SPRING 2020

Project Haystack

ISSUE 07

connections

Journal of the Haystack Community - Solutions for Interoperable Device Data

The Mission: Making Data Easy to Work With

- Design Consultant's & Property Manager's View
- Easy Tag-Based Graphics
- Bringing Standardized Data Modeling Upfront in Project Commissioning
- Breaking Through System Integrators' Tagging Adoption Barriers

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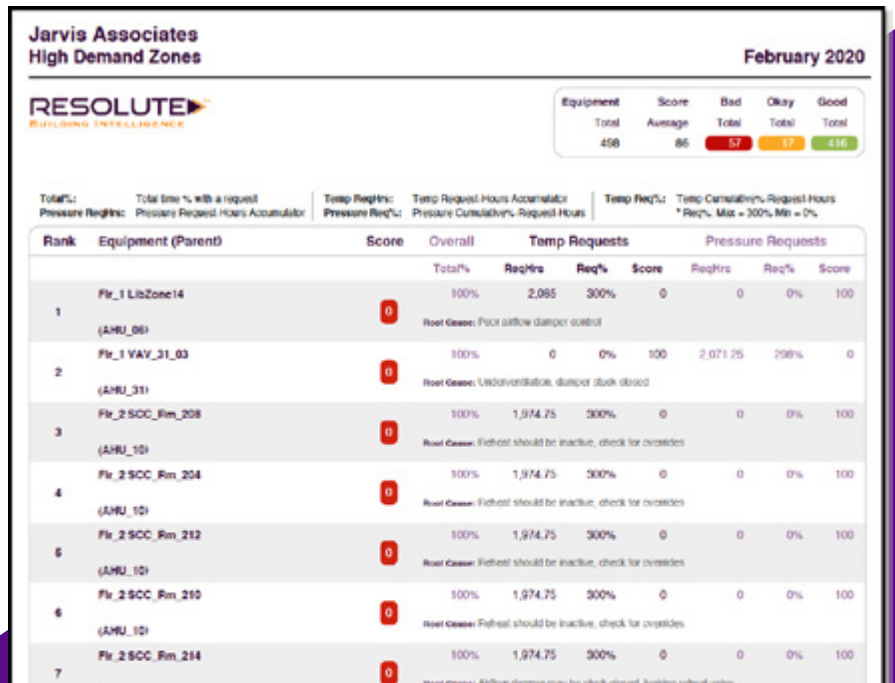
Jarvis Associates
High Demand Zones
February 2020

RESOLUTE BUILDING INTELLIGENCE

Equipment Total	Score Average	Bad Total	Okay Total	Good Total
498	86	57	17	416

Total%: Total time % with a request | Temp Req'Hrs: Temp Request Hours Accumulator | Temp Req'%: Temp Cumulative% Request Hours
Pressure Req'Hrs: Pressure Request Hours Accumulator | Pressure Req'%: Pressure Cumulative% Request Hours | * Req'%. Max = 300% Min = 0%

Rank	Equipment (Parent)	Score	Overall	Temp Requests			Pressure Requests		
			Total%	Req'Hrs	Req'%	Score	Req'Hrs	Req'%	Score
1	Flr_1 LibZone14 (AHU_06)	0	100%	2,085	300%	0	0	0%	100
2	Flr_1 VAV_31_03 (AHU_31)	0	100%	0	0%	100	2,071.25	298%	0
3	Flr_2 SCC_Rm_208 (AHU_10)	0	100%	1,974.75	300%	0	0	0%	100
4	Flr_2 SCC_Rm_204 (AHU_10)	0	100%	1,974.75	300%	0	0	0%	100
5	Flr_2 SCC_Rm_212 (AHU_10)	0	100%	1,974.75	300%	0	0	0%	100
6	Flr_2 SCC_Rm_210 (AHU_10)	0	100%	1,974.75	300%	0	0	0%	100
7	Flr_2 SCC_Rm_214	0	100%	1,974.75	300%	0	0	0%	100

- Direct cloud-to-cloud connection
- Automated configuration
- On-demand performance reports
- Deep-dive equipment & energy analytics
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- Real-time fault detection & alerts
- Prioritized action items

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usa.siemens.com/desigo-optic

Who's in on this Mission?

by Robin Bestel, Managing Editor, Project Haystack Connections Magazine

Welcome to the Spring 2020 issue of the Project Haystack Connections Magazine. It is a true testament to the mission that the Haystack Community is committed to and highlights many of the accomplishments that have been made over the past six months. We feel it is especially relevant during these challenging times as we redefine how we work and manage the built environment.

Project Haystack has continued developing the expanded and widely accepted standard for semantic modeling methodology and building our tagging libraries for more and more applications. This community-driven, open-source process is engaging companies that work on different facets of specifying and implementation. They understand the importance of making data easy to work with for all.

For this reason, it seemed appropriate to make the theme of this seventh issue of Connections Magazine "**The Mission: Making Data Easy to Work With**.

We had 13 companies contribute articles to this Connections Magazine Spring 2020 issue which includes a Design Consultant's and Property Manager's View, "***Georgia Tech: The Kendeda Building for Innovative Design***", provided by Donny Walker, a Partner at Newcomb & Boyd who leads their Intelligent Building Systems group, and Shan Arora, the Director of The Kendeda Building for Innovative Sustainable Design at Georgia Tech. Stephen Holicky, a Niagara Product Manager with Tridium, Inc., contributed an article on "***Easy Tag-Based Graphics***". "***Bring Standardized Data Modeling Upfront in Project Commissioning***" is an article written by Jamie Lee, Product Manager and Scott Harvey, a National Operations Manager for Siemens Industry Inc., Smart Infrastructure. "***Breaking Through Systems Integrators' Tagging Adoption Barriers with a Unique Approach to (Auto) Tagging***" is an article contributed by Nick McLellan, a Product Manager with Johnson Controls.

Brian Frank, President and Co-Founder of SkyFoundry, provided an update on Haystack 4. The Project Haystack website, **www.project-haystack.org**, is being transitioned to the new Developer website, **www.project-haystack.dev**, to focus on the new Haystack 4 methodology and assignment of tags. The activities of the Working Groups and the developer Forum conversations will be transitioned to the Developer site soon, as well.

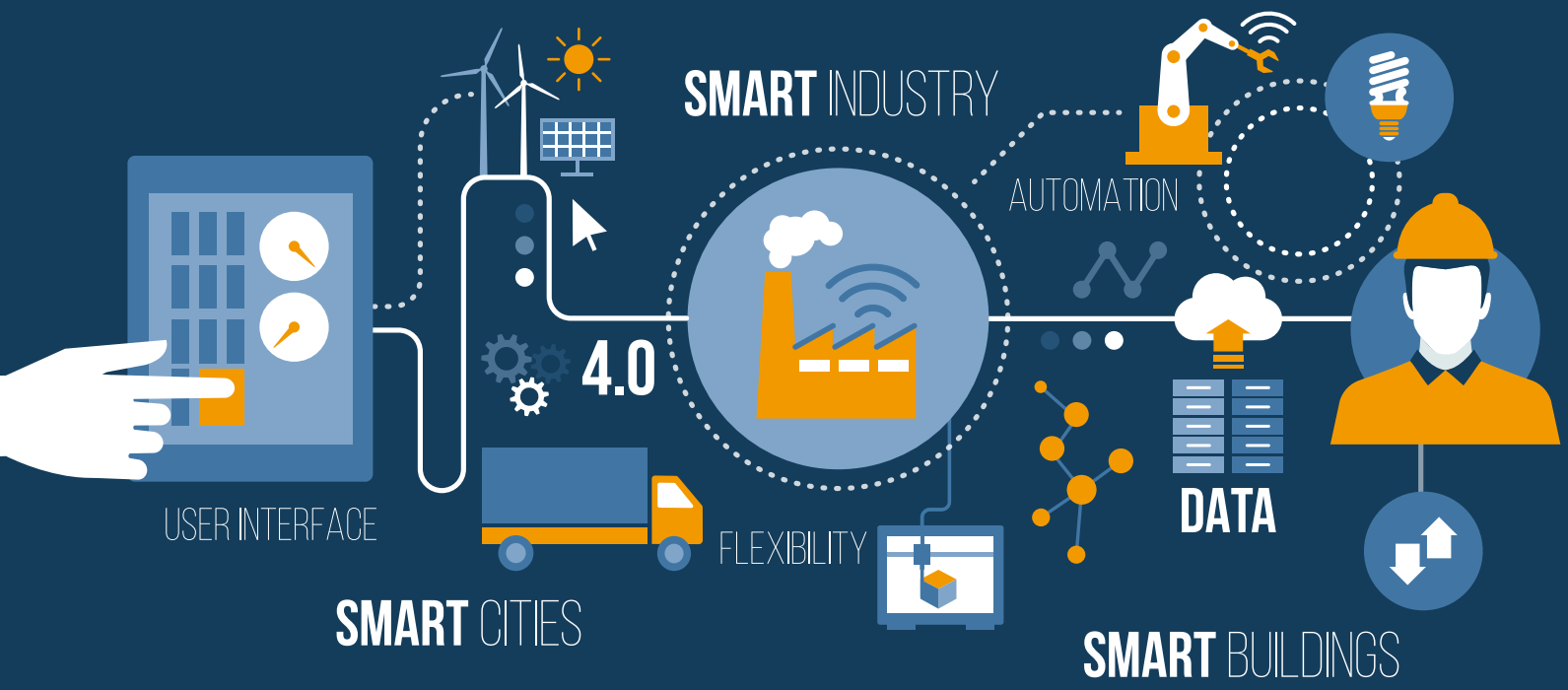
Since our last issue of Connections Magazine, the Project Haystack organization has ***four*** new Associate Members: **Brainbox AI**, **KODE Labs**, **Resolute Building Intelligence** and **SmartGreen**.

Looking back just a few months ago, we collaborated with Ken Sinclair of **automatedbuildings.com** on a free educational session "***Haystack 4 - The Continued Evolution of Semantic Tagging – What it Is and Why it Matters***" during AHR Expo 2020. If you missed this session, the presentation is available **here**.

Project Haystack **Working Groups** contributed updates to their work. And as always, we have sections dedicated to **Tools for Developers and Integrators** and **How to Get Involved**, a curation of social media highlighting Project Haystack Member new **Projects, Practices** and **Products**, and our **Members Directory**. There is a list of all the **Advertisers**, for whom we thank for their support and sponsorship of Connections Magazine.

It has been a pleasure, and even a comfort during these times of having to spend so much time alone, to look forward each day to work with everyone to create another informative issue of Project Haystack Connections Magazine. The Project Haystack community mission is being realized, thanks to all of you.

I look forward to the next six months when my mission, once again, will be to bring you another Connections Magazine.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DATA
FLEXIBILITY
SMART CITIES
SMART BUILDINGS

The Mission: Making Data Easy to Work With

This 7th issue of our Haystack Connections magazine comes at a unique time for the world and our industry. As we look back on our planning process, which starts months before release of each issue, our final review created a feeling that can best be described as nostalgia – nostalgia for what we all viewed as normal in 2019 and even as we began 2020. Plans for meetings, trade shows, speaking engagements, and even initial planning for our Haystack Connect 2021 conference, changed right before our eyes. Like you, we see those plans on hold and await a clear path forward in business and life.

That said, one thing that remains unchanged and in fact has accelerated during this time, is the importance of data to society and across industry. Now, there is an urgent need to bring diverse data together so that it can be transformed into insight, knowledge and value, quickly and easily. Hence, the theme of this issue "**The Mission: Making Data Easy to Work With**". Interestingly enough, we had selected this theme well before the pandemic. We think you will agree it is even more relevant now.

Since our founding, the Project Haystack organization's mission has been to make data easy to work with by providing an open-source methodology for defining the meaning of data produced by devices and equipment systems using "**tags**" to represent facts and descriptors. Haystack tagged data is understandable to machines and software applications and the humans involved in working with these equipment systems. The Haystack methodology is fully extensible, which means that it can be adapted to virtually any application.

The proof of Haystack's success is in the thousands of facilities worldwide currently specifying and using Haystack tagging in building equipment and management systems.

The community aspect of Project Haystack has been essential to its success and remains so. Project Haystack provides the "**meeting place**" for the people involved in managing and operating facilities to work together to address and overcome the challenges of integrating data from diverse systems and devices.

These real-world practitioners have a vested interest in creating efficient, deliverable solutions to their project needs and bring insight from the ground level. Their contributions and the stories they share in this publication accelerate learning and best practices.

The built environment and the systems that support it and make our daily lives and the economy possible, is complex and generates incredible amounts of data. That data has exceptional value - not only to drive efficiency and sustainability, but also to support safety and economic activity.

We want to thank all of the contributors from around the globe for their stories and also thank you for your continued support of Project Haystack.

John Petze
Executive Director
Project Haystack

Marc Petock
Executive Secretary
Project Haystack

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Project Haystack Founding Member

Business Consultant's View

Why Is Open Source the Future of Smart Buildings?

Charlton Morris.

We know open source is the future of smart buildings, supporting innovation and creating automation innards. It brings countless benefits to building owners, property managers, end users and automation providers.

To find out why this is becoming a popular opinion throughout my network, I spoke to John Petze, Founder of Project Haystack and owner/co-founder of SkyFoundry, as well as many other senior leaders in the smart buildings industry.

Open source is nothing new to the software industry. It's been around for over 40 years. However, for smart buildings, the history is far more recent and its uptake could change this industry as we know it.

"If you want to be successful, everything has to be open source. Otherwise you're restricting your potential." Ronald Zimmer, President & CEO of CABA.

Initiatives like Project Haystack are leading by example for open source solutions. This project received the Best Intelligent Building Technology Innovation award back in 2013 at Realcomm, the commercial real estate conference.

Project Haystack promotes a community driven approach that focuses on the development of standardized tagging conventions and taxonomies. Its goal is to provide semantic meaning to the operational data produced by equipment systems and smart devices.

Utilizing a standard, open source data tagging means that all collected data from devices will be both machine-readable and people-readable - reducing engineering hours for back-end tasks like data processing and mapping. This will make processes more streamlined, sustainable and cost-effective.

"Eliminating manual data would bring huge fiscal benefits and streamline the beneficial use of equipment data for analytics and reporting." John Petze, Executive Director of Project Haystack and COO & Co-Founder of SkyFoundry.

Improving lives for building owners, open source is highly flexible because it allows you to integrate different smart devices into your systems. This means that you can customize solutions that work best for you and shop around for the best-priced, open source hardware.

Open source also removes building owners' reliance on vendors and, with that, reduces the risk of changing vendors which can be costly if their systems aren't compatible.

While the community aspect of open source may cause cyber security concerns, you might be surprised to find out the case is the opposite.

Open source networks have higher robustness, security and auditability. That's because each piece of hardware/software is tested in multiple ways, through different systems and by a variety of member companies. With open source, you can also write your own code for a piece of hardware or a personalized solution, again strengthening devices within the network.

"Thanks to AI, the merging of OT and IT is happening at light speed." Terry Swope, President & CEO of Lynxspring.

The move to open source is inevitable because technology is advancing quicker than we can keep up.

That means physical controls equipment is now outgrowing its associated software support, meaning constant updates are required. This can't be done with closed source unless you adopt the 'rip it up and start again' mentality, accepting this will need to be done nearly every week with very costly consequences.

Switching to an open standards-based system solves this issue. It keeps everything compatible, making it easier and cheaper to stay in touch with the latest technology and updates.

"Every building is a snowflake, which means the data needs to be managed and the systems are fragmented. Haystack applies standardization and structure to data. Whether it's one building or another." Leon Werfel, Founder of BUENO.

While this all sounds wonderful, there are some hurdles the industry must overcome to reap the rewards of an open source community.

John Petze and I agreed that education is one the biggest barriers to adoption.

Companies need to understand that this is where the market is heading, appreciate the countless benefits open source offers and move away from their single use, rigid system - never mind if that's 'what they know'.

At some point companies will have to make the leap of faith to open source providers. Without this, many closed source companies will maintain their market position asking the question: "who would you call in your service agreement, should something go wrong?"

There's too much potential at stake to keep the market at standstill like this though.

"There's so much data, so much that needs to be done - drive costs down, make it easier for technology to use, adopt better energy usage, the list goes on." Rob Glance, President of BuildingFit.

There are multiple open source initiatives on the market, from data tagging standards, to hardware designs that can be downloaded and produced by a range of manufacturers. While the choice is great, some companies are waiting to see which will be the market favourite before adoption. That's because the best adopted will be the strongest.

Whatever initiative ends up on top, open source is the future of smart buildings.

Lewis Martin is a Business Consultant specialising in recruitment within the building automation industry. Experienced working on behalf of many major clients, Lewis possesses the knowledge, skills and specialist network to successfully build talented teams for his clients. Lewis is passionate about his work and finds it exciting to be working within such a booming industry.

Design Consultant's & Property Manager's View

Georgia Tech: The Kendeda Building for Innovative Design

Newcomb & Boyd CONSULTANTS AND ENGINEERS

Georgia Tech

The Kendeda Building was designed and constructed to be the most environmentally advanced education and research building constructed in the Southeast and is the latest example of the Georgia Institute of Technology's sustainability leadership and innovation. The building is expected to achieve Living Building Challenge (LBC) 3.1 certification - considered to be the world's most ambitious building performance standard.

After an extensive planning and design period, the building took less than two years to be constructed. Georgia Tech began welcoming guests in the fall of 2019. The Kendeda Building has approximately 47,000 square feet of programmable space, of which nearly 37,000 square feet is enclosed and conditioned space.

The Kendeda Fund, a private family foundation, committed $25 million in 2015 to fund 100 percent of the design and construction cost of the project. An additional $5 million was gifted for the building's programming. The partnership between The Kendeda Fund and Georgia Tech has two overarching goals. The first is to construct a certified Living Building in the Southeast, a region known for its hot, humid climate, and for harsh weather swings throughout the year. The second is to leverage The Kendeda Building as a change-agent capable of influencing thought leadership around the world. It should serve as a catalyst in the Southeast to help reshape thinking of our built environment and its interaction with our immediate surroundings.

LBC certification focuses on achieving 20 performance Imperatives grouped into seven "Petals" – Place; Water; Energy; Health and Happiness; Materials; Equity; and Beauty. The criteria encourage and enable building structures that give back more than they take from the environment. In order to meet certification standards, the project team had to meet all 20 Imperatives and, from the beginning, ensured that every single action, material, or process was able to satisfy more than one Imperative. For example, the building's solar canopy produces on-site renewable electricity to satisfy the net positive energy Imperative. In addition, it provides shade that lowers the building's heat gain in the summer and forms part of the building's rainwater catchment system, which is required for the building to satisfy its net positive water Imperative.

As another example, to satisfy requirements in the Place Petal, The Kendeda Building was built on previously developed land that is directly east of a portion of Georgia Tech's future Eco-Commons. The planned campus-wide 80-acre ring of greenspace comprising the Eco-Commons is also being constructed on previously developed land and will enhance stormwater management on campus, increase total tree canopy, and reduce the carbon footprint of campus.

The LBC is different from other green certification standards in that LBC certification can only occur after providing actual performance data from at least 12 months of continuous occupancy and operations. In other words, The Kendeda Building has to prove that it is net energy and net water positive.

Interesting technologies that are designed to help achieve net energy and net water positive include:

- Water systems that allow for The Kendeda Building to only use water collected and treated onsite for both potable and non-potable uses, as well as recycle/manage all stormwater, greywater, and sewage.
- Energy efficient materials and mechanical systems, coupled with on-site solar, that collectively are designed to allow The Kendeda Building to produce at least 105% of the project's energy needs on a net annual basis.

While most of the building's technologies have no daily impact on users, there are two technologies that warrant attention. Foam-flush, composting toilets are a key technology that, as designed, should allow the building to attain its net water positive goal. As compared to conventional toilets, these use a minuscule amount of water. The waste collects in composters in the basement where natural processes convert the blackwater into useful and nutrient-rich fertilizers that are periodically hauled offsite for beneficial reuse. While the building's water system will serve as a best-in-class example of how to promote the continued prosperity of the Atlanta region, it does require behavior change in users. For instance, occupants have had to learn how to use the foam-flush, composting toilets.

The building has an unconventional heating and cooling strategy. To minimize the size of the onsite solar system, the design-build team incorporated a high-efficiency HVAC system consisting of a dedicated outdoor air system (DOAS), a unique radiant heating and cooling system in the building floor, and over 60 fans for air circulation. Radiant heating and cooling takes time to generate the desired effect; therefore, the building's operators will have to factor the lag time into their operations procedures to ensure that occupants are comfortable. Occupants themselves will experience temperature set points that are different that conventional buildings. For example, the building will have a set point of 78 degrees in the summer, which would normally be too high in conventional buildings. However, the combined impact of the radiant effect of the slab, dehumidified ventilation air, and variable speed ceiling fans in every space will result is a space that is more comfortable than traditional setpoints.

In order to reduce the amount of solar needed to offset the energy budget, every system and component was evaluated for optimizing energy usage. The audio visual (AV) systems were designed with centralized AV-over-IP technology that utilizes more than 50% less energy than traditional switched systems. When the energy usage is reduced to these levels, even something as small as the building's coffee cart could throw off the energy budget. The coffee station was outfitted with a submeter to better understand what this energy profile looks like throughout the day and allow for better energy modeling opportunities in the future.

To manage the data from all of the systems and provide a single pane of glass for analysis and dashboarding, The Kendeda Building has a smart building platform that normalizes all of the data utilizing Haystack data tagging. This allows the analytics engine to consume data from any system and compare it against the building's energy model for understanding actual usage versus the predicted model.

This platform builds on the existing building automation and metering systems provided for the campus. However, this is also a new operational system for the campus. Navigating a new system and building the new insights into the operational model is a challenge for a campus environment that has well established operational responsibilities and structure. These are the types of challenges that The Kendeda Building project will need to overcome to achieve Living Building Challenge certification.

Using the information that the building produces will help Georgia Tech better understand building usage and how occupants affect a building's energy performance. Understanding that the data for this analysis comes from many different systems, and the need for integrated systems and systematic data modeling continues to challenge the building industry. The coordination for this level of integration begins in the design concept phase and must continue through construction.

This article first appeared at: **www.realcomm.com/news** *on March 12, 2020.*

Donny Walker, Partner, Newcomb & Boyd, leads their Intelligent Building Systems group. He has over 20 years of engineering, project management, and partner-in-charge responsibilities in communications, security and integrated building automation systems. His experience includes aviation facilities, health care buildings, judicial facilities, advanced technology developments, military installations, data centers, mixed-use developments, performing arts facilities and college campuses. With prowess designing technologically sophisticated campuses, his background encompasses over 150 projects specializing in an integrated design with network-enabled systems.

Shan Arora is the Director of The Kendeda Building for Innovative Sustainable Design at Georgia Tech. He is responsible for programmatic and operational oversight of Kendeda and coordinates efforts to ensure the operation and certification of the building under the LBC standards. Shan also champions sustainable design in the built environment throughout the Southeast.

The Evolution of Grid-Interactive Energy-Efficient Building Controls

Pacific Northwest
NATIONAL LABORATORY

BUILDING INTELLIGENCE
GROUP
LLC

"The vision of grid-interactive energy-efficient buildings will be realized through effective integration of energy savings and automated demand response technologies enabled by advanced building energy management systems with two-way grid interacting capabilities."

Over the last 40 years, we have seen several revolutionary changes in commercial building controls. This includes the shift from pneumatic to DDC, then from early DDC to the use of open protocols like BACnet and LonWorks, and finally to the use of web-based control systems. More recently the pace of change has slowed, and many of the control systems being produced today are fundamentally the same as what was available a decade ago. That is not all bad as systems are largely high quality, widely available and at reasonable cost. But there are several fundamental changes coming to controls that will drive us toward new control solutions and architectures.

Why Change?

So why do we need to change? As members of the Haystack community are well aware, there are several key drivers for improving control systems. These include:

- **Design and Installation Challenges:** There are numerous challenges with being able to properly design, specify, install, and commission control systems. These result in systems that don't provide the performance needed by owners. Programs within ASHRAE and other organizations including DOE are working to fix these challenges. The use of new technology also has the potential to allow systems to self-install and diagnose problems.
- **Lack of Documentation and Semantic Information:** The movement toward systems that are ongoing sources for data so that owners can effectively do fault detection and analytics require better semantic information. The work of the Haystack community has been key to helping to resolve this issue. Including tagging as a core element of new systems will be essential.

- **Need for Predictive Control:** Control systems today are largely "rule based" and utilize fixed algorithms to do real time control. An example of a rule is "Enable the economizer when the outdoor air temperature is below 60 degrees". For most control systems, being rule based is fine, but what it doesn't do well is to allow the control system to anticipate how the system will react. The ability to anticipate or predict is required both for highly energy efficient, passive systems, as well as for successful adoption of grid interactive buildings. For example, if you were to shift the zone setpoints for all VAV boxes, what would be the reduction in building demand? How long would it stay reduced before increasing again? The technology to make these predictions is called "Model Predictive Control" or MPC. The use of MPC works hand in hand with semantic tagging to make building control systems more intelligent and also more useful as a source not only of control but for information and optimization.

Need for Advanced Control System

Control of commercial buildings can be a challenge due to uncertainties in weather conditions, equipment performance, and usage patterns. Most modern medium to large-sized commercial buildings are equipped with Building Automation Systems (BAS) to monitor and control HVAC, lighting, and other subsystems. These control systems, if correctly specified and implemented, can provide an acceptable level of comfort and safety for the building occupants. In the recent past, energy efficiency has been a critical driver for improving building design and operation. Innovative system components coupled with optimized control methods and fault detection and diagnostics remain the state-of-the-art strategy for enhancing energy performance in commercial buildings. The software solutions must autonomously acquire and process the data from control hardware and instrumentation products in real-time and rapidly adapt to changes in sensing systems or control devices.

Beyond reducing the cumulative energy use, buildings operations can be optimized to support improved demand-side energy management necessitated by the increasing penetration of intermittent renewable energy on the electric grid. Buildings are widely recognized as potential sources for demand flexibility due to their significant contribution to the grid electricity demand and peaks. The building thermal mass allows effective shifting

and shedding of HVAC energy demand with minimal or no impact on occupants. Other building resources such as water-heating, refrigeration, lighting, and onsite generation and electrical storage can also be managed to enhance demand flexibility. For example, building energy consumption can be reduced during peak times or shifted to morning hours through space pre-cooling. Moreover, electricity demand can be coordinated with onsite battery charge/discharge strategy to smooth the power injected to the grid, maximize the use of variable renewables or dampen grid power fluctuations.

Advances in direct digital control of building systems, combined with the increased connectivity of end devices now enable greater participation in cost-effective demand-side management. Smart building resources can be aggregated to maximize cost savings for building owners/tenants and allow electricity suppliers to more easily balance supply and demand. The aggregation could be at the device level (e.g., electric water heaters) across multiple buildings or at a building or campus level where all the diverse energy resources are coordinated for demand optimization. Pilot programs have demonstrated load shedding or shifting in response to variable-rate billing. The ability to quickly change the speed of variable frequency drive-controlled building motor loads for high quality fast ancillary services, such as grid frequency regulation, has received a lot of attention recently.

Key drivers for widespread adoption of grid-interactive technologies, from a building owner perspective, are clear financial value and tenant/occupant satisfaction. While the precise integration mechanisms and incentive design differ by location and are evolving, compensation of demand flexibility typically depends on performance. Advancements in power metering (e.g., smart meter) and data analytics are being utilized to measure and verify a resource or aggregated asset energy or power delivery in response to a demand response event or dynamic pricing or control signal. Accurate determination and control of building flexibility are equally essential to ensure the occupants' needs (e.g., indoor comfort) are not compromised while providing the grid services). A new control paradigm is needed to holistically optimize the diverse and distributed building energy assets to achieve these multi-criteria objectives. For example, the need to proactively shift building loads in time and space, depending on weather and building occupancy pattern and behavior, calls for scalable control methods with prediction, optimization, and adaptation capabilities.

The vision of grid-interactive energy-efficient buildings will be realized through effective integration of energy savings and automated demand response technologies enabled by advanced building energy management systems with two-way grid interacting capabilities. The same control platform and data management infrastructure can be leveraged to deploy analytic algorithms and decision support tools for building auto-commissioning, preventive maintenance solutions, and other data-driven operations.

How Do We Get There?

In the research domain, MPC has become a dominant Artificial Intelligence (AI) based control strategy for optimizing building operations. The main benefit of MPC is its capability of thermal comfort improvement with simultaneous energy savings spanning from 15% up to 50%, as well as grid flexibility services via price-responsiveness and active demand response capabilities. The strength of MPC lies in the use of a predictive model of the building and the use of inputs such as weather forecasts to anticipate and adapt to future operational conditions.

It has been also demonstrated that advanced control strategies could be used to enhance rule-based systems either by their supervision, adaptive tuning, or automated generation of optimized rules from simulations and operational data. Hence, leveraging the existing controls infrastructure in the buildings, decreasing the installation costs of these AI-based solutions.

There are several options for the integration of MPC with existing control strategies and BAS infrastructure. The most complex solution is a complete takeover of the control points by centralized MPC running-real time locally in the building's BAS system. This solution brings the promise of the highest performance gains, but comes with a cost of increased installation costs, which might be more appropriate for new large-scale buildings. The most common solution is to employ MPC as a so-called "reference governor" optimizing setpoints for the lower-level control loops in an automated way. The third option is to use the prediction capabilities of advanced controls as a recommender system for the suggestions of setpoint modulations, or tuning of the rule-based controllers with human operators in the loop. The advantage of the last two solutions is that they can be installed not only locally, but they can also run in the cloud, or be delivered as control as a service via a web-based interface.

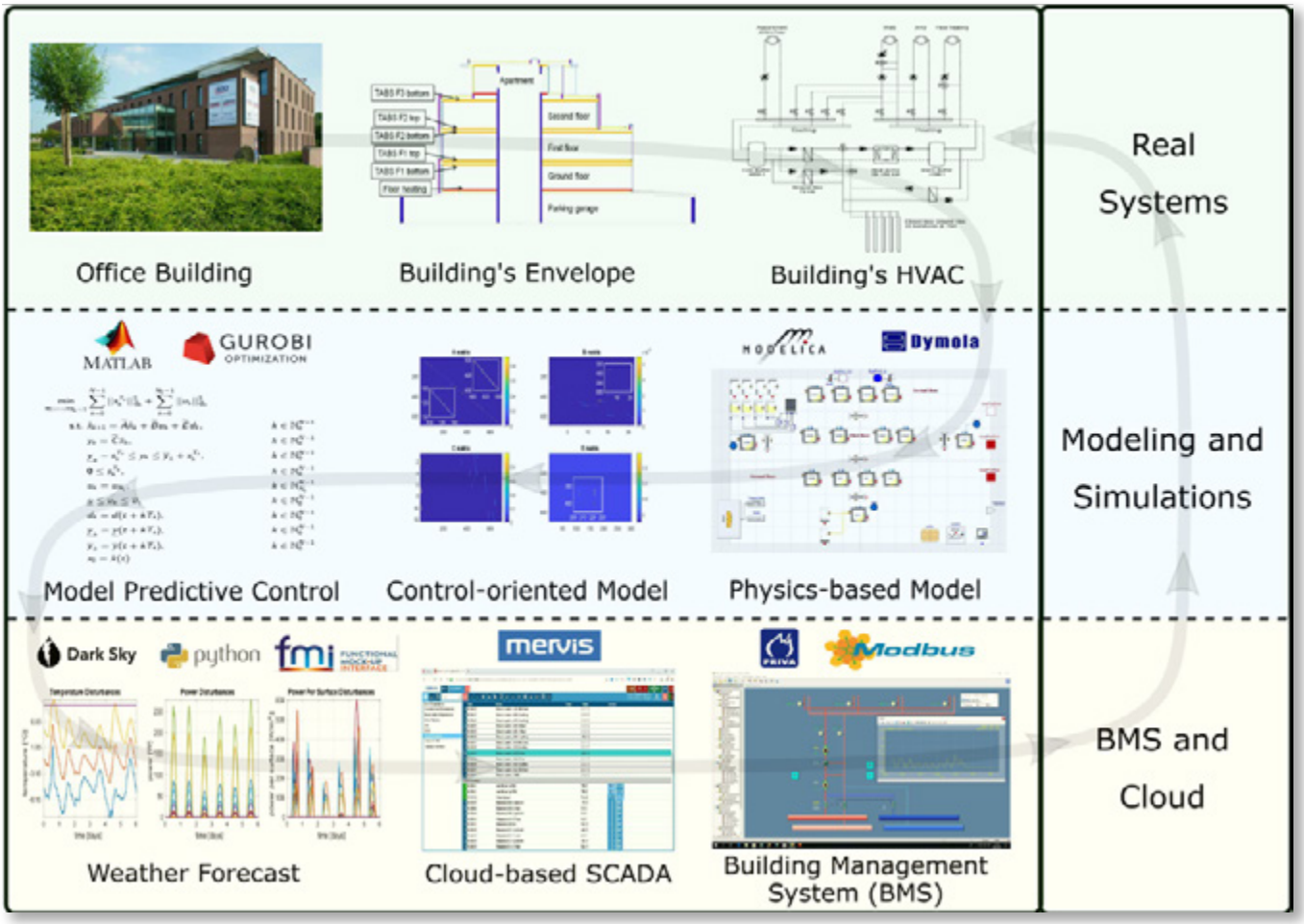

Figure 1. Approaches for Application of MPC.

However, the transfer of these AI-based solutions to the building market has shown to be problematic. One of the challenges is the slow adoption of standardized tagging conventions such as Haystack in the communication interfaces of the BAS systems. Another difficulty stems from the fact that BAS installers and commissioning engineers do not have experience with and education in these advanced control methods and tools to allow swift and cheap utilization of their potential. Moreover, every building is a unique system that requires tailored modeling and control design, hence imposing increased engineering time and associated installation cost.

There are several steps that need to be done to overcome these barriers. First, there is a need for standardized semantic tagging and taxonomy of data points in modern BAS. The standardization will allow the design of automated interfaces for BAS with advanced control algorithms based on MPC and machine learning. Collective efforts are undertaken in the research community to bridge this gap by developing standardized documentation templates for increased transparency and compatibility between building modelers, control designers, and commissioning engineers.

Additional developments are being made in easing up the expert requirements for the design and tuning of advanced control methods. These efforts are concentrated on several key aspects of MPC, in particular, automated building modeling, automated control policy design and tuning, and automated code generation for deployment in modern buildings or web-applications.

The modeling efforts are centered around two threads of research. The first one is the development of component-based libraries for modular construction of building models by experts compatible with building information modeling (BIM) standards. The other one is the automated construction of predictive models directly from the measurement data. Both approaches have their own advantages, challenges, and proponents, the first is being considered as a promising solution for newly constructed

large-scale buildings, while the latter one brings promise for modeling of already existing building stock with a potentially large variance in the building types and operational conditions.

To address the last challenge, the researchers are developing software tools for flexible, expert-free, and automated design and deployment of advanced controllers for complex application domains such as buildings. These challenging requirements stimulate new research avenues on combining modern machine learning methods with classical model-based design principles, creating the next generation of AI-based control methods and tools tailored to the practical needs of the industry.

Conclusion

The coming changes to allow buildings to provide both improved control and support for grid optimization require a series of new technologies including broad use of semantic tagging and implementation of predictive control. These solutions can be provided both as part of new systems, and potentially added to existing building controls.

Veronica Adetola is a Control Systems Scientist and Team Lead in the optimization and control group at PNNL. She has more than ten years of experience in developing physics-based and data-driven advanced control solutions for energy-efficient systems and grid-interactive buildings.

Ján Drgona is a Data Scientist at PNNL with expertise in control theory, machine learning, and backgrounds in chemical and mechanical engineering. His current research focus falls in the intersection of model-based optimal control and physics-based deep learning methods with applications in the energy sector, mainly in the context of building modeling and control.

Draguna Vrabie is a Chief Scientist in the Data Sciences Group at PNNL. Her work focuses on integration of machine learning and predictive control in support of the Department of Energy.

Paul Ehrlich, P.E., is the founder and president of Building Intelligence Group LLC. His work is focused on building controls, integration, and improving efficiency of commercial buildings.

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The Update on Haystack 4

Haystack 4

Let's recap by starting with a review of Haystack 4 – what it is and how it advances the state of the art in applying metadata to equipment system and sensor data. Haystack 4 is a development effort to redesign how Haystack tags are formally defined. How you use tags to model building, equipment systems, and sensors remains fundamentally the same as today under Haystack 3 which is widely deployed – our best information shows Haystack being used in over 30,000 facilities of widely varying types.

Haystack 4 is focused on the definition of tags, their inter-relationships and the tools that can be used to work with metadata. Haystack 4 introduces several new features towards this goal.

The foundational feature of Haystack 4 is a new mechanism to define tags we call **defs**. Defs are themselves modeled as a Dict (dictionary) of name/value pairs. This makes defs themselves normal Haystack data which can be encoded and exchanged using Haystack data formats and protocols.

Haystack 4 also introduced a new concept called **conjuncts** used to easily coin new terms from combinations of tags. Conjuncts are like compound words; they are created by conjoining two or more tags together with a dash. For example, chilled-water is the conjunct created by combining the chilled and water tags together. Conjuncts simplify and streamline the application of tags to real world systems.

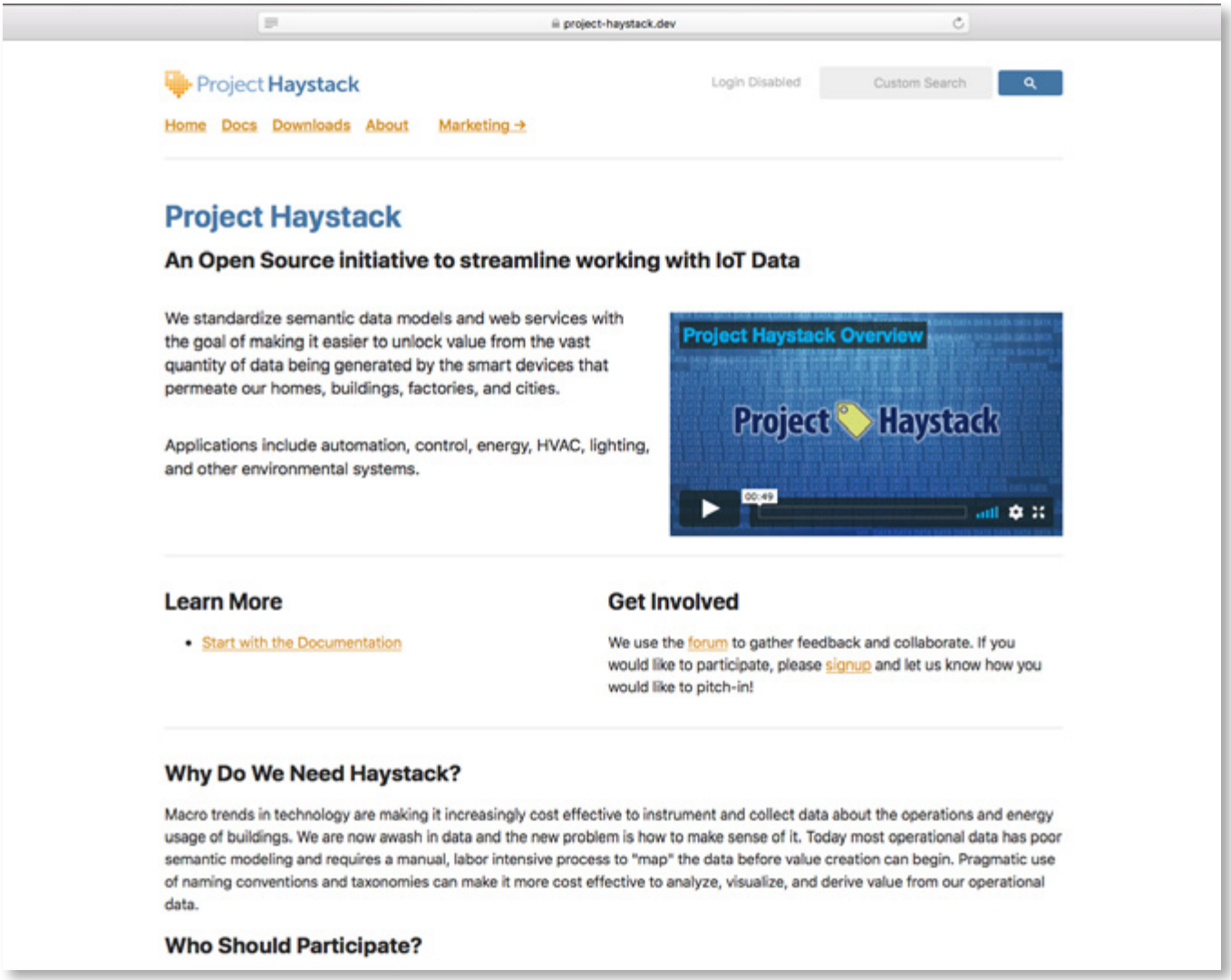
Another major advance in Haystack 4 is that it enables us to organize all of the tags created by the community over the last 8+ years into a tree structure called a taxonomy. The taxonomy organizes tags from general concepts to more specific concepts using the notion of *supertypes* and *subtypes*. For example, we now specify that CRAC units (computer room A/C) are a specialized *subtype* of the more general concept of FCUs (Fan Coil Units). These taxonomy relationships unlock powerful inference techniques we can now use with Haystack data models.

We have also redesigned our relationships work to build a more complete **ontology**. Ontology captures the concept of relationships between entities. Haystack 4 enables the definition of relationships that capture deeper semantics to model concepts like "containment" and the flows of air, fluids, and electricity between system entities.

A key requirement for Haystack 4 is to make it easy for vendors to create point-and-click tools for system integrators to build their data models. This is where the key challenge lies for the industry as it moves to adopting data semantics across equipment, devices and systems. We can't expect everyone in the industry to be data science PhDs. An important new design concept to enable vendor tools is the introduction of **prototypes**. Prototypes are a mechanism to create equipment and point "templates". For example, Haystack 4 now defines the types of ducts an AHU might contain or which types of sub-equipment and points a duct might contain. Prototypes are being used to power new vendor tools so that integrators can build compliant data models through the use of simple point-and-click menus.

We have also formalized RDF (Resource Description Framework) as a first-class data format for Haystack. This means that you can now export your data models to common RDF formats including Turtle or JSON-LD. RDF is an important interoperability format for integrating Haystack data into other standards and ontologies.

The Haystack 4 design process has been running for two and a half years under Haystack WG 551. This process included collaboration with other standards groups working on the metadata challenge. We worked to incorporate the best ideas from all contributors to make Haystack 4 a true superset of the work being done



by industry. One year ago, we began the public review for Haystack 4. During the review period, we have been running a separate website www.project-haystack.dev with all the new documentation. This website is updated on a periodic basis as new content is developed by the community. Sometime this year, we will transition the primary website to Haystack 4. Those interested in this important work should monitor the Project-Haystack.org forum for updates to Haystack 4 where we post build notes whenever a new release is completed. Since the Fall issue of Haystack Connections, we have added several new chapters to the documentation and completed porting most of the Haystack 3 tags.

Finally, I would like to offer thanks to all that have participated in the Haystack 4 effort, and invite people to get involved to support the effort.

Brian Frank is President and Co-Founder of SkyFoundry, a software company specializing in storage, analysis, and visualization of data from the IoT. He also serves as the technical lead for Project Haystack, working with the Project Haystack community to curate domain models and technical specifications.

Using Data to Increase Velocity as the World Slows Down

"A few recent project examples highlight how our nearly decade-long investment in resilient IT infrastructure, coupled with well-organized data analytics enabled by Project Haystack, are helping our business and our clients increase their velocity amidst the lock-downs."

Economic downturns always create winners and losers. This is often associated in our modern financial history with the "**have's**" and the "**have-not's**". The current and emerging COVID-19 induced financial crisis is unprecedented in many ways, but we are likely to see this same "**have's**" and the "**have-not's**" story play out, perhaps with a new twist.

The unprecedented "lock-downs" and stay-at-home orders across the U.S. and the world are exposing a new category of winners and losers – the data "**have's**" and the data "**have-not's**". Many of those whose businesses are built on a foundation of reliable and meaningful data continue to thrive and even accelerate while much of the world shuts down. They have put in place the infrastructure, protocols, and analytics to continue to reach their customers, add value, and deliver goods and services.

A couple high-profile examples of note – Amazon's ability to prioritize critical needs across its delivery platforms to keep essential supplies in people's homes, and Tesla's ability to leverage strong data-driven customer connections to still sell cars and conduct contactless deliveries (while they still had cars to deliver).

This is playing out in the real estate sector as well. A ***few recent project examples*** highlight how our nearly decade-long investment in resilient IT infrastructure, coupled with well-organized data analytics enabled by Project Haystack, are helping our business and our clients increase their velocity amidst the lock-downs.

New Coronavirus lab performance commissioning at a major university

As the severity of the COVID-19 crisis began to sink in around the nation, corporations, non-profits, and universities (among others) began to look at how they could provide the supplies, medicines, and research needed to save lives and ultimately re-open our economy. Responding to this urgent need, one of our university clients quickly mobilized to open multiple critical research labs with the ventilation, pressurization, and temperature

controls needed to conduct fundamental SARS-CoV-2 (the novel coronavirus that causes COVID-19) research. However, the campus was on an effective lockdown and we could not get into the spaces to perform typical commissioning and performance verification. But thanks to a robust existing IT infrastructure, and the properly organized and tagged data analytics database in SkySpark® by SkyFoundry, our team was able to immediately jump into the data, analyzing system and equipment performance related to pressurization, ventilation, and temperature controls. By going deep with our data integration to the devices at the edge, the extent of the data allowed us to cross-validate the data itself, through multi-sensor and system response analysis. In the end, we were able to complete a full cycle of commissioning in less than seven days, coordinating issue resolution with the teams who could be on-site, helping get this important research moving quickly and safely.

The unprecedented "lock-downs" and stay-at-home orders across the U.S. and the world are exposing a new category of winners and losers – the data "have's" and the data "have-not's".

Equipment start-up validation in a new construction project

Throughout the COVID-19 crisis, most construction sites have remained open while adopting measures to try to limit the infection risk on-site. However, due to company policies, not everyone has been allowed or been able to be on-site. But the construction process must go on and schedules need to be maintained. Equipment needs to be started-up and that process needs to be validated. In the past, this has been primarily a manual process in the field

involving checklists. But thanks to the power of semantic tagging and remote IT infrastructure connections, we can use data to more effectively validate equipment start-ups, increasing velocity to identify issues such as bad sensors, stuck dampers, etc., as soon as the equipment is powered up, enabling us to get immediate resolutions. This approach enables our project to move faster and more nimbly during a time of increased scheduling unknowns and risks.

Energy efficiency master plan implementation across a large healthcare system

We have been working with one of our healthcare clients for more than a year to develop a multi-year energy master plan aimed at reducing their operating costs by more than $20M by 2030. The first projects to begin implementation started in March 2020, right as the coronavirus pandemic started to overwhelm hospital operators and shut down life as we know it. But again, strong IT know-how combined with data analytics enabled by Project Haystack have allowed us not only to continue with the first efficiency projects, but also to accelerate the program across an additional dozen sites. This will ensure we can deliver more energy cost savings even faster, helping our client be better prepared for the budget unknowns that lie ahead.

As we all take stock of where we are and where we want to be on the other side of this pandemic, ask yourself – are you a data "**have**" or a data "**have-not**"?

Instead of slowing down, have you been able to leverage data to increase your velocity? .

Jim Meacham is a founding principal of Altura Associates, where he is responsible for managing a team which provides services for some of the world's most energy efficient real estate projects. As a California registered mechanical engineer, Jim has managed scores of deep energy retrofit, commissioning, and data analytics projects.

Easy Tag-Based Graphics

TRIDIUM

"If I was a kid starting now, I'd be going business-to-business with a service like labeling for AI."

Mark Cuban wouldn't be so successful at the businesses of sports, tech and TV if he didn't know how to define a customer pain point quickly. The snippet of conversation captured above was just one of many entrepreneurial ideas offered by the Internet pioneer and investor during a recent interview with tech journalist Kara Swisher. The phrase about labeling (MIN: 39) was just a note in a bigger description of how apps that leverage ambient computing, voice-based computing and augmented reality will be core to the technology response to COVID-19. But, with that phrase, he identified the gap that needs to be filled first. He drew the short line between emerging UI technologies and the need to apply semantic tags that are both machine-readable and human-understandable to a universe of physical and digital things.

Within the Niagara Community, we have long recognized the tagging challenge and its relationship to better UI. With each new release, Tridium has evolved tagging support within Niagara Framework® to enable easier, more automated and more flexible ways to apply and use semantic tags. Now in Niagara 4.9, not only can you leverage tags to optimize your facility's operation, but you can also use tags as the basis for your systems' graphical visualizations. This article will present a practical application of how to incorporate tags into Niagara station visualizations, while saving valuable time in the process.

Tag Based PX Bindings

Tagging has emerged as an extremely vital component for building automation due to its utility in enhancing facility systems monitoring and the analysis of large quantities of equipment data. Even more, due to the requirements of Division 25 design specifications and the recently proposed ASHARE Standard 223.P, the tagging of facility systems data has been increasingly essential for new and existing building controls projects.

As of Release 4.6, Niagara Framework has supported mobile-friendly Px graphics to create a responsive UI page that flexes to various screen sizes. With Release 4.9, Tridium developers have added tag-based PX bindings. Now, rather than using point naming conventions to resolve and render associated graphical components when designing a customized UI, you can apply and then leverage tagging. Tags for tag-based bindings can be pulled from multiple custom tag dictionaries, as well as the Project Haystack standard. Niagara Framework is tag-agnostic to provide the utmost flexibility when applying tags to Niagara stations and building systems. The result is visualizations that are reusable and manufacturer- and equipment-agnostic. Tag-based bindings streamline on-site efficiency, save time and provide more flexibility when deploying graphic templates on new and existing Niagara stations.

How it Works

Tag-based Px bindings utilize the Niagara Entity Query Language, or NEQL, within a standard query, or ORD, to resolve graphical components. NEQL-based ORDs are resolved on the station-side instead of on the client-side (or browser). They are not executed across the entire station, but rather scoped to descendants of, or entities related-to, the component on which the graphic view is placed. Once the graphic is loaded, the underlying NEQL queries are not resolved again to ensure consistent UI responsiveness.

Before you can implement tag-based Px bindings in a station, a tag dictionary service needs to be installed in the station services container, along with a tag dictionary. To create the example VAV graphic shown in Figure 1, the Niagara and Haystack tag dictionaries, as well as a custom tag dictionary were installed. A second prerequisite to a tag-based Px binding is tagging station components and defining all necessary entity relationships. Here, the custom tag dictionary used had specific tag rules which automatically applied Haystack tags to the station components based on defined conditions.

Creating a tag-based Px binding is a matter of choosing from a cascade of options available from the Px Editor:

- **Neqlize Ords** automatically converts direct or relative ORDs to a NEQL based ORD and will save considerable time when incorporating tags in your Niagara visualizations (Figure 2).
- **Neqlize Options** launches a dialogue for specifying the conversion mode. From this menu, you can also exclude specified relations and tags that were utilized for the Neqlize Ords feature (Figure 3).

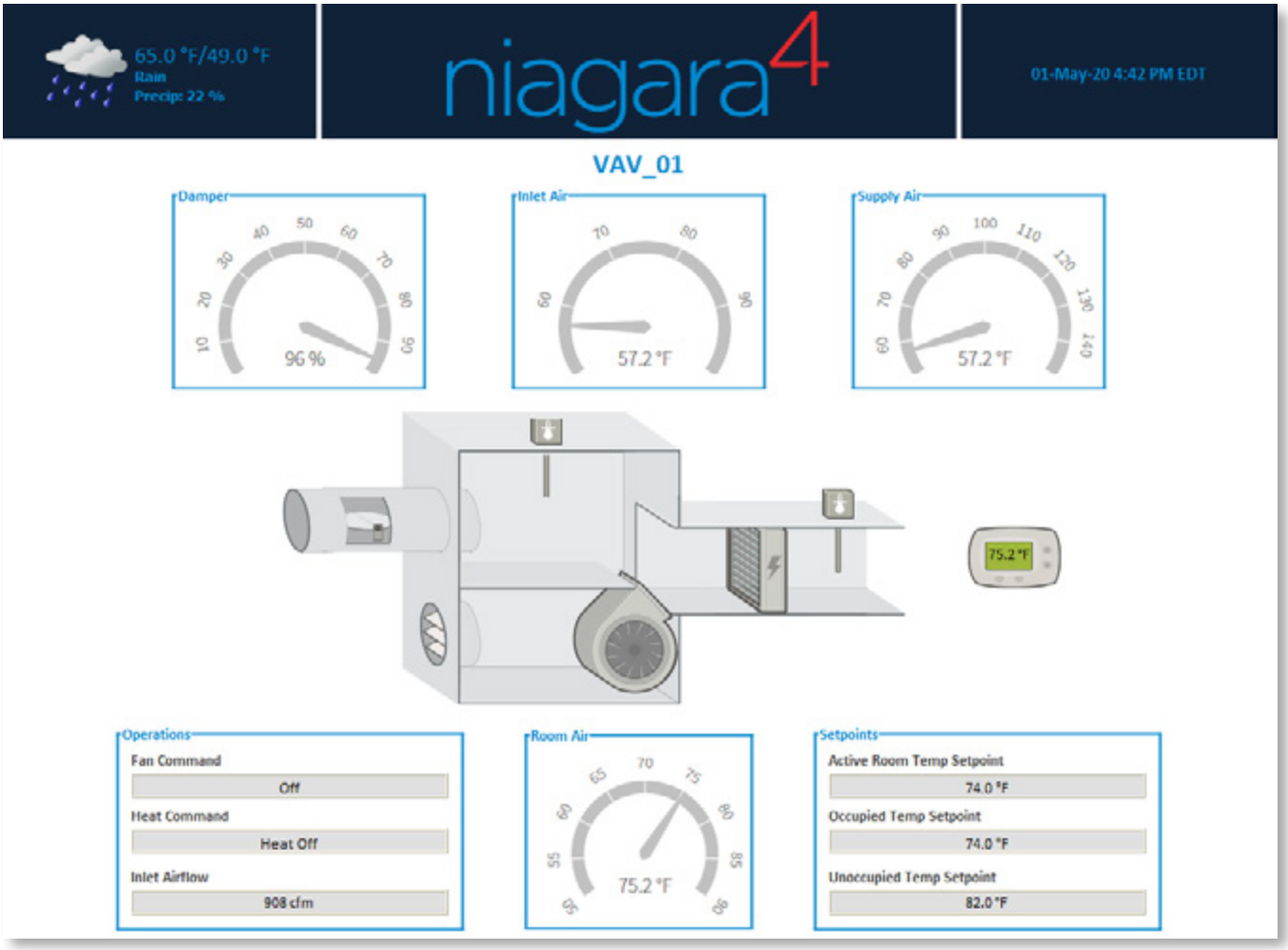


Figure 1. Example AHU VAV Graphic.

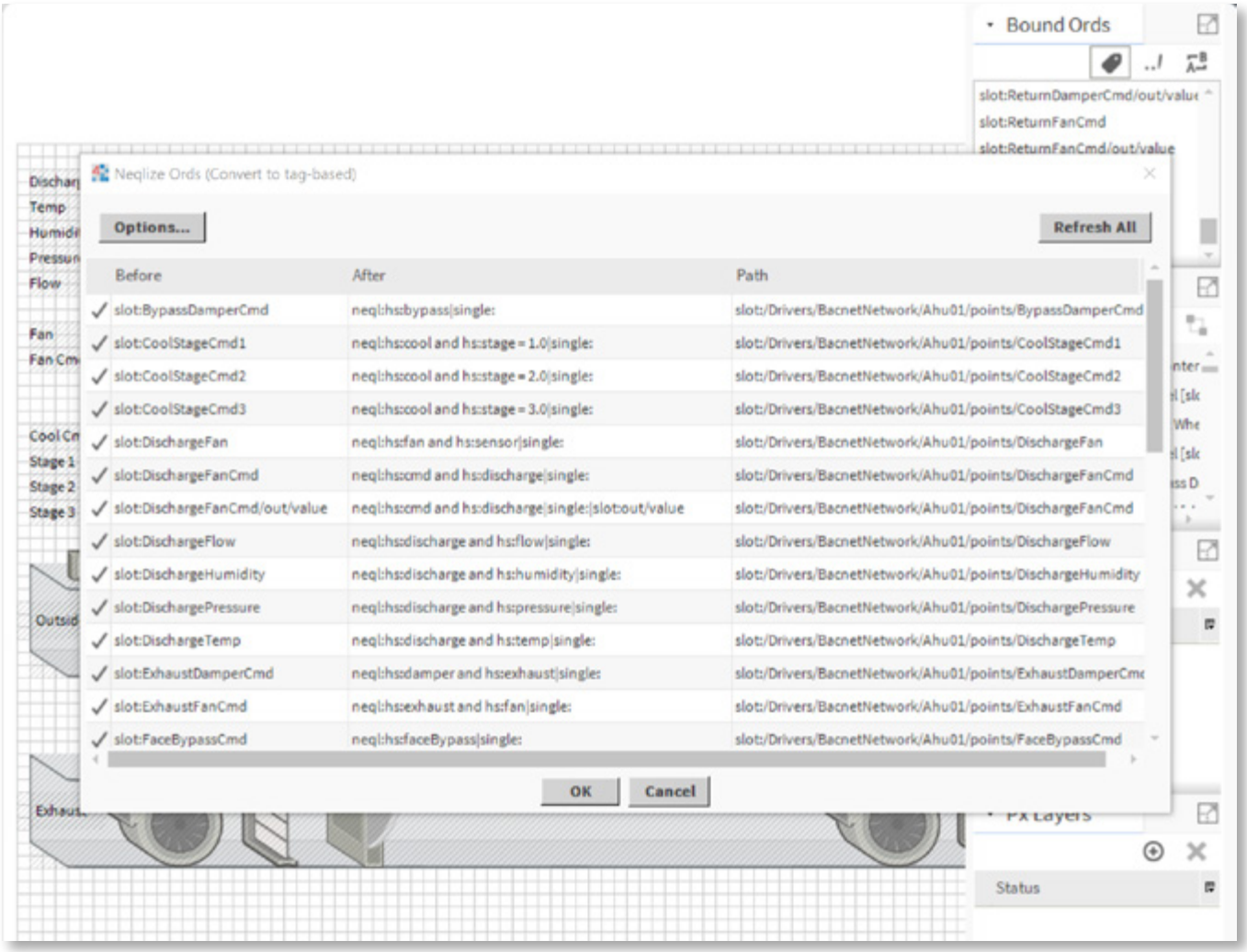


Figure 2. Neqlize Ords Dialogue.

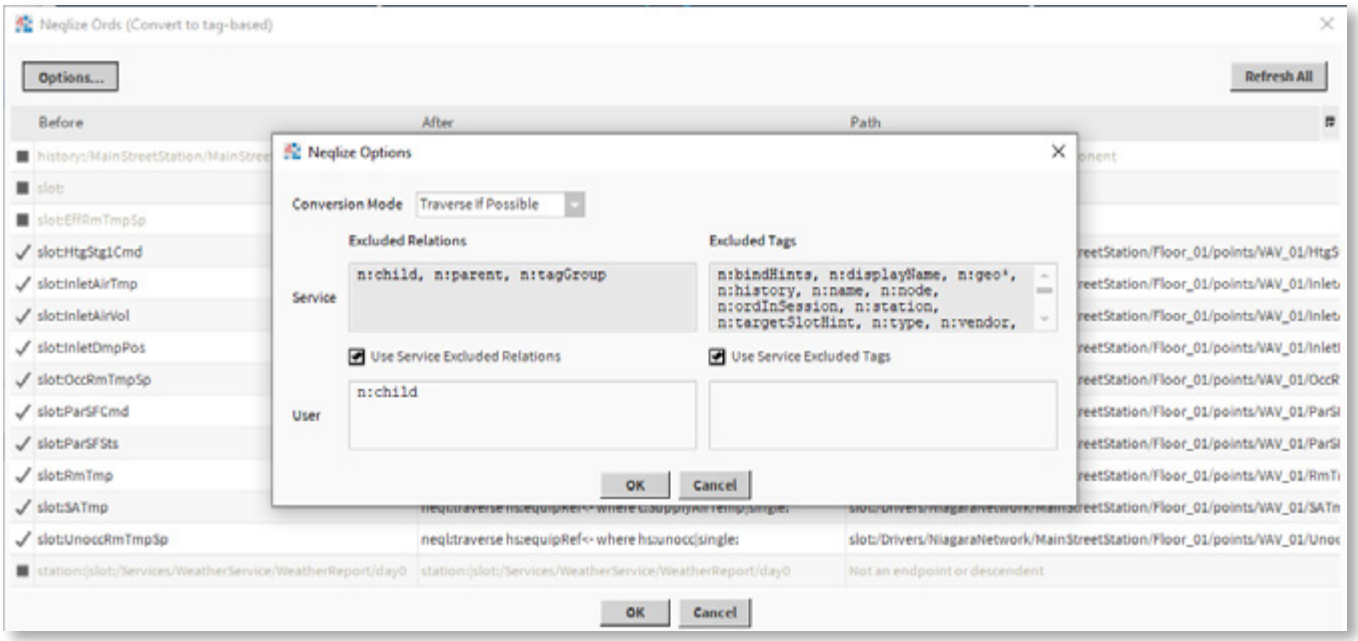


Figure 3. Neqlize Options Dialogue.

- **Neqlize Options – Conversion Mode** prompts you to select between Traverse If Possible, Traverse Only or Select Only. A Select statement is a NEQL statement for selecting a collection of Entities, whereas a Traverse statement is a NEQL statement for selecting a collection of Entities by traversing a relation from either end of the relation. The default setting is "Traverse if Possible", which ensures both statements will be utilized upon its conversion.
- **Neqlize Options – Excluded Tags and Relations:** You may want to exclude specific tags and relations from the conversion process. In this example, certain tags and relations that are commonly used within a Niagara station have been excluded. Including an n:child relationship, for example, would yield multiple results during the conversion process, thereby needlessly complicating or invalidating the final NEQL ORD. So this tag has been excluded.

Practical Application

How would tag-based bindings be of practical use in some common building control situations? Consider the case of an air handling unit, or AHU, that is served by two different field controllers from different OEMs. Ideally, you would want to redeploy a preexisting AHU graphic for this unit without having to reconfigure its ORDs.

Prior to Niagara 4.9 and tag-based Px Bindings, you would have had to edit each ORD according to the component architecture of the original graphic view. This exercise can take up valuable time when trying to get the job done right. Even worse, if the component names are non-intuitive or even remotely complicated, it can be an exhaustive effort to ensure each ORD matches the component architecture such that the graphic points resolve correctly. Additionally, you would be unable to utilize a relativized graphic for this scenario. The only option would be to manually edit the ORDs. As of Niagara 4.9 and tag-based bindings, the process is simplified to NEQL-izing the graphic ORDs and defining each as a view on a component.

For the AHU under discussion, you would simply need to convert the ORDs within the existing AHU graphic using **Neqlize Ords**. Then, all the ORDs can be converted to a NEQL-based ORD. The next step would be to take the graphic and define it as a view on a device folder named AHU02. It is now this easy to configure graphics to point multiple field controllers.

Summary

Tag-based Px Binding is another step toward easier customization of UI graphics for Niagara users, and thus better UI experiences for end-customers. This streamlined way to convert-slot path ORDs to tag-based NEQL ORDs improves the reusability of a Px view and saves time in the process. Tridium is striving to make effective tagging of assets and data easier with each release of Niagara. You can find additional information on tagging, relations and NEQL by searching in the Resource Center at www.niagara-community.com.

Stephen Holicky is a Niagara Product Manager with Tridium, Inc. His experience spans building systems engineering, smart building master planning/design, specification development, commissioning and energy auditing.

Contributed Article

The Importance of Edge-to-Cloud Technology for the Building Industry

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Before the Internet, when Building Management Systems (BMS) first came on the scene, the only way to configure and manage your BAS was to be physically in front of it. When the modem was invented, remote connectivity was achieved using dial-up modems via point to point communication. As the Internet evolved, so did connectivity, allowing us to connect our BMS through ADSL modems. Finally, Broadband connection became an even better solution, as it offered higher data transmission rates and always-on connection.

This 'always on' connection, however, was not secure. The first Virtual Private Network (VPN) was created in 1999, enabling secure remote connectivity. VPNs allow secure connections through the use of firewalls on the host end and a software client on the remote end to create secure "tunnels" through which encrypted data can pass without the threat of being viewed or altered. This point-to-point connection, however, has been complicated and costly to implement. More recently "off-the-shelf" VPN solutions have been developed in an attempt to address this issue, but even these have a cost and the installation of a special hardware box is required.

Even the latest technologies through cellular APN (Access Point Name) using 4G in a private network is not a simple solution. Like a VPN, you need technical expertise in order to set-up the mobile phones, SIM Cards, and required hardware. A better alternative would be to connect to the BMS through the site's internet connection. The problem is that in order to remotely access the devices, additional ports in the company's firewall need to be opened and set-up by an IT professional.

These challenges are compounded by the proliferation of new internet connected devices being used in our smart buildings. According to Gartner, **building automation is predicted to have the largest annual growth rate in 2020** in IoT devices, making the need for easy and secure access to building data more significant than ever. This need for connectivity impacts multiple stakeholders in the building industry.

Current problems in the industry

For system integrators and installers, having to make unnecessary site visits for small adjustments is a strain on resources. While troubleshooting remotely is possible, it requires coordination with the IT department or the cost to implement an off-the-shelf VPN solution.

For facility managers who are on-site, making remote access VPN requests to IT systems managers can be a challenge. They often have to mediate the need for accessibility with cybersecurity requirements, which slows down projects and creates more work for all involved.

For end-users, creating and maintaining user privileges for the various stakeholders who need access to their building is challenging. They often face out-dated BAS systems that require local user access for database management, which, as the number of sites and systems grows, compounds the problem.

For OEMs that provide hardware and firmware for building HVAC systems, the issue is that once an item of equipment is installed, they typically never see it again unless there's a problem with it. They have no visibility regarding the performance or maintenance data, which would give them valuable insights to help them improve their products. Many manufacturers have begun to address this by offering direct connection options, but the cost and complexity has constrained their ability to roll-out such propositions.

How Edge-to-Cloud solves these problems

The way the IoT market is solving these problems is by the introduction of highly secure certificate authenticated web services connections, which push the data from edge devices on the site to cloud servers. This eliminates the need to open firewall ports and the complexities of VPN. At J2 Innovations, we call this Edge2Cloud. We have chosen to implement this using the Haystack protocol over MQTT for edge-to-cloud communications.

For the system integrator and installer, edge-to-cloud technology greatly simplifies the deployment of remote access provision, so can significantly reduce the need for on-site visits and improve service level and response times. Having the ability to remotely analyse the data can also provide insights to enable proactive identification of issues. In the large scale context of big data, this can be daunting, but through the use of Haystack tags and queries, it's a more manageable task.

For the facility manager, edge-to-cloud provides secure communications through the use of IoT web services technology, thus eliminating the need for coordinating VPN setup. This gives a facility manager the ability to have easy access to the BAS (as if they were on-site) so they can react faster to incident calls from tenants.

For the end-user, edge-to-cloud makes it easy to add and manage users by means of an easy to use web portal, providing comprehensive user and device management across multiple sites. Building portfolio operators can easily manage permissions for different users and groups in a very granular way; granting the appropriate level of access for the various staff and service providers who need the remote access.

For OEMs, edge-to-cloud offers a new opportunity to expand their business and enhance their products. By connecting to the equipment they've supplied on site, they will have the ability to monitor performance over time, generating huge amounts of aggregated data across multiple customers. With this data, analysis of how their equipment performs under various conditions can help identify optimization opportunities and, potentially, make software updates automatically that will enhance future performance.

Over the years, connecting to devices has evolved dramatically - from the early days of dial-up modems to the age of the Internet. The challenges of getting remote connectivity and managing devices and users remotely has evolved as well. Edge-to-cloud offers a solution to all of the challenges various stakeholders face when attempting to remotely access and manage their BAS and IoT devices. This opens up lots of opportunities with big data, and a few new challenges which Project Haystack is well suited to solve!

Chris Irwin joined J2 Innovations to develop sales in Europe, the Middle East and Asia. Chris comes with a wealth of experience in the building automation market and with skills in strategic business development and strategic marketing..

New Release

FROST & SULLIVAN
Smart Building Integration
2020 Award
VALUE LEADERSHIP

Get Ready for What's Next in niagara4

Niagara Framework® has emerged as the single platform that master integrators of smart building systems prefer for harmonizing the controls systems and digital data sources that contribute to achieving performance goals and occupant comfort. This year, Tridium is pleased to have received the Frost & Sullivan Customer Value Leadership Award for Smart Building Integration. As F&S analysts observe, Niagara Framework's widespread adoption has been pushed by the combined trends of Internet of Things (IoT) transformation, the rising adoption of building automation technology, developments in communication technologies, massive growth in building automation-centric wireless protocols, and breakthrough smart-city infrastructure strategies. To continue to earn the support of the large Niagara Community of partners and customers, Tridium keeps evolving Niagara in terms of visualization, rapid deployment, edge control, physical and cyber security, connectivity, certification and IT compliance. Check out 4.9 for exciting new features in each category.

Visualization UI/UX

Build UI faster with Tag-Based Graphics. Also, enhanced HTML5 visualization for cameras

Deployment & Move to Edge

ACE Engine for real-time control now available for Niagara portable devices. ACE also works with IO-R

Security & Cyber Defense

Single Sign-On now supported without need for separate IdP

Connectivity & Move to Cloud

MQTT Authentication Plus, easily reformat data destined for the cloud with the JSON Toolkit

Certification & Compliance

Expanded Support for Databases, OS's and Browsers

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Bring Standardized Data Modeling Upfront in Project Commissioning

SIEMENS
Ingenuity for life

Utilizing standardized tags on building systems and devices during initial project design, system specification, programming or commissioning provides a ripple effect of benefits for the building and each stakeholder involved to enhance system interoperability and data optimization.

As reliance on the Cloud and IoT technology adoption increasingly becomes more mainstream, new opportunities exist to implement standardized tagging principles upfront during project commissioning. Such opportunities provide greater benefits for numerous stakeholders involved in greenfield and brownfield projects—beyond systems integrators and commissioning providers.

Adopting this mindset can better ensure smarter building processes and a streamlined plan for future expansion and growth. This article will address some of the challenges or risks various stakeholders face, which can occur short- and long-term as a result of disparate tagging and data modeling actions. More importantly, it will dive into the advantages gained when standardized point tagging becomes a part of the planning, specifying and design phases of the overall construction process.

Why Tag Standardized Points Upfront?

From initial actions such as planning, specifying and design, to material ordering, to system implementation and commissioning—there are various steps in a multi-phase construction project timeline that are relevant before a building is open for business. Now, consider that in that project timeline, there are multiple decision makers involved—from the building owner to the design team (which could comprise the consulting specifying engineer, project architect and designer), to the facility manager, systems integrator, general contractor and more.

Utilizing standardized tags on building systems and devices during initial project design, system specification, programming or commissioning provides a ripple effect of benefits for the building and each stakeholder involved to enhance system interoperability and data optimization. Because data affects every aspect of a building and its occupants, applying standardized tags to data points and devices is critical to allow for predictive building maintenance and operations.

Standardized point tagging also complements current digitalization practices to create smarter buildings. This is especially relevant as not all building owners or operators manage one building and could benefit from standardized tagging implementation across multiple sites to increase future serviceability. The potential results? Decreased construction timelines, reduced risk and increased profit margin as relevant for the system specification, programming and commissioning phases of a project.

It's evident that devices, equipment and systems—such as Building Automation Systems (BAS)—become smarter to provide actionable data analytics that can be applied in Cloud applications for such processes as data visualization dashboards or reporting purposes. In fact, the steady

growth of connected IoT devices is estimated to reach 41.6 billion and generate 79.4 zettabytes (ZB) of data in 2025.[1] This means more data flowing into the Cloud that, if not defined universally, can easily get lost in the 'Cloud clutter.' Consider that one system (depending on the size of the building) can have hundreds of thousands of points. Data on those points would also serve little purpose. To make it valuable, actionable data must be tagged intelligently. End users and stakeholders that understand properly organized data can then begin to formulize it and analyze the interconnection of how it all fits together.

Consider a different scenario, such as the industrial aspects of the global oil and gas industry. When mixed data—such as that from wells, seismic data, transportation data or production data from drills—is not tagged universally, it can provide costly complexities across capital projects. In the case of a company operating several thousand gas wells, when it came time to upgrade their supervisory control and data acquisition system (based on a proprietary data-communications format), the new vendor hired had to recreate the data-communications format, thus costing the company $180,000.[2] Standardizing data tagging would eliminate scenarios such as this.

Stakeholder Gains From Standardized Point Tagging

By factoring in a flexible methodology around standardized point tagging upfront, data has more meaning both on- and off-premise across various systems, multi-discipline sites and organizational processes.

Building Owners: Faced with managing stakeholder expectations, multi-site campuses and pressure to differentiate in a competitive market, upfront, streamlined tagging processes are a welcomed opportunity. Risk mitigation is top of mind when trying to control construction timelines, budget and errors.

By using standardized point tagging in the construction process, building owners can benefit from:

- Enhanced interoperability between systems
- Simplified future integration of systems as needed to support the life of the building and its occupants
- Faster project timelines resulting in on-budget costs
- Cost containment over time
- Reduced risk when factoring in standardized data points upfront
- Easier, achievable optimal performance
- Efficient systems integration that can leverage digital twin capabilities more easily as a result of universal metadata use
- Longer-term success with actionable data and analytics tools

Systems Integrators: Often there are multiple system integrators on one project site. If integrators are individually tagging or building points in a siloed process, the result could be many disparate systems that would require further integration efforts or cause difficulties when servicing the existing system. It would also make it more difficult to mine the data correctly and efficiently, resulting in cost and operational issues.

By using standardized point tagging in the system integration process, integrators can benefit from:

- Improved access to building data
- Easier processes when servicing a site long-term
- Simpler commissioning of increasingly complex and smarter systems
- Reduced time spent on the job
- Streamlined access to building data during operations
- Provided ongoing value to their clients (i.e., building owners)

Property Managers: A property management company with multiple buildings may seek consistency and standardization in building management as well. If data points have been tagged inconsistently, confusion and time lost will be the negative result.

Standardized point tagging can help property managers:

- Streamline staff workloads
- Maintain operational efficiency while maintaining low OPEX costs
- Easily duplicate and deploy standardized tags for multiple campuses
- Quickly identify equipment or devices that need to be decommissioned and replaced
- Employ more predictive maintenance procedures (i.e., less "run-until-it-breaks" methodologies)

Engineers and Contractors: The E&C industry depends on new technologies to address increasingly complex and expensive construction projects. New applications and tools are emerging, many coming at a significant cost to companies that wish to employ them.[3] When engineers and contractors are brought in to work on an existing system, hours are lost and costs are incurred due to the lack of standardized tagging.

Consider a building which has a rooftop unit (RTU) that needs to be serviced. In some cases, Fault Detection and Diagnostics (FDD) processes will be used, during which algorithms will look at the various data points and alert the contractor that a specific part of the RTU (e.g., the compressor or damper) is showing signs of wear and tear. The contractor can then proactively schedule a service call for the customer instead of the customer waiting for the part to fail and then calling for emergency service.

By utilizing standardized point tagging, engineers and contractors are able to provide all the proper device and system names and information necessary at the beginning of a project for accurate design and spec purposes. Doing so can result in a cascade of benefits that affect all project phases.

Standardized Data Tagging Equals All-Around 'Win-Win'

Positive changes are taking place around standardizing data point tagging, giving increased meaning and context to data. This allows for communication among devices and point characteristics such as trending and alarms to exist in a common ecosystem.

When all components of a building and its systems utilize Project Haystack tagging standards, streamlined processes make it easier to interpret and correctly understand the data that is exchanged. Informational interoperability—using common language where all parties agree on the meaning of words—offers benefits such as workflow improvements, less setup time, reduced labor, and increased standardization.

Systems that are easily scalable, minus any proprietary layers, allow end users to access critical information when they need it. Standardized tagging provides small- to mid-market organizations with many opportunities. When the various points are integrated and tagged at the beginning of the process, tags are used to their full extent from beginning to end.

Jamie Lee is a Product Manager for Siemens Industry Inc., Smart Infrastructure. With more than 12 years of experience in the building automation industry, he has led multiple integrations of open and proprietary systems for government, higher education, retail, and commercial buildings.

Scott Harvey is a National Operations Manager for Siemens Industry Inc., Smart Infrastructure. He holds more than 34 years of experience in the controls industry, including robotics and building controls, with former roles as a firmware/software engineer.

References:

1. IDC, "The Growth in Connected IoT Devices is Expected to Generate 79.4ZB of Data in 2025, According to a New IDC Forecast," June 18, 2019: https://www.idc.com/getdoc.jsp?containerId=prUS45213219
2. Deloitte Touche Tohmatsu Ltd., "Connected barrels: Transforming oil and gas strategies with the Internet of Things," Aug. 14, 2015: https://www2.deloitte.com/us/en/insights/focus/internet-of-things/iot-in-oil-and-gas-industry.html
3. McKinsey, "The new age of engineering and construction technology": https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/the-new-age-of-engineering-and-construction-technology

Self-Service Analytics: how to get instant insights on Haystack [data]

WideSky

With excellent developer support, the Haystack API is a must-have to ensure interoperability. However, I wouldn't recommend its use exclusively. One main drawback is its time-series data handling.

For anyone working with large amounts of IoT data, I generally recommend data modelling standards like Project Haystack. It streamlines how you work with IoT and building data while also ensuring interoperability. But unfortunately, not everyone has the skill or resources to script their next smart building data insight.

In this article, I'll show you how we've taken a query language from Facebook to create a new interface that allows anyone to build insights on Haystack data in a few clicks.

Project Haystack

Project Haystack is an open-source initiative that I highly recommend to anyone considering a new smart building or energy monitoring solution. This popular open-source initiative offers leading solutions in two key areas:

- Community driven standards for structuring your data with tagging. The context surrounding your information is captured via standardised tags, making it vastly easier to manage.
- A standardised method for exchanging data via a REST API that improves interoperability and eases integration headaches for 3rd parties.

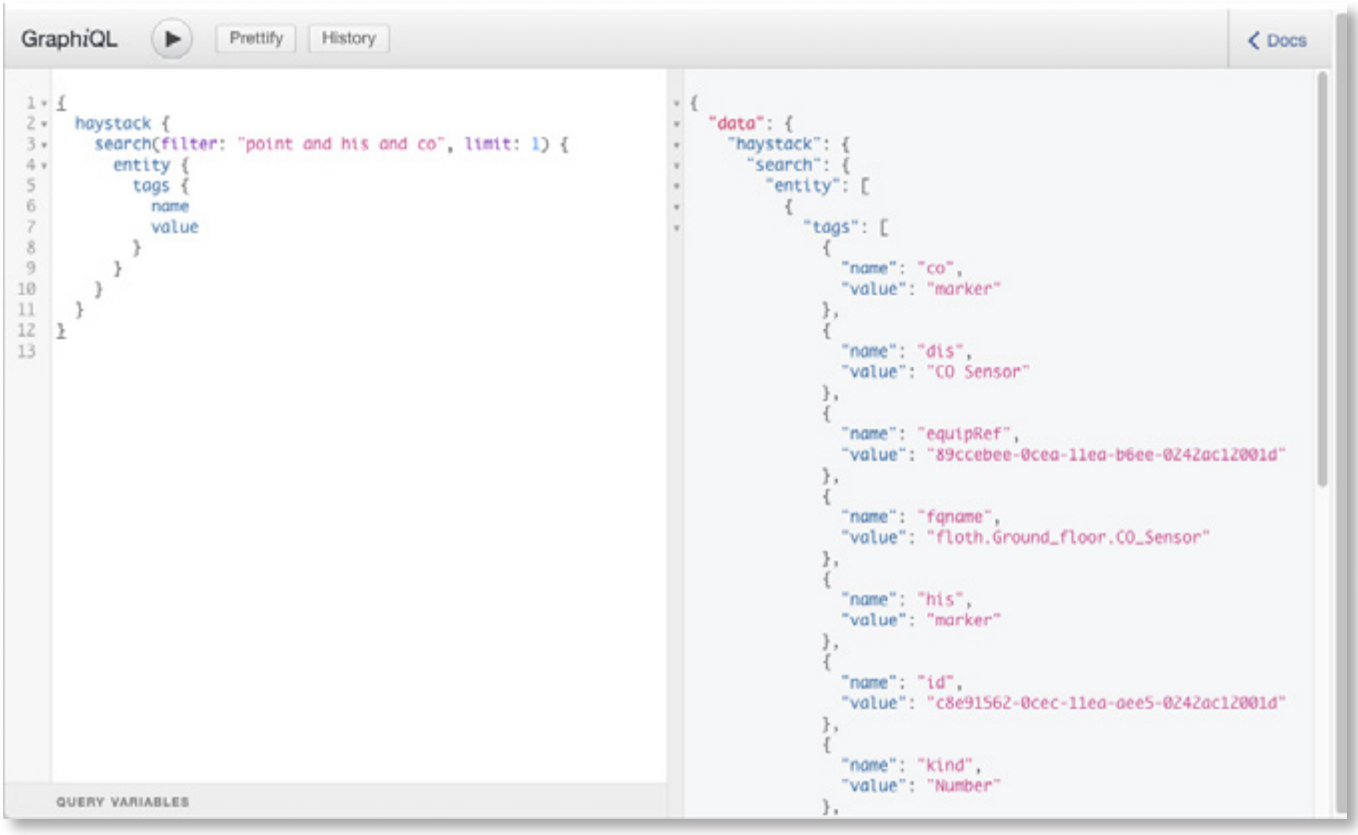
With excellent developer support, the Haystack API is a must-have to ensure interoperability. However, I wouldn't recommend its use exclusively. One main drawback is its time-series data handling. Anyone wanting to build an insight is required to copy all the raw data into 3rd party software or spreadsheet and perform the calculation themselves. This no-frills API limits ad-hoc analysis and is something we've recently addressed in WideSky Cloud that allows customers to ask data questions directly from their browser. To power this new analytical feature, we used a technology called GraphQL.

What is GraphQL?

While you might think the 'QL' in GraphQL means it's a query language for graph databases, it's more accurate to think of GraphQL as a query language for APIs. Developed internally and eventually open-sourced by Facebook in 2015, tech companies have taken to it quickly to streamline how clients can communicate with servers.

To use GraphQL, a user submits a query structured with precisely what they want in a single request, and the server responds with the data in the same structure. You 'ask for what you need', and 'get exactly that' while avoiding any looping in code.

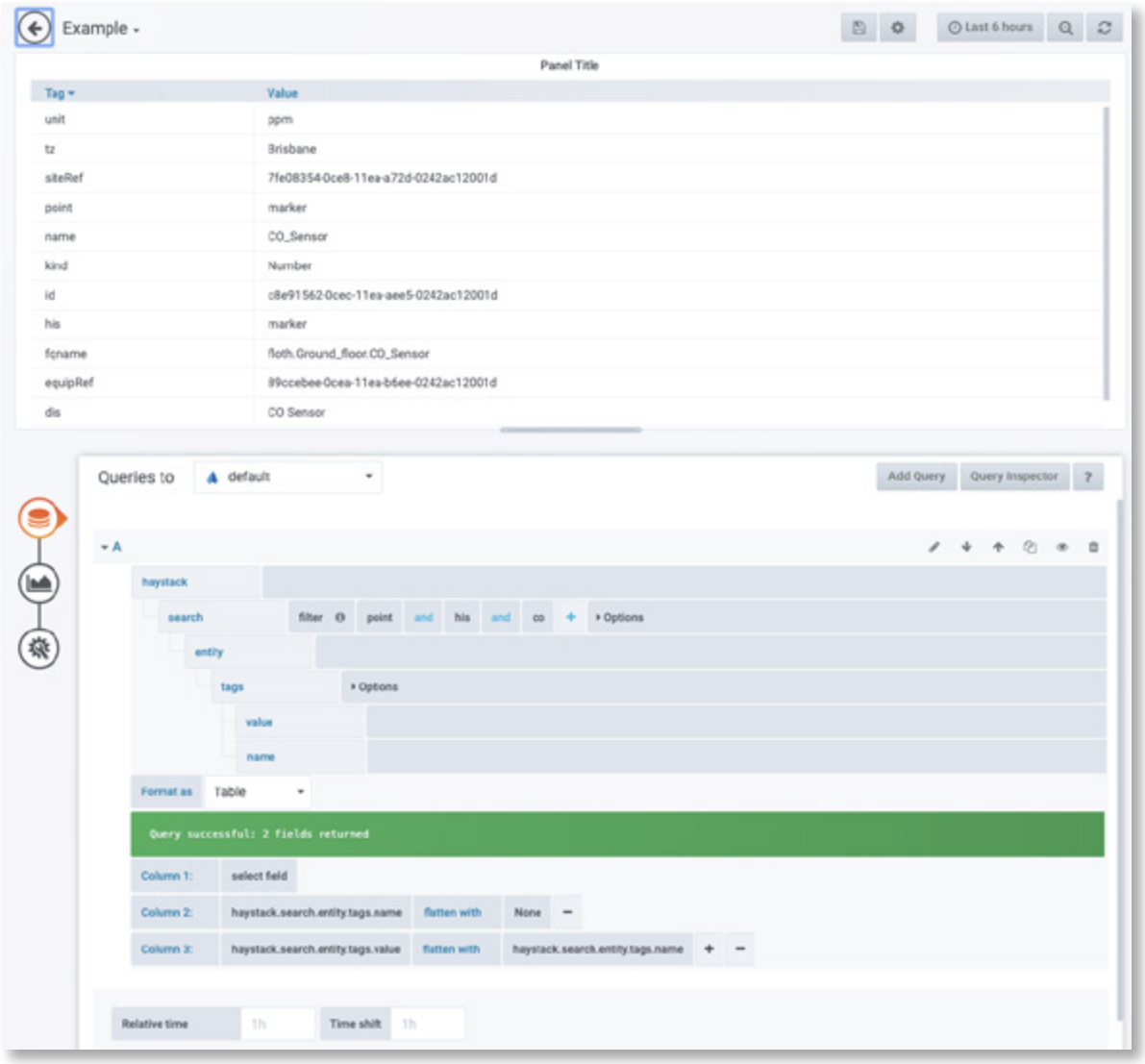
See this example below in a GraphQL query tool:



Now while you might say, 'That is still scripting!' you'd be right. Fortunately, we took it a step further and built a clickable interface in our favourite vis tool Grafana. Here anyone can create insights in a few mouse clicks instead of having to worry about syntax errors.

Here is a screenshot of how you build the same query in a Grafana dashboard:

Note: This Grafana dashboard edit view places the visualisation (in this case, a table) in the top half and the query at the bottom half.



Every element in the query builder is clickable with built-in helper suggestions making it's easy to use. Dashboards become a breeze to create and share as you can focus on the insights rather than how to code them up.

If you've had experience in other data science fields, you may be thinking: 'Why didn't you use, SPARQL/OData/a scripting language/(other data science tool) instead?'. There are plenty out there, and while we evaluated most of them, we kept coming back to our ease of use goal and found that with its focus on simplicity, GraphQL is a perfect fit.

Living Lab Example

Let's get right to it with a simple building energy monitoring example while comparing against the Haystack API.

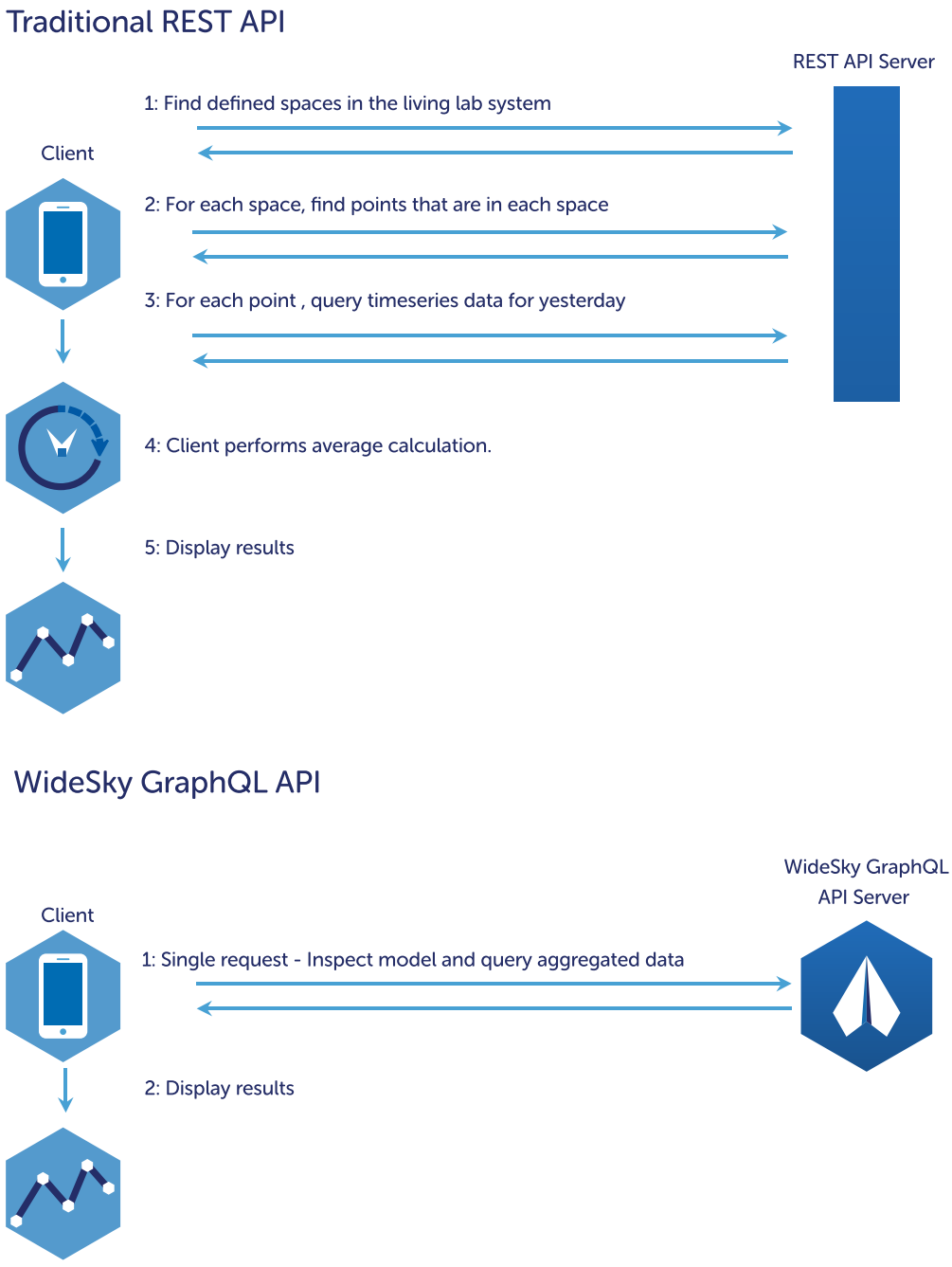
Our WideSky office has a range of fun IoT toys and smart building devices we use to demonstrate WideSky capabilities in our Living Lab. In this example, we'll use the energy meters that report to WideSky.

Question: What was yesterday's average power consumption for each electrical meter, in each area of WideSky Living Lab?

Old Way: Via the Haystack API, we have to write a script, and because we don't know the name of the entities upfront, we have to loop through to discover them. For example, we'd search for spaces followed by points with elec and power tags. Finally, for the matching entities, we query all the raw data for yesterday and perform the averaging calculation ourselves.

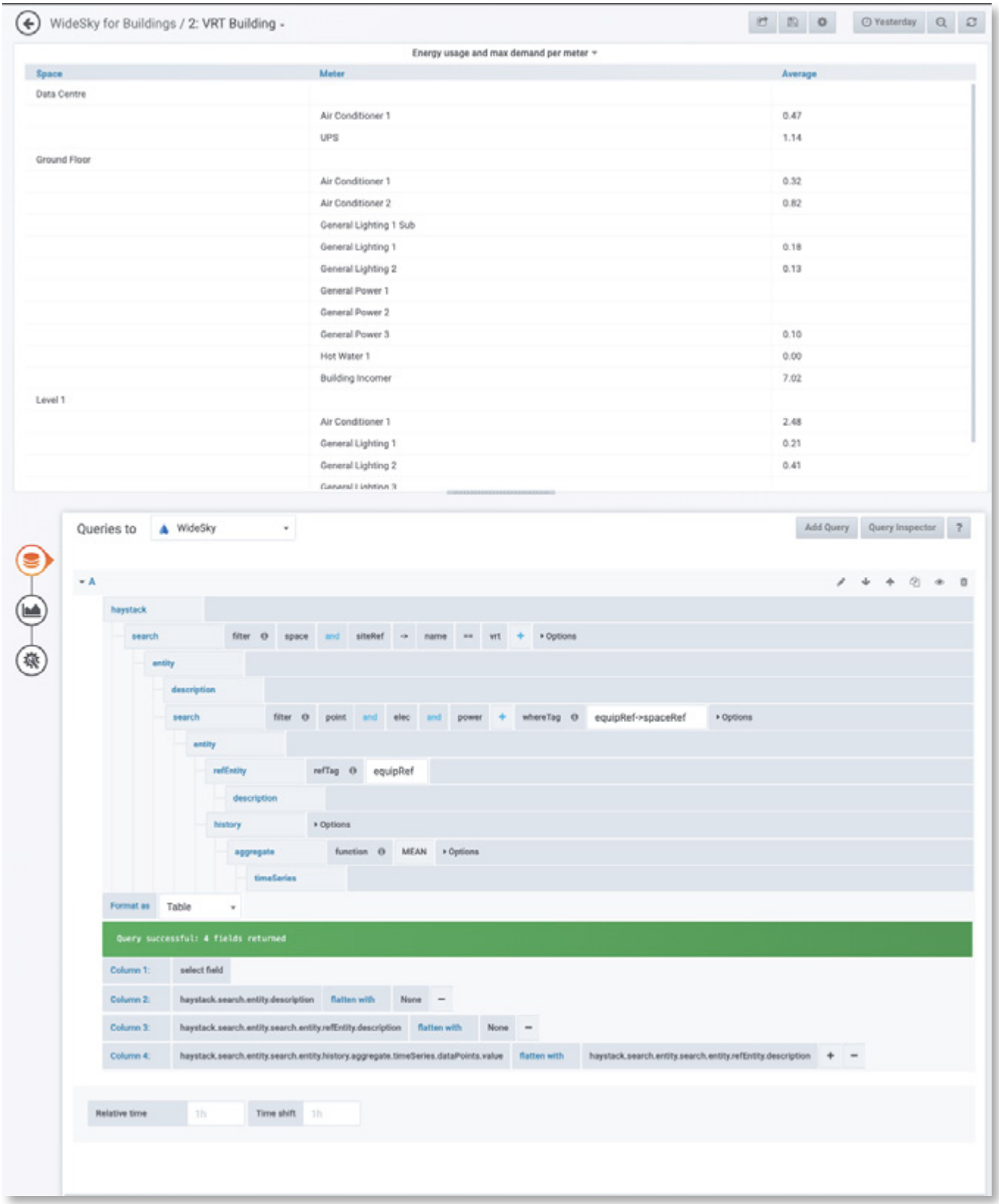
New Way: With GraphQL, it's incredibly easy. We create a single request to match the nested query for spaces and points and ask WideSky to calculate the average for us. We only have to display the results.

The illustration below highlights the two approaches:



The screenshot below shows the completed example in Grafana:

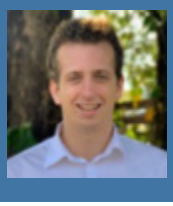
Note: This Grafana dashboard edit view places the visualisation (in this case, a table) in the top half and the query at the bottom half.



Notice how we're able to search for entities recursively? What would have taken 24 HTTP exchanges using the Haystack API is now 1 with a GraphQL query. This nesting capability allows us to create powerful model walks, giving you the freedom to explore any way you like. The calculations are also fast; this example returns in 82ms.

Conclusion

GraphQL streamlines interacting with Haystack and IoT data. Combined with a clickable interface in Grafana, anyone can work with Haystack data. No more asking your dev team or data wrangler to create that report for you. You can also leverage the valuable investment in implementing Haystack tagging as domain specialists who may not be the best data-wrangler can now build insights themselves. With WideSky's Self-Service Analytics, you can get back to finding the value in your data instantly – by yourself.



Leading the technology department in WideSky since its inception, Patrick Coffey balances his operational and information technology experience to bring new IoT products and solutions to customers in the energy, building and industrial sectors.

Breaking Through Systems Integrators' Tagging Adoption Barriers with a Unique Approach to (Auto) Tagging

Johnson Controls

Getting systems integrators to understand both the immediate outcomes of tagging and how a well-designed tagging feature can help them ready their sites for the future is paramount.

The inherit value in tagging is obvious to just about anyone. Adding contextual data to your system database through tagging provides standardization – creating metadata on what system points are, what they're doing, what pieces of equipment they're tied to and more. So why does the adoption rate of tagging by systems integrators continue to lag?

Understanding the Persistent Challenges for Systems Integrators

There are a lot of solutions that provide tagging capabilities. But the reality is that they are very cumbersome. They require a ton of time to configure. They're hard to learn. They're not scalable, and they're known to be very, very error prone. Simply put, these challenges understandably put systems integrators off. For example, when using a typical tagging solution, the time required to set up an accurate and comprehensive tagging database for a medium-sized, new construction project can take upwards of twelve weeks, resulting in expenses and timelines that nearly all building owners just won't tolerate.

Helping Systems Integrators Realize Both Near- and Long-Term Benefits

Getting systems integrators to understand both the immediate outcomes of tagging and how a well-designed tagging feature can help them ready their sites for the future is paramount. There are some easily recognizable short-term benefits that natively come from tagging your site. You can execute tasks like performing a global search to quickly find the critical data needed through a simple query similar to an internet search engine, create custom views or even create custom, modular graphics.

But perhaps what's less obvious is that tagging – when designed well – also prepares sites for easy integrations with cloud-based offerings. Tagging makes it easier to deploy and integrate into a cloud-based offering by allowing a system integrator (and owner) to focus on data visualization and making decisions about how their facility operates instead of spending time mining for their facility's valuable data.

Furthermore, tagging is essentially preparing sites for future integrations and enabling systems integrators to be better prepared to perform large, complex integration projects. By deploying well defined tags throughout a BAS, data can be normalized regardless of naming conventions utilized by multiple vendors or systems integrators.

Unique Approach to Tagging Made Easy

At Johnson Controls, we designed a distinctive approach to tagging with our Facility Explorer (FX) Building Automation System to truly make tagging work for systems integrators. We developed a tag library and software tool features that automatically deploy device and point tag information; specifically, it is a mechanism within the FX Workbench toolset that automatically adds a comprehensive set of tags to a customer's entire system database.

Using FX Appliance

We were able to achieve this with enhancements to FX Appliance, a productivity tool that allows for quick and easy creation of the system configuration database. Exclusive to the Facility Explorer product line, FX Appliance automates many major space and creation components when using the FX programmable equipment controllers. The Auto Tagging feature in FX Appliance provides a carefully curated set of tags that are automatically applied to a station when importing database features. The Auto Tagging feature works with full line of FX programmable equipment controllers and utilizes Haystack, Niagara and Facility Explorer tags.

A quick step-by-step overview of how this happens within FX Appliance is as follows:

1. The fully customizable Johnson Controls Tag dictionary is predefined based on device and point objects and added to the FX Station. The tags are automatically applied during the import process.
2. The FX Station is instantly searchable without any special workflow (outside of normal FX Appliance workflow).
3. FX Equipment and Spaces wizards help to predefine the equipment and spaces relationships within the FX station to build custom navigation hierarchies.
4. The Project File workflow supports full FX tagging implementation while creating the FX Station database through an easy-to-use spreadsheet, including equipment and spaces hierarchies, which improves FX Station navigation.

The result? Tagging capabilities uniquely designed to reduce programming time, errors, and create standardization and a clear and easy path for systems integrators and our partners to 1) enter into the Haystack world, and 2) prepare their systems to communicate with third party systems and devices.

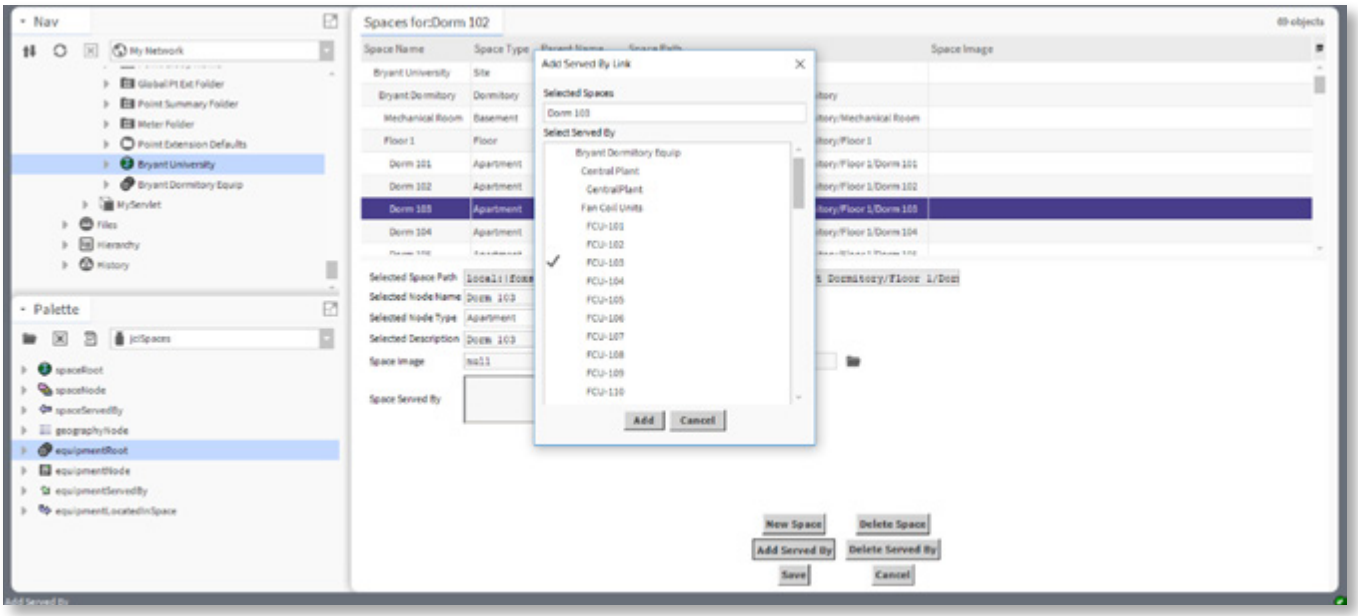


Figure 1. FX Appliance Spaces Wizard from Facility Explorer by Johnson Controls

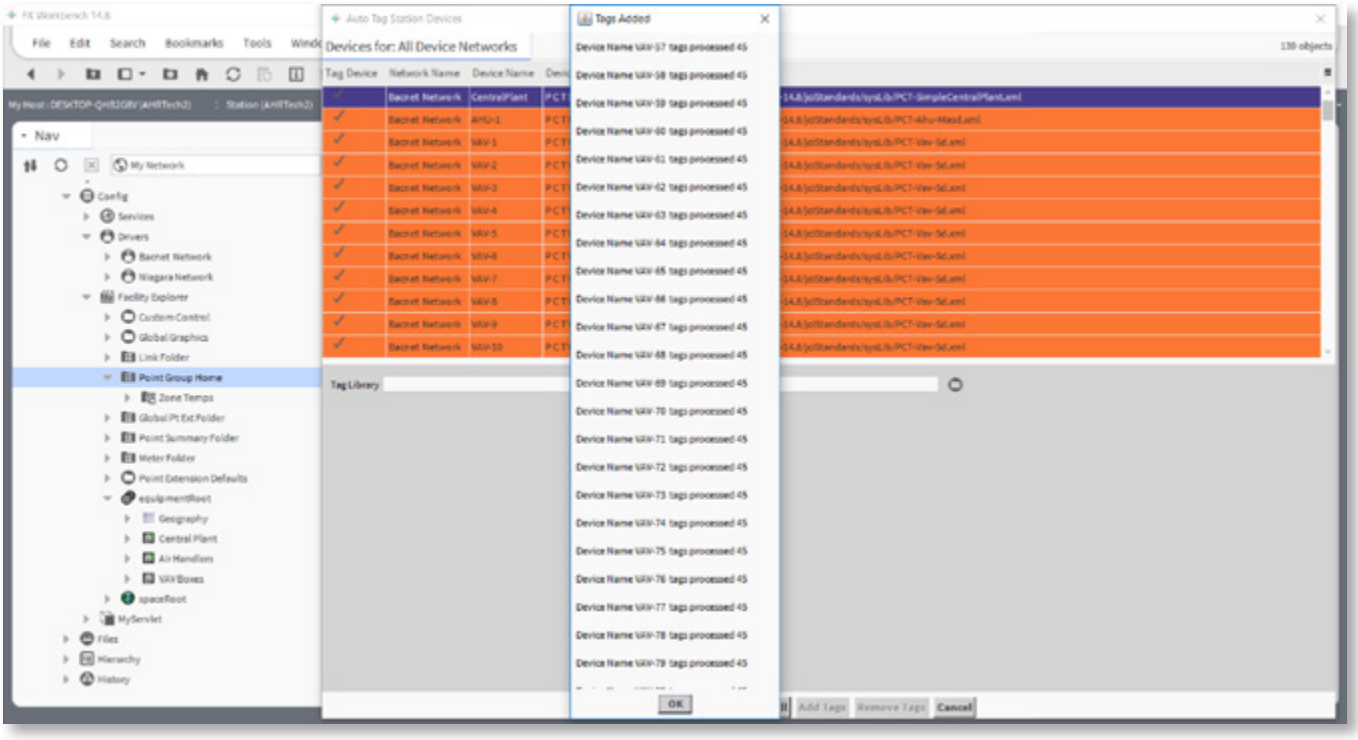


Figure 2. Tagging Existing Devices Using FX Appliance from Facility Explorer by Johnson Controls

Workflow for Existing Installations

We've also implemented a mechanism to tag existing sites after commissioning has already been completed. Existing FX Stations can be programmatically tagged for devices and points through the Auto Tagging Wizard.

"[The FX Auto Tagging feature] saves a lot of time," says Eric Stromquist of ControlTrends. "It's not like people couldn't get data before. It was just so expensive to do it. So if you're an integrator, you know what we're talking about. The owner wants all of these data points…it's too expensive, and by the time you quote them on it, they don't want to do it anymore. But with this new feature…it takes the best of the best, and makes it even better."

The patent-pending FX Auto Tagging feature enables systems integrators to have meaningful conversations with both their engineering teams and with their building owner customers on how to use data to their collective advantage – not about how will they ever going to figure out how to implement and define tagging. Which, in turn, enables them to more cost effectively tackle complex integrations jobs.

For more information on the FX Auto Tagging feature and the latest enhancements in the FX product line, watch our recorded webinar at: **https://www.johnsoncontrols.com/events/webcast/whats-new-with-facility-explorer/registration**.

The Facility Explorer BAS is a comprehensive, fully scalable system that is engineered for fast and easy installations for the authorized distributors, contractors and systems integrators who sell and deliver it. Key capabilities include: simple configuration, distributed system architecture and new, industry-leading networking options.

Nick McLellan is a Product Manager with Johnson Controls and is responsible for defining the strategic direction of Facility Explorer Building Automation System. With over a decade of industry experience, he has held roles in engineering, R&D, and strategy. He holds a Bachelor of Science in Mechanical Engineering from the University of Wisconsin-Milwaukee.

The Importance of Tagging for Data Quality

LYNXSPRING®

"There are several ways by which Haystack tagging contributes to data quality — accuracy, completeness, reliability, relevance, and timeliness."

Every building generates heaps of structured and unstructured data. Data quality is no longer a nice to have; but rather, a must. If you have bad data quality, you will have data that is incomplete, inconsistent and inaccurate which results in bad information. Bad information creates shortcomings and impacts the ability to meet core objectives and deliver desired business outcomes.

While there are many definitions of data quality, two predominate ones are "***Data is of high quality if the data is fit for the intended purpose of use***" and "***Data is of high quality if the data correctly represent the real-world construct that the data describes***".

One of the actions that ensures data quality is Project Haystack data tagging. Haystack tagging allows users to organize information more efficiently by associating pieces of information with tags, keywords and associations. Haystack provides a standards-based, yet flexible, data-tagging methodology that can be used in a wide variety of systems and applications, and includes standard equipment models to enable you to define and describe the meaning of data from smart devices in a way that can be consumed by other applications and systems. Once your data is tagged, applications can automatically interpret, consume, analyze and present high-quality information that enables owners and operators to know how their facilities are actually performing – all based on the ability to automatically interpret its meaning.

There are several ways by which Haystack tagging contributes to data quality — accuracy, completeness, reliability, relevance, and timeliness.

Accuracy

As the name implies, this data quality characteristic means that information is correct. Accuracy is a crucial data quality characteristic because inaccurate information can cause significant problems with severe consequences. By adequately tagging equipment system data we streamline the process of implementing analytics and alarms to identify inaccurate data values.

Completeness

Completeness refers to how comprehensive the information is in relation to your equipment systems and assets. When looking at data completeness, think about whether all of the data you need to effectively monitor and assess system performance is available. For example, are you gathering all of the data needed to assess performance on an air handler, chiller or boiler system. Why does completeness matter as a data quality characteristic? If information is incomplete, you may not be able to accomplish the goals you set out with.

Reliability

In the realm of data quality characteristics, reliability means that a piece of information doesn't contradict

another piece of information in a different source or system. Reliability is a vital data quality characteristic. When data is missing, have incorrect values, or pieces of information contradict themselves, you can't trust the data.

Relevance

When you're looking at data quality characteristics, relevance comes into play because there has to be a good reason as to why you're collecting this information in the first place. Why does relevance matter as a data quality characteristic? If you're gathering irrelevant information, you're wasting time as well as money. Your analyses won't be as valuable.

Timeliness

Timeliness, as the name implies, refers to how up to date information is. The timeliness of information is an important data quality characteristic, because information that isn't timely can lead to people making the wrong decisions.

"Once your data is tagged, applications can automatically interpret, consume, analyze and present high-quality information that enables owners and operators to know how their facilities are actually performing."

Data quality is a crucial part for operating and managing buildings. Properly organized, managed and tagged device and equipment data is a valuable building asset that drives informed decision-making throughout an organization. Implementing effective data tags are essential to retrieving the quality data you need.

Marc Petock is Executive Secretary on the Board of Project Haystack and Chief Marketing & Communications Officer at Lynxspring, Inc. Lynxspring is a Founding Member of Project Haystack and leading developer and manufacturer of smart building technologies and solutions.

The Newest Associate Member Companies Joining the Mission

BRAINBOX AI

kodelabs

BrainBox AI is at the forefront of the green building revolution with its unique technology combining artificial intelligence and cloud computing to create a fully autonomous commercial HVAC solution. BrainBox AI overlays deep learning algorithms on existing HVAC functionality to automate the modulation of each component, reducing a building's total energy spend by up to 25% while improving occupant comfort by 60%. The solution leverages AI to predict building energy consumption at a very granular level and enables our autonomous HVAC system to operate the building pre-emptively versus the current reactive approach of existing HVAC control systems.

Headquartered in Montreal, a global AI hub, BrainBox AI has a workforce of over 50 employees and supports real estate clients in numerous sectors, including office buildings, commercial retail, airports, hotels, multi-residential, long-term care facilities and grocery stores. BrainBox AI also works in collaboration with research partners including the US Department of Energy's National Renewable Energy Laboratory (NREL), the Institute for Data Valorization (IVADO), as well as educational institutions including Montreal's École de technologie supérieure (ETS) and McGill University.

Learn more at **brainboxai.com**.

KODE Labs' team combines 30 years of expertise in building operations, temperature controls, and systems integration with an in-house development team that has 15 years of software development and data science experience. We've brought simplicity and clarity to facility management teams servicing millions of square feet of commercial real estate.

We're using our expertise in buildings and software to build a 21st century portfolio management solution. By focusing on core building management needs we're able to deliver operational diagnostics, energy management, and data analytic tools to optimize your portfolio. KODE Labs was founded to bring simplicity and innovation to the real estate technology industry.

KODE Labs delivers an enhanced platform with open communication protocols and integrations with 3rd party vendors and services. We've designed an easy to use system that allows building engineers to identify issues the moment they happen, monitor and control assets directly from the field through native mobile applications, and track performance through comprehensive device history.

KODE Labs utilizes Haystack's API and semantic tagging to complete our device templating framework and data standardization. We understand that clean data is essential to providing a simple and easy to use interface for our customers and we support Project Haystack's mission to bring more standardization and clarity to this industry.

Learn more at **kodelabs.com**.

The Newest Associate Member Companies Joining the Mission

RESOLUTE™
BUILDING INTELLIGENCE

Resolute provides a building-performance analytics and reporting software solution that integrates seamlessly with the Tridium Niagara Framework, enabling you to quickly and reliably use real-time data, analytics-driven insights, and on-demand reports to better manage buildings and to achieve quantifiable performance gains. Leveraging the power of Project Haystack's standardized data and tagging models and the Niagara open-source connectivity protocol, our software allows you to connect directly to the Resolute Cloud™ from your Niagara instance—regardless of brand—without the need for additional devices, lowering costs, minimizing integration complexity, and accelerating time-to-value.

Resolute's powerful building-performance analytics and reporting software can help you:

- Be the first to know about building issues, needs, and other initiatives to provide additional value to customers.
- Improve customer retention by delivering consistent, quantifiable, and documented results that build trust and strengthen customer relationships.
- Show customers and prospects how your services leverage real data and powerful analytics to help ensure optimal performance of their buildings.
- Replace assumption-driven guesswork with data-driven answers.
- Improve profitability.

Learn more at **resolutebi.com**.

SMARTGREEN

Founded in 2013 and headquartered in Israel, SmartGreen is a provider of advanced solutions that optimize the operational and energy performance of commercial and industrial buildings and facilities. Our flagship product, OptiNergy™ is an innovative cloud-based platform that combines machine learning algorithms, big data analytics, and Internet of Things (IoT) technology and devices.

Our team is comprised of engineers and physicists with multidisciplinary expertise in software development, data science and complex electro-mechanical systems and equipment; led by a seasoned management staff with extensive experience in bringing measurable value to organizations worldwide.

Learn more at **smartgreen.co**.

Demand for Project Haystack participation is up at events around the world and community members have risen to the call.

Smart Buildings Show 2019

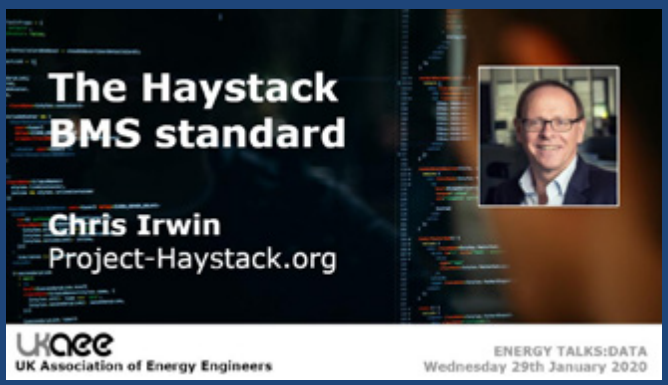
Olympia, London
October 9 - 10, 2019

Project Haystack exhibited at the Smart Buildings Show 2019 in Olympia, London.

UKAEE 2020

London
January 29, 2020

Project Haystack presented the Haystack BMS Standard at the UKAEE Conference.



AHR Expo 2020

Haystack 4 - Free Education Session
February 4, 2020

Understanding of the need for semantic modeling of device and equipment data has matured significantly in the last decade, and the requirements and techniques for applying semantic modelling to equipment data are advancing rapidly. As we have learned, semantic modelling is critical for humans to work with and understand the ever-increasing amount of data coming from their systems, but the process of manually applying that semantic model is not scalable. We need our tools to simplify and automate how the semantic model is applied.

Haystack 4 builds on the eight years of experience in applying Haystack across thousands of buildings worldwide, the input from practitioners in the community throughout that time, as well the collaborators that have participated in the activities of Haystack Working Groups and BACnet Groups.

If you missed this session, the presentation is available by CLICKING HERE.

PRESENTED BY: AutomatedBuildings.com.

WG Working Group Updates

Tagging initiatives are made official by launching a Working Group with a defined proposal and good visibility. Join a WG now!

#551

Haystack Kind Reference

Champion:
Brian Frank,
SkyFoundry

We have transitioned this working group to public review - see:

https://project-haystack.org/forum/topic/687

Haystack 4.0 includes a brand new website and documentation engine. So for the public review we are going to run the new website and documentation on a different domain - https://project-haystack.dev. We will run this website in parallel to the current website until the review process is complete. The new website has a refreshed look and feel, but will have login and forum disabled.

#609 AHU Standing

Champion:
Jay Herron,
BuildingFit

Here are the results of some work on AHUs that was accepted into the Haystack standard. Specifically, the following changes were made:

Humidifiers

`humidifier` will be a new top-level equip, with `run/enable state point` children. It will operate similarly to `fan`, where it can either be a point on an `airHandlingEquip` or a separate equip entirely.

Dehumidifiers

`dessicantDehumidifier` will be a new tag to indicate a Boolean point that controls the dessicant dehumidifier, and will be added to `airHandlingEquip` children (similar to `heatWheel`).

Non-dessicant dehumidifiers (those relying on reducing air temp beyond the dew-point) will not be defined, as modeling them using existing cooling/heating equipment is already possible.

Economizers

`economizing` will be a new tag for boolean points that indicate the state of an economizing mode. Economizing in this context means an energy-reduction process, which on AHUs translates to increasing outside air flow to reduce heating/cooling requirements.

This tag is pretty general so that it may be used to indicate economizing conditions on other equipment, like `chilledWaterPlants, chillers`, etc.

https://project-haystack.org/forum/topic/609

#792 Haystack JSON Encoding

Champion:
Gareth David
Johnson,
J2 Innovations

I'm the working group champion for a new JSON encoding format for Haystack. I'm hoping that eventually this will become part of the Haystack standard.

The new standard (a.k.a. as HaySON) hopes to improve upon the existing JSON encoding by making Haystack data more accessible to developers and tools that utilize JSON data. HaySON is easy to use, simple to write and takes advantage of the fast native JSON parsers already available in existing software platforms the world over.

So far the proposal has had some positive feedback from participants all over the world. I'll soon be scheduling a presentation to go over the proposed standard with the rest of the Working Group. Many thanks to everyone who has contributed so far!

https://project-haystack.org/forum/topic/792

Project Haystack Working Groups List

WG	Topic	Champion
#514	Dry Bulb Points and The 'air' Tag	Jay Herron
#551	Haystack Type System WG	Brian Frank
#626	RESET Standard and Air Quality Tags	Cory Mosiman
#496	Lab/Fume Hood Working Group	Gabe Sandoval
#501	Flow Modeling working group	Karine Lavigne
#503	Access Security Working Group	Justin Tashker
#505	Refrigeration System	Nathan Rona
#506	Unitary Equipment Working Group	Eric Loew
#553	Reference Model	Patrick Coffey
#492	New Data Center Tag Working Group	Ron Snyder
#530	BIM/Haystack Working Group	Chris Renter
#667	Cybersecurity Working Group	F Gordy
#701	Data Center Tags	Jason Ganiatsas
#709	Haystack RDF Export - Working Group	Matthew Giannini
#776	Working Group: Greenhouse Gas	Matthew Giannini
#734	Working Group: ATES systems	Jaap Balvers
#497	Chiller Plant Enhancements Working Group	Sean Stackhouse
#595	Invitation to Project-Sandstar Working Group	Alper Üzmezler
#705	Lighting Systems WG	Jeremy Yon
#792	Haystack JSON Encoding	Gareth David Johnson
#609	AHU Standing WG	Jay Herron

To learn more or to join a Working Group, visit: https://project-haystack.org/forum/wg

The Project Haystack community develops and freely offers a range of reference implementations to enable product manufacturers and application developers to quickly implement Haystack tagging and communications in their products.

Wiki

Haystack Wiki: Source for docs, and tag definitions

Java

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

Niagara

nHaystack: New Updated Niagara module to add Haystack tagging and Niagara REST API for AX and N4

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

Check out these documents and audio resources to quickly come up to speed on Project Haystack tagging benefits and the methodology.

Download Detailed Reference Implementation Document. "Implementing Project Haystack: Applying Haystack Tagging for a Sample Building."

Download Harbor Research whitepaper with technical overview. Defines the concept of tags, breaking down and explaining the essential data elements.

Listen Audio Stream of "Making Internet of Things Device Data Just Work!" a Memoori webinar featuring John Petze and Marc Petock on Project Haystack.

Open REST API Description. Explains simple mechanism to exchange tagged data over web services

Download Haystack Guide Specification. Now available in English, French and Chinese.

Download CABA whitepaper that outlines how to use Haystack tagging in applications related to buildings, energy, and facility management.

The online magazine and web resource that provides news about the rapidly evolving industry that automates and implements truly intelligent, integrated buildings.

Project Haystack Supporter

#RUIOTREADY @kensinclair

Want to get involved in the Project Haystack open-source community? There are a number of ways and levels of involvement.

Contribute your expertise: Participate in the Project Haystack open forum discussions.

Join a Working Group: Project Haystack has members working together on developing tag sets and resolving other challenges related to particular topics. See the list of active Working Groups that you could join today here.

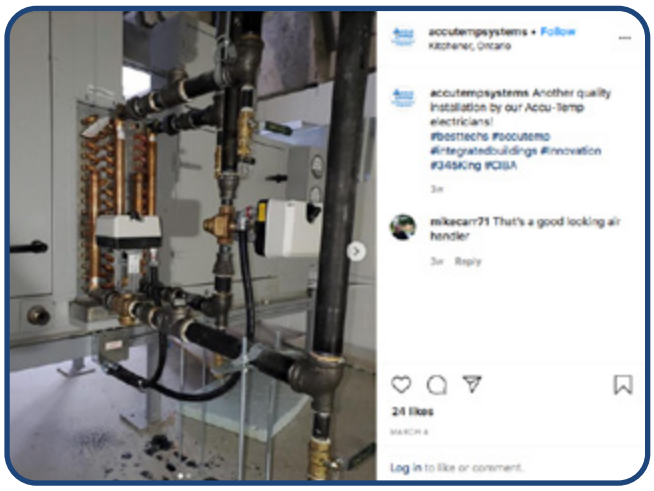
Become a Member: Project Haystack Corporate Associate Memberhip has many advantages. Email us to learn more at projecthaystackinfo@gmail.com.

Social Media Curation

Here is some of the information shared by Project Haystack members on Instagram, Twitter and LinkedIn. Follow them to learn about Haystack-enabled recent projects, products and practices.

Projects

CABA working on reseach project about intelligent building energy management systems.



Accu-Temp Systems New Air Handler Installation.

Guiding customers through the installation of KMC Conquest Wireless Sensors remotely.

WideSky to deliver range of energy efficiencies for Sydney's largest renewal projects.

Practices

Episode 356 of ControlTalk NOW features Resolute BI CEO, Chris Hallendy.

Happy 30th Birthday KNX!

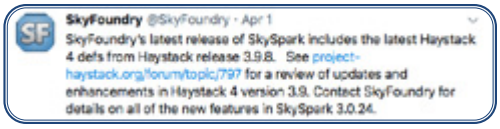
What are the new risks to building owners and managers?

Is AI becoming a more integated part of our cities future landscape?

Brainbox AI Free HVAC Optimization Service in Response to COVID-19.

#ProjectHaystack is streamlining the way to work with data.

Products

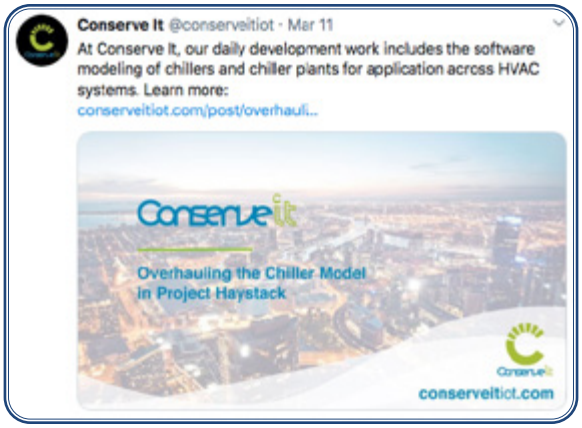


SkyFoundry's latest release of SkySpark include Haystack 4 defs.

Latest BuildingFit connector packages available through #StackHub.

Conserve It Edge IoT 534 combines a controller and web server duties.

Tridium urging the trade-up to Niagara 4!

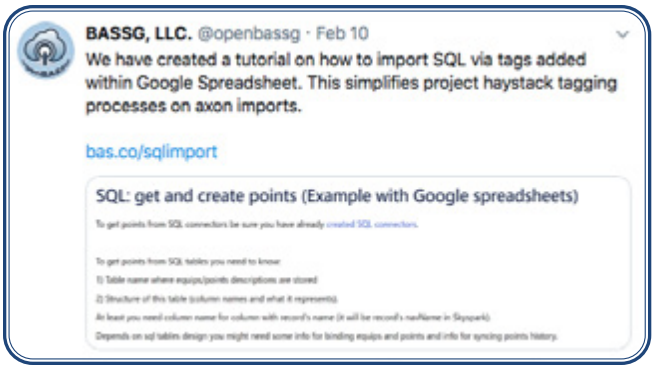


Overhauling the Chiller Model in Project Haystack.

Lynxspring launches Onyxx XM 34IO-B Extender Module.

New JSON Toolkit using the Niagara platform.

Lynxspring launches JENEsys Edge 534 Controller for Monnit Sensors.



Simplifying Project Haystack Tagging processes on axon imports.

Project Haystack

connections

Become an Advertiser

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 8,000+ known readers, it is an incredibly cost-effective advertising opportunity. For rate info, email **robin@haystackconnect.org**.

Members

Founding Members

Conserve It was founded in 2007 with a focus on centrifugal chiller efficiency systems. Over time it has diversified into complete HVAC&R plant management including monitoring, reporting and controls, energy performance contracting, energy management consulting and distribution of industrial and building automtion products and sensors from leading international suppliers worldwide. Conserve It provides a range of unique products and services in this area.

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 brings powerful engineering tools, visualization and software technology to those involved in BAS installations. J2 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.

Embracing open software and hardware platforms, Lynxspring develops and manufactures innovative edge-to-enterprise solutions. We enable better building automation, better energy management systems, better control systems and specialty machine-to-machine and IoT applications. Deployed in billions of square feet of commercial buildings across North America and beyond, Lynxspring's smart solutions simplify integration and interoperability, and help connect your smart building's data.

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.

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. 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.

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.

BrainBox AI is at the forefront of the green building revolution with its unique technology combining artificial intelligence and cloud computing to create a fully autonomous commercial HVAC solution. BrainBox AI overlays deep learning algorithms on existing HVAC functionality to automate the modulation of each component, reducing a building's total energy spend by up to 25% while improving occupant comfort by 60%. The solution leverages AI to predict building energy consumption at a very granular level and enables our autonomous HVAC system to operate the building pre-emptively.

BUENO Systems 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.

BuildingFit creates unique solutions for clients to ensure a proper fit between SkySpark® and their team. We do this through site construction, analytics, custom programming, SkySpark® Apps, reports, training, SkySpark® Licensing. BuildingFit is a SkyFoundry endorsed SkySpark Essentials provider.

Associate Members

The Continental Automated Buildings Association is an international not-for-profit industry association dedicated to the advancement of integrated technologies for homes and buildings. The organization 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.

EMA is a new and innovative association that is dedicated to advancing the quality of energy management products and services for the benefit of the building owner. The founding members are certified Energy Management Professionals (EMP), a program that was developed by ACG, the world's leading association of certified commissioning authorities. Management of the program has been transferred to EMA.

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, provides 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.

Associate Members

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.

Kodaro expands building system connectivity through dynamic software developed for the Internet of Things. It helps contractors, controls companies and end-users find value in building data gathered from the edge to the cloud. It develops software to create more connectivity between systems, giving increased access to better data, not bigger data. Kodaro's goal is to provide actionable analytic information, developed from real-world expertise with all building systems.

KODE Labs has developed an enterprise level platform which streamlines the routine tasks of discovery, templating, tagging and data configuration and provides complete monitoring and control of building systems. The KODE Labs platform offers a data focused interface that surfaces the critical insights necessary to maximize operational efficiency across your portfolio.

Resolute provides a building-performance analytics and reporting solution that integrates with the Niagara Framework®, enabling quick and reliable use of real-time data, analytics-driven insight and on-demand reports to better manage buildings and achieve quantifiable performance gains. Leveraging the power of Project Haystack standardized data and tagging models and the Niagara open-source connectivity protocol, our solution allows direct connectivity to the Resolute Cloud™ from a Niagara instance - regardless of brand - without the need for additional devices.

Founded in 2013 and headquartered in Israel, SmartGreen is a provider of advanced solutions that optimize the operational and energy performance of commercial and industrial buildings and facilities. Our flagship product, OptiNergy™ is an innovative cloud-based platform that combines machine learning algorithms, big data analytics, and Internet of Things (IoT) technology and devices.

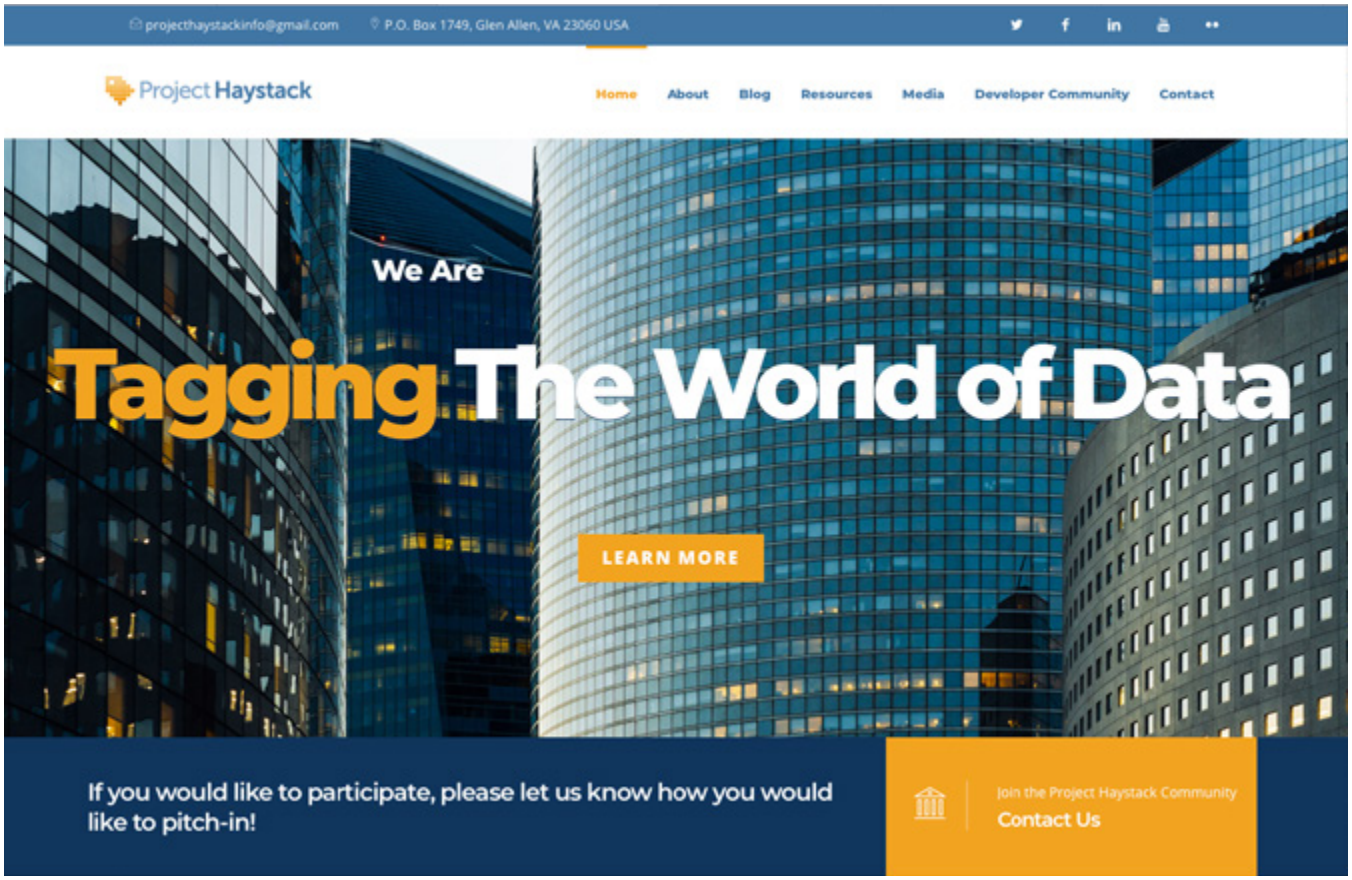
Tridium is a world leader in business application frameworks - advancing truly open environments that harness the power of the Internet of Things. Our innovations have fundamentally changed the way people connect and control devices and systems. Our products allow people and machines to communicate and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

Associate Members

Through the implementation of WideSky®, we aim to unlock the value of your energy, environmental and building data. Our scalable, intelligent solutions can improve profits and sustainability of your business. The qualified and experienced WideSky team has decades of operational and information technology experience. Coupled with our partner network, we can implement future-proofed, well-supported solutions tailored to your business on a global scale.

Yorkland Controls has roots in distributing and warehousing heating control products such as Flame Safeguard and Burner and Boiler Management Systems, and has expanded into new markets including Building Automation, Lighting, Security and Energy Services. It works to promote the advantages of controls to the industries and markets that it serves and to demystify available technology for its customers.

For all the latest Project Haystack marketing activities visit marketing.project-haystack.org.



Project Haystack

www.project-haystack.org