

Niagara Framework® & AI

Part 1: How the Niagara Community is Advancing Along the Journey to AI Enablement

by Amod Kamat, Chief Technology Officer, Tridium

Over last few decades, the steady pace of technological change has been accompanied by a long list of buzz phrases that rise and fall in popularity. Every 2 to 4 years there is a new one—Web 2.0, Web 3.0, Cloud, Business Intelligence, IoT, Machine Learning, Augmented Reality, Blockchain, etc. The noise around Artificial Intelligence (AI) is at a crescendo today. Anyone that has been involved in an ‘atoms-side’ industry like commercial building construction and operations must ask if all this talk is just more hype from the ‘bits-side’ worlds of digital media and finance. Or is it different this time? Will current AI breakthroughs, such as large language models, impact the building industry in general? Most particularly, how can these new AI technologies be leveraged in the context of Tridium’s Niagara Framework®? This article will explore some of the possibilities.

Whether you call it AI, Machine Learning or just a series of IF-ELSE statements, there is a three-step flow to any programmatic solution that starts with data collection. For a Smart Building, data collection starts in the BMS.

BMS REPRESENTS IT/OT CONVERGENCE

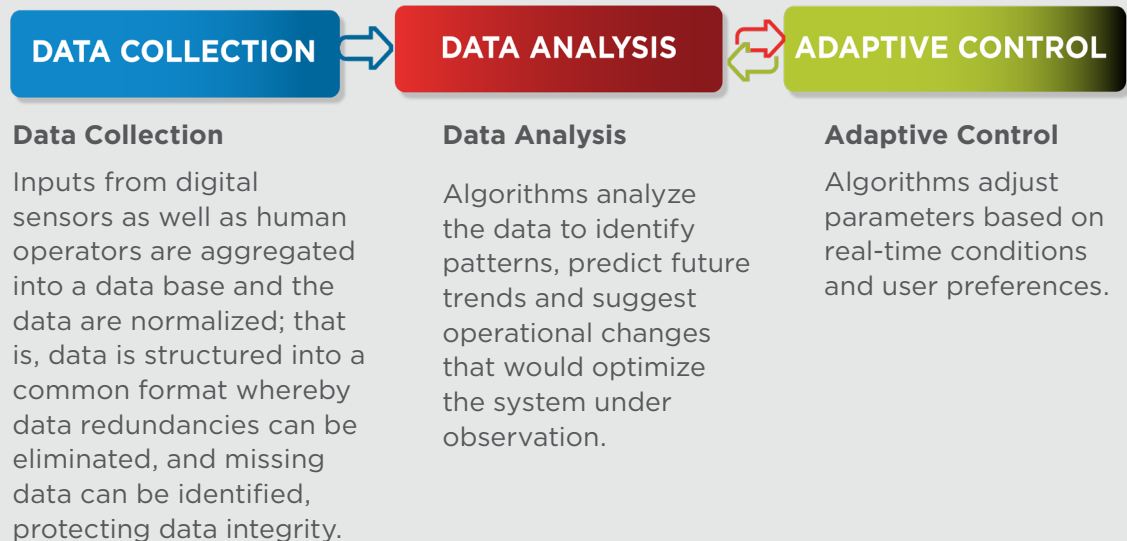
The entry of this generation of AI technologies into the marketplace for connected building/connected industrial solutions is something

that could be easily predicted. There has been a trend toward IT concepts and companies making forays into industrial operations (OT) markets since web services were introduced almost three decades ago. Not all these forays have been successful, but certainly the Building Management System (BMS) has shown staying power.

BMS were primarily designed to orchestrate operations between varied building systems (HVAC, power, lighting, etc.) and their human operators to meet occupants’ needs. Once it was proven that a BMS could successfully collect and normalize operational data for control purposes, it was a natural next step to ask what other value can be derived from the stores of operational building data that were a by-product of the systems integration process.

Developers in the community of innovators amassing around Tridium’s open-protocol Niagara Framework® were more aggressive in asking that next question because algorithm-training data was more accessible when the customer deployed a Niagara-based BMS. By 2015, most global HVAC equipment manufacturing brands were offering a Tridium-JACE®-based BMS, which broke the lock on data silos formerly maintained by proprietary-protocols. Data collection across big multi-story buildings, large campus holdings and geographically dispersed building portfolios became easier. There were two more steps needed to close the feedback loop in the

KEY ELEMENTS OF ANY PROGRAMMATIC SOLUTION



programming flow: data analysis and adaptive control. Developer partners within the Niagara Community were early to offer software solutions in these categories.

First-generation solutions were rule-based and often described as “Machine Learning” (ML) algorithms. The first use cases included Predictive Analytics and Energy Optimization. Building owners, particularly larger corporations and higher education campuses with large and diverse building portfolios, have attested to how ML-category solutions like automated fault detection and diagnostic software have enhanced the experience of occupants while reducing operational costs with respect to energy savings, longevity of equipment and faster resolution for user issues. The ecosystem of ML developers and customers — many in the Niagara Community — provides a ready springboard for AI’s use in buildings.

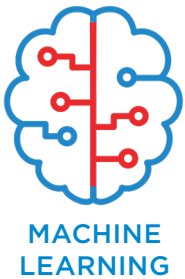
In the context of a connected building, the BMS has a central role at every step of the workflow that underlies the capabilities of and opportunities for AI enablement:

Data Collection

The BMS can serve as the centralized source of data collection for varied AI applications in the building domain. Through the BMS, system data is collected at varied intervals from the equipment and devices that determine the comfort, safety and security of the building. Many BMS systems also provide the ability to integrate with proprietary systems and external sources like utility meters and weather information.

Data Analysis

Traditionally, many facility managers, system integrators (SI) and operators depended on data exported from the BMS to external tools designed specifically for data analysis, like Microsoft Excel and its many competitors in the Business Intelligence (BI) software category. With advances in analytics and machine learning, there are multiple analytics tools available for the system integrator setting up a BMS, for the energy manager tapping the BMS to conduct data-driven energy conservation activities, and for the facility managers using





the BMS as part of normal operations. Today analytics software is delivered as part of the BMS out-of-the-box experience and as external tools. The goal in all cases is to provide actionable insights, and the pathway toward that goal is seamless integration and easy exchange of data between the BMS and a full host of systems and equipment communicating via a multitude of protocols, both industry-standard and proprietary

Adaptive Control

Output of the data analysis can come in the form of reports for facility management for reference or taking corrective action, or it can come in the form of programming changes that directly adjust equipment operation. A BMS can provide the interface for AI/analytic systems to take corrective action on equipment through the BMS's APIs.



NEXT STEPS TOWARD AI-ENABLEMENT OF BUILDINGS

When Tridium started in 1996, just one year after the internet was commercialized, the vision of Tridium's founders was to create a system

with open connectivity that would lead to "Connecting Minds and Machines." At the time of this article's writing, Tridium's Community of Developers is actively working on Niagara 4.15—another release of our platform taking us yet closer to that vision.

"We aren't in these industries because we went into them, we are here because our community took us here."

- Tridium Leader, Circa 2015

It is amazing how our community leverages Niagara Framework® capabilities to drive AI adoption in the building industry. In the period from the introduction of Niagara 4 in 2015 to our current release 4.15, Tridium has had a strong focus on supporting connectivity, analytics and cybersecurity. These together lay a strong foundation for our community to leverage the Niagara Framework® for AI in the buildings industry in all the following ways:





DATA COLLECTION

Innovations in Data Collection Enabled by Niagara

Tridium's Niagara Framework® provides customers the ability to collect, analyze and orchestrate building operational data all the way from the edge to the Cloud. Here are some of the ways Niagara is distinguished from other operational technology platforms on the market:

- ▶ Niagara Framework offers connectivity for both open and proprietary protocols that have been tested and verified by Tridium. [There are currently around 40 drivers supported out of the box for the Niagara Framework.](#) Examples include BACnet, OPC UA, Modbus, SNMP, LON, and MQTT. [A full list of supported protocols is available on this page of tridium.com.](#)
- ▶ If Tridium doesn't offer the protocol you need, our community has several hundred drivers built for varied purposes. [See this document for a list of drivers available for Niagara Framework.](#)
- ▶ If a driver is not available out-of-the-box from Tridium or from a Development Partner in the Niagara Community, a customer with developer talent can create their own using the nDriver library. The nDriver library is used both internally and externally by our Niagara Community.

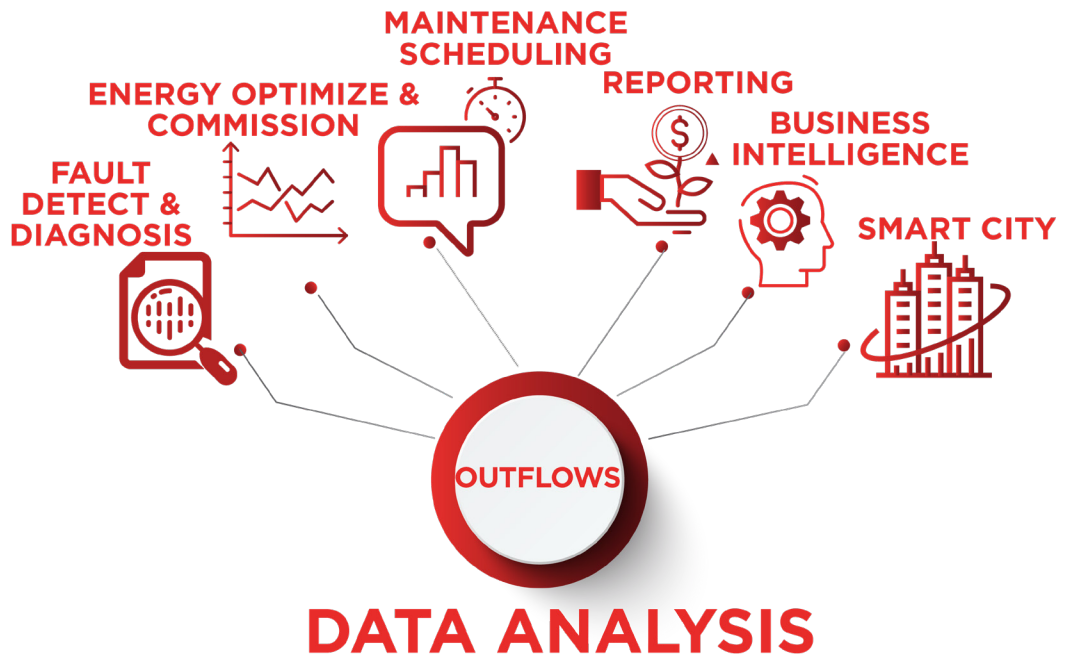
HOW AI WILL BE LEVERAGED BY NIAGARA GOING FORWARD

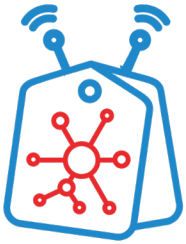


DATA ANALYSIS

Innovations in Data Analysis Enabled by Niagara

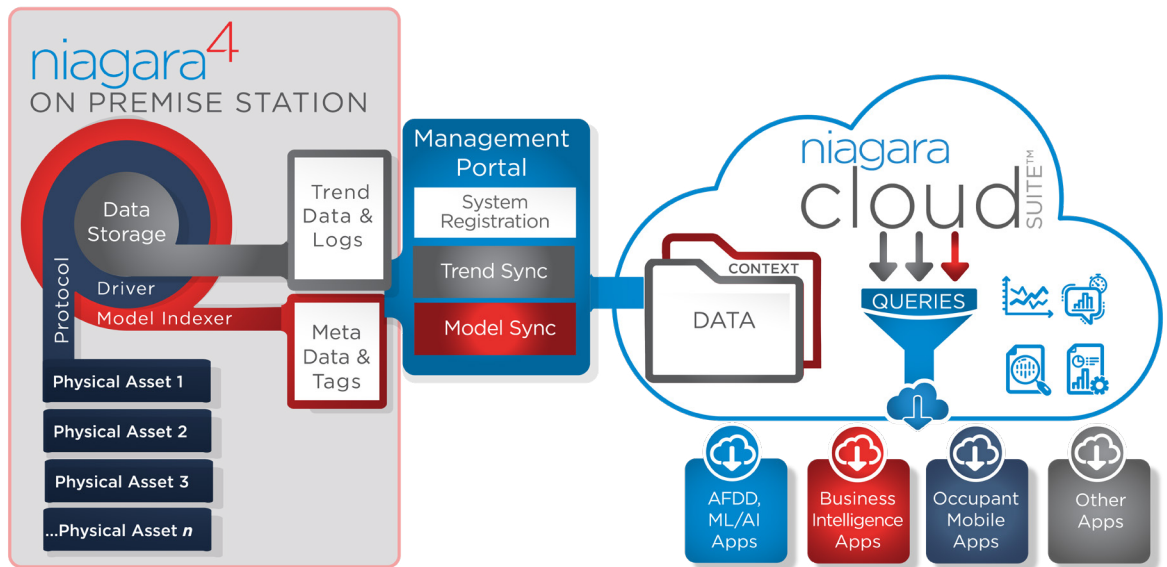
When data is collected at the edge of a network under BMS control, the device - for example a digital thermostat - may talk its own proprietary or specific-protocol-defined language. The Niagara Framework® is purpose-built to collect and normalize such data for further processing. In addition, it has the advanced features listed below to make integration easy for other community members and third-party analytics applications.





AUTO-TAG AGENT

- ▶ **Data Context through Meta-Data Tagging:** A prerequisite to running any type of data analytics on a data set is that the data be organized first. A data model sets the standard for this organization, and semantic tags serve as descriptors that give data meaning and establish relationships. Customers have the option to leverage industry open standards for semantic data modeling like Haystack 4, the Brick ontology or any other customer specific semantic descriptions. Note that there are Developer Partners within the Niagara Community working on AI agents to assist in the tagging process. [See this TridiumTalk webinar for an example.](#)
- ▶ **Data Transfer to/from Cloud:** As illustrated below, Niagara Data Service™ provides API access to data stored in a Niagara database. Built using industry standard and IT friendly technologies, this subscription service makes Niagara data accessible to the end-customer's choice of AI models.
- ▶ **HTTP Client Driver:** Another way that Niagara Framework enables access to near real-time building data is the HTTP Client Driver. System integrators can use this feature with web-based tools such as graphics and Business Intelligence suites. [For a demo, watch the TridiumTalk webinar linked to here.](#)
- ▶ **Built-In Analytics Tools:** The advanced analytic algorithms built into native Niagara Analytics™ can simplify the task when there is no need for the expanded storage and processing resources of the cloud. You can run analyses, generate reports and create algorithms on-premises. Niagara Analytics can be performed on real-time data from an embedded controller or on historical information that you've already saved. [For more information refer to this tridium.com webpage.](#) You can watch a demonstration of how to get Niagara Analytics setup in your station in [this Niagara PRO TIPS video.](#)



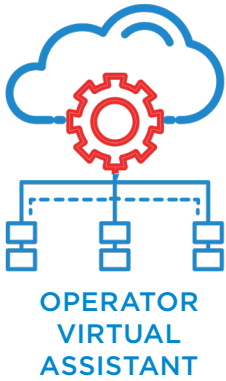
With a subscription to Niagara Data Service™ customers can access Model, Historical and Live data from a building through web APIs which are commonly used by web and AI developers to feed data to their specific AI models. Learn more about in this [Niagara Data Services TridiumTalk Webinar.](#)



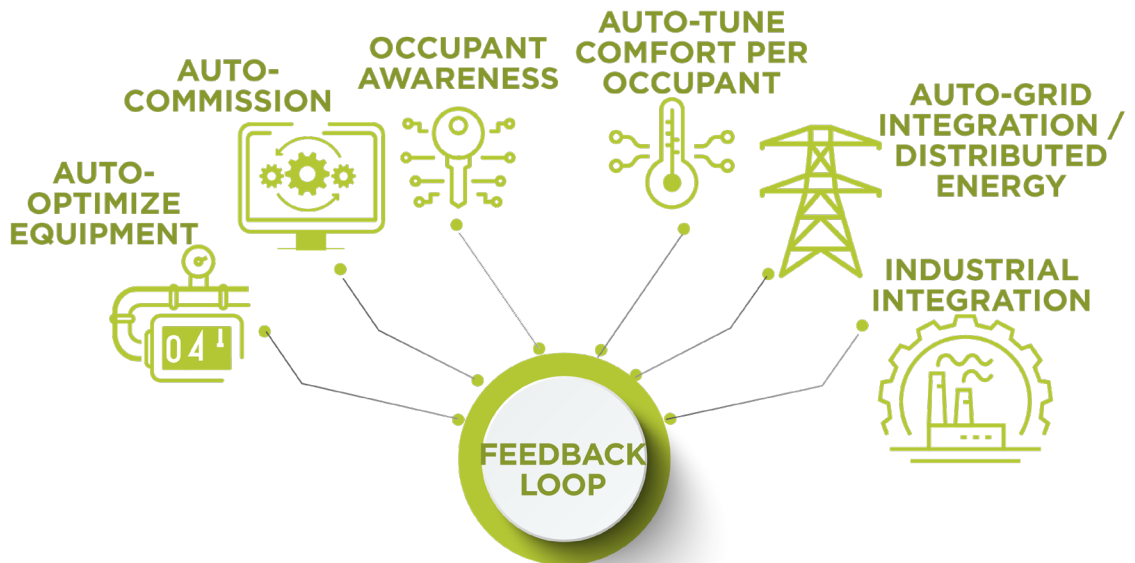
ADAPTIVE CONTROL

Innovations in Adaptive Control Enabled by Niagara

While AI model execution is typically done remotely via cloud-hosted services, consideration should also be given to the follow-through. A customer can sometimes act upon the recommendations of an AI with another remotely executed algorithm, for example to change a set point in the building to drive energy efficiency. More often, however, onsite work by a human technician is required to deploy and test the full list of recommendations made by an AI agent. The Niagara Framework® provides the flexibility to handle a full spectrum of follow-through actions in a cost-effective way, for example:

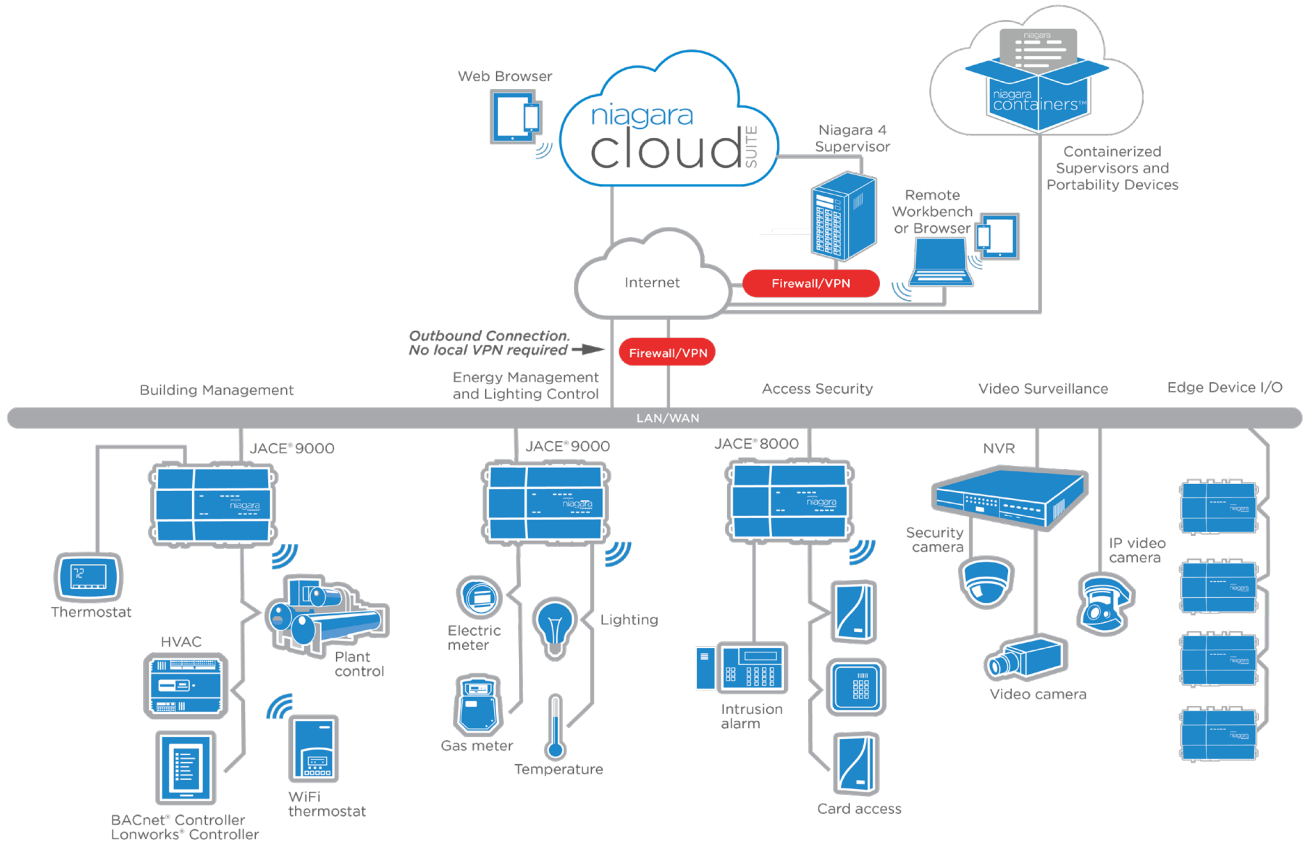


- ▶ Facility managers and their systems integration consultants can leverage Niagara Remote™ to work through system configurations and sequence of operation (SOO) programs remotely without a truck roll. More generally, the ability to do wiresheet programming and design graphics remotely through a browser-based interface can save costs and lead to faster response times. [For more details about Niagara Remote™ refer to this tridium.com webpage.](#)
- ▶ Third-party systems can securely perform a remote update to an on-premise system configuration using Niagara Live Write APIs. This capability built into Niagara Data Service™ enables safe update operations for customers, without the need for manual intervention. [To learn more about live Read-Write with Niagara Cloud Suite, watch this TridiumTalk Webinar.](#)
- ▶ **Niagara Analytics** also executes commands needed for configuration changes as defined by system integrators and building operators.



ADAPTIVE CONTROL

Enterprise Application / Integration Architecture Powered by Niagara 4



As detailed above and seen in several recent demo's, the Niagara Community is already leveraging the power of both the Niagara Framework® and AI to meet customer needs around occupant comfort, safety and security. Along the way, this community is also meeting goals around compliance and sustainability. There is no shortage of innovation and collaboration in our community. Through our software product development work and in our customer projects, we're proving that AI can play a vital role in advancing our industry. Taken together, AI and the Niagara Framework® can:

- ▶ Make the tools SI's use most in their day-to-day activities more intuitive, flexible and powerful, reducing complexity everywhere we can
- ▶ Provide a more streamlined and standardized BMS user experience for all other stakeholders involved in building design and operations, including facility

staff, financial decision-makers and specifying engineers

- ▶ Enable building project teams to resolve customer issues and needs faster
- ▶ Ease key challenges around skilled labor, attracting and empowering the next generation of SIs, facility managers and operators
- ▶ Deliver AI Co-Operators that can augment the capabilities of facility operators, satisfying the comfort and informational needs of occupant customers with less human labor.

Tridium is committed to staying at the forefront of the fast evolving AI-tech landscape. We always appreciate feedback from our community. If you have ideas about how we might help on your AI journey, please reach out to us.



Coming Soon:

Part 2: AI Use Case Examples

This companion whitepaper will delve into how AI tools are being deployed to solve unique customer challenges and to evolve workflows for greater productivity and flexibility. Check the Tridium Library pages regularly so that you don't miss this paper as well as other case studies from Tridium and our Partners around the world.



tridium.com

Support
North America & Latin America
support@tridium.com

Europe, Middle East & Africa
ordersEMEA@tridium.com

Asia Pacific
tsupportAP@tridium.com

© 2025 Tridium Inc. All rights reserved. All other trademarks and registered trademarks are properties of their respective owners.

Information and/or specifications published here are current as of the date of publication of this document. Tridium, Inc. reserves the right to change or modify specifications without prior notice. The latest product specifications can be found by contacting our corporate headquarters, Richmond, Virginia. Products or features contained herein may be covered by one or more U.S. or foreign patents. This document may be copied only as expressly authorized by Tridium in writing. It may not otherwise, in whole or in part, be copied, photocopied, reproduced, translated, or reduced to any electronic medium or machine-readable form.