Open Systems and Interoperability

Open Protocols, Open Systems, Open Data – Definitions, Examples, Benefits and Challenges

A Presentation for Engineers, Building Owners and Operators

Presented at New England Chapter of AEE

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April 6, 2016
Lets Start with Some Definitions

- **Interoperability**: The process of combining different systems to enable data sharing, coordinated control actions and unified user interaction.

- This can be done even when systems do not support standard protocols - *it just takes more work*. 😊
Let's Start with Some Definitions

- **Open Systems**: Products that include documented communications interfaces that provide supported methods to enable connection and communications.
  - These may include industry standard protocols, or may be proprietary interfaces that are documented and accessible for use.
  - So… Open doesn’t necessarily mean Standards-based.
Definitions

- **Open Protocols**: Communication protocols and data exchange interfaces based on accepted standards. Most often managed by, or approved by, non-commercial industry organizations.

- Examples of Standards-based protocols in the Buildings Industry:
  - BACnet® (ASHRAE)
  - Modbus (modbus.org)
  - Obix (OASIS)
  - Haystack (Project-Haystack.org)
  - LonTalk® (Echelon/ANSI)
  - SNMP (IETF)
  - OPC (opcfoundation.org)
  - DALI (dali-ag.org)
The Facets of “Open”
Its More Than One Thing

- **Device Connectivity**
  - Communication protocols – BACnet, LonTalk, Modbus, oBIX
  - Enables device connectivity & multi-vendor systems
  - *This has been the primary area of focus and what most people “in the business” mean when they say open*

- **Application Connectivity via APIs** (Application Programming Interfaces)
  - Enables third parties to connect software applications that can access data from systems and perform value-added function
  - *This is the new area of value creation*
The Facets of “Open”
It's More Than One Thing

- **Purchasing and Acquisition** – Can I buy it from multiple sources?
  - Access to products for initial purchase and system expansion
  - Multiple supplier options to create a competitive situation

- **Access for Service**
  - If I don’t like the car dealer down the street I can bring my car to another service center
  - Can I get service from multiple providers?

- These are what owners often expect when they say “open”
The Facets of “Open”
Its More Than One Thing

- **Open Database Compatibility**
  - Compatibility with standard databases
  - Can data from the system be easily stored in, and retrieved from, common database software with a standardized query language?
  - Examples:
    - MS SQL, MySQL
    - ODBC, JDBC support
The Facets of “Open”
Its More Than One Thing

• **Open Source**
  • The software “source code” is publicly available for use and extension under a well defined license
  • Examples:
    • Apache HTTP Server [http://httpd.apache.org/] (web server)
    • MySQL [http://www.mysql.com/] (database)
    • OpenOffice.org [http://www.openoffice.org/] (office suite, including word processor, spreadsheet, and presentation software)
    • BAS Example: Project-Haystack.org (data tagging technology and related communication protocol)
The Facets of “Open”
It’s More Than One Thing

• **Open Programming** – Can someone other than the installer or mfg program the system

• You can have a product that communicates information via an open protocol but does not allow for programming by other than the mfg/installer
  
  • Examples: Pre-engineered appliances or self contained systems
  
  • The mfg of a 1000HP boiler may be happy to communicate all data from the boiler but not willing to let you go in and reprogram it - for good reason!

• BAS systems may require programming tools/applications that are not readily available to other parties
Open Communities – Another Facet

- The ability for an independent ecosystem of developers to create complementary applications for users of a product

- Examples: Apple App Store, the Android Market

- Open systems enable the growth of open communities to create value added applications and services not controlled by the equipment mfg
Supporting Open Communities

- Allow third party developers to create Apps, Tools, integrations, algorithms both external to AND inside the product
- There may need for certification – to protect the customers and the brand
- The developers may need to buy a “kit” but it would have reasonable costs (in line with desktop technology (like MS)
- Financial transactions may involve the platform supplier (or not). Example: Apple gets their share of any sale via the App Store
- No one arbitrarily “stops” development of Apps by third parties – any rules/certifications are “known”
The Benefits of “Open”

- Purchase best of breed products that will work together
- Eliminate vendor “lock in”
- Combine control systems with software applications that were not developed by the product manufacturer
- Combine products that were never envisioned to work together by their manufacturers
Benefits of “Open”

• Competition and lower cost

• Creativity – foster the development of independent apps and tools that the manufacturer doesn’t provide

• Data!!! – The data from equipment systems has become a tangible asset to improve facility performance. I want my data!
Access to Data – The Newest Benefit of Open
Data Enables Analytics
Improve Facility Operations with Data

- Analytics software automatically looks for “patterns” in our data….

- Equipment faults, deviations from expected performance, actual results vs goals or benchmarks, etc

- **Unlike energy efficiency measures that involve the installation of major capital equipment, analytics can work with existing data sources – including historical data**

- Relatively easy to add to what we have – but we need access to data – so open access to data matters!
New Uses for Data Highlights a New “Open” Requirement

- To enable building owners and operators to take advantage of their data open access is just the first step
- If the costs of using data is too high is it really “open” for the owner
- If I said I could add an option to your system to make it open, but it costs $1M would it be of much value to you?
- … Probably not 😊
New Uses for Data Highlights a New “Open” Requirement

- So if the reason I want an open system is to have access to data for analytics, visualization and reporting to improve operations...
- ...if the cost of using that data is too high I am really not getting the benefits I hoped for...
The Costs Involved Accessing and Using Data to Improve Operations

- The new challenge for cost effectively using our “open” data…
- Data semantics… Data modeling… Meta data… Data mapping
The Data Semantics Challenge – A Use Case

Lets say I am asked to analyze this: zn3-wwfl4 = 76.2
Hmmmm… What is it? Deg C, F, KW, kPa, ???
Need to know units: Lets say it is Deg F
Hmmmm… Is 76.2 Deg F OK?
What is it? Zone temp, Return air temp, chilled water temp?
   Lets say it’s a Zone temp
What is the schedule? Schedule #1 = 7:30 AM - 6:30 PM
What AHU is it served by? AHU-1

*How can I convey these answers in a standard way that other software can interpret?*
Use Case – Haystack Representation of Data

id: 150a3c6e-bef0ee0e (RecId)
dis: zn3-wwfl4 (Str)
sensor: ✔ (Marker)
air: ✔ (Marker)
temp: ✔ (Marker)
unit: °F (Str)
curVal: 77.60 °F (Number)
equipRef: Carytown AHU-4 (Ref)
siteRef: Carytown (Ref)
tz: New York (Str)
zone: ✔ (Marker)
vav: ✔ (Marker)
floor: 4 (Number)
scheduleRef: occSchedule-1 (Ref)
Project Haystack

- A open source, open community, open protocol methodology for defining and communicating the meaning of device data
- Also known as semantic tagging, meta data or data modeling
- Open source, highly flexible, applicable to data of all types
- Example of Haystack tags to describe a point in a system:
  \[ \text{AHU1-SAT} = \text{sensor, discharge, air, temp, deg F, ahuRef} \rightarrow \text{AHU-1} \]

<table>
<thead>
<tr>
<th>the original point Name</th>
<th>descriptive tags</th>
<th>association tag</th>
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Haystack Data Tagging – What It Enables

- Applications that just work!

- Example: Graphics can auto-generate just by reading the meta data associated with points

- Easier integration with external software applications

- Example - analytics software can understand and consume data without human effort required to manually “map” data

- A new generation of engineering tools to streamline project implementation tasks
Introduction to a New Open Community Addressing the Open Data Challenge

- Open source initiative to develop data tagging conventions and taxonomies for building equipment and operational data
- Define standardized data models for sites, equipment, and points related to energy, HVAC, lighting, and other environmental systems.
- >1000 industry experts from around the world contributing to this open source standard

http://project-haystack.org/
“Open” is more important than ever for efficient, cost effective building operation

Need to define what open means for your application

Be informed

Demand the openness you need to achieve your goals

Lots of options out there today

Make sure your data is open too!
So What is an Owner To Do?

• Understand the facets of openness
• Understand which facets apply to your needs
• Clearly define requirements related to openness
• Insure that your procurement process will result in you getting the openness you need and expect
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