Project Haystack

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connections

Covering Semantics, Tagging and Interoperable Data Strategies for Smart Buildings, the Internet of Things and More.

CONTENTS

Haystack Connections reports news from our international open-source community and informs about our methods and success strategies, as we work to standardize semantic data modeling across applications, markets and industries.

Darwin and the Dynamism of an Open Source Community

by Therese Sullivan, BuildingContext.me
Managing Editor, *Haystack Connections*

The Charles Darwin observation quoted on the opposite page is a good reminder of how living things evolve. In it, I find new appreciation for open source organizations like Project Haystack. With our worldwide membership and longterm focus, our work will carry on, even *if* something as momentus as the US government changing course on climate action and pulling back on its investment in energy efficiency happens. Project Haystack's drive to standardize tagging and data modeling practices straddles diverse industries, applications, companies and geographies.
After putting together this issue of *Haystack Connections,* I'm feeling more confident than ever that 2017 will be a year when our industry thrives, not just survives.

Haystackers are working toward the day when most building equipment, meters and other connected devices and software comply with standard tagging and modeling conventions. Specifying engineers will write their RFP's with the clause that all vendors build in support for Haystack data modeling. And end users will have an established in-house point taxonomy that they communicate and enforce among all stakeholders in their buildings' design, operations and maintenance. In the short amount of time that has passed between the publication of the Spring/Summer edition of Haystack Connections in 2016 and today, there has been steady and certain progress toward realizing this vision, for example:

- Project Haystack membership has expanded, adding more solution vendors and engineering and commissioning firms. ARUP, one of world's most well-known MEP firms has recently joined. Other new members include Connexx Energy, SensorFact and IoTWarez.
- The work of the community has accelerated and intensified. This issue contains articles about the release of new tagging definitions and Software Developer's Kits (SDKs).
- The Haystack community's biennial conference, Haystack Connect, is scheduled for May, with the list of sponsors and pre-registrants growing. You will find more details about the conference in the following pages.
- More end-users are expressing interest in Project Haystack. This edition includes an article that summarizes Project Haystack's value proposition with these newcomers in mind.
- Haystack members and supporters are more engaged in educating the wider market about Project Haystack, which is evident by the growing number of trade press articles and whitepapers. I sample those in this publication too.
- Another way that I keep up to date on the impact of Project Haystack is by following member companies on social media. You will find my curation here.

There is a lot more to explore in these pages. More than that, I'm looking forward to the Haystack Connect conference this year. To apply Charles Darwin's thinking, collaboration through open source and standards organizations is a vital adaptation that is enabling the entire commercial building industry to evolve in a sustainable way. Our events and publications are an essential part of how that collaboration happens. So, I hope you like Haystack Connections. And, see you in Tampa in May.

Where Data Gets Real

If you want to know the real story and see the real technologies that are changing our physical world, there is only one place to be—Haystack Connect 2017.

There is no question that data from the Internet of Things and the analytics and visualization technologies that have emerged to create value from that data are revolutionizing the way we manage and operate buildings, equipment systems energy and our physical world.

Along with real, tangible results, the field is also experiencing a significant amount of hype. This hype can result in confusion for end users and even the most experienced industry practitioners.

It's a known fact that machine data can produce amazing results – it's also known that it takes real work, knowledge of the underlying systems, and new skills to implement successful data solutions. The Project Haystack community is singularly focused on addressing the real world challenges involved in using machine data to create and drive value. Haystack Connect 2017 will be the place where data and creating value from it gets real. The sponsors, speakers, and technical program will provide attendees with the most concrete, factual information available. This Information will help owners, operators, and systems integrators and end-users separate reality from hype. Vendors will present solutions that demonstrate their tangible value, steering clear of hype-filled claims that gloss over the real-world challenges.

The conference website with more details is now live at www.haystackconnect.org. Companies that have already committed to sponsorships are Intellastar, J2 Innovations, KMC Controls, Kodaro, SkyFoundry and Yardi Systems and the Platinum level; Airmaster Australia, Cochrane Supply and Lynxspring at the Gold level; and BAS Services & Graphics, Connexx Energy, and Contemporary Controls at the Silver Level. All will be exhibiting in the Vendor Showcase. AutomatedBuildings.com is a media sponsor. Additional sponsorships are still available.

The Call for Speakers is open until March 15, 2017. Learn about how to submit a proposal on your topic area of expertise at our website.

Why End-Users Should Demand Project Haystack

Marc Petock,Chief Communications Officer & Vice President, Lynxspring
& John Petze, Principal, SkyFoundry

When it comes to data, it is one thing to have access to data; it's another to make it actionable. With more data available than ever before the industry is presented with a new challenge. Device data is stored and communicated in many different formats. It has inconsistent, non-standard naming conventions, and provides very limited descriptors to enable us to understand its meaning. Simply put, the operational data from smart devices and equipment systems lacks information to describe its own meaning. Without meaning, a time consuming manual effort is required before that data can be used effectively to generate value. The result is that the data from today's devices, while technically "available", is hard to use, thus limiting the ability for building operators to fully benefit from the value contained in the data.

That's why Project Haystack is taking center stage as a naming convention and modeling scheme. Project Haystack is an open-source, collaborative community utilizing tags and semantic data models to define and describe the meaning of data from smart devices of all types. It addresses the challenge of utilizing semantic modeling to streamline the interchange of device data among software applications.

The Project Haystack community has defined an easy-to-use methodology to describe the meaning of data using a simple, extensible data-tagging approach and standard models for common equipment systems. The community-developed material includes detailed documentation describing the data modeling techniques, significant libraries of equipment models, and software reference implementations allowing software applications to easily consume smart device data that is marked up with "Haystack Tags". These data descriptors allow software applications to automatically consume, interpret, analyze and present data from IoT devices, smart equipment and systems.

Project Haystack methodologies are used in millions and millions if square feet of commercial buildings and facilities of all types and sizes, and it provides a higher quality of data; reduced costs, less time to implement and reduced risk.

We are often asked, what are the benefits and value driven by Project Haystack methodology for end users? Well, there are several and we have outlined them on the next page.

Benefits of the Haystack Methodology

ENFORCE BEST-PRACTICE PROCESS

Insures that the data contained within systems have been understood and categorized in a standard way. For example, you can't implement tagging of system data without having the necessary "as built" information on "what is what." It forces that part of the process to be done

KICK-START YOUR DATA STRATEGY

Sets you on the right path toward an overall data and analytics strategy because you should always start with tagging and semantic modeling

FLAG DATA WITH SPECIAL VALUE

Permits you to choose certain types of data to classify and identify as commercially valuable and useful data

MAKE DATA SELF-DESCRIBING

Provides consistency of definitions that helps reconcile the difference in terminology, as well as clarity of relationships to help resolve ambiguity and inconsistencies. Also provides clarity of data lineage as it contains information about the origins of a particular data set

STANDARDIZE NAMES & DEFINITIONS

Enables users to make sense of data by defining and categorizing it, and establishing standard definitions and descriptors, so that your data can be consumed by all information systems and people in your organization

PREP DATA FASTER

Normalize data and define it in terms of what it is and what attributes it possesses. Easily query and derive reports

AVOID VENDOR LOCK-IN

Insures that the data within systems is available to external applications using standard, known descriptor techniques. This makes their data more portable for use with other applications and minimizes the risk of vendor lock in

KEEP 'ALL SYSTEMS' HUMMING

Helps end users design well-functioning database & provides a foundation on which to build business processes. Helps navigate challenges & opportunities and drives better decisions.

MAINTAIN TIES WITH LEGACY NAMING

Allows existing point naming conventions (or point naming "disasters") to remain in place but provides a uniform way to interpret the meaning of those points, whether it be by humans simply reading the tags on the points in a text document or tabular presentation, or by software that can automatically interpret the tags to determine the meaning of the points

WORK SMARTER

Enables you to see relationships and redundancies, resolve discrepancies, and integrate disparate systems so they can work together

TAP INTO A GREAT KNOWLEDGE BASE

Gain entry into a community of highly skilled and experienced professionals when it comes to the operational aspects and infrastructure of buildings and facilities

Bird's-Eye View on Haystack Community Activities

One way to gauge the impact that Project Haystack is having on the industry is to listen in on the social media announcements from the membership. Watching my Twitter and LinkedIn feeds, I've been following along as members announce Haystack-enabled projects, new ways of working–ie new best practices– and new products via Twitter. I've organized them here according to those categories. Click through for more.

Projects

Every PlantPro project is Haystack-ready out-of-the-box, enabling easy integration into SkySpark, Niagara, FINStack or any other compliant system.

Haystack methodology is at the core of this NREL whole-campus monitoring project.

KMC Commander deploys Haystack tagging by incorporating FINstack from J2 Innovations

UCSF is participating in the Smart Energy Analytics Campaign with Haystack-enabled Connected Cx.

More from Bueno on Page 20

practices

Lighting is being leveraged as a communications network & more.

RE owners should seize the opportunity to command their energy future.

YARDI
@Yardi

@EggersMatt covers the rise of new energy technologies & the future of utilities yardi.com/blog/news/deat...

Daintree Networks
@Daintreenet

#Daintree blog showcases exciting new apps that leverage #lighting network. app.advo.ninja/u/mk0YcF

3rd-party look at connected analytics platforms. Researchers ask how value will be created from machine data in the future.

SkyFoundry
@SkyFoundry

SkyFoundry and SkySpark 3.0 are the subject of a Harbor Research whitepaper.Available here: skyfoundry.com/forum/topic/24...

Niagara pro's are presented with ever more choices. What to use where, and at what cost? No one explains it better.

otipro
@ot_integrators

@IoTBrianTurner explores what's coming in #Niagara4 #bIoT devices

products

Sleek new way to automate Haystack tagging.

Lynxspring, Inc.
@lynxspring

Introduction to the Lynxspring Onyxx BH311 BACnet to Haystack Data Pump: youtu.be/a8UCWldgrqr4?a via @YouTube

ConnexxEnergy
@connexxenergy

Simply and efficiently deploy #smartenergy Secure #datamanagement and visualization.

Haystack modeling combined with interface support for a full range of analytics dashboards.

An edge controller that combines Haystack support, an open-source BMS engine, and the brain of a smart phone.

FIN Products
@finproducts

Introducing a new series highlighting the top 6 payoffs of Haystack tagging blog.j2inn.com/payoffs...

BASSG
@basservice

Do remote #buildingmonitoring www.eac.io.

The amount of connected devices increasing every day, potential value is also increasing exponentially.

Perspectives from Project Haystack Members & Supporters

In this editorial, Leon Wurfel points out why Australia is the launching point for so much Smart Building tech. Membership in Project Haystack is one way his firm, BUENO, stays ahead in data. Leon was recognized by his country's Air Conditioning, Refrigeration and Building Services industry (ARBS) with the 2016 Young Achiever Award. His acceptance speech captures more of the story. See it here.

Big Data - Big Noise: How to Cut Through

Leon Wurfel
Managing Director, BUENO - Built Environment Optimisation

The big data and analytics space is an increasingly appealing commercial opportunity for companies in the property industry. This opportunity co-habitates within the machine cognition and Energy Management Information Systems (EMIS) which are respectively forecast to be USD$200BN and USD$10.8BN global markets within the next 4-8 years. Also strong incentives exist in combating the risk of many traditional property stakeholders being commoditised out of the market if their expertise is codified into servers and algorithms. The sum of these parts means that we are seeing the gold rush phase of the cycle of adoption of big data ideologies in the marketplace. With so many solutions becoming available in the marketplace, the practical challenges for end users of these types of solutions are:

Features vs Outcomes: At the end of the day, this kind of work is driven by a business case. Tech sheet evaluations are mostly useless in such a new and dynamic field. There is not enough actual evidence to show which features are connected to which outcomes.

Track Records: In such a young field, where the established players are only 3-4 years old, it is difficult to pick the companies who have been able to successfully implement these types of solutions. There is no license to use buzz words and hyperbole. So many end users struggle to pick out the established players who have established products and services from the players new to the space, who are selling their big data solution before they are built.

Local Applicability: Australia is a globally unique market with high expectations and tribal knowledge for executing real building performance. No other markets have had the benefits of programs like NABERS to drive their buildings past the green "bells and whistles" into real sustainability outcomes. The Australian market has mature performance expectations and tools developed to suit other markets may not satisfy local needs.

Strategic Fit: Data, Integration and Converged Systems all form part of a "Smart" strategy for industry stakeholders. It is important that the solution fits with the strategic goals of the business and complements their strategies for how technology will influence their business model over time.

Depending on who you are in the industry, any one of these four could be your biggest concern when embarking on a big data journey. Shoot us a comment if there is any one of these that you're most interested (and why) and you might be in luck and have that topic bumped to the top of the queue!

The team at Hepta Control Systems is leading the way in intelligent buildings, from state of the art data centers to environmentally conscious facilities. HCS is playing a big role in building operational analytics for the cutting-edge Quicken Loans Technology Center in Detroit, for example. In this article, Keith Bishop of HCS explains the motivations and mechanics of his participation in Project Haystack.

Why I'm Active on the Haystack Forum

Keith Bishop,
Director of Analytics, Hepta Control Systems

As the lead analytics engineer on a team concentrated on the development of fault detection and predictive analytics systems, it is my responsibility to set the right course regarding metadata tagging. Our team is responsible for analytics solutions across all of the Hepta family of companies which extends past standard building systems and into data center infrastructure management (DCIM) and electrical grid based greenhouse gas emission solutions. IoT Warez, an HCS company, joined Project Haystack in 2016 to be an active participant in its open-source evolution. We understand just how important a commonly recognized metadata schema is to continuous innovation in our analytics software and the rest of our solutions. When I participate in the details of creating Haystack tag definitions, I'm laying the foundation for our future solutions, in terms of how well they will model the physical world and predict performance under varying conditions.

For example, when it was brought to my attention recently that there was a significant discrepancy in how Haystack handled a **valve** tag as opposed to a **damper** tag, I proposed a new **damper** definition on the forum page. To anyone that doesn't deal in making legacy HVAC equipment and new sensor systems interoperate, the discrepancy might not have seemed like a big deal: it was that a damper position could only be expressed as a numerical percentage value, while valve position could be either a percentage value or a Boolean on/off. I pointed out that in actual operation, there is very little difference in how valves and dampers are used. The fluid involved simply changes between the two. (I understand there are air valves, but those are not generally encountered.)

My new proposed damper definition reads:

"Marker tag on point which indicates a damper used to regulate or control the flow or pressure of air. It is used with cmd to indicate the damper command: true/false (open/close) or 0% to 100%. It may also be used with sensor to indicate a feedback sensor such as a voltage giving exact position between 0% and 100% or open/close as indicated by end-switches."

Agreement by others in the community came within 24 hours, and the definition was officially changed in the Haystack library.

Similarly, I worked openly with Stephen Frank through the Haystack forum on the new set of electric meter tags. This open-source way of working inside the Project Haystack community gives me an opportunity to add our insight at just the right moment in the evolution of the Haystack metadata schema. I see participation in Haystack as one effective way to translate the real-world experience of our Hepta team into software that will make our tools better and will advance the state of Intelligent Buildings overall.

Kevin Binnie explores the pervasiveness of meta-data tagging and puts Project Haystack in a larger context. Kevin has over 20 years of experience in product management, marketing, mergers & acquisitions, and new market development.

What is Tagging?

Kevin Binnie

In the physical world, we are familiar with tags. Perhaps the most obvious example is at birthdays or during the holiday season when gifts are tagged: I can tag a gift with information about who the gift is for and who it is from and even the occasion that the gift is intended to celebrate without knowing anything about the gift itself.

In everyday life, tagging technology has helped make our lives more convenient: barcodes or Universal Product Codes (UPCs) are a form of tag that tells the scanning system at a grocery store that the item scanned is a box of cereal with a particular price. This eliminates human error in identifying the price of that box of cereal, including if the cereal happens to be on sale. Another everyday use of tagging is the popular hashtag in social media, identifying a popular subject. In the recent US election, hashtags like #election2016, #HRC (Hilary Rodham Clinton) and #trump2016 gave voters an easy way to read about goings on during the election. We can also scan QR Codes with our smartphones to take us quickly to popular websites or download coupons.

In the world of Building Automation Systems (BAS), tags can be used to help unravel the complexities of the building equipment, including the relationships between various pieces of equipment. For example, I can tag a particular piece of equipment "Boiler" and I can tag another piece of equipment "Boiler fed reheat." In practice, I would likely work to create tags that are simple, easy to follow and readily convey the specific information that I need. I can even tag abstract concepts such as "schedule" or "temperature."

In BAS, controls engineers have been effectively tagging trend logs for years in the way that they name the trend log. It's not uncommon for a trend log to be named something like "AHU_1_VAV_2_SAT," which contains a significant amount of information: just by looking at the trend log name, I can guess that it is the Supply Air Temperature entering Air Handler 1's VAV number 2. That's quite helpful for someone who is looking at the trend log and trying to understand what it is.

There are, however, several challenges to this method. Firstly, not all trend logs are named in a way that is this easily understood. Secondly, since typically trends are named by hand one at a time, they are prone to typographical errors, which can change the context significantly. Thirdly, since it's permissible in the BACnet standard to name the trend log anything, this same trend log could just as easily be named "VAVST," which is a lot less clear or helpful. Finally, and perhaps most importantly for owners and operators of multiple buildings, if the buildings were set up by different operators – or worse, use different controls – the naming convention will almost certainly be different, which means I can't automate the categorization of the trend logs for review or analysis.

Haystack Tagging

It's clear that the use of some form of tagging helps to get around many of the challenges presented by trend log naming. But what is the best tagging model and why is it important? Project Haystack is an organization founded by a group of concerned companies to set out a framework for the BAS industry. Project Haystack defines both a structure and a set of tags that are commonly used in BAS. There are 217 pre-defined Haystack tags, and they offer a tremendous advantage over named trend logs. They are standardized across all vendors that adopt the standard, so there is much more clarity of information on standard equipment types between buildings. They help create a common nomenclature between applications, so set up time for applications such as Building Management Systems and analytics programs are significantly reduced.

Most importantly, they can be set in equipment and controllers at the manufacturer, virtually eliminating the need for onsite naming by contractors. This last point also means that the likelihood of getting it right the first time is significantly increased.

So how does Haystack work? Haystack provides a framework for the industry to share relational (meta) information on common devices in a building. It is comprised of a series of definitions for the TagModel or tagging framework, the Structure, which defines the key entities, Time Zones, Units, Grids to support the representation of tagged devices in a table (like in Excel) and Filters. There are a lot more elements to Haystack which coders will find important, but they are not critical to understanding Haystack.

The TagModel is simply the definition of how tags are structured for interoperability when sharing data between applications and/or devices, such as between a controller and the BAS. First are entities, which is the virtual (computer) definition of a real-world item, like a piece of equipment, a sensor point or even a site. Next is the definition of tags, which in the Haystack world, are name/value pairs that are associated with a particular entity. I could, for example, tag an entity with *vav*, which indicates that the entity is a VAV. I could further tag it with *coolOnly*, which further defines the VAV to be a cool-only VAV with no fan power. Or, I could tag the VAV's fan with the tag *fan*. I could further add the tag *damper* to indicate the damper position.

Free-Form Tags

Haystack provides a great many advantages in a BAS, but free-form tags are perhaps even more useful. While they require more manual effort than the convenience Haystack tags offer, since individual tags have to be created and applied manually, their flexibility makes them useful across a much broader range of uses than the limited Haystack set. A free-form tag is one that is defined by the user and is generally a word or series of words that have some context for the user. They are also generally shareable and able to be combined to act as a form of filtering to get to specific information of interest.

Tagging tools are available for tagging everything from pictures and music to blogs and websites. The popular Customer Relationship Management software service SalesForce supports tagging of knowledge based articles to allow customer-support personnel to find articles on a subject matter of interest quickly. These articles and tags can even be exposed on a website that allows customers to 'self-serve' help articles.

"Tagging is a way to create a relationship between a number of items in software without having to change or understand the underlying information (code or schema) about those items."

In the building context, free-form tags would allow users to track information on the system (VAV, AHU), building or even the portfolio level. For example, if I had a portfolio of buildings across North America, and those buildings were a combination of different building types, such as retail, commercial and mixed residential, I could free-form tag those buildings by type, location, size and more. I could tag buildings as being South, West, or South and West. I could then quickly filter down to all commercial buildings of 100,000 square feet or less in the Southwest. Combining with Haystack tags, I could further filter down from that set of buildings to all buildings with boilers, and more specifically those boilers with gas meters to compare their relative energy efficiency.

It won't be long before these tools are adapted or incorporated for use in BAS and BMS solutions; some already support tagging in one way or another. It will, of course, take time for the full benefits of Haystack tagging to be realized as more and more vendors adopt the standard and incorporate tags in their equipment right from the factory. But in the meantime, free-form tagging offers a path to making buildings and their equipment more accessible.

Kevin Binnie can be reached on LinkedIn and on Twitter @KevinBinnie.

Alper Uzmezler is an industry thought-leader on edge computing and machine learning for Smart Buildings. He co-authored a series of 6 articles recently for automatedbuildings.com. Each piece acknowledged that an open and universally recognized metadata tagging system was foundational to the next cycle of innovation. Here is a summation of these posts.

How Edge Computing, a Common Metadata Tagging Framework, and Machine Learning Work Together

Alper Üzmezler,
Founder, BASSG LLC

The next phase in Smart Buildings is starting now, with the introduction of edge controllers that can handle the tasks of gathering, analyzing and presenting real-time data locally. Soon, the bulk of the information sharing and processing will happen between these edge controllers and the sensory networks that surround them. Less reliance on centralized supervisory control and the need to send volumes of raw trend data to a remote cloud-hosted repository simplifies control automation programming and enables faster, more secure machine decision-making. Peter Levine of the storied Venture Capital firm Andreesson Horowitz predicts that edge computing will explode within the next five years.

Edge computing is how the goals of interior environments that are responsive to occupant comfort and building equipment that is self-correcting will be achieved. We can thank Moore's Law — the theory that processing power for computers doubles every two years — for the ability to package so much intelligence and storage into edge devices at a price that makes it possible to smarten-up every piece of equipment, light fixture or other thing that would make people more satisfied and productive if brought under digital control.

Another law that may best describe what will happen next in Smart Buildings is Metcalfe's. First used to explain how telecommunications networks grew over the second half of the last century, Metcalfe's Law states that the value of a network increases in proportion to the square of the number of connections. Edge Analytics Controllers (EACs) and the networks of sensors that will orbit around them will proliferate at a geometric rate in commercial building settings. The success of one edge application will lead to more, making even more sensed data available which will spur ideas for more applications, and the pattern will repeat.

We are already seeing Metcalfe-pattern growth in the number of talented developers and successful companies joining Project-Haystack. Haystack is a web service that provides definitions that help developers build their applications, and it also is a repository for live data and historical data from specific definitions. The proliferation of Haystackable edge devices is going to add to that repository and continuously boost the value of the Project-Haystack network overall on a Metcalfe-predicted trajectory.

Edge computing and a universally-understood metadata tagging system are a few of the factors transforming the buildings industry. Another factor on the horizon is Machine Learning.

Google, Amazon, Facebook, Apple and other tech giants are in the midst of reinventing themselves as Machine Learning (ML) companies. In fact, they are in heated battle to be ML's #1 contender. They've recognized that ML is the edge that they need to be the best in advertising, cars, consumer marketplaces or whatever other business they'd like to enter in the future.

Readying Your Buildings for ML

ML algorithms have advantageous self-correcting behaviors that will be the best navigators of a digitized world. But, these come at the price of being more complex to understand and work with than, for example, rule-based analytics programs. And they require a continuous and ample supply of structured data to deliver any meaningful results. In preparation for the ML era, building owner/operators and their key consultants need to plot a data strategy today that will maximize the predictive value that can be extracted from their building operational data. Adopting Project Haystack methodology is a great start.

Once whole buildings, even whole cities, are modeled in a semantic web system like Project Haystack, there will be demand for data scientists specializing in buildings operations. This work only makes sense once the data experts can count on having the training data needed to support ML algorithms. Like successful pattern-recognition analytics today, ML spiders will be built to look for situations with known patterns that can be expressed as variables in a complex algorithm. They will collect the necessary data, grabbing all the points involved from the zone, multizone, whole building, whole campus levels—whatever the scope involves. As long as they are working on current reliable data, they will return impressive results.

You will know when Machine Learning becomes a reality in your building when computers, rather than engineers, start making decisions. For example, today data analytics programs regularly crunch building operational data looking for faults and anomalies and generating alerts and alarms. An engineer looks at that data, makes some decisions about it, and possibly takes some actions, like replacing a chiller. In the era of ML, you will start with a question "Do we need a new chiller?" Then you will give the algorithm the data set and it will tell you what to do. As Google and many other data center operators have already found out, the ML approach to infrastructure management pays off. They are constantly adding and swapping servers with changing power, thermal, downtime risk and cost implications. DCIM is definitely an early market for the type of decision support that ML algorithms provide.

Building equipment manufacturers are also positioned to take early advantage of ML. There has been a growing trend to incorporate sensors and telematics (in other words, the IoT) into maintenance and service contracts. Collecting and sending operational data to factory technicians for remote monitoring improves preventive maintenance, helps to avoid warranty disputes, and opens the door to more flexible pay-for-performance pricing models. Applying ML algorithms to the collective data for a particular make and model AHU, for example, is a natural next step. The investment in algorithm development makes financial sense when it can optimize thousands of AHUs.

The Role of Hybrid Edge Controllers

For Smart Buildings, the near future will be a transition time. Two characteristics of newer controls architectures are that:

- The onsite PC supervisor is becoming a thing of the past. Now, AHU controllers are more likely communicating to a cloud-hosted BMS via secured Ethernet connections.
- Customers are demanding that data be freed from walled gardens protected by proprietary protocols. More and more, controls designers can count on data interoperability from their equipment through full implementations of BACnet or other industry standards.

The biggest change yet, however, will be the introduction of hybrid edge controllers that can act as either Global Controllers or Field-level DDCs. These will have the full stack of resources needed to host applications for graphics, trending, alarming, control logic and advanced analytics, including support for Project Haystack. Hybrid controllers will make the logic designs for controlling chilled water, hot water, demand response, integration of renewables and other building infrastructure networks more obvious, easier to maintain and more solid to build upon for years to come.

New Tagging Systems and Software Developers Kits

Much of the work involved in building consensus about the best methods and definitions for easy data interchange happens on the Project Haystack forum pages. In open-source fashion, some members step up and take the lead in establishing working groups that define tag definitions in specific categories. Once a tag set is working-group approved, it is proposed to the wider community. Haystack members share the work they've done on software developer kits (SDKs) through the forum as well. In the last months, some important new tag and SDK proposals were released. These are sampled here.

Stephen Frank, Engineer, National Renewable Energy Laboratory, led the working group that just introduced tag revisions and new tags to cover a large majority of the types of electrical quantities that are measured and recorded in buildings or by electrical-power-quality meters.

Comprehensive Tags for Electrical Meters

Stephen Frank,NREL

In the Spring of 2014, I brought it to the attention of the community that standard tags for the demand and consumption points as a measure of energy were needed. An example use case would be a BTU meter on the output of a chiller or boiler plant. The meter typically calculates a measured volumetric flow rate and a measured temperature delta, providing a totalized output. On our campus, we also have BTU meters on the input lines to specific buildings to track thermal energy consumption from our centralized hot and chilled water systems. Typical units for measured power would be BTU/h, kBTU/h, or possibly tonrefh (tons of refrigeration per hour). Likewise, one can often get inlet and outlet temperature (°F) and volumetric flow rate (gal/min) out of the same meter. Other Haystack members concurred that standard tags that disinguished the directional information as well as standardized unit or units for these two points were needed.At Haystack Connect 2015, we formed an informal working group to address electrical meter tags. This group put together the proposal. A summary is presented below. We are forming a working group on equip-level tags for electrical equipment next. If you would like to participate, please contact me.

NEW ELECTRICAL METER TAGS

The primary measured quantities in an electrical system are:

- **power:** typically measured in "kW"
- **energy:** typically measured in "kWh"
- **volt:** typically measured in "V"
- **current:** typically measured in "A"
- **freq:** typically measured in "Hz"
- **pf:** power factor

AC power measurements are further qualified by:

- **active:** typically measured in "kW" (default)
- **reactive:** typically measured in "kVAR"
- **apparent:** typically measured in "kVA"
- Voltage and current measurements are further qualified by:
- **mag:** magnitude (assumed as default)
- **angle:** phase angle, typically measured in "deg"
- **imbalance:** imbalance between phases, in percentage %
- **thd:** total harmonic distortion, measured in "%"

Three phase electicrical measurements are qualified by:

- **phase:** A, B, C, AB, BC, CA, N
- **avg:** for current, voltage, and power factor (assumed as default)
- **total:** for power and energy (assumed as default)

Energy exchange with the utility is qualified by:

- **import:** energy imported from the grid
- **Export:** energy exported to the grid
- **net**: net exchange (assumed as default)

In addition we define the following general purpose tags:

- **ac:** alternating current
- **dc:** direct current

With leadership from Richard McElhinney, the nHaystack module for Niagara 4 was released for general availability this year. A healthy number of community developers participated in defining features and testing elements of this popular Project Haystack Software Development Kit.

nHaystack 2.0.1 Release

Richard McElhinney, Chief Software Architect , AirMaster Pty. Ltd.

For its first three years of development, the nHaystack effort was led by Jason Briggs and the team at J2 Innovation. In mid 2015, just as the Niagara AX version of nHaystack was largely complete and released to the field for testing, Richard McElhinney of AirMaster, stepped up to take the lead on nHaystack.

As Jason reported that May "NHaystack is installed in 1000s of buildings already, and we can't wait to see where it goes next." Of course, the next step was to develop the Niagara 4.x version. In mid-June of this year, Richard released the nhaystack module for Niagara 4 for general availability.

Using NHaystack, external applications receive data that includes essential meta data (tags) to describe the meaning of the data.

When acting as a server, NHaystack automatically generates standard tags for all the ControlPoints in your system. This feature allows for connecting immediately to the Niagara Station via Haystack once the NHaystack module has been installed, without requiring any further configuration. It makes discovering the points in your station as easy as issuing a simple query.

NHaystack-as-a-server also streamlines the process of adding user-specified Haystack tags to Niagara systems, by providing a GUI tool that allows users to add the tags directly to Niagara components. Once tags have been defined, the data associated with the Niagara components, including the tags, are available over the Rest communications interface. This combination of the tagging tool and the Haystack protocol "engine" reduces the effort involved in connecting Niagara data to external software applications.

NHaystack can also act as a Haystack client, via an AX driver that models remote servers as AX devices. This allows haystack devices to exist "underneath" AX stations.I'm looking forward to feedback from the community, particularly if you run into any issues. For now I am particularly looking for feedback on using this with a Jace 8000, so if someone could volunteer to do some testing on the new Jace I'm keen to work with you offline.

Any questions please post here on the forum.

NHaystack is licensed under the Academic Free License ("AFL") v. 3.0.

Python is a popular coding language among data scientists based on the strength of its core libraries, e.g. pandas, for data manipulation and analysis of time-series data. Two Project Haystack Software Development Kits for Python have just been released.

pyHaystack Release

Christian Tremblay, Servysis

The teams at Servisys and VRT have updated their Haystack Software Developer's Kit for Python coders. The latest implementation is robust and documentation has been improved.

pyHaystack can be reviewed on github

This release supports units using pint and allows histories to be accessed using well known Pandas Series or DataFrame tools. Building data experts can explore using pyHaystack along with their preferred Python client (Jupyter Notebook, for example). The resulting work can be written to a Haystack server. Currently, connection can be established with:

- NiagaraAX by Tridium
- Widesky by VRT
- Skyspark by SkyFoundry

Note that connection to Niagara AX requires the nHaystack module by J2 Innovations. Also, pyHaystack depends on hszinc which is a special parser for zinc encoded data. The documentation page for pyHaystack can be found by clicking here.

pyhs Release

Peter Michalek, Connexx Energy

Connexx Energy has released a beta version of a Haystack client implementation in Python.

This beta version can be reviewed on github.

This Python Haystack client was developed indepent of the alternative Python SDK, pyHaystack, ie before pyHaystack was published. Therefore, it doesn't reuse any of the other project's code. Here are some essentials to be aware of to decide which implementation best fits your needs:

- This version currently has minimal dependencies (requests for HTTP client, nose for unit tests)
- There is no need for parsing of haystack Zinc
- No dependency on write/encoding of Haystack for Zinc/Csv/JSON
- It has been tested to work with Niagara and other products that provide Haystack servers

Resources

The Project-Haystack community developed a range of reference implementations to enable product manufacturers and application developers to quickly implement Haystack tagging and communications in their product. Currently reference implementations are available in Java, C++, Dart, Niagara, Javascript (NodeJS) and Python. Here's a current list of downloadable software kits. Click to learn more and to reach the download page.

Wiki — Haystack Wiki: Source for docs, and tag definitions.

Java — Haystack Java Toolkit: Light weight J2ME compliant client and server implementation

Niagara — NHaystack: Niagara module to add Haystack tagging and REST API

C++ — Haystack CPP: C++ Haystack client and server implementation

DART — Haystack DART: Client library for Dart programming language

Node — Node Haystack: node.js client/server implementation

Python — pyHaystack: Python client implementation

Get Involved!

Project Haystack is an open-source community-based effort. Want to get involved? There are many ways.

Contribute your expertise

Participate in the open forum discussions.

Become a Member

Project-Haystack Corporate Associate Memberhip has many advantages. Email us to learn more.

Attend Haystack Connect 2017

Come to our third biennial conference. More information at www.haystackconnect.org

Speak at Haystack Connect 2017

Call for Speakers is now open. We look forward to getting a lot of submissions before the deadline of March 15. Descriptions of current topic categories and more about the submission process can be found on the Call for Speakers page.

For any other information, email us at

projecthaystackinfo@gmail.com

Events

CABA Intelligent Buildings & Digital Home Forum

April 26-28, 2017
Santa Clara, CA

This year's CABA Intelligent Buildings & Digital Home Forum will be co-located with CABA Board Member, Intel Corporation at their campus in Santa Clara, CA. The CABA Forum brings together leading organizations involved in the integration of intelligent building systems and connected home technologies. CABA estimates that over 200 key stakeholders and industry leaders will gather to discuss current trends in the intelligent buildings and connected home sectors. Also, this will be the opportunity to interact with the 23 CABA Board members, who will be meeting at the CABA Forum.

The CABA Forum incorporates a 'Start-Up Pitch Fest' this year. The Pitch Fest will give new organizations an opportunity to showcase their company and products/services.

Call for PitchFest

REGISTER

Lynxspring Exchange 2017 Conference

October1-3, 2017
Scotsdale, AZ

The 2017 Lynxspring Exchange Conference being held at the Hyatt Regency Scottsdale Resort & Spa at Gainey Ranch in Scottsdale, Arizona will bring together Lynxspring's ecosystem and community of customers and business partners, integrators, contractors, OEMs, technology partners, industry professionals and practitioners to exchange, collaborate, network and learn about today's operating systems and solutions for operating facilities smarter, safer, securely, more efficiently, and at peak performance levels and the latest in advanced smart-device applications. It is an opportunity to Connect, Converse, Exchange, and Interact with real individuals delivering and deploying technology and solutions that are changing how buildings and facilities are managed and operate.

Agenda

REGISTER

Membership

Founding Members

Founded in 1988, Airmaster delivers professional management in air conditioning, ventilation, heating, process cooling and building automation throughout Australia and South East Asia. It has grown to comprise a team of more than 500 employees with offices in all states of Australia. Its comprehensive service offering extends beyond Service and Maintenance to also include Control and Automation, Energy Management, Installation and Design.

J2 Innovations was founded in 2009 to bring powerful engineering tools, visualization and software technology to those involved in BAS installations. It is the developer of FIN Stack, a software technology that combines the core functionality of a Building Automation System (BAS) for connecting and controlling devices with the added benefits of a Building Operating System (BOS) to manage and leverage data. The technology uses Project Haystack tagging and data modeling to provide unprecedented capabilities and functionally.

Enerliance/Yardi is the company behind LOBOS, the original Load Based Optimization System. This intelligent HVAC platform brings never-before-seen levels of efficient operation to large commercial buildings and campuses. Compatible with most modern HVAC systems, LOBOS significantly reduces energy consumption while enabling automated demand response participation and system-level fault detection and diagnostics, all with an emphasis on improving tenant comfort.

Lynxspring is changing the way devices, systems, and people communicate and collaborate across enterprises and out to the edge. Its technologies, solutions and services are enabling users to go further to manage and operate their facilities and equipment smarter, safer, securely, more efficiently, and at peak performance levels. It is remaking the way control systems are built, secured and distributed with brands like JENEsys®, JENEsysONE™, LYNX CyberPRO™, Helixx™ and Onyxx™ brands

SkyFoundry's mission is to provide software solutions for the age of the "Internet of Things". Areas of focus include building automation and facility management; energy management; utility data analytics; remote device and equipment monitoring; and asset management. SkyFoundry products help customers derive value from their investments in smart systems.

Siemens Building Technologies consists of three Business Units: building automation (BAU): control products and systems (CPS); fire safety and security (FSS). These business units combine offerings for building security, life safety and building automation within one company as a service and system provider, and as a manufacturer of respective products. By virtue of the unique combination of these business sectors, the company occupies a leading position worldwide.

WattStopper specializes in energy saving controls for the electrical industry. It is part of the Legrand Building Controls system division and is most recognized as the leader in occupancy sensing technologies. Over the past decade and more the brand has grown into a systems-capable company and leads the connectivity of open lighting control systems in the intelligent building. It is committed to open standards with our control systems, leading the transformation from proprietary solutions to BACnet and IP platforms.

Associate Members

Altura Associates is a professional services firm that goes beyond the traditional consulting model. Rather than simply providing a one-size-fits-all solution, our team works closely with our client organizations to develop programs that offer immediate and lasting impacts, build capacity, and drive long-term value. The team combines expertise in mechanical/ electrical engineering, energy management, environmental science, and financial analysis.

Arup is an independent firm of designers, planners, engineers, consultants and technical specialists offering a broad range of professional services. Through their work, they make a positive difference in the world, highlighting their mission statement 'We shape a better world.'Investing heavily in research and development is important to Arup as it informs its approach to projects, and keeps it focused on future-proofing its designs and best practices.

BASSG is an innovator in building automation technology and BAS analytics delivery. Its BASSG branded in-house developed easy-to-deploy, multi-system software tools reduce BAS implementation and facility management energy costs. BASSG also has multiple distributorships and can be a one-stop provider for everything-BAS at unbeatable value.

BUENO is the Australian leader in data and information driven operational property services. BUENO delivers superior data related and technology driven services based on fault detection, optimization and business intelligence that simplify their clients operations and enhance their effectiveness across all building sectors and building information systems.

Building System Solutions builds open-architected solutions that integrate HVAC, security card access, video surveillance, lighting, and irrigation into a single unified, interoperable workflow. Its ZEUS IoT offering visualizes and analyzes valuable building systems and energy consumption data. The team includes Certified Energy Managers and IT Professionals and is designed to combine building controls technology with advanced energy saving techniques to reduce utility costs.

The Continental Automated Buildings Association - CABA is an international not-for-profit industry association dedicated to the advancement of integrated technologies for homes and buildings. The organization was founded in 1988 and is supported by an international membership of over 300 organizations involved in the design, manufacture, installation and retailing of products relating to home and building automation. Educational Institutions and public organizations, including utilities and government organizations are also members.

Connexx Energy is a recognized leader and implementer of 'last mile' energy solutions for Smart Grid and Smart Buildings and is the developer of Connexxion, a versatile, secured Enterprise Energy Intelligence and Management platform for facility, energy, and business operational information. Connexxion streamlines the secure integration and creation of smart energy data into the corporate business intelligence layer. It enables users to simply and efficiently deploy intelligent energy practices to make real-time decisions and data driven calculations about the ongoing energy and operational performance of any building.

Controlco - Controlco delivers leading-edge automation and solutions to address the Internet of Things for commercial buildings, (BIoT). Controls deliver the industry's best software and hardware products, develops software applications, and provides hosting services to improve business performance and peace-of-mind. With dedicated sales and implementation teams, Controlco offers total solutions for all building and energy management needs in this BIoT world. Since 1958, Controlco has completed successful implementations in energy monitoring, enterprise-wide energy dashboards and customized energy-saving strategies for hundreds of clients in North America. The company actively participates in controls and integration projects of all sizes and continues to grow its data center capacity.

Grosvenor Engineering Group a leading Australian provider of intelligent hard technical services, design and construction solutions delivered via a unique data driven approach to asset maintenance and life cycle management. The ultimate aim is to add value to buildings by making them safer, comfortable, and more productive and energy efficient at the lowest cost possible.

Intellastar Technology is at the Intersection of Smart Buildings and Smart Grid.
The InferStack Software Platform is deployed in Servers and T-Star Field Devices, communicates over Intellastar Connect Cellular Data Service, to provide a complete technology to deliver Smart Buildings and Smart Grid solutions.InferStack connects to the in-building systems to provide Energy Monitoring and Analysis, Analytics for Fault Detection and Diagnostic, Control for Plant Optimization--all features to make a smart building and reduce energy consumption and waste.

Intelligent Buildings, LLC, a nationally recognized smart real estate advisory services company providing planning and implementation of next generation strategy for new buildings, existing portfolios and smart communities. Their work includes "The Smartest Building in America", the largest energy analytics project in North America, the smart buildings standards for the U.S. and Canadian governments, conception and management of a Clinton Global Initiative and the recently released Intelligent Buildings CyberSafe service.

IoT Warez develops custom software that helps technologies communicate together. From state of the art data centers to environmentally conscious facilities, our software development team is capable of building solutions that connect anything and everything. IoT Warez offers a suite of hosted software options that provide customized solutions. Our platform-as-a-service connects multiple brands of software into one platform that can be remotely managed from a smart device.

KMC Control is an American manufacturer of open, secure, and scalable building automation solutions. From secure hardware devices to smart and connected software, KMC delivers embedded intelligence and optimized control.. It is committed to providing industry-leading Internet of Things-enabled automation solutions with leading tech suppliers to increase comfort, convenience and to help reduce energy usage. The KMC Commander™ IoT platform as a service (PaaS) makes system interconnectivity, data visualization, and energy optimization for small and medium buildings easier and more cost effective than ever before.

KNX Association represents KNX technology now used in applications for lighting and blind control, security systems, HVAC, monitoring, alarming, water control, energy management, smart metering as well as household appliances, audio/video and more. KNX provides a single, manufacturer-independent design and commissioning tool (ETS), with a complete set of supported communication media and configuration modes. It is approved as a European and an International standard.

SensorFact is a cloud-based data acquisition and storage service for sensor data. It allows for sending sensor data from one location, through their pointCollex technology or directly to their pointCollex API, to a client account in sensorFact. Once there, clients can name, organize, tag, monitor, and choose which sensors data to store long-term. In addition, sensor data is available to share or integrate with other systems.

www.project-haystack.org