BACnet 101

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Our Agenda

- What is BACnet?
- The Business Case/Value Proposition
- Working with BACnet
- The Future of BACnet
- Success Story (if time permits)
Part 1
What is BACnet?
What is BACnet?

- An open standard
- A data communications protocol
- An acronym: Building Automation and Control Networks
- A means of automating buildings and integrating building systems
- A registered trademark of ASHRAE!
So . . .

- BACnet is a data communications protocol and an agreed-upon set of rules for creating interoperable networks of building systems.
Encompassing . . .

- HVAC equipment and terminal units
- Lighting systems
- Access systems
- Security and CCTV
- Life safety
- Renewable energy sources
- Windows and shading

- Parking facilities
- Irrigation
- Smoke control doors & dampers
- Mass notification
- Elevators
- Emergency power
Who Created BACnet?

- A working group (standard project committee) of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
- Began work in 1987 under tremendous opposition (some said it would NEVER be done).
- Published as a standard in 1995.
- Supported and maintained by ASHRAE Standing Standard Project Committee (SSPC) 135.
It’s Alive!

- By design, the standard is under continual revision.
- It’s also an ANSI and ISO standard
Some BACnet Terminology

- Objects
  - The standard uses an object-oriented model to represent information.
  - Defines more than 50 standard objects
  - Manufacturers can create non-standard objects

- Product manufacturers combine objects to create Devices
Some BACnet Terminology

- **Services**
  - Standard also built on an application services model
  - Think of services as the messages that BACnet devices send to each other.
  - Some services read and write properties of one or more objects.
  - Other services send notification of alarms or special events.
  - Still other services read and write files.
Some BACnet Terminology

- **Services**
  - Again, implementers can pick and choose which services to incorporate into Device functionality
  - Grouped into
    - Object access
    - Alarm and event management
    - Scheduling
    - Trending
    - Files
    - Device and network management
Some BACnet Terminology

- Devices (or Device Profiles)
  - Defined by Objects and Services supported
  - Operator Workstations (B-AWS, B-OWS, B-OD)
  - Controllers (B-BC, B-AAC, B-ASC, B-SS, B-SA)
  - Miscellaneous (B-RTR, B-GW, B-BBMD, B-GEN)
What the Standard Defines

- In essence, the standard defines the messages that devices exchange and how they are delivered.
Common Transport Options

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<td>MS/TP</td>
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Miscellaneous BACnet Benefits

- It can be implemented on low-cost networks (dedicated or shared) and is extremely flexible in LAN types.
- BACnet devices are cost-competitive with long-standing proprietary devices.
- The standard specifically provides for scheduling, trending, and alarming.
- It is easily scalable at all levels for any size job.
- It is completely open and not dependent on specific hardware.
- It provides for automatic device discovery (saving installation costs).
What BACnet Isn’t

- BACnet is not “plug-n-play.”
- BACnet does not replace the need for DDC or control logic and does not attempt to standardize how devices are programmed.
- BACnet does not replace the need for specifying what a user wants or needs. (It simply provides some standardized tools to help enable the creation and specification of systems that can interoperate.)
Part 2

The Business Case and Value Proposition
It’s Open

- As digital communications emerged in the controls space, company-specific (or proprietary) languages were developed by manufacturers.
- They worked and worked well. They just didn’t play well with others.
Proprietary BAS from Building Owner Perspective

- Consider the hiring challenge of trying to find qualified operators and technicians.
  - Those familiar with Brand X may be in short supply.
  - Meanwhile the best candidates may be familiar with Brand Y and Brand Z but have no experience on X.
  - And when the external service provider is the only game in town, I can be held hostage.
  - How long will I tolerate that?
Proprietary BAS from Building Owner Perspective

- A proprietary system joins me at the hip to a single product manufacturer and, perhaps, a single manufacturer’s representative.

- If my control strategy needs to change in light of building dynamics, will I receive the necessary responsiveness?
Today’s automation systems have to play well in the entire enterprise.

Less and less are they standalone entities controlling your mechanical systems, for example.

Integration of systems is becoming more necessary due to increased efficiency and the need to have accurate data across the enterprise.

Frequently, enterprise systems or energy management add-ons, such as dashboards, will want to pull data from the BAS.

When the communication protocol is proprietary, the sharing of such data becomes problematic.
Proprietary BAS Life Cycle Issue

- “After seven years, BAS become very difficult to support and with proprietary based control networks, can be made to be functionally obsolete by being incompatible with the next generation product lines.”

  --Raed Salem, Director of MEP Engineering for Chicago AE firm, Larson and Darby Group
But BACnet is Open

- Choice of Providers:
  - ASHRAE issues vendor identification numbers to companies choosing to develop BACnet products.
  - The total number of vendor IDs surpassed 800 by the beginning of 2015; now exceeds 950!
  - That means there are more than 950 businesses out there developing products that can interoperate.
It’s Interoperable

- Device-to-device compatibility
  - Speak the same language
  - Have the same interests
  - Go to the same places
  - Have matching sweaters
It’s BACward Compatible

- While BACnet, as a standard, is under continuous development, its very nature is one of backwards compatibility.

- A controller of a generation 1 will continue to perform its assigned functions even as controllers of generation 2 are added to the network or as software of generation 2 assumes network management.

- The same is true for generation 1 of Brand X and generation 2 of Brand Y.
Seven Year Replacement?

- Raed Salem continues: “This issue is dependent on whether the existing system is based on an open control network standard or is a vendor proprietary control network. A worst case scenario would be for the proprietary control network requiring complete replacement (100 percent) and a best case scenario would be no system replacement with the open standards based control network (because of existing system compatibility with the next generation BAS components).”
It’s Enterprise Ready

- BACnet is an integration engine.
  - Systems are often interrelated
  - Consider building access and occupancy-based lighting and HVAC
  - Synergies can be realized such as the learning of one user interface versus several
Encompassing . . .

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- Lighting systems
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Part 3

Working with BACnet
Seeing Specs

- Contractors/Service Providers
  - “The Controls Contractor shall supply and install a complete Building Automation System (BAS) as required to accomplish . . .”
  - “Building Automation System (BAS) shall consist of native BACnet . . .”
Native BACnet?
What to Look For
Remember: It’s Not Plug-n-Play

- The standard does not stipulate how devices are to be configured or programmed.
- That means that each manufacturer can have its own programming tool.
- Can still be brought under a single operator workstation or user interface.
- Mapping points from one brand of devices to another can be tedious.
Another Potential “Gotcha”

- BACnet standard provides for manufacturers to implement their own special capabilities through the use of proprietary objects & properties.
- Some better than others at using standard data types to promote interoperability.
- Sometimes, so much proprietary activity going on that true interoperability is thwarted.
Don’t Forget the Training!

- Major controls manufacturers provide training to contracting partners.
- Especially important for technicians.
- And, for in-house facility professionals, consider the extent to which you want to be trained:
  - Changing schedules
  - Modifying or adding graphics
  - Etc.
Some Helpful Diagnostic Tools

- Device logs, file captures, history reports
  - Trends and logs provide information for further optimization of the system as well as for documentation requirements for building certification.
- BACnet network browsers
- Communication wire captures
Part 4

The Future of BACnet
Building Intelligence
Automation

- Hardware and software for monitoring and controlling various building systems.
- The low-hanging fruit of building intelligence.
Automation—What’s Next?

- IoBT, the Internet of Building Things
  - Device to enterprise connectivity through IP and wireless
  - Sensors, sensors, sensors
  - Meters, meters, meters
  - Mobile apps
Integration

- Bringing together automated systems.
  - Typically through a common user interface
  - Also through supervisory control devices
Integration—What’s Next?

- IoBT, the Internet of Building Things
  - Data, Data, Data
  - More measurement & verification
  - Cyber threats and cyber protection
  - A new generation of IT-savvy system integrators
D A & V—What is it?

- A means of visualizing and interpreting all of that data
It’s trendy!

“The use of data analytics or predictive analytics allows organisations to efficiently extract, clean and standardise data from multiple operational and legacy systems, as well as data in the public domain, to deliver real insights to business stakeholders.” (Deloitte)
D A & V—What does it looks like?

- Starts with attractive graphical representation of building systems and operating parameters.
- Moves on to dashboards.
- Culminates in intelligent analysis; portending options or recommending courses of action.
D A & V—What does it looks like?
D A & V—What’s Next?

- IoBT, the Internet of Building Things
  - Truly actionable analytics
  - Customized and customizable views
  - The cloud
  - Strange bedfellows
BACnet is Keeping Pace

- **SSPC 135 Working Groups drive continuous development of the standard**
  - Working Groups include Information Technology, Network Security, and Smart Grid, and Data Modeling, among others
- **Product Manufacturers & Developers**
  - Just visit the building automation and controls showcase here at the show.
Part 5
A Success Story
Success Story

- TDK Headway Technologies
  - Market: Technology Manufacturing
  - Owner: TDK Corporation
  - Location: Silicon Valley
  - Building Size: 115,000 ft²
  - Project Type: Energy Retrofit
Success Story

- **Their Business:**
  - Manufactures aluminum titanium carbide wafers consisting of thousands of read/write heads used in computer hard drives.
  - TDK sales of such devices account for about 1/3 of all such sales worldwide.
  - ISO-14001 registered quality system and Class 100 clean room manufacturing
Success Story

The Situation

- Corporate mandate of continuous improvement
- Annual energy-use reduction goals but dictated by fabrication requirements
- Location costs challenge them to be ultra-competitive in a worldwide arena
- Had achieved year-over-year energy reduction goals for 5 previous years
- BUT, had done so through low-hanging fruit
Success Story

The Challenge

- Achieve 10% energy reduction goal
- WITHOUT disrupting the fabrication (24/7/365 operation)
- Maintain environment at 68° +/- 1 degree and 45% RH +/- 2.5%
Success Story

▪ The Solution
  ○ Deep energy audit
  ○ System-level thinking
  ○ From conditioning 100% of air to conditioning supply and make-up air (sensors and BACnet controls)
  ○ For water usage (chilled, hot, steam), all requiring gas, added VFDs, staged cycle usage, sensors and BACnet control to maintain only required pipe pressures
Success Story

- The Results
  - ROI in 10 months!
  - Electricity: 5.4 to 4.4 megawatts continuous demand ($800K savings)
  - Gas: of 10 boilers in operation before, only 5 in operation now
  - PG&E rebate check: $633,500
  - Mayoral recognition for CO₂ reduction
See More Success Stories

- Over 80 such stories published on

www.bacnetinternational.org