again reflects the difference in the technical training level, along with the more likely long-term thinking. The challenge of having to manage a large set of heterogeneous existing buildings also makes interoperability very attractive.

Worldwide, there is one thing in common among the planners and operators of real estate: they want technical equipment/machinery (e.g. heat pumps, UPS systems, chillers, etc.) as well as all trades which can be integrated into their automation system at the management level. That in itself is already assured when products that have been certified by WSP Lab in Stuttgart are used.

Conclusion:

Every expert in building automation or operator, planner and service provider should know and be able use this standard. BACnet is the only system with this holistic approach from the field to the control level. It does not need special semiconductor chips like LON or Profibus, and no special software tools with version-based risks and compatibility issues as with KNX and LON. BACnet/IP works using standard Ethernet and BACnet MST-TP based on RS-485 cabling, which in the meantime is also dominating the field.

This absence of mandatory and specific „elements" in hardware and software, however, requires that the decision makers and planners have a good basic knowledge of BACnet and that various tasks during approval as well as control of operations can be „automated" in order to ensure a well functioning operation.

Juergen Lauber
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BACnet Forum Shanghai – Efficient System Integration for Green Buildings

This year the second Chinese BACnet Forum took place in Shanghai. This event was jointly hosted by BACnet Interest Group China (BIG-CN), BACnet International (BI), and BACnet Interest Group Europe (BIG-EU). Wang Jiejung elected member of BACnet China, Raymond Rae from the Board of Directors of BACnet International and Torsten Szypulski as representative of the BIG-EU opened the ceremony.

About 150 delegates, coming mostly from China but also from Europe and North America, attended the BACnet Forum Shanghai.

About 150 delegates, coming mostly from China but also from Europe and North America, attended this conference and listened to technical presentations such as "Connecting devices to an infrastructure while building with BACnet". These presentations were aimed at recommending and explaining why, as George Thomas from Contemporary controls put it, "BACnet/IP should remain at the top of the network hierarchy".

BACnet is increasing in importance in China, a country where 80 % of the building automation devices are implemented in new constructions. Energy saving is an important issue in Europe, while in China it is a top priority. BACnet is presented as one of the most efficient solutions.

Energy management based on BACnet was also one of the cores of this meeting, placing emphasis on smart metering and recording individual energy use in order to reach the goal of green buildings. This international Chinese BACnet Forum permitted the audience to learn about the initiatives of the different countries on this issue, and the trade show allowed the attendees to learn about new products.

During the second part of the conference, Jürgen Lauber CEO from Saia Burgess gave the answer to the ones who are not still quite sure whether they should plan with BACnet or not: "Nowadays there is no point in discussing the pros and cons of BACnet, including "if" or "whether". "BACnet is simply a factual and normative power in the building automation markets and no one can ignore that".

How best to boost and promote BACnet in China, was on the agenda of the BIG-CN members' meeting which followed the conference.

This forum was made possible thanks to the commitment of companies like Carrier, Delta Controls, PcVue, Reliable Controls, Saia Burgess, Schneider Electric, Siemens, Thermokon, Contemporary Controls, Force Controls and Elesta who sponsored this annual event. Last but not least, the 3rd issue of the BACnet China Journal was a good complementary support, covering information (including technical articles) related to the development of BACnet in Asia, particularly in China.

The international Chinese BACnet Forum permitted the audience to learn about energy management.

Forum in London – UK Reaches Out for BACnet

The intelligent building market in UK reaches out for BACnet. Several members of the BACnet Interest Group Europe (BIG-EU) were asked for information about the capabilities of BACnet in terms of construction projects, system integration and retrofitting. The BIG-EU will meet this growing demand for information in the UK during the three days of intensive BACnet promotion in London. The highlight will be the BACnet Forum London on April 13th, 2011, the final event following the two day BIG-EU meeting.

The Forum will be hosted by the BIG-EU in association with CIBSE – the Chartered Institution of Building Services Engineers. It will be the first independent BACnet event in the UK in 10 years. As in the past, 10 years ago, the London Forum will once again be an important meeting point for the European and American market.

"Increasing the Value of Properties with BACnet – Successful Interoperability and Building Systems Integration" is the title that clearly focuses on the benefits of BACnet for sustainable buildings. The capabilities of BACnet for efficient building management systems will be reported on. Best practices in the UK and abroad, the future positioning of the standard with details about the recent addenda and an outlook on updates, as well as an exhibition with the newest controllers and workstations which provide open communication, will complete the program.

Comprehensive information about this event, how to become a sponsor and how to register for the conference can be obtained at www.bacnetforum.org

Why a BACnet Forum in London?

- All members of BACnet Interest Group Europe (BIG-EU) agree that the time frame for the BACnet Forum London is favourable. The British market increasingly requests more information about BACnet, its application and profitability.
- The Forum is a meeting point of building services engineers, specifiers, planners, integrators, facility managers, owners, investors and providers of open building automation
- The Forum includes the future positioning of the standard. 10 years after the last independent BACnet event in UK it will again be a meeting point of British, European and American experts.
- London will host the Olympic Games in 2012 and has attracted a lot of investors and decision makers from the building sector.
- BACnet was successfully promoted in Europe and worldwide by 11 BACnet Forums, the last ones having taken place in Frankfurt and Shanghai. London as no. 12 will be one of the most attractive ones.

Agenda • BACnet Forum London 2011 • www.bacnetforum.org

Monday, April 11th, 2011

- **BIG-EU Advisory Board Meeting**

Tuesday, April 12th, 2011

- **BIG-EU Working Group Marketing (WG-M) Meeting**
- **BIG-EU Working Group Technique (WG-T) Meeting**
- **Get together on the eve of the BACnet Forum London**

Wednesday, April 13th, 2011

BACnet Exhibition

- **Latest BACnet devices and services, presented by experts for open building automation**

  The Forum is accompanied by the exhibition of the latest BACnet products and services. It takes place in the broad Smile Suite and Lounge of the Prospero House. The length of the breaks leaves enough time for discussions with the BACnet experts.

BACnet Forum

- **BACnet in the UK – Development and Chances of Open Building Automation**
- **Increasing the Value of Property with BACnet**
- **BACnet as Enabler for Green Buildings**
- **Building Service Engineering with BACnet**
- **The Standard that never sleeps – Recent addenda and Outlook on Updates**
- **BACnet Best Practice – Multivendor References in UK and from Abroad**

Networking Cocktail Hour

- **Relaxed business meeting closes the Forum**

  Meet your business partner in the relaxed ambiance of the networking cocktail hour. After the presentations there is plenty of time to discuss current needs and new projects.

PlugFest 2010 participants working to test interoperability.

The one-on-one testing sessions are designed to allow each team to test their products with individual company products in scheduled sessions.

Kraig Ritmanich (ABB)

Coleman Brumley (PolarSoft), Steve Karg (WattStopper)

Barry Richards, Lori Tribble, David Campfield, Todd Scheving (Automated Logic Corporation)

Barry Richards, David Campfield, (Automated Logic Corporation)

PlugFest 2010 – Annual Interoperability Workshop

The BACnet International BACnet Testing Laboratories Working Group hosted manufacturers of BACnet products to attend the eleventh Annual Interoperability Workshop at the Westin Atlanta Perimeter North Hotel in Atlanta, GA November 16 – 18, 2010.

BACnet International PlugFest 2010
Where the pieces come together

This annual event permits vendors to test their BACnet products in a neutral and friendly environment with BACnet devices from other vendors. This year more than 95 BACnet engineers representing 37 companies attended the workshop and improved their BACnet implementations and testing methods. "51 teams attended PlugFest 2010, the largest gathering of engineers for hands-on interoperability assurance in PlugFest history. After three days of pairings and roundtables, every team went home with some interesting new information to ponder, and to incorporate into their products for better BACnet in years to come," espoused BTL Manager Duffy O'Craven.

The Workshop has two types of testing: one-on-one testing and round table testing.

The one-on-one testing sessions are designed to allow each team to test their products with individual company products in scheduled sessions. There were one hour and two hour sessions during the workshop. Pairings were assigned by the BTL based on vendor availability and vendor preferences.

There were also round tables available on Day 2 and Day 3 of the Workshop. This table is available every year to teams who wish to have unscheduled testing with other vendors who may be participating in the round table. According to "BACnet Bill" Swan, "One of the more fun elements of the BACnet International Plugfests is the round-table, a semi-chaotic event where everyone participating plugs into the same set of networks and starts testing, ad-hoc or pre-arranged."

We hope to see you in the fall for PlugFest 2011! www.bacnetinternational.org

BACnet International Announces "Leaders of the Pack" Award Winners

BACnet International today announced the winners of its annual, "Leaders of the Pack" awards to recognize the achievements of individuals and companies involved in the BACnet community. The Award Ceremony took place during the 2010 Facility Decisions Conference & Expo on October 5th – 6th, 2010 in Las Vegas, NV. The award categories along with award explanations are listed in the table below.

Andy McMillan, President of BACnet International and General Manager of Philips Teletrol, shared his appreciation to the community. "With this year's theme, the Leaders of the Pack, we at BACnet International set out to distinguish those who, at the pinnacle of their careers, still take the time to enrich this organization in every way they know how." McMillan continued, "The building automation industry is consistently evolving and it is because of the tireless efforts of these companies and individuals that BACnet International is able to not only remain competitive, but remain an organization that is globally admired and respected. A great many members have contributed to this success, so my thanks go out to all of them."

About BACnet International

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. The BACnet standard was developed by ASHRAE and has been made publicly available so that manufacturers can create interoperable systems of products. BACnet International complements the work of the ASHRAE standards committee and BACnet-related interest groups around the world. BACnet International members include building owners, consulting engineers and facility managers, as well as companies involved in the design, manufacturing installation, commissioning, and maintenance of control equipment that uses BACnet for communication. For more information, please visit www.bacnetinternational.org.

The awards presented by Andy McMillan (President, BACnet International) to:

Steve Tom accepting on behalf of Automated Logic Corporation

Roy Kolasa, Honeywell accepting on behalf of David Fisher, PolarSoft

Mark Jones accepting for Carrier Corporation

Ben Dorsey accepting for KMC Controls

Michael R Wilson, OEMCtrl

Grant Wichenko, Appin Associates

Winners 2010

Award	Winner	Comment
Alpha Dog Award	Michael R. Wilson, OEMCtrl	The Alpha Dog Award was presented to Michael R Wilson as an individual who exhibits outstanding leadership. This person is a constant and dynamic voice of BACnet International through his leadership of the Marketing Committee and the organization's social media presence.
St. Bernard Award	KMC Controls	The St. Bernard Award goes to KMC Controls for always coming to the rescue. Besides providing a solid product, KMC is always there in terms of support of BACnet International.
German Shepherd Award	Dave Robin of Automated Logic	The German Shepherd was awarded to Dave Robin who is known for keeping the group in line and upholding the BACnet Standards. As the chairman of ASHRAE SSPC-135 and a member of the BACnet International board, Dave works tirelessly to push the technical scope of BACnet.
Labrador Award	David M Fisher of Polarsoft	The Labrador Award was presented David Fisher for showing unquestioning loyalty to BACnet International and the BACnet Standard. David is one of the early "founding fathers" of BACnet. David built his career around educating others about BACnet and created much of the early educational materials for the protocol.
Rottweiler Award	Grant Wichenko of Appin Associates	The Rottweiler Award was presented to Grant Wichenko to honor his fierce protection of BACnet International and BACnet Standards. Grant is a fixture in BACnet International who contributes by participating on the BACnet International Steering Committee and is constantly spreading the word about BACnet.
Jack Russell Award	Automated Logic	The Jack Russell Award went to Automated Logic for always doing something for the betterment of BACnet International and the BACnet Standard. Automated Logic participates in almost every BACnet International committee, pushing both the BACnet standard and BACnet International.
Howler Award	Terry Hoffmann of Johnson Controls	The Howler Award was given to Terry Hoffmann to recognize his efforts to make a lot of noise about BACnet International and BACnet Standards. Terry is the "E.F. Hutton" of the BACnet International Marketing committee, and has truly made a significant impact since he started participating.
Fox Hound Award	Carrier Corporation	The Fox Hound Award was awarded to Carrier Corporation for quickly and stealthily moving to the front of the pack in BACnet International. After formally joining in 2009 Carrier has made an immediate splash by participating in committees and tradeshows. Their i-Vu Open is Carrier's first BTL Listed BACnet Building Controller (B-BC) – and their first truly open BACnet solution.
Best in Show Award	Kuwait Oil Company project	The Best in Show Award went to Kuwait Oil Company for their project posted in the BACnet Success Stories. This well documented multi-BACnet-vendor Success Story demonstrates both BACnet vendor interoperability and international acceptance and application of the BACnet Standard. It is compelling, well composed and accompanied by some great photos.

Meet the New Standard in BACnet®

building automation and energy management solutions

DISTECH CONTROLS™

Innovative Solutions for Greener Buildings

Learn more at www.distech-controls.com/bacnet
Visit booth N4862 at the AHR Expo
or call 1-800-404-0043 / 1-450-444-9898

BACnet International

BTL

BACnet International Promotes Interoperability Through Education

BACnet International had selected sessions in the education tracks to educate attendees about the BACnet interoperability platform at Facility Decisions October 5 – 6, 2010 at the Las Vagas Convention Center. The free 2-day trade show and conference for all facility professionals included management courses, exhibit hall and networking.

FACILITY DECISIONS CONFERENCE & EXPO
October 5-6, 2010 • Las Vegas Convention Center

Starting at the top left going from left to right you see: Mike Olson, Andy McMillan, Natalie Nardone, Lisa Kisil-Dense, Sarah Jackson, Bill Swan, Ben Dorsey and view of the facilities.

Debbie Hanamann
Senior Account Executive
NFMT/Facility Decisions/Facilities Mexico
www.facilitydecisions.com

Welcome to BACnet International

Gold Membership

Open General Pty Ltd
Australia
www.opengeneral.com

More information on joining BACnet International is available at www.bacnetinternational.org. Questions about the membership can be sent to info@bacnetinternational.org.

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Suite 200C PMB 302
Marietta, GA 30062
Phone 770-971-6003
Fax 678-560-9112

Silver Membership

Grundfos Management A/S
Denmark
www.grundfos.com

Samsung Heavy Industries
South Korea
www.samsung.com/sec/

Touch Plate Lighting
United States
www.touchplate.com

iCONICS
United States
www.iconics.com

Shimizu Air, Hitachi Appliances
Japan
www.hitachi.co.jp

Yaskawa Electric America, Inc
United States
www.yaskawa.com.

Integrator Membership

Control Technologies
United States
www.controltechinc.com

Generiton
Taiwan, R.O.C.
www.generiton.com

RoviSys
United States
www.rovisys.com

Calendar of BACnet Events

Date	Location	Event	Information
2011			
Mar 15-17, 2011	Baltimore, Maryland, USA	NFMT	Natalie Nardone, BACnet International Office, natalie@bacnetinternational.org, www.bacnetinternational.org
Apr 13, 2011	London, United Kingdom	BACnet Forum London	BIG-EU Office, info@big-eu.org
May 2011	Saarbreucken, Germany	BIG-EU Plugfest	BIG-EU Office, info@big-eu.org
June 25-29, 2011	Montreal, Quebec, Canada	ASHRAE Annual Conference	www.ashrae.org
Oct 10, 2011	Rome, Italy	BIG-EU General Meeting	BIG-EU Office, info@big-eu.org
Oct 11-12, 2011	Las Vegas, Nevada, USA	Facility Decisions 2011	Natalie Nardone, BACnet International Office, natalie@bacnetinternational.org, www.bacnetinternational.org
Fall 2011	TBA, USA	PlugFest 2011	Natalie Nardone, BACnet International Office, natalie@bacnetinternational.org, www.bacnetinternational.org
2012			
Jan 21-25, 2012	Chicago, Illinois, USA	ASHRAE Winter Conference	www.ashrae.org
Jan 23-25, 2012	Chicago, Illinois, USA	International Air-Conditioning, Heating, Refrigerating Exposition (AHR Expo)	Natalie Nardone, BACnet International Office, natalie@bacnetinternational.org, www.bacnetinternational.org
Apr 15-20, 2012	Frankfurt, Germany	light+building 2012	Jochen Willems, MarDirect, willems@mardirect.de
May 09, 2012	Amsterdam, The Netherlands	BACnet Forum Amsterdam	BIG-EU Office, info@big-eu.org
June 23-28, 2012	San Antonio, Texas, USA	ASHRAE Annual Conference	www.ashrae.org