

Investigating Open Systems:

Comparing LONWORKS[®] and BACnet[®]

White Paper Excerpts

Executive Summary Excerpt:

Open Systems have changed the way we address building automation. The Open System vision of a total building control network that encompasses every building system is now within reach for every building owner. Open Systems provide building owners with the opportunity to break the sole-source lock of proprietary solutions, enable competitive bidding and allow best-in-breed product selection. For an Open System to deliver this vision it must have a dynamic application, be able to utilize enterprise technologies and present new opportunities and added value for manufacturers, system integrators and owners alike.

The challenge in the market is selecting an open system technology. There are many technologies available that claim to be an "open system technology". Each has its merits, but only the LonWorks Technology and the BACnet Standard have gained wide acceptance and application. They both aspire to the same goals; however, they have very different network, software and hardware requirements. For all practical intents they are mutually exclusive solution approaches. Ultimately, one must be chosen over the other. (The two can co-exist at an installation, but are relegated to sharing information through a gateway. This architecture defeats the benefits of an open system and underutilizes each technology.)

Before deciding between LonWorks and BACnet three areas need to be considered: the Open System goals; respective market presence; and solution approach. Both aspire to the Open System goals of implementing an End-to-End solution that is Open, Interoperable and Multi-Vendor. Comparing market presence illustrates the influence each has on the market and comparing solution approach reveals the strengths and weaknesses of each approach. A comparative evaluation of LonWorks and BACnet with respect to the Open System goals provides the basis for making an informed decision.

Comparing solution approach shows the similarities and differences between LonWorks and BACnet. Evaluating their similarities shows that both can deliver complete End-to-End solutions with an array of control devices and operator interface options. Focusing on their differences shows significant divergence in several notable areas including device interoperability (and interchangeability), network management, product distribution and integration of new technology.

- The device level interoperability differences affect network architecture and the ability to create multi-vendor solutions.
- Network management functions are used in every control solution to design, configure, commission and install devices.
- Product distribution and the integration of new technology are two vital areas for commercial success and market influence.

Selecting an Open System solution is a matter of choosing either a LonWorks or BACnet solution. Both are capable of delivering an End-to-End solution, however, for product availability, product diversity, vendor choice and the latest technology, LonWorks has a significant market lead.

LonWorks and BACnet Solution Approach Comparison

Topic	LonWorks	BACnet
History	1988 – Protocol developed by what later became Echelon Corporation (1990) 1994 – LonMark Organization formed 1995 – 1 st LonMark Certified Device 1997 – LNS 1.0 released 1998 – 100 th LonMark Certified Device 1999 – 200 th LonMark Certified Device 1999 – i.LON [®] 1000 release - IP integration 1999 – LonTalk becomes ANSI/EIA standard 709 2001 – i.LON 100 release - XML Web services 2001 – 300 th LonMark Certified Device 2002 – LonTalk Update release by ANSI/EIA 2002 – 400 th LonMark Certified Device 2004 – 500 th Certified Device	1987 – ASHRAE [®] committee formed 1995 – BACnet1995 released 1995 – BACnet1995 becomes ANSI standard 1998 – BIG-NA and BIG-EU established 1999 – BMA established 2000 – BTL established 2000 – BIG-AA established 2001 – BACnet2001 released 2001 – BACnet2001 becomes ANSI standard 2002 – BTL begins product testing 2002 – XML Work Group established 2003 – Becomes ISO Standard 16484-5 2003 – 35 BTL listed devices
Network Architecture	<ul style="list-style-type: none"> • A “bottom up” solution focused on device interoperability • Open standard that employs a common protocol • Flat network topology 	<ul style="list-style-type: none"> • A “top down” solution focused on HMI integration • Open standard that can employ multiple protocols • Tiered network topology
Network Management	<ul style="list-style-type: none"> • Network Management tools available from many sources (approximately 30) • Single tool to access any vendor's devices - not vendor specific • Single tool to access all media types • View and configure network devices • View network variables and establish peer-to-peer communications • Single tools enable graphical presentation of network and common database to store network characteristics 	<ul style="list-style-type: none"> • Limited network management functions • No network management tool to view all supported protocols, typically requires tool from manufacturer that supplied subsystem or system • No common database for network characteristics
Operator Interface Software	<ul style="list-style-type: none"> • LNS developed as a vehicle for HMI communication • OpenLDV[™] with core LNS components available with Echelon NICs to allow any non-LNS based HMI to interface with LonWorks networks • Many native LNS HMI applications • Many manufacturer specific communication drivers • LNS DDE available from Echelon • LNS OPC available from several 3rd party developers/suppliers • LNS database back-up and restore features 	<ul style="list-style-type: none"> • Originally BACnet was intended for use at the operator level • Several native BACnet HMI applications • Several manufacturer specific communication drivers • Most HMI communication uses IP or ARCNET protocols
Design Guidelines	<ul style="list-style-type: none"> • LonMark Association sets LonWorks guidelines (physical layer; application layer via functional profiles), which define mandatory and optional data elements, and product certification requirements • 68 - LonMark Functional Profiles (LFP) • 30 - LFPs in development • Define standard data types (SNVT and SCPT) <ul style="list-style-type: none"> ○ Over 170 published SNVT ○ Over 290 published SCPT • LonMark Association certifies products 	<ul style="list-style-type: none"> • BACnet standard defines architecture and sets broad development guidelines • Identifies data types, PICS format, BIBBs and device profiles • 150 - published data types • 23 - published standard objects • 67 - published BIBBs • 6 - published device profiles • BACnet committee maintains the BACnet standard, but does not certify products

Topic	LonWorks	BACnet
<i>Certification</i>	<ul style="list-style-type: none"> • Device certification performed by the LonMark Association and through Certification Centers using manufacturer independent tools • Devices certified against LFP • LFP defines mandatory and optional data elements (direction and type) that manufacturer must implement • Published LFPs available at LonMark website 	<ul style="list-style-type: none"> • The BACnet Testing Laboratories (BTL) test and list BACnet products using manufacturer independent tools • The BTL does not set BACnet development guidelines; they not establish mandatory/optional data elements for devices • The BTL test and verify manufacturer's selected use of BACnet • Certified devices include a complete PICS document, which indicates BIBBs used • Ultimately, the BTL is to test all BACnet products - devices and software
<i>Device Architecture</i>	<ul style="list-style-type: none"> • Generic controller - Neuron Chip processor, Neuron C programming language, I/O Channels, Transceiver • Hosted controller - Neuron Chip plus 3rd party processor • Non-Neuron - 3rd party processor with ported implementation of LonTalk • Majority of LonWorks controllers use the Neuron Chip processor 	<ul style="list-style-type: none"> • Processor independent • Programming language independent • Final controller specification at manufacturer's discretion • No device protocol usage guideline • Majority of devices use MS/TP protocol
<i>Devices</i>	<ul style="list-style-type: none"> • All devices use LonTalk, most devices use the Neuron; some are non-Neuron devices • Infrastructure - Routers, web servers, gateways, NIC • Non-HVAC - Access, Energy Management, Fire & Smoke Control, Motor Control, Lighting, etc • Data Collectors - schedulers and trend loggers 	<ul style="list-style-type: none"> • All devices are protocol specific • Routers - used to translated between protocols or extend existing LAN • Supervisory Devices - typically use multiple protocols • Gateways - most commonly developed BACnet device • Non-HVAC - Access, Lighting
<i>Diagnostic Tools</i>	<ul style="list-style-type: none"> • Network Diagnostic tools available from several vendors • Single tool can access and evaluate a multi-vendor network • Single tool can access all media types 	<ul style="list-style-type: none"> • Very few diagnostic tools available • Must be maintained to include new BACnet objects and data types
<i>Protocols</i>	<ul style="list-style-type: none"> • Single protocol - ANSI/EIA-709.1 (LonTalk) • EIA/CEA-852 to tunnel LonTalk over IP • Embedded into every Neuron Chip • Can be ported to almost any processor or microcontroller • All LonWorks devices use LonTalk • Supports various media including unshielded twisted pair, fiber optics, radio frequency, infrared, and power line carrier. 	<ul style="list-style-type: none"> • Multiple protocols supported • BACnet/IP, Ethernet, ARCNET, MS/TP, PTP, LonTalk • All industry standard protocols • Each with specific implementation and media requirements
<i>XML, IP & Web Services</i>	<ul style="list-style-type: none"> • i.LON device series <ul style="list-style-type: none"> ○ Peer-to-peer ○ Web Services ○ Ethernet NIC • EIA-852 - LON/IP products available from several manufacturers • LNS API accessible over IP directly • Porting existing LFP profiles to XML (coordinating effort with the "XML/Web Services Guideline" development under the auspices of CABA) 	<ul style="list-style-type: none"> • XML Work Group established to investigate the application of XML in the BACnet Standard • Long-term goal to develop an XML method for the automated configuration of BACnet systems • Developing a machine-readable device description language tentatively referred to as "XPICS" for "XML Protocol Implementation Conformance Statement"

Topic	LonWorks	BACnet
Distribution	<ul style="list-style-type: none"> • Direct from manufacturer as part of a complete solution • Many companies produce solution independent LonWorks devices (lighting, sensors, drives, power metering, security, life safety, diagnostic tools, etc.) • Independent distributors representing devices from multiple vendors 	<ul style="list-style-type: none"> • Direct from manufacturer as part of a complete solution • Very few companies produce solution independent BACnet devices (lighting, diagnostic tools, gateways) • No independent distribution
Related Standards Qualifications	<ul style="list-style-type: none"> • IFSF – International Forecourts Standards Federation (EU petrol station controls) • IEEE 1473L– In train controls • AAR – Electro-pneumatic braking controls; USA • SEMI – Semiconductor Equipment Manufacturer's Industry • Finnish Homes – Automation standard • CEN-TC247 – EU government buildings (in process) 	<ul style="list-style-type: none"> • ISO Standard 16484-5 • CEN-TC247 – EU government buildings • Korean National Standard • Endorsed by NEMA

For More Information

The content of this document is an excerpt from the Strata Resource white paper entitled *Investigating Open Systems: Comparing LonWorks and BACnet*. The complete unabridged document is available from Strata Resource. For more information on this and other industry topics contact Strata Resource Inc

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