Cost-Effective Integrated Systems That Work

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Cost-effective Integrated Systems That Work

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Overview

- Building Needs And Industry Drivers
- Focus On Customer Requirements
- Simplifying Protocols
- Construction Specifications
Why Integrated Systems?

**Smart Building Needs Hierarchy**

- Business Performance
- Building Optimization
- Systems Optimization
- Occupant Comfort

**Open Standard Protocol Foundation**

- Asset Management, Energy Supply, Utility Optimization
- Building Pressurization Control, Free Cooling, Heat Recovery
- Occupancy Scheduling, IAQ, HVAC Optimization
- Lights, Temperature, Ventilation, Humidity

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**Key Industry Driver = Technology**

- **Processing**
  - Power, Speed, Size
- **Networking and communications**
  - MS/TP, ARNCET, Ethernet
  - ISDN, DSL, T1, Broadband
- **Internet**
  - Systems Data Sharing
  - Anywhere Access
- **User interfaces**
  - PC, PDA, Cell Phones
Leveraging Technology Change

**Insist On Open, Standard Protocols**

- **Within The Building Automation System**
  - Unit Controllers: HVAC Equipment, VFD’s
  - Subsystem Controllers: Lighting, Security, HVAC
- **Beyond Building Automation System**
  - Data Sharing Outside The BAS
- **Why?**
- **How?**

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The Market Is Excited!

**Why?**

- **From End Users:**
  - “Finally, I have the choice to select the best equipment and controls for my project.”
- **From Consulting Engineers:**
  - “You mean open system specifications can be simple?”
- **From Contractors:**
  - “I can get competitive bids for the controls and equipment?”
- **From Controls Companies:**
  - “We can finally get out of the custom gateway business?”
- **From Equipment Manufacturers:**
  - “When we develop new controllers for our products, we don’t have to worry about developing our own protocols?”
Open Systems

The Value of Open Systems

- Customers Now Have Choices
  - Equipment Flexibility
  - BAS Flexibility
- Don’t Have To Buy Everything From One Supplier.
- Most Control Systems Are Now Shipping With Open Options.
- Customers Now Can Take Advantage Of Factory Mounted Controllers.
- Customers Can Select The Best Solution For Their Building.

Key: Pay Attention To Customer’s Needs Rather Than The Technology.

What Do Our Customers Want?

Owners And Building Operators:

- One System To Operate
- Take Advantage Of Factory Integrated, Microprocessor-based Controls On Equipment
- Select The Best Equipment And Controls For Their Building(s)
- Easily Add To, Or Upgrade Their Systems
- Most Of All, They Want Their Buildings To Work!
What Do Our Customers Want?

**Consulting Engineers:**
- Minimize Labor Hours On A Project
- Get Competitive Bids For The Owner
- Select The Best Equipment And Controls For Their Projects
- Minimize Their Risk (The Building Must Work Without Adds Or Extras.)
- A Simple Way To Specify Open Systems

**Contractors:**
- Choices And Alternatives
- Minimize Their Risk

**Controls Companies:**
- Get Out Of The Custom Gateway Business
- Minimize The Time They Spend On A Project
- Take Advantage Of The Data Available Inside New Digital Controllers Supplied On Equipment
What Do Our Customers Want?

**Equipment Manufacturers:**
- Don’t Want To Develop Protocols
- Take Advantage Of Factory Integrated, Digital Controls
  - Improves Equipment Performance
  - Sometimes Necessary To Meet Industry Standards
  - Lowers Cost
  - Improves Quality And Reliability
- Minimizes Time Spent On Interfaces To BAS Integrators

Open Protocols Are Gaining Momentum

**Driven By:**
- Owners Who Want Flexibility And Competitive Bids
- Consulting Engineers Who Want Choices And Limited Risk
- Controls Companies Who Want Simplified Integration To Equipment And Systems
- Two Standards Organizations
  - LONMARK International
  - BMA
### Background On Protocols

#### LonSpeak
- **LONWORKS** – Network Developed By Echelon.
- **LONMARK International**
  - Independent, Non-profit Standards Organization
  - Purpose To Facilitate Interoperability
  - Developing Standard Functional Profiles (Agreed Upon Lists Of Information) For Different Kinds Of Equipment.
  - Administer LONMARK Certification

#### Common LONMARK Functional Profiles In The HVAC Industry
- **SCC** – (Space Comfort Controller) – Maintains Room Temperature
- **DAC** – (Discharge Air Controller) – Maintains Discharge Air Temperature In Air Handling Equipment (Make-up Air Systems, VAV Air Systems)
- Chillers
- Water Source Heat Pumps
- **LONMARK International**
  - Certifies Products To These Profiles
  - Maintains A Website On Certified Controllers
- **LONMARK certification is key to our success.**
**Example: LONMARK Chiller**

**Functional Profile**

**Mandatory Network Variables**
- Inputs
  - Chiller Enable
  - Cooling Set Point
- Outputs
  - On/Off
  - Active Set Point

**Optional Network Variables**
- Inputs
  - Capacity Limit
  - Entering Chilled Water Temp.
  - Chiller Mode
  - Heating Set Point
- Outputs
  - Actual Capacity Level
  - Capacity Limit
  - Entering Cond. Water Temp.
  - Leaving Cond. Water Temp.
  - Alarm Description
  - Chiller Status

**Background On Protocols**

**LonSpeak**
- LonTalk – Can Be Communicated Over A Number Of Different Media. Most Common Is
  - Non-polarity Sensitive, Twisted Pair
  - Using FTT-10A Transceivers At 78KB
- Standard Methods Used To Document The Information Available From A Controller (XIF files).
- Each LON Device Has A Unique Address That Is Set When The Neuron Chip Is Manufactured.
LONWORKS System Example

LonWorks Controllers

Self-Contained Unit (DAC or SCC Profile)

Unit Ventilators (SCC Profile)

LonWorks Network - FTT-10A

System Controller

Centrifugal Chiller (Chiller Profile)

Applied Rooftop Unit (DAC or SCC Profile)

LonWorks Workstation

System Controller

Controls Companies That Support LONMARK (Depends On System And Vintage)

- Honeywell
- Invensys
- Johnson Controls
- Siemens
- Staefa
- TAC (CSI)
- Trane
- Tridium
Background On Protocols

Key Specification Items

- LonTalk Technology By Echelon
- FTT-10A Transceivers (RS-485)
- Appropriate Functional Profile (SCC, DAC, WSHP or Chiller)
- LONMARK Certification (www.lonmark.org)
- Vendor Must Supply XIF File
- List Of Desired Points
  - Control / Sequence Of Operation
  - Graphical Display
  - Maintenance Logging
  - Troubleshooting

Background On Protocols

BACnet Standard

- ASHRAE Committee, Started In 1987.
- Can Be Communicated Over Variety Of Media
  - MS/TP (RS-485 Twisted Pair)
  - Ethernet
  - Ethernet IP
  - Arcnet
  - Many others
- BACnet Standard Defines
  - Objects
  - Object Properties
  - Applications Services
  - Physical Media.
Background On Protocols

BACnet Standard

- BACnet Does Not Define Functional Profiles (Like LON Functional Profiles)
- BACnet Does Define Device Profiles
  - Smart Sensor
  - Smart Actuator
  - Application Specific Controller
  - Advanced ASC
  - Building Controller
  - Workstation
- BACnet Testing Labs (A Part Of BMA)
  - Tests Products Against BACnet Standards
  - Listed Products May Display The BTL sticker

BACnet

Protocol Implementation Conformance (PIC) Statement

- Defines Vendor And Product
- Describes How Device Conforms To BACnet Standard
- Assists In Interoperability
- ALWAYS Require Vendor To Supply A PIC Statement From The Equipment And Control Vendors!
BACnet PIC Statement

- **BACnet Standard Device Profile**
  - Operator Workstation (B-OWS)
  - Building Controller (B-BC)
  - Advanced Application Controller (B-AAC)
  - Application Specific Controller (B-ASC)
  - Smart Actuator (B-SA)
  - Smart Sensor (B-SS)

  - Replaced Conformance Classes
  - Standard Device Profiles Defined
  - BIBBS (BACnet Interoperability Building Blocks)
  - Describe The Functionality Of The Interface

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BACnet PIC Statement

**BACnet Interoperability Building Blocks (BIBBs)**

- **Functional Requirements Denoted In Pairs**
  - Device A Client - User Of Data
  - Device B Server - Provider Of Data

- **Five Interoperability Areas**
  - Data Sharing: Read And Write Objects
  - Alarm And Event Management: Notification, ACK
  - Scheduling: Time Synchronization
  - Trending: Periodic Data Capture
  - Device and Network Management: Reinitialize, Restart

- **Standard Object Types Supported**
BACnet PIC Statement

Data Link Layer Options
- ISO 8802-3, 10BASE5
- ISO 8802-3, 10BASE2
- ISO 8802-3, 10BASET
- ISO 8802-3, Fiber
- BACnet IP, (Annex J)
  - 5 ARCNET, coax star
  - 2 ARCNET, coax bus
  - ARCNET, twisted pair star
  - ARCNET, twisted pair bus
  - ARCNET, fiber star

- MS/TP master, baud rate(s):
- MS/TP slave, baud rate(s):
- Point-To-Point, EIA 232, baud rate(s):
- Point-To-Point, modem, baud rate(s):
- LonTalk, medium:

BACnet System Example
Background On Protocols

Controls Companies That Support BACnet (Depends On System And Vintage)

- Alerton
- Automated Logic
- Delta Controls
- Invensys
- Johnson Controls
- Siemens
- Trane
- Tridium

Key Specification Items

- Products Must Meet The ASHRAE BACnet Standard
- Required Communications Media (MS/TP, Ethernet)
- BTL (BACnet Testing Lab) Listing
- PICS (Protocol Implementation And Conformance Statement) Furnished At Bid Time And With Submittals
- List Of Desired Points (For control, Display, Troubleshooting) - Points List Is Even More Important For BACnet Since No Functional Profiles.
What Protocol Will Win???

- Both Will survive
- BACnet Is Supported By The HVAC Community Worldwide.
- LONWORKS Is Supported By Many Industries Worldwide.
- McQuay Supports Both Protocols And The Popular Communications Media
  - LONWORKS FTT-10A
  - BACnet MS/TP, IP, Ethernet
- Most Other Equipment Companies Can Offer Both LONWORKS And/OR BACnet Options.

Making Open Systems Work

The Controls Companies Are Very Interested in Making Integrations Work

- Recognize Gateways Are Too Expensive.
- Realize Factory Mounting Is Less Expensive Than Field Installation.
- Are Working On Integration Testing And Joint Documentation To Make Integrations Successful.
- Are Creating Standard Objects And Graphics To Reduce Field Labor.
- Are Educating Their Field Offices On How To Be Successful With Open Solutions.
Johnson Controls Metasys®
BACnet/IP Example

Siemens® APOGEE™
BACnet MS/TP Example
Specifications - Unit Controls

**LONWORKS**

- “The Unit Controllers shall reside on the LonTalk FTT-10A network and provide data using the LonMark standard network variable types and configuration properties. Units shall be LonMark Certified.”
- “The Unit Controllers shall support the (SCC, DAC, Chiller) LonMark functional profile.”
- “The Unit Controller manufacturer shall provide a XIF file documenting their support of mandatory, optional or vendor-defined network variables.”
- “The Unit Controller shall provide data available to the BAS as specified in the points list.”

Making Integrations Work

**A Few Questions You Need To Ask....**

- Existing Control System Or New?
- If Existing, Does The BAS Support Open Protocols?
- Does The Customer (Or Engineer) Have A Preferred Controls Supplier? (Schools In Particular)
- Does The Customer (Or Engineer) Have A Preferred Equipment Supplier?
- What Needs To Be Specified So The Owner Gets What They Want?
**Specifications - Unit Controls**

**BACnet**

- "The Unit Controller shall communicate using the ASHRAE/ANSI Standard 135-2001 BACnet protocol and be BTL listed." "The Unit Controllers shall reside on the BACnet (MS/TP, Ethernet, IP) network and provide information via standard BACnet object types and application services."
- "The Unit Controller manufacturer shall provide a PIC statement documenting their conformance with the BACnet standard."
- "The Unit Controller shall provide data available to the BAS as specified in the points list."

**Specifications - BAS**

**BAS Specifications (Should Also Be In The Equipment Specification)**

- "The Systems Integrator / Controls Contractor shall provide any necessary interface gateways to permit the sharing of information and control as defined here and in Section 15XXX."
- "All point mapping required to accomplish the above shall be the responsibility of the Systems Integrator / Controls Contractor . . ."
Specifying Open Systems

Resources -

- **LONMARK**
  - LONMARK Building Automation System Master Spec
  - Coming US Army Corps Of Engineers (UFGS/UFC) Spec
- **BACnet**

Leveraging Technology Change

**Insist On Open, Standard Protocols**

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- **How?**
Beyond The BAS

Cost-Effective Integration That Works?

- BAS Workstation
- PC Technology, PDA, Cell Phones
- Web Access - What About Security?
- Need To Utilize BAS Data For Better Asset Management

Use Standard Protocols

- Protocols From The Information Technology (IT) Industry
  - Hugh Resources Compared To The Commercial Construction Industry To Advance And Maintain Protocol Standards: XML, SOAP
  - BAS Systems Evolving Toward IT Technologies
  - Security Issues On Web Can Be Addressed To Meet Needs
  - Industry Resources: CABA, oBIX
Open Systems Summary

- Open, Standard Protocols Bring Real Value To Our Industry.
- Most Equipment Manufacturers Can Support BACnet And Or LONWORKS networks.
- Most BAS Companies Do Support Either BACnet or LONWORKS (Or Both).
- Specifications can be simple
  - Equipment That Supports Both BACnet and LON
  - Automation That Supports BACnet Or LON
  - Automation Vendor Responsible For Integration (It’s Their Job)
  - Certification (BTL or LONMARK), Documentation
  - Points List Required To Control And Operate The Building

Use Open Standard Protocols

For Cost-Effective Buildings That Work

- For The Lowest Life Cycle Cost
- For Customer Satisfaction
- For Customer Choices
- For Integrated Systems That Continue To Work
Panel Discussion

Alerton – Paul Czerwin
Automated Logic Controls - Steve Tom
Invensys - Ebbe Hassl
Johnson Controls – Chris Lane
Siemens – Shirley Hall
Staefa – John Mitro
Tridium – Scott Boehm

McQuay – Amy Momsen