Project Haystack

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connections

Journal of the Haystack Community—Solutions for Interoperable Device Data

Haystack Connect Highlights

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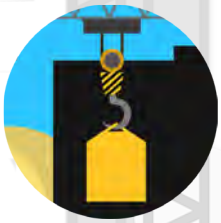

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CHILLER PLANT CONTROLS AND OPTIMIZATION AT THE EDGE

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How the Community is Streamlining its Data Engineering Work

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

This third issue of Haystack Connections came together naturally around the theme of "The Work Continues," ie how the community goes about developing a semantics methodology for device data that can be used to tag not only building data, but virtually any IoT or smart-and-connected device application today.

We have collected some of the best data engineers with building-performance experience in the world into our organization. Most of our community collaboration happens online. But, the excitement of bringing these minds together in one place was palpable last Spring at Haystack Connect 2017. A lot of work was accomplished in the relaxed setting of the Saddlebrook Resort, so there is a big *Haystack Connect Highlights* section in this issue.

> ***Margaret Mead famously said "Never doubt that a small group of thoughtful, committed, citizens can change the world. Indeed, it is the only thing that ever has."***

Looking around the room at Saddlebrook, I took stock of the collective impact of our member's projects over the past six years — projects like top engineering university campuses, state-of-the-art data centers, Fortune 50 industrial campuses, major hotels in tourist centers, big-city multi-tenant offices and retail complexes — all now Haystack-tagging enabled. My objective was to offer a snapshot of that progress in this magazine.

Here I report on the keynotes by Rita Wouhaybi of Intel and Milan Milenkovak of IoTSense. It is validating to hear leading data scientists and researchers acknowledge the Haystack approach to semantic tagging. They like it for what it is, and, especially, for what it is not — heavy and complex.

Learn what Milenkovak means when he says "What is needed is an internet-inspired minimalist approach to semantic interoperability." Internet-inspired' conveys concepts like linked-data principles, modularity, extensibility, readiness for decentralized applications, true data ownership for the people and organizations originating the data, and respect for their security and privacy. These are all aspects of Project Haystack work.

And, don't miss the article about the End-User and Engineers panel discussion. I've excerpted key quotes from each of the panelists and provided a direct link to the video recording so you can watch the whole discussion at your convenience. Intelligent Buildings' Rob Murchinson built on Milenkovak's theme of growing big by keeping your code and your organization lightweight, distributed and small. First, he offered an idea of the scale of Haystack's impact by describing, one

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Analytics at the Edge

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of his firm's bigger customer deployments which has an analytics application that looks at a billion data points a month. That portfolio of buildings is geographically dispersed across the country, built in the range of 2 to 100 years ago, overseen by different facility management companies, and run by different engineering partners. "Without Haystack, tagging you cannot solve for this complexity," Murchinson says.

And then he teed up one more big-little paradox: "People passionate about data tend to want to make the results of their work as robust as possible as soon as possible. I would advocate not tackling the whole thing at once. Take little bites."

He was aiming this advice at data analytics project teams. But, the same holds true for the Haystack organization itself. One small-bite increment Project Haystack employs is the concept of the Working Group. Eight new semantic tagging Working Groups were launched this summer. We have an article from Matthew Giannini, who has led the effort to make project-haystack.org site more working-group-friendly in this issue. Look under the new 'WG' tab he has set up to see how quickly the community has come together to focus on the specific semantics and tagging challenges of data centers and lab environments, as well as on refrigeration and chiller plant specifics. When it comes to expressing spatial characteristics, like zones in a space, there is great overlap with BIM modeling standards. A BIM expert within the community, Chris Renter of Stuart-Olsen is leading the BIM Working Group. (Renter spoke about Haystack at CanBIM Toronto 2017 last month I've included an article from Working Group champion, Karine Lavigne of Hydro-Quebec Research Institute. She is keen to have Haystackers consider some new types of tags that would improve the ease with of expressing how energy, air, water, electricity, and other flows move between points or objects. I hope the sample coverage in the magazine piques your interest enough to explore the Working Groups on the Project Haystack website—and perhaps to even join one.

I hope the sample coverage in the magazine piques your interest enough to explore the Working Groups on the Project Haystack website—and perhaps to even join one.

A new feature that I've launched with this edition is the *Member Profile*. Matt Horton of Tampa Bay-area-based SensorFact Services, a cloud-based data acquisition and storage service for sensor data, was the member that I interviewed and wrote about this time. You can also read editorials from other Haystack members in the *Voices* section of the magazine including posts from Anno Scholten of Connexx Energy, Alper Uzmezler of BASSG and Anka Labs, as well as B. Scott Muench of J2 Innovations. In the *Resources* section, we are excited to announce the availability of the Haystack Guide specification in Chinese. This new document was the result of work by Project-Haystack.org members in China and shows our growing international support. Likewise, on the *Events* page note that John Petze will be traveling to Europe to speak about Project Haystack at Projekt BMS 2017 this month.

As part of the Project Haystack open-source community, I'm witnessing the power of collaboration. We're solving the data mark-up language issue using open source methods with no financial backing from big business, big academia or big government, That's a big deal. To once again quote Rob Murchinson of Intelligent Buildings: "100% of us believe in the value of data, and that is why we are here. But, in the broader market—across the 87 billion square-feet of real estate just in the US—we're a small minority."

The anthropologist Margaret Mead famously said "Never doubt that a small group of thoughtful, committed, citizens can change the world. Indeed, it is the only thing that ever has."

That is certainly the case here!

Message from the Project Haystack Board of Directors

by Marc Petock and John Petze

This year saw the third biennial Haystack Connect conference, and what a conference it was. It was by far, the largest — from the attendance, to the number of sponsors, to the number of educational sessions and the level of content presented. This issue of *Haystack Connections* provides a focus on many of the highlights of the event. We expect our readers will see great value in this recap – even if you attended the event – as there was just too much to take in at once.

For those of us tasked with planning and delivering the event, the thing that stood out the most was that the community now has a momentum all its own. More high quality papers were submitted than could be presented in the sessions. Community members at the front lines of working with device data are adapting and enhancing the Haystack methodology and tools on their own. There are now more working groups than ever before – each working to address data models for new applications and equipment systems in their area of expertise. It's clear that people have taken the ball and run with it.

Perhaps the most notable "news" in all of this, however, is that the work of the community keeps on going, without fanfare, without huge marketing budgets, without official endorsement by many of the companies that are actually using Haystack in their products, projects and internal processes. The reason is that Haystack solves a problem that is on people's plate today – a problem that cannot wait years for conventional standards development efforts – the need to "markup" data from a wide range of devices and systems and make it interoperable so that it can be used to generate value for owners and operators.

This type of fast action, with solutions tested by meritocracy and a spirit of community, is how software standards advance and take hold.

This type of fast action, with solutions tested by meritocracy and a spirit of community, is how software standards advance and take hold. It's a key reason we took the approach of a true open source project when we launched Project-Haystack, and it continues to serve the community and the industry well.

Haystack has shown the flexibility to adapt to new systems, equipment, applications and industries, and the community has demonstrated the ability to enhance Haystack tagging libraries and equipment models as we as an industry learn from real-world challenges in working with device data. The work continues, but the solutions created by the Haystack community are changing the industry today.

HaystackConnect 2017 Highlight Reel

The third biennial Haystack Connect 2017 Conference was held at the Saddlebrook Resort near Tampa, Florida from May 8-10, 2017. Over 300 industry leaders from 14 countries were in attendance. They were end-users and corporate representatives involved in automation, control and Internet of Things applications. Over 30 technical sessions were held along with a vendor expo where attendees could see live demonstrations and meet face-to-face with the controls innovators, software vendors and systems integrators that are new to the community, as well as those that have been at the core of our open-source effort from the start. The big presence of new board-level member Intel and Silver-level sponsor Dell signaled that dominant forces in IT have taken notice of Project Haystack and recognize our data science and Internet of Things leadership, particularly in built-environment use cases. Industry researchers and analysts were there as well. Here is a published field report from one such industry observer:

Interoperability for Buildings and Beyond

Harbor Research

by Adam Wise

Hundreds of building equipment, controls and software vendors descended on a sleepy resort in Tampa last week with a simple goal: solving the interoperability challenge facing the Internet of Things. To be fair, Haystack Connect's stated purpose is enhancing data fluidity and freedom with an open source metadata framework that allows building stakeholders to unlock new value from networked devices and equipment. Don't be fooled: Project Haystack will accomplish far more than this, and the companies that came together in Tampa know it.

Excitement was in the air at the bi-annual gathering of Project Haystack supporters. If the mood of 2013's Connect was one of "I'm curious" and 2015's was "I'm interested," the vibe at 2017 was unmistakably "I'm ready." The organizers and vendors I spoke with made clear that they have moved beyond simple excitement over the vision that Project Haystack paints. Equipment

and controls manufacturers, software vendors and systems integrators are today creating value for themselves and clients with the framework. Intel's recent announcement that they were joining the organization as a Founding Member further validates the feeling that this framework is ready to extend the open-source standard throughout the buildings market and beyond.

Data on Data

Those of us who don't work in the buildings industry might tend to overlook that the built environments in which we spend much of our lives are in fact highly engineered systems that are designed, developed, operated and maintained by a variety of players. As digitization has pervaded every other aspect of our lives, so too has it commandeered buildings. Networked sensors, devices and systems throughout buildings now feed data to analytics tools designed to enhance the efficiency of operations and the services offered to tenants.

However, the variety and fragmented nature of the buildings suppliers landscape challenges the ability of any supplier to deliver a valuable, seamless experience to end users. Central to this challenge is that systems from different vendors describe data in different ways. Semantic data models, as they are known in the digital world, provide standardized ways of describing where data was generated and what information it contains. This data about the data, or "metadata," make it far easier for various users to create value from data through visualization and analytics tools.

From Realization to Value Creation

This year's Connect was abuzz because the firms supporting Project Haystack are actively taking advantage of the benefits offered by open, common metadata conventions to meet rising end customer expectations. Building operators and end users have come to expect a high level of service via tightly integrated systems – such as phones or cars – from the loosely integrated building spaces that they manage and occupy.

As they expand in depth, end user demands expand also in breadth. Low-cost, wirelessly-networked sensors and actuators are giving building operators unprecedented visibility and control over everything from lighting to access systems, air distribution to network management. Operators demand integrated control of this expanding suite of connected systems, seeking a single dashboard for managing building system efficiency as well as building tenant comfort and peace of mind.

Equipment and controls manufacturers like KMC and Contemporary Controls proudly advertised the ease with which software partners utilize data generated from their offerings in advanced analytic tools to identify new opportunities for value creation. Software players like J2 Innovations, Kodaro and SkyFoundry detailed how Haystack is allowing them to spend less time cleaning and formatting data sets, freeing them to focus on visualization and analytics and reducing the overall cost of providing these value-adding services. Systems integrators related the ease with which they can now to deploy disaggregated offerings that utilize vendor-agnostic, Haystack-consistent data.

> ***"...the firms supporting Project Haystack are actively taking advantage of the benefits offered by open, common metadata conventions."***

By delivering the services that end users truly demand rather than complex, expensive packages of services, solutions providers like Lynxspring, Activelogix and Altura are able to provide a better end user experience at lower cost. These shifts are enabling vendors to not only offer a broader set of solutions for large commercial buildings, but also serve the small commercial and multifamily residential markets where the costs of holistic building automation systems have traditionally been prohibitive.

Haystack is not only changing the way that buildings stakeholders operate, but also how

they co-operate. The open framework is providing the foundation for the formation of multi-vendor ecosystems, in which flexible and tailored offerings can be delivered to end users at far lower cost than the aggregated services traditionally delivered by building automation vendors. Guess who doesn't love that?

Change is Hard

The building automation space has been dominated by a few names for two decades – Honeywell, Johnson Controls, Siemens and Schneider Electric together control about 30% of the global market. Global HVAC and lighting controls companies leveraged the massive energy draw of their equipment (about 1/3rd of US energy consumption is in commercial buildings) as the basis for delivering control and automation services to customers. Bundled equipment, software and services contracts have been sold to major buildings customers via a largely unchanged model since automation reached the buildings venue. Central to this model is the control of information generated by building equipment, ensuring that vendors alone are able to deliver services atop of their hardware. It is thus understandable that these players have been dragging their feet through every push towards standardization that the industry has experienced.

"… Project Haystack is laying the foundation for a wave of substantial disruption in the building automation and control market."

Initially, the vendor moat was protected by proprietary communications protocols, which limited equipment communications to the vendors alone. The industry began converging around BACnet in the mid-90's, standardizing how equipment

shared data. End-user demand then drove the development of the Niagara Framework, providing a standardized front-end for managing diverse building systems and equipment.

Historically, leading BAS vendors adopted open frameworks as slowly as possible and often highly disincentivized adoption of standards-compliant offerings. Systems integrators shared anecdotes of clients who, faced with the option of a proprietary system or a BACnet compliant offering that was $100K more expensive, were effectively forced into a long-term contract for a closed system. The same SIs could hardly contain a grin as they predicted, "they won't get away with that anymore."

Revenue from Smart Buildings Systems is forecast to grow from $19.2B in 2017 to over $130B by 2023. Rising expectations and awareness of alternatives to the top incumbent players threaten to leave players who fail to adapt with a smaller and smaller piece of a rapidly growing pie.

Project Haystack is laying the foundation for a wave of substantial disruption in the building automation and control market. The framework's potential, and the desire of the attendees of Haystack Connect, is even more ambitious.

But Change is Happening

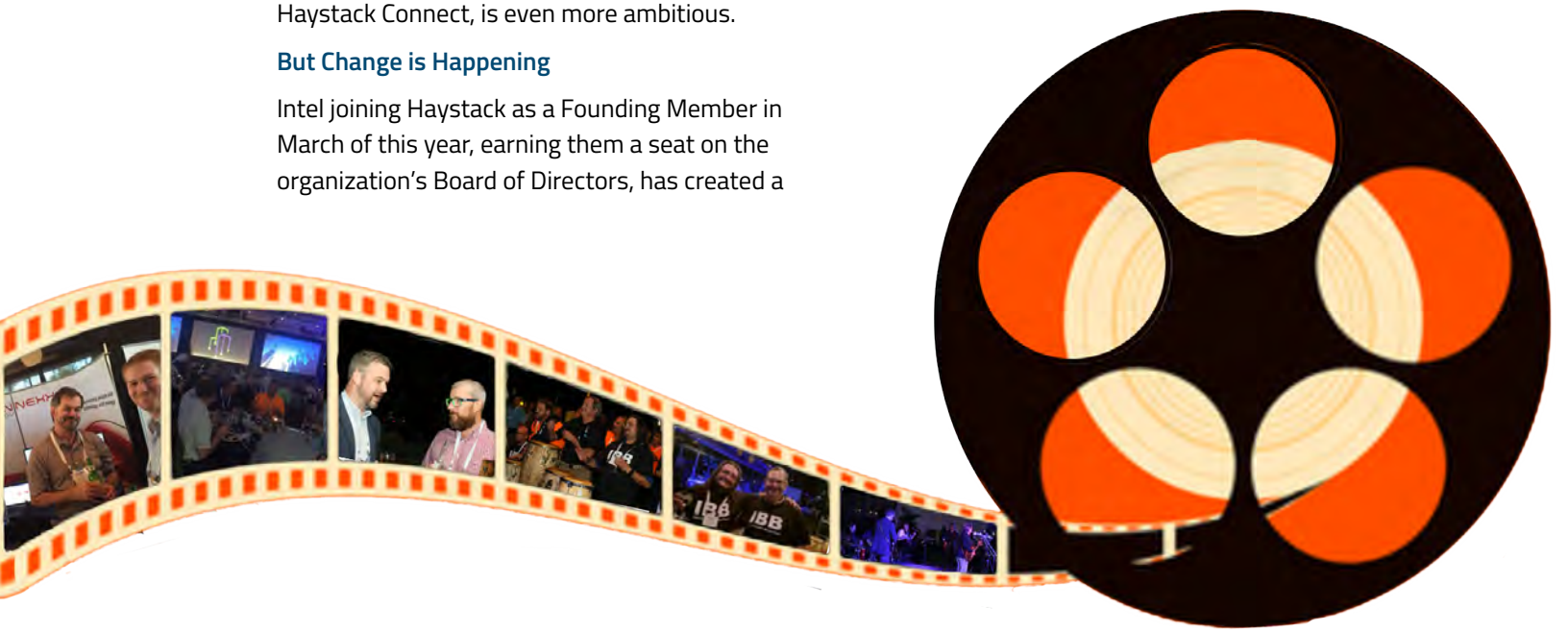
Intel joining Haystack as a Founding Member in March of this year, earning them a seat on the organization's Board of Directors, has created a wave of validation for the framework both within the community and beyond. The time for the standardized metadata model to be deployed at scale, to create new opportunities for suppliers and generate new value for end users across the buildings market, has arrived. Intel's involvement will not only increase end user awareness of and demand for Haystack-compliant solutions, but also encourage other standards bodies to explore integration with the framework to accelerate data interoperability across verticals.

> ***"...flexible and tailored offerings can be delivered to end users at far lower cost than the aggregated services traditionally delivered by building automation vendors."***

Capturing the true value of the IoT and opening the opportunity it presents to an inclusive group of participants demands that data be fluid and free to be fused in creative combinations. Without a common convention for metadata, this will never be achieved.

If Haystack can continue to grow and prove value at the pace it has within buildings, it will soon extend outside of them and unleash the cross-vertical value creation that is central to maximizing the IoT opportunity.

Read the Entire Post at Harbor Research.



Beyond Buildings: Data Models & Project Haystack

by Rita H. Wouhaybi, System Architect, Internet of Things Group, Intel Corporation

Rita is the technical liaison into Project Haystack for new Board-Level member Intel Corp. Her expertise spans peer-to-peer and distributed networks, game theory and the use of machine learning in networking and social networks.

Intel is known for Moore's Law and the drive for continuous optimization. As a matter of fact, we're ***optimization geeks***. You give us something, and we think about how to shrink it and put more into it. My first ten years with Intel I spent researching and working with health and wellness data, data routing issues, exposing data through APIs, new algorithms—the common factor was always data. So, Intel has long been interested in optimizing not only microprocessor hardware, but also databases and the design of data models. It made sense for me to move over to the Internet of Things Group where hardware, databases and models are coming together to define the future of computing, and where optimization needs to happen at every level.

I believe Project Haystack is ahead of the game in the way it describes smart building data due to its elegance and simplicity. It could be launched into other domains. I also believe, as a community, we need to continue to be out there thinking about where the future of data going. There are some things to watch for.

You should know about two academic projects that Intel has been supporting. You might already know about the work of David Culler of University of California at Berkeley, who for 30 to 40 years has been looking at databases, particularly databases for smart buildings. A few years ago,

> ***"Project Haystack is ahead of the game in the way it describes smart building data due to its elegance and simplicity..."***

Professor Culler oversaw a study of the various ways of describing data for smart buildings. He worked with graduate students to design a way to gain empirical evidence about which is doing better than the rest. Their methodology for assessing the effectiveness and completeness of the current standards in buildings was interesting.

First they scanned the market to find 89 applications from different vendors that created or used building data – equipment feedback, control and fault detection, occupancy tracking and personalization, energy efficiency/demand response, etc. They grouped these into eight categories, and eventually five, based on the use case supported.

Then they came up with five graphs representing relationships that all these categories of application require to be expressed – user versus entity, thing, sensor, etc.

> ***"Intel is interested in optimizing not only in terms of high-performance hardware, but also in databases and in the design of data models."***

Next they took all 89 applications and evaluated results given each of the three ways of describing data – Industry Foundation Classes (IFC), Semantic Sensor Web and Project Haystack. They scored them along three axes: completeness, relationship capture, and flexibility.

Some of the scores on the score card can be ignored because the students didn't understand Haystack's extendibility or the extent to which it is used. Nevertheless, working with academia to do an empirical, side-by-side benchmark study like this has value. This study scored Haystack lower on occupancy modeling. Maybe that is something to look at? Or perhaps there is something to learn from the other methods. In any case, having a tool like this study is a useful thing for data scientists, who always like to see measurement and evaluation taking place.

I have talked to multiple data science teams inside and outside of Intel, asking them "What is so hard about creating meta data?" There were three common themes in their responses:

1. Metadata shouldn't be too hard to develop: Haystack aces this issue. There were complaints about some others, along the lines of "You

download the pdf of the manual to realize it is a 400-pager—just to get started. By that time, the development team is anxious to start running."

2. Meta data shouldn't be poorly defined: This is the #1 problem that Haystack solves. If all they have is ***LI02_T1_KG1***, then users start guessing and creating hacks. This gets really ugly!

3. Metadata shouldn't be incompatible with the analytics users want to run against it:

You want to avoid being in the position of saying "When we designed the data model, we didn't think anyone would ever run this linear regression on it." Deep learning, big-data use cases, etc.—we need to think about correlation when creating data models.

In short, the balance a meta-data mark-up should achieve is to be easy and descriptive, while not becoming bulky and just extra overhead. It shouldn't take a lot of queries to filter for a solution; analytics should not look like JOIN operations. Data models should not slow the data flow. They should stay flexible, open and use-case driven.

Intel is also working on next-generation storage for the IoT. So we asked "How can we create a time-series database that is very fast?" One answer that, like Haystack, is simple and elegant is the Berkeley Tree Data Base, developed by computer scientist Michael Anderson. The BTrDB stores data with nanosecond-precision timestamps using tree structures. It relies on pre-compute values based on use cases and arranges them accordingly. It increases efficiency in database read-and-write at rates 100X the performance of Casandra. **The role that metadata could play in further optimization is an open research problem!**

To sum up, I'm excited to be here and representing Intel as part of the Project Haystack community. The work you are doing is foundational to achieving the kind of friction-free data flow needed for the next generation of computing and machine learning.

Watch the Full Presentation Here.

Project Haystack connections

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Advertising Opportunities

The Haystack Connections Magazine advertising program is a cost-effective way for companies that provide complementary products and services to reach the growing and dynamic Project Haystack Community. This community is at the very forefront of intelligent buildings and the IoT. Haystack Connections is a premier advertising vehicle to reach this prime audience. With over 8,000 known readers, it is an incredibly cost-effective advertising opportunity. Click here to see the media kit and check our rates.

What is IoT Interoperability for Big Data Applications?

by Milan Milenkovic, IoTSense

Milan Milenkovic is founder of IoTSense and an IoT technology strategic advisor to Intel as well as to other large companies and start-ups. He is currently working on IoT data and meta-data-format interoperability across standards and domains.

The IoT's 'Big Data' promise is that it should be easy to create large, useful aggregations of sensor data for data mining, analytics, machine learning, AI, etc. The effectiveness of all such post-processing apps increases with the size and diversity of data sets. But, to date, that promise has been out of reach. IoT data are fragmented and locked in silos due to incompatibility of formats in proprietary platforms and in numerous evolving standards that focus on limited domains. Now, the landscape of IoT standards is so vast, and the advocates for each are so entrenched, there is little chance of a 'one-IoT-standard-to-rule them all' outcome. It is time for all those with a stake in the IoT's future to start focusing on the more realistic goal of semantic data interoperability across specifications and domains.

Interoperability Background

There are at least two very important levels of data interoperability in IoT system hierarchies:

- Machine-to-machine (M2M), device-level interoperability
- Aggregation level interoperability, as provided to cloud services by data queries and APIs

M2M Device-level interoperability is the one most commonly talked about and it is the target of most IoT standards under development, including OCF (formerly OIC, now merged with AllJoyn and UPnP), W3C WoT, IPSO, OneM2M. For devices to interoperate, such standards – in addition to data models – often define or assume communication protocols, security, discovery, and sometimes add configuration and device management. Interoperability is often claimed,

> ***"It is time for all those with a stake in the IoT's future to start focusing on the more realistic goal of semantic data interoperability across specifications and domains. "***

but at this level it means that devices, such as home appliances, from different vendors will interoperate if all of them implement correctly the same specification or run some common middleware. Similar functionality may be achieved by installing proprietary, vendor-specific middleware on all target devices, albeit without the benefit of a public specification and with the ensuing vendor lock in. Interoperability at M2M level is typically intra-specification and intra-domain, i.e. it can be achieved among a group

"What is needed is an internet-inspired minimalist approach to semantic interoperability."

of devices with compliant implementations of a common specification.

The problem in practice is that there are many different IoT standards proposals with incompatible data models and definitions, usually aimed at rather narrowly focused domains – such as the many flavors of industrial and consumer product users. While IoT is poised to thrive by using Internet connectivity, as well as the designs and technology that have evolved to serve the Internet's vast community of users, unfortunately so far it has failed to create a moral equivalent of HTML for sensor data.

Data interoperability at the aggregation or cloud service level implies providing a common data "meta" model or annotation for data queries used by services. One should be able to query aggregate data and meta-data sets and obtain results in a common form, regardless of differences in formats used to originally encode data when captured at the edge. The Industrial Internet Consortium (IIC) refers to this as conceptual interoperability; i.e. the data is represented in a form whose meaning is independent of the application generating or using it.

How to Get There?

Aggregation- or service-level interoperability requires a common methodology for trans-specification data and meta-data annotation or modeling. What is needed is an internet-inspired minimalist approach to semantic interoperability. The payload carried by a model should be simple descriptive data and meta-data annotation. The world doesn't need another object-oriented data model. The annotation should be in a common format with recognizable names for what a thing is, or how it is used. In other words, similar to the Project Haystack approach. But,

"IoTSense has already demonstrated the feasibility of this approach with a proof-of-concept (POC) project that translates sensor data encoded in IPSO, OCF, and Haystack into a common, semantically-interoperable form in realtime. "

standards bodies like Project Haystack need to work on semantic interoperability across domains and specifications. IoTSense has already demonstrated the feasibility of this approach with a proof-of-concept (POC) project that translates sensor data encoded in IPSO, OCF, and Haystack into a common, semantically-interoperable form in realtime. There is still much work to be done to achieve semantic interoperability across domains. **Let's do this together!**

Download Full Presentation Here.

Engineers and End-User Panel

Project Haystack Executive Directors John Petze and Marc Petock led the conversation on semantic tagging for buildings with a panel of best-practice leaders. Here's a sample of some of the most memorable quotes:

Rob Murchison, Intelligent Buildings

"100% of us here believe in the value of data, and that is why we are here. But, in the broader market—across the 87 billion square-feet of real estate just in the US—we're just a small fraction. But, we're seeing technology have an impact on changing this. It's an imperative, not an option.

"We start by listening to our customers' problems. Broadly speaking, these fall into three categories: sustainability, occupant experience and reducing operating costs. As you peel back the onion, it always gets back to data. Data is the foundation to a solution; but, data alone won't get you there.

"We apply Scrum, Agile concepts to building management challenges. We introduce the OODA Cycle – Observe, Orient, Decide then Act. Tagging helps you observe the data. It gets you into the first phase. But, you need to start changing behavior to get all the way through to Act.

"Those of us passionate about data often have a desire to do it all at once, eat the whole elephant. Don't! Take little bites. DIvide the problem up and get pieces around the OODA loop. In this way, you will get the organization to start changing, and then you can go faster.

"We have enabled Haystack tagging for a lot of customers over the past six years. One of our bigger ones is looking at a billion data points a month. Without Haystack that doesn't happen. That portfolio of buildings is geographically dispersed across the country, built in the range of 2 to 100 years ago. They are overseen by different facility management companies with different engineering partners. Without tagging you cannot solve for this complexity and do portfolio-wide analytics."

Matthew Schwartz, Altura Associates

"Getting connected and deploying semantic tagging has fundamentally changed our building commissioning and building performance consulting business. We made the transition about six years ago, and we never looked back.

"We have a client that allows us to test bed a lot of the technologies just emerging. We've gone all the way from field controller to cloud analytics, with all Haystack technology. We deployed our

standard names at the field level which went through a standard tagging tool at the BAS. This put the tags on points instantly without custom work. That ported to our analytics cloud where those pre-named and tagged points had analytics deployed on them with less effort than ever before. We've got this real example now thanks to people in this room. We 've taken what's available today as far as one can. The efficiency is there.

"When you get into conversations with IT, you have to be able to demonstrate IT knowledge. When you cross from the building layer to the enterprise layer, you need to have ready answers to security. One of the things Haystack does is to enforce best-practice protocols—like authentication—which you might not have if you are passing BACnet IP across a campus. Haystack can bridge that gap, in effect Haystack can enhance your network security—something IT is going to like hearing.

"While Haystack's #1 use case is analytics. We see this transforming into other uses. There is value in the one-to-many aspect of tagging. You can broadcast changes based on tags, rather than the copy-and-paste mentality which is now prevalent in BAS. Being able to plug your existing legacy systems into any 3rd party app is going to be driven by the standardization of tags."

Zachariah Nobel, Constellation,

" We're an Energy Services Company focused on retrofits, not new construction. Earlier we had an in-house analytics tool. Then about 3 years ago we decided to go with an industry standard—Haystack. We transitioned to a tagged-based platform then.

"introducing semantic tagging to customers for the first time is analogous to pointing out a door to the left in a hallway that they have been walking along for a while. They get it, but just didn't realize why it was important before.

"Whereas many of you are focused on a few projects where you can delve in deep with analytics to get a lot of information, as an ESCO, we have a lot of projects with limited scope and we are more resource constrained. We are asked to perform analytics across a broad spectrum of tools. Some customers have standardized on their own tools; but, many are complete newcomers to analytics. Customers ask 'What kind of tools are you bringing to the table?' They want best practices. In a lot of cases, we are informing them. We are having conversations on a lot of levels—financial, facilities etc.

"I did networks for solar monitoring for a decade or more…That technology and this one are on very similar paths. Exciting times! Things are moving up!"

Ben Talbot, DLR Group

"The 2030 Challenge is driving us internally. More of our projects are targeting net zero energy. And if we are contractually obligated to a specific EUI, we need to be able to prove that we are meeting that.

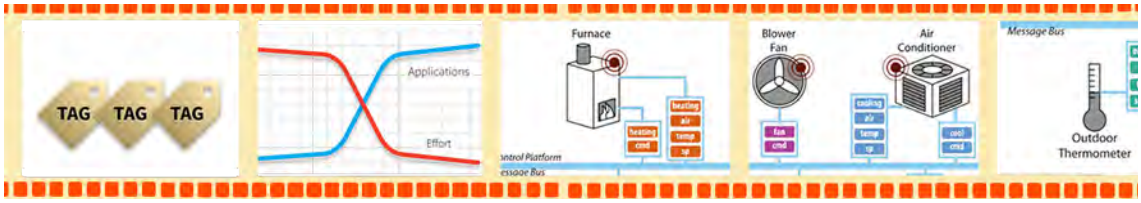
"We got started in semantic tagging and Haystack through our retro-commissioning process. We went from downloading trends in Excel and making graphs to doing integrations with Haystack tagging.

"Now when we go to a building for a first meeting, we already know so much. We can talk to the customer about analytics findings like 'you've been leaving these four air handlers on. We see that some economizers dampers aren't moving. A couple of reheat valves leak, and there are a few of bad PID loops.' In short, we are able to quickly drill down into the issues, spending more of our time on-site figuring out the solutions. So being more effective right away.

"We have widened the scope of the end product we offer to our clients. We're carving a new competency in building optimization.

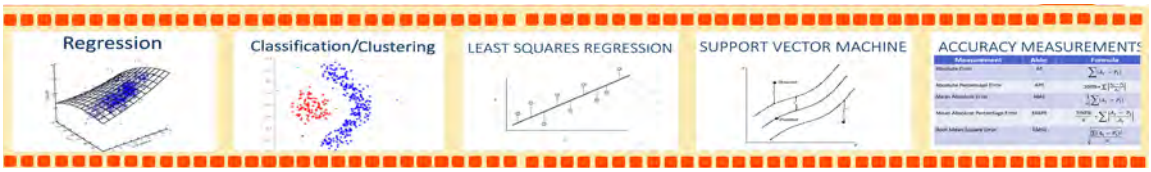
"I'm always surprised by how little our customers are using their data. We encourage them to do more by showing them case studies of what can be achieved when you do proper data management and analytics strategy. It's our goal to take it from front-end design to back-end operations.

Introduction to Haystack for Facilities Managers



Stephen Frank of National Renewable Energy Labs (NREL) and B. Scott Muench of J2 Innovations give an introduction to the mechanics and benefits of data modeling and Haystack tagging for new users and stakeholders. Click button to download the presentation.

Statistical Learning to Improve Model Accuracy

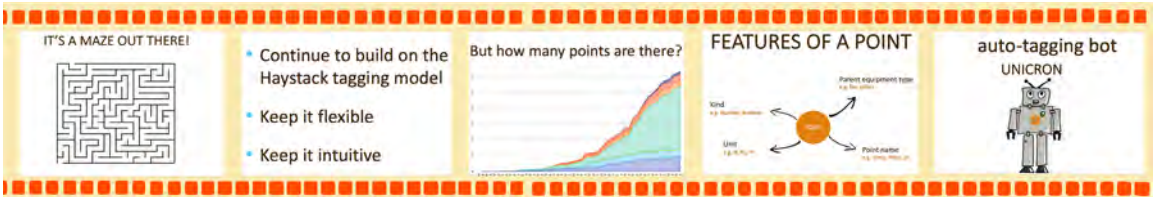


Keith Bishop, Director of Analytics, Hepta Control Systems, and Gia Nguyen, Senior Analyst, Altura Associates, give a brief overview of what's new in statistical learning. Anyone interested in analytics should know the basics of major algorithmic functions like regression and classification/ clustering. Learn how these building performance data engineers are applying functions like Least-Squares Regression and Support Vector Machines. Click button to download the presentation.

Building Analytics Beyond HVAC & Metering

Tyson Soutter, Deployments Team Leader, BUENO, has used the Haystack method to tag device data models for systems like fire, waste and car park management systems, also for vibration analysis on pumps.In the absence of standardized tagging/naming conventions for the other systems, Haystack is meeting the need and delivering savings and other benefits. Click button to download the presentation.

Leveraging Tagging to Enable Root Cause Analytics at Scale



Jess Thomson, Application Engineer, BUENO Systems, oversees the implementation of the Haystack tagging library across its big portfolio. Hear her recommendations about mapping each site into a standardized building model. Learn about UNICRON, a machine learning auto-tagging bot that is automating tagging and tag checking. It's the only way forward to deliver analytics at scale! Click button to download the presentation.

All of the Haystack Connect 2017 Technical Session presentations are available for download under each Speaker's Profile at www.haystackconnect.org. To Return to Contents Page click button.

sensorFact℠

by Therese Sullivan, BuildingContext

In this Haystack Member Profile, we take a deeper look at SensorFact Services, a cloud-based data acquisition and storage service for sensor data. We learned more about this Tampa Bay Area-based member of Energy Control Companies by interviewing Chief Technology Officer, Matt Horton. Here is a write-up of that conversation.

All of the ideas weren't bad, just early. That is how some participants now see the dot.com era. Matt Horton, President and Co-Founder of sensorFact, agrees. Horton was working in the telecom industry in the late 1990s, setting up large-scale transactional systems for data centers. He remembers "If data was being generated, we captured, analyzed and expected to do something with it." After the dot.com bust, his company and the whole tech industry underwent a reset. He moved over to the building automation and energy control business. There he noted that data was generated and then just discarded. Now, that seemed like a bad idea.

> ***"We believed our data platform had use beyond energy management. Studying the growing demand for predictive maintenance (PdM) for equipment and facilities, we recognized a market-need match..."***

Horton was waiting for the moment when his commercial and industrial customers would begin to recognize all the value in their facilities' operational performance data. He recognized this happening when buzz about predictive and conditional maintenance contracting started to grow in 2013. He was in a right-time-place-skillset situation when he was tapped by Energy Control Technologies (ECT) to manage the development and operations of a new internal team focused on the data acquisition, monitoring and analysis challenges faced by ECT's existing customer base. In 2015, after developing a cloud-based solution that satisfied current customer demand, the team was spun out of ECT as sensorFact Services, Inc.

"We had two years to build a prototype that could aggregate and ingest sources like legacy building equipment and sensor networks. It was a great opportunity to architect and build a cloud storage and management environment from the

ground up. We developed an application protocol interface (API) for collecting massive numbers of sensor readings. It can scale to billions of points and capture data at rates down to 60-second intervals. We believed our data platform had use beyond energy management. Studying the growing demand for predictive maintenance (PdM) for equipment and facilities, we recognized a market-need match to the platform we'd built," said Horton.

Predictive Maintenance as Game Changer

Predictive Maintenance involves analyzing data in real-time to identify non-optimal equipment performance and/or instances when operational limits are exceeded. In terms of the data challenges it presents, PdM is a significant step up from preventive maintenance support. It is not enough to automate the scheduling of work and the tracking of how it gets done. PdM support involves automating the capture of live equipment data, evaluation of trends, and incorporation of known equipment limits. Predicting failure requires the frequent running of algorithms against near real-time data.

"We found that talking about Project Haystack, semantic interoperability and tagging was a good way to start a conversation on common ground. . . "

The sensorFact team briefly considered offering a data utility to equipment manufacturers getting into PdM contracting. But, as Horton explains, "Manufacturers tend to be focused on the sale of their own hardware above all else. Data services are second-tier, at best. The data solutions for predictive maintenance that were on offer from big OEMs favored server-only architectures. We had a cloud platform that was hardware-agnostic, protocol-agnostic and immensely scalable. Our differentiator was the ability to collect massive amounts of data. It would be a hard-sell to OEMs given their motivations and biases. We recognized that a better way to reach PdM end-customers would be to partner with Computerized Maintenance Management (CMMS) providers."

The relatively mature CMMS market has grown to include +170 providers including some of the biggest names in Enterprise Resource Planning (ERP). It is typical for a CMMS provider to have an install base across many facility types — offices, kitchens, hospitals, schools, factory floors, etc. The data sources cannot be compartmentalized into one or a few types of equipment. For this reason, when CMMS work-order generation and other programs need to pull in equipment performance data, they conventionally rely on hand-entry.

Haystack as Conversation Starter

When sensorFact started to approach CMMS providers, it discovered that the technology developments driving customer interest in PdM—big data, cloud architectures and the Internet of Things—did not seem highly relevant to many players. But, by 2015, SAP already had a PdM package, and some customers were seeing that as a compelling reason to switch vendors. So, the more competitive CMMS vendors had PdM on their radar, and sensorFact began to initiate discussions with this type of CMMS, offering its expertise in acquiring, archiving, analyzing and making accessible all sorts of time-series data.

"A CMMS developer will work with you to develop and test an API, but they can't and won't become experts in the field of control systems—or even their customers' controlled equipment. Why would they? We found that talking about Project Haystack, semantic interoperability and tagging was a good way to start a conversation on common ground," explained Horton.

The points sensorFact covers in these early sessions are basically the Haystack community's binding tenets:

- Recognize that the ingestion of actionable information is preferable to raw data
- Whenever possible, use a RESTful API, rather than export/import or direct database connection

- Whenever possible, use semantic modeling, rather than "freeform" asset attribution
- Whenever possible, use persistent data feeds, rather than batch updates

"Haystack methodology builds their comfort level with the challenges of dealing with live data. It is a well-documented and standardized approach that is easy to understand. The way it captures the hierarchy of relationships between sites, equipment, points, current values and tags easily correlates with the mappings CMMS providers already use to track assets. And, the resulting data is self-describing with meanings easy to infer. The fact that Project Haystack is open-source and wouldn't lock them into working with sensorFact exclusively was also important to the CMMS companies. The growing adoption of Project Haystack across commercial and industrial groups further boosted their level of confidence in moving ahead with sensorFact as their PdM data partner," Horton continued.

"From the CMMS providers' viewpoint, Project Haystack support is enabling new functionality and reinvigorating a static user base."

CMMS Customers as Ultimate Haystack Beneficiaries

Once sensorFact and their CMMS partner have an API that makes it possible to accept live data, they still don't have everything needed to support a PdM process. A lot more information is needed from the customers about their equipment, their facilities and their key performance.

Project Haystack Working Groups Multiplying Fast

Matthew Giannini, Software Engineer, SkyFoundry

At Haystack Connect, many community members championed various tagging initiatives. To make it official, they have launched formal working groups with defined proposals and good visibility at www.project-haystack.org. Join us there!

I'm pleased to announce that we've just rolled out a new feature for the website to support Working Groups (WG). This enhancement is based on feedback from the "Community Working Group" session we had at Haystack Connect. We hope this feature will provide more visibility into all the activity going on within the Project Haystack community and enable you to more easily participate in Working Groups that you have expertise or interest in. Let me briefly describe how they will work.

Every WG begins as a normal forum post; perhaps as a suggestion for a working group, or one we have already decided to form through other channels. A project haystack admin will then mark the post a "WG". All forum posts that become WGs will have a special tag in the forum index to make them easily identifiable. Also, all WGs can be easily viewed by clicking the "WG" link in the navigation bar. (You may have noticed this forum topic is also a WG!)

The only thing required to get a working group going is a "champion". The champion will be responsible for working with the other group members to complete whatever task the WG is working on. By default, the champion will be the user who first posted the topic on the forum, but it can be re-assigned.

Anyone can join a working group. Just view the WG post, and there is a button at the bottom that allows you to "Join" the group. Members of a group will have the ability to see each other's emails for the purposes of offline discussion.

Working groups have a very simple life cycle:

- Open: The working group has been formed and has a champion and active work is being done on the project.
- Review: The working group has posted a proposal to the topic and is requesting feedback from the larger community on its proposal. Note: anyone can post to a working group topic (you don't have to be a member).
- Closed: The working group project is finished and accepted/implemented.
- Cancelled: The working group is not active and the work proposed in the WG will not be completed.

Eight new semantic tagging working groups were launched this summer. Anyone that wants to keep up to date with what is happening in working groups, or the forum in general can configure their settings to receive a daily digest of activity on the forums. Thanks!

Working Group Dynamics

"People passionate about data tend to want to make the results of their work as robust as possible as soon as possible. I would advocate not tackling the whole thing at once. Take little bites." ***—Rob Murchinson, Intelligent Buildings***

Rob Murchinson is a skilled instructor of Agile software develop methods and he advises clients to work in terms of OODA loops—Observe, Orient, Decide Act. He says: "Get little pieces around that loop. Get the organization to start changing so that you can go faster and faster and faster."

Listen to the whole quote by viewing the End-user and Engineer's Panel Discussion.

You can get a sense of how OODA works by observing how a team of Haystackers OODA-ed the tag set for air temperature over a few weeks this summer. Their collective wisdom and experience will get folded into the Haystack standard tag set for weather points and be made available to all members.

Haystack Working Group posts a proposal to the community requesting feedback on their semantic modeling topic. Members observe their Haystack deployments with respect to the proposal, considering their need for new tags or changes to existing tag sets.

A mark-up language should make it easy to find points with a minimum of filtering. The logic of how you construct a point name and its respective dictionary should be intuitive. Any changes or additions should avoid 'breaking' applications in the field that query against the existing mark-up, if possible.

A Working Group discussion is conducted on the online forum wherein the proposal is revised and restated with respect to feedback from the community. Discussion within the Working Group continues until the proposal is brought to a resolution.

Members put forth a balanced solution to be incorporated into the Haystack standard, recognizing that there is never just one, ideal solution with semantic tagging and that the topic will likely be revisited as libraries and databases managed by Haystack members evolve in the field.

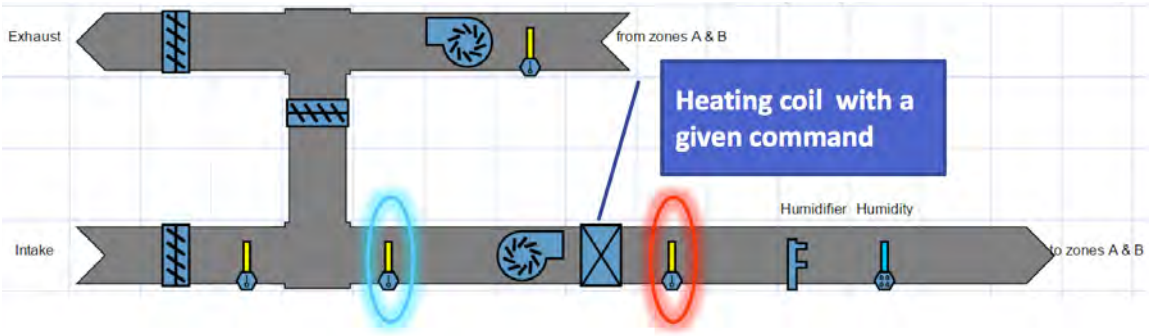
Flow Modeling Working Group

by Karine Lavigne , Laboratoire des Technologies de l'Énergie (LTE) of IREQ (Hydro-Quebec Research Institute)

Researchers at Hydro-Quebec are working to increase the energy efficiency of commercial and institutional buildings though the development of continuous commissioning and energy simulation tools, as well as through demand response and building control optimization projects. Karine's involvement in Project Haystack stems from this work.

Join our new Working Group to improve Haystack tagging to better reflect energy flow thoughout a space, building or campus. Already Project Haystack tagging makes it easy to express nesting relationships and the location of points from an equipment point of view. Users have no problem doing high-level matching of a chilled water plant to associated air-handling units (AHUs) and of an AHU to all associated VAVs using references such as ahuRef or chilledWaterPlantRef. Likewise, users can tag with references (equipRef) to express an inclusive relationship (nesting). But what about when you want to express a sequential relationship? Or an order between points or objects? Project Haystack would benefit from some new types of tags to more easily express how air, water, electricity, etc. moves between points or objects. So we've launched a working group to consider how to set up a system of reference tags to capture such notions of flow. Our working group will explore tags designed to make it easier to auto-identify sensors in an inlet/outlet configuration. Such a tagset will open great possibilities for advanced analytics that diagnose what is happening between them and for automated controls that enable self-healing. We invite you to join the effort!

See Karine Lavigne's presentation.



Is the heating element working? The Flow Modeling Working Group is exploring a set of tags to explicitly express flow relationships, such that an advanced fault detection algorithm could more easily verify what is happening between these temperature sensors.

This section highlights some of the noteworthy milestones the Haystack community has achieved in delivering new and updated tag sets, as well as programming tools and software developer kits.

Haystack, N4, SkySpark Interoperability

by Larry Andriunas, President of Kodaro, LLC

The Kodaro team is hard at work creating ways to connect building controls through software drivers, software applications, and enterprise solutions.

Haystack tagging in N4 and SkySpark is a hot topic these days. N4 is arguably the number one integration platform in the building automation space and SkySpark is arguably the best analytics platform for building data, so it makes sense that people are trying to get the data from each system synchronized. But there is a lot of confusion about the best way to do this.

Some History

The nHaystack module was created for the last generation of Niagara (commonly referred to as AX) because AX simply did not support tagging of any kind. Similar to the current version of BACnet, it allowed integrators to add "slots" to house meta-data for each point or device, but not as a native function of the framework. nHaystack, created and open-sourced by J2 Innovations, made it possible to get data from AX into SkySpark. The nHaystack developers also created tools to make a tighter integration between their legacy product (largely built on the same database as SkySpark) and Niagara AX.

Fast forward to 2015 and the release of N4. Tridium recognized the need to incorporate a fully supported tagging mechanism into N4 out of the box, so they created Niagara tagging which allows for graphics, hierarchies, Niagara Analytics, alarms, and histories. They added "Name Spaces" that are not defined in Haystack but are a standardized function in N4. This new N4 tagging is Haystack-compliant by the dictionary definition, but does not truly support the Haystack protocol for accessing the tags.

Most people assumed the new N4 tagging would be supported by the original open-source nHaystack module. And maybe it will at some point, but it is not there yet. In the meantime, Kodaro, a Niagara 4 Developer, has created a

new interoperability module for data sync called ***Haystack+***. It bridges the gap between native Haystack products like SkySpark and the new N4 tagging options, so that those who are migrating to the new Niagara 4 framework can continue using SkySpark and the Haystack tagging protocol.

How it works

The module drops into the N4 database using the Haystack Rest API and connects to a SkySpark database. The point data, history data and tags can be pushed into SkySpark from N4 at will. Once this connection is established, new tags can be created in N4 or SkySpark – the Haystack+ driver can sync in both directions. When data is going from SkySpark to N4, Haystack+ converts Sparks into Niagara alarms and creates them in Haystack compliant format. The driver also offers secure export-only functionality. The Kodaro Haystack+ driver is not open source and does have a licensing fee to support the engineering time needed to configure and upkeep the driver.

Find the driver download and user guide at www.kodaro.com.

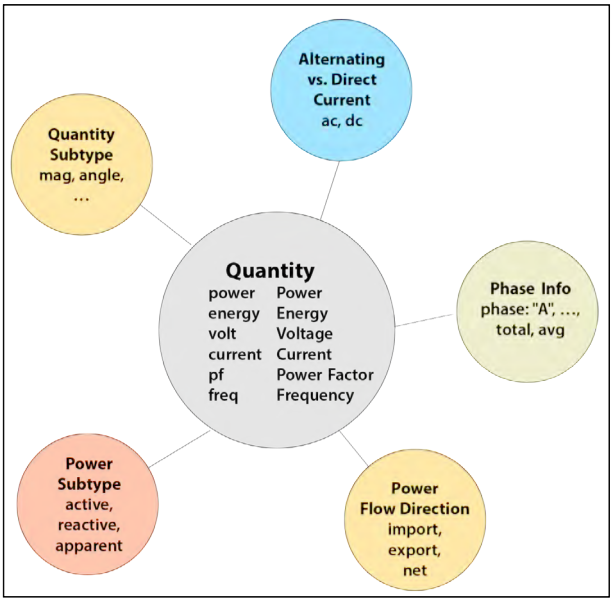
Understanding the Elec-Meter Tagset

by Steven Frank, NREL, Commercial Buildings Research Group

Steve Frank's areas of expertise at the National Renewable Energy Lab are electric power distribution systems, DC power systems, linear and nonlinear optimization, and energy informatics.

Electricity meters are probably the most common type of meters modeled. They are tagged as **elec meter**. Haystack supports a model designed to scale from very simple meters (just a power and energy point) up to a comprehensive point list for three-phase power quality meters. The latest **elec meter** dictionary is designed for explicitly describing six physical quantities using 21 Haystack tags in six mutually exclusive sets with 31 point templates!

Electricity meter points are described by combining these tags. You need all of these to express the type of complex electrical measurements made in energy use cases, for example, in energy loads conventions where you need to express energy consumed versus energy produced.



Read more about all the **elec meter** tags in the Energy Section of the Haystack documentation.

Updates to Plant and VAV Tagging

by Paul Berquist, Business Development, SkyFoundry

Paul has a leading role in helping partners and owners take advantage of advanced operational analytics toward the creation of truly intelligent buildings.

Plant operations can be more efficiently and consistently described based on the plant's output, rather than its primary equipment–i.e., chillers, boilers, etc. Project Haystack has thus updated its model to reflect this. This was a breaking change from existing terminology. So, to be up-to-date, users should replace existing chillerPlant tags with **chilledWaterPlant** tags.

Per this new model, there are three types of plants:

- **chilledWaterPlant** depicts outputs of chilled water
- **hotWaterPlant** depicts outputs of hot water
- **steamPlant** depicts outputs of steam

Many people from the community have contributed to the thinking around this update. There were contributions from Sentient Building, Controlco, DR Associates and others. Review

Forum Post #341 to understand the full scope of the model.Included are tags for heating plants and points, Boiler equip and points, and storage tank equip and points. They are all fairly self-explanatory following the existing Haystack methodology.

Equip-level tags model the specific equipment described. Chillers and other equipment such as pumps, CTs and heat exchangers are modeled as **equip** that reference the plant. Cooling towers are tagged as **equip** that reference the **chilledWaterPlant** that they serve.

There are **equip**-level tags to define boiler point specifics, such as tags to reference a parent plant. There are new **hotWaterPlant** tags for depicting system-level points that may be associated with a plant or system, but not necessarily a specific piece of equipment (**equip**). A special grouping of tags for tanks extends to representing all types of applications beyond heated water production.

The work on Plant and VAV tagging continues: Regarding heat exchangers, there is a proposal to add **hotSide** and **coldSide** tags. There is also opportunity to extend **centralPlant** and **districtPlant** tags and their relationships, specifiically in terms of operational data, production data and energy data. Likewise, our working group is considering how to better tag for equipment with lead/lag and rotating/sequencing characteristics. Please comment and join us.

Click to see Steve Frank's & Paul Berquist's presentation.

Perspectives on the Market from Project Haystack Members

Participation in the Haystack Community drives innovation and inspires big-picture thinking. The following editorials from members & supporters are full of insight about where the industry will go next, once an open framework for tagging is commonly understood and supported.

Smart Buildings and Their Digital Twins

by Anno Scholten, President of Connexx Energy

Every piece of infrastructure, sensor, personal mobile device, and business process in a building today is a potential source of valuable data for improving operations and user experience. Insightful facilities project teams are beginning to direct it towards the creation and maintenance of digital twins. A digital twin is a dynamic software model of a physical thing or system. The digital modeling world has been working toward this moment since the first computer-aided design (CAD) tools for drawing symbols and geometries were introduced in the 1960s. Early CAD led to the very sophisticated BIM (building information models) that performance design engineers working in architecture & engineering firms use today to analyze and optimize systems. The big advancement that distinguishes Digital Twin modeling is that it encompasses not just predictive design-phase data, but also time-series data captured from an occupied and operating building.

Digital twins can serve as repositories of data from BIM, building automation systems (BAS) and sensor networks associated with lighting, physical security or other infrastructure. The replicas will come alive as they are fed time-series data from actual operations. A range of analytics packages will be run against the real-time data to glean insight about operations on a continuous basis or on demand by users. The information contained will become more granular as more data is accumulated, organized and interpreted. We're likely to interface with digital twins

by simply viewing a piece of equipment or space via augmented-reality(AR) apps and glasses. Ultimately, anytime anyone has a query about the building, they'll start by consulting its digital twin.

Consider, for example, representing a building's chiller in software. The model might start as a simple block diagram showing component parts like condenser, motor, pipes, etc. As you add chiller performance data, the virtual twin becomes more information-rich, like a 3D wireframe view. By adding IoT sensor data, you can get more granular information about aspects of chiller operation. Metaphorically, you're adding detail, shape and color to the digital twin. As you pull in more data, you can make it more and more like the physical chiller. The digital twin can also include equipment documentation, with links to online resources.

"... the amount of data that can be collected, aggregated and analyzed is practically limitless due to cloud architectures. It is now within reach to create a full proxy of a building in the cloud."

Fault detection and diagnostics (FDD) for specific equipment, like chillers, can be run against a relatively sparse 'young' digital twin. When there is need for more granular data on specific aspects of operations, wireless sensors can be placed to gather the information of interest. For example, hot/cold calls from occupants may trigger interest in air supply temperatures at a handful of points. There is no necessity to bring every point captured by a sensor system into a BAS. Likewise, there's no reason not to keep populating a digital twin with the information. With today's cloud architectures, the added cost to store and manage the additional data is minimal, and you don't know what new use for the data will arise in the future.

FDD analytics are an important tool in the arsenal, but they are not the only tool. To optimize chiller operations, for example, you want to be able to query the chiller's observed heat curve, then adjust the Sequence of Operations (SOO) programming accordingly. Today there are many commercial off-the-shelf statistical programs that do curve fitting. Another category of operational analytics is model-based predictive and prescriptive control algorithms. Fed historical and real-time trend data, these tools look for patterns to predict what will happen next. If predicted performance would result in energy waste or other undesired outcome, they can prescribe actions to course correct, and sometimes affect the necessary adjustments—like changing variable-speed motor settings, for example. These analytics packages are leading the buildings industry closer to machine-learning and AI. Project teams will want to plan for the eventuality of running this type of analytics against the data stored in their digital twin.

How much time-series data would a building project team need to feed its digital twin? If trend data were collected for 50,000 points over five years, about 4.2 terabytes of time-series data would be created. To navigate this enormous data store a well-defined reference architecture and standard meta tagging system like Project Haystack is needed. As an estimate, about 200MB of Haystack meta data would be sufficient to navigate the 4.2TB of time-series data collected from a 50,000-point building space.

Inherent to the digital twin concept is the idea that its value increases over time. As the information contained gets more granular, you will get more meaningful and reliable results to the analyses run against it, and the what-if scenarios you run through can start to get more complex. Consider the challenges of an engineer overseeing chiller operations for four geographically dispersed resort hotels. Perhaps the chiller operator in one geography has discovered a better sequence of operations. Or, perhaps after doing forensics on a chiller failure, she has suggested changes to the SOO to safeguard the equipment. Should the head engineer institute the updated SOO at all properties? Running simulations on a digital twin from the comfort of his chair is much less risky than testing the proposed changes in the real world. Innovation and greater efficiency would happen a lot faster with a digital twin available to consult.

In short, a digital twin platform should accommodate tools we know today, and those to come. It should not be tied to any specific analytics type or brand. The architecture should feature security as well as open, low-friction data interoperability at each level. Software stacks supported by open-source communities provide the safest future growth path today. A digital twin should be designed to scale, evolve and reincarnate for the lifespan of the building it represents.

We also must expect that the digital twin trend is going to accelerate technology disruption and the remaking of many business and industrial processes.

Nevertheless, the most forward-thinking facilities project teams are going to embrace the concept. Users of the Connexxion® Platform are already on their way toward creating digital twins. They rely on this scalable, secure data management and data visualization platform to transform and unify disparate data sources, to bridge heterogeneous networks, and to quickly deploy the analytics and other applications that various stakeholders are demanding. With Connexxion as their partner, these users are leading the way into the 'digital twin' era of smart building operations.

J2 Innovations Presents at NREL IN2 Summit

by Scott Muench, VP of Marketing, J2 Innovations

Last January, J2 Innovations was among 20 small businesses selected to participate in round three of the Wells Fargo Innovation Incubator (IN2) program. This five-year, $10 million program is aimed at facilitating early-stage technology companies.

In early August, we presented at the IN2 Summit. As you may know, we've been beta-testing the newest FIN feature, Automated Commissioning with a team at NREL. Automated Commissioning brings together Project Haystack, tagging and data modeling, and the FIN framework and automates the commissioning process.

We had 5 minutes to show just how powerful this combination is, specifically in conjunction with Energy Plus simulation software. The breakthrough is that, through this effort with NREL, applications using Haystack protocol can now connect to any simulated building and weather conditions in real time!

More About IN2

The IN2 selection committee looks for scalable solutions with big potential to reduce the energy impact of commercial buildings. The US Energy Department's National Renewable Energy Laboratory (NREL) is a partner in IN2, providing technical and project support. Launched in 2014, IN2 is funded by the Wells Fargo Foundation and co-administered by NREL.

Selected companies also receive access to Wells Fargo financial services, products, education and mentorship, and ultimately an opportunity to potentially beta test their technology within the Wells Fargo footprint.

The IN2 Summit, is a full-day, invitation-only

working session that brought together IN2 stakeholders, subject matter experts and investors to share knowledge, learn from one another, and help inform the direction of IN2 toward its goal of creating sustainable communities.

"As an organization managing nearly 100 million square feet of real estate, we know that efficiency matters, and we are pleased that our efforts to build and foster an ecosystem that accelerates the commercialization of clean technologies for commercial buildings is bearing fruit," said Ashley Grosh, vice president and co-lead for Wells Fargo. "Companies from rounds one and two have achieved significant milestones on their way to the commercial marketplace. We are pleased to add this third round of innovators to IN2 and expect the momentum we've seen to date continue across the program.

Building Automation's 21st Century Edge

by Alper Uzmezler, Founder, Anka Labs

New edge controllers – those that support the full software stack needed to collect, store and run analytics on time-series data from a building's many digitized sources – are going to be a powerful force in building automation. They are already of interest to stakeholders from specifying engineers to controls contractors to occupants that want to pull building performance data from wherever it exists and push it to wherever it can help them make better decisions and be more productive. But, do we see the size or speed of the disruption they are bringing? Looking at what is happening in edge control and analytics in cars is one way to gain perspective on how edge technology will bring buildings into line with 21st Century service demands.

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Most software-is-eating-the-car discussions start with the On-Board Diagnostics specification, OBD-II. OBD-II specifies the standard hardware connector to vehicle computers as well as the protocol for communicating standardized diagnostic trouble codes. Car makers around the world have been evolving and supporting this specification for expressing car performance information since the first version was introduced in the early 1980s. While it is not an Application Programming Interface (API) per se, it is stable and detailed enough for software developers to use like an API.

A prime example of a car edge device that leverages OBD-II is the mobile diagnostics adapter from Automatic Labs. Unlike previous PC-based and hand-held OBD-II readers, which were targeted for use at car repair shops by certified car mechanics, the Automatic adapter and competitors like Verizon Hum are marketed directly to car-owning consumers. Their developers recognized that car owners would use car data in ways never considered by car mechanics. So, they launched their edge devices along with mileage-tracking apps that interfaced to the type of cloud accounting services used by small businesses, gig workers and entrepreneurs.

And, they mashed in Google Maps and other web mapping services to create trip tracking apps attractive to more business users and parents of teen-drivers. To further popularize the device category, they worked to build a community of 3rd-party app developers around their car diagnostics adapters through an app store modeled on Apple iTunes and Google Play e-commerce sites. The ecosystem contributed a host of new online services targeted to car owners that involve mobile shopping, home-automation management, even fitness—and yes—newer, better ways to work with car repair shops and related services. It all seems to be working well for Automatic Labs. It was just purchased by SiriusXM.

Verizon, SiriusXM, these are not traditional car companies. They are data companies carving out their share of the growing Connected Car market. They have a powerful market position in that the data they are collecting and analyzing is valuable machine-learning training data for the coming era of autonomous cars.

What are the takeaway lessons here regarding how edge analytics controllers will disrupt the current building industry? First, there is the necessity of an open specification that is sufficiently detailed and supported to serve as an API for software developers. What is the BAS-industry equivalent of OBD-II? BACnet protocol

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mainly addresses communications and syntactical interoperability. Project Haystack, on the other hand, focuses on semantic interoperability and is more suitable for application development inside and outside the traditional buildings industries. Then, in the BAS world, you need BMS software to express the architecture of the target hardware and functional logic of the controller. The open-source Sedona BMS framework used in combination with open-source Haystack modeling is as close to an OBD-II equivalent as the BAS industry has right now.

OBD-II innovators recognized that car performance data in the hands of end-users would be used in ways far beyond car maintenance. The same is true of building performance data. Matt Schwartz of Altura Associates, described it this way at HaystackConnect:

"Field data is already in Haystack format, so it is a cinch to pull it into our cloud analytics platform."

"It's our job to leverage data to find issues in buildings faster and to track them to resolution. But we go further, we ask owners or other stakeholders 'How might you leverage this data to be more successful?' Then we work with our clients to integrate building performance data into their workflows. Leveraging analytics to find the full value in their data is becoming key to almost every proposal we submit to our clients."

Matt Schwartz and others at Altura Associates are early users of edge analytics controllers (EACs). During the interview, he describes deploying about a dozen to pull pressure and flow readings at strategic locations from a massive centralized compressed air system that serves a large university campus:

"Field data is already in Haystack format, so it is a cinch to pull it into our cloud analytics platform. The EACs also store and trend data locally, so it is accessible by the customer and other parties that understand open Haystack. They have enabled us to quickly identify and implement leak repairs. The campus now knows, for example, how much compressed air it wastes and how much that is costing."

Haystack Community Social Media Curation

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.

Realcomm interview with Chip Pierpont, Director of Facility Technologies, U.S. General Services Administration (GSA) reveals that Haystack-enabled GSAlink analytics responsible for an average of 24% reduction in energy across portfolio.

Read how tagging helped unify a university campus, and gave more options for facility management.

OTI has found in Grupo Cinsa a partner that is willing and eager to implement the IoT.

practices

Listen to two industry thought leaders converse about the life of a master systems integrator

New Deal for Buildings blog strives to bridge design/construction disconnects.

If you are not following Brian Turner's posts, Start! This one details best practice for OT networks. Good read.

oti_pro
@ot_integrators

More on IT/OT in new construction "New builds are often some of the most insecure, least optimised environs for IoT"

On the Buildings IoT "One Network" Debate and What's Been Missing from th...
The Internet of Things is sparking debate around physical building networks and where best to implement enterprise solutions that touch both IT and
linkedin.com

New model explores whether IoT data is worth more than the sale price of the device itself.

Nice KMC short feature from @ DellEMC's 1st annual report to customers. Click to watch.

KMC Controls @kmccontrols

How KMC Controls and @DellEMC make buildings smarter with the IoT with open technology.

Pete Horton @Pete_Horton

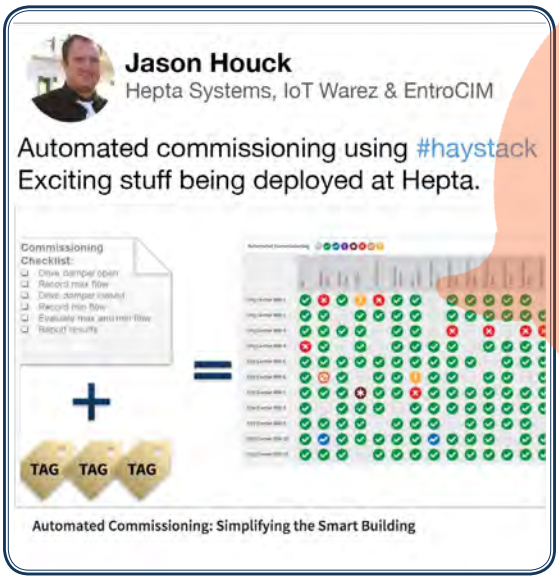
Data monetization and #Haas (hardware as a service) applied to lighting and controls.

IoT monetization will allow device manufacturers to offset production costs and support costs to either add more features or lower costs entirely
rtinsights.com

Conserve It @Conserve_It

Don't miss our #LynxspringExchange Keynote Day 2 "Chiller Plant Controls and Optimisation at the Edge"!

Chiller op's can be over half of a big building's electrical consumption. Conserve It and Multistack team up to talk about central plant control.



J2 Innovations FIN 4.0 new Automated Commissioning feature is tweet-worthy.

Create customized apps, data views and reports without software development skills.

Sleek new way to automate Haystack tagging.

Try this open-sourced tool to ease into Project Haystack adoption.

Resources

The Project-Haystack community develops, and offers at no cost, 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

Events

Lynxspring Exchange 2017

October 1-3, 2017
Scottsdale, AZ

Project Haystack is one of the sponsors of this gathering of Lynxspring partners, customers and supporters including building operators and facility managers, engineers, service technicians and OEM's. Lynxspring Exchange is a great opportunity to collaborate and network with peers and to learn about today's operating systems and solutions. Anyone interested in operating facilities smarter, safer, securely, more efficiently, and at peak performance levels should come. It is the place to be to learn the latest in advanced IoT and Edge device applications.

Agenda

REGISTER

Projekt BMS 2017

October 18-19,2017
Warsaw, Poland

Project Haystack will be the subject of the official conference opening session at Projekt BMS, a European flagship, annual event for suppliers and recipients of Building Management Systems, Smart Building Systems and Building Automation Technology. John Petze, Executive Director of Project-Haystack and Partner at SkyFoundry will be the speaker introducing the attendees to the concepts of data modeling for device data and Project-Haystack technology. The European market is seeing increased adoption of Project Haystack which will be the subject of presentations at other conference events in France and elsewhere this fall.

Agenda

REGISTER

SkyPosium 2017

November 14-15, 2017
Dulles, VA

The very first "SkyPosium" event will bring together the entire community of SkySpark users – reseller partners, end users, engineering consultants, and SaaS providers – everyone that uses or applies SkySpark. Two program tracks will cover everything from business topics, application examples, and detailed product demonstrations, to developer level technical topics. The program will cover the new features that have been added, (and continue to be added), to SkySpark Everywhere. Haystack technologies will be a central theme of many of the sessions. In addition, a vendor showcase will provide attendees with the opportunity to meet with companies that offer complementary products and services.

Agenda

REGISTER


NOW
Available in
CHINESE
Click to download
Haystack
GUIDE
Specification
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Technical
Overview
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REST API
Description
Click here to open
Applications
Description
Click to download whitepaper
Defines the concept of tags breaking down and explaining the essential data elements
Explains simple mechanism to exchange "tagged" data over web services
Outlines how to use the modeling standard in applications related to buildings, energy, and facility management.

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 2019

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

For any other information, email us at

projecthaystackinfo@gmail.com

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.

Intel has been leading the pursuit of Moore's Law for its entire existence. We have continuously advanced silicon technology and moved the capabilities of the industry forward. Today, the unmatched scope and scale of our investments in R&D and manufacturing ensure Intel continues to maintain industry leadership and drive innovation to provide our customers and consumers with leading-edge products in high volume.

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.

As a leader in electrical and digital infrastructure solutions for all types of buildings, Legrand helps enhance everyday life for its customers. Legrand's Eliot program (Electricity and IoT) is speeding the deployment of Legrand's connected devices and accelerating the evolution of connected buildings. Eliot is powering development of new Legrand products for the benefit of private and professional users alike.

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

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.

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.

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.

Associate Members

Accu-Temp Systems is committed to delivering safe, comfortable environments for its customers. It leverages tools like secure mobile devices, cloud computing and advanced analytics. It offers systems integration services that help building owners protect their investment in existing direct digital controls, extending their useful lifetime while enjoying next-generation access and control.

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.

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 delivers leading-edge automation and solutions to address the Internet of Things for commercial buildings, (BIoT). It offers software and hardware products 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. 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.

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.

Tridium is a world leader in business application frameworks—advancing truly open environments that harness the power of the Internet of Things. Our innovations have fundamentally changed the way people connect and control devices and systems. Our products allow people and machines to communicate and collaborate like never before. They empower manufacturers to develop intelligent equipment systems and smart devices for enterprise and edge assets.

www.project-haystack.org