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The Niagara Framework: Measuring Up to Open

A White Paper

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In the world of computer and software technology "open" is a word with different meanings to different people. Throughout the technology marketplace there are many different measures of open.

The final determination of whether any technology or product is open varies, determined in large part by factors specific to the application. This paper will provide a clear overview of the key elements of "openness" as they relate to building automation, and then measure Tridium's Niagara Framework against these elements.

The criteria discussed in this paper can be used as a measuring stick to evaluate the claims of other products and technologies. In the end, the challenge is yours to decide which solution best meets your unique application requirements.

Key Elements of an Open System

There are many facets of openness: device connectivity, support for accepted standard protocols, end user access to products for initial purchase and system expansion, third party development of complementary enterprise applications, public interfaces (or "APIs") to allow third party access to data, compatibility with standard databases. These are the most common aspects to evaluate when considering openness. Each has relative importance in a given situation. Let's review these topics focusing on simple definitions:

Device connectivity – how many products of importance to my application can a given technology or system communicate with?

Support for accepted standard protocols – does the system in question support the "lion's share" of relevant standard communication protocols?

Access to products for initial purchase and system expansion - where can I buy these products? where can I get them installed or serviced? how many suppliers? is it a competitive situation?

Third party development of complimentary enterprise applications – can independent developers create new products and applications that work coherently with the system?

Public interfaces (or "APIs") to allow third party access to data – are there published interfaces that makes it easy to access system data?

Compatibility with standard databases – can data from the system be easily shared with common database formats used throughout my enterprise?

Now, Let's take a quick overview of the Niagara Framework focusing on these "open measures".

Niagara Framework: Created to "Solve" Open

Tridium's goal in developing Niagara was to create a universal software platform that makes it possible to unify disparate smart devices so that they work together and can be managed by the user as if they were developed by a single manufacturer.

Niagara brings about a convergence of information, Internet and automation and control technologies to accomplish this goal. In doing so, it addresses major challenges being faced by companies and end users that manufacture, use, manage, support and service embedded smart devices. Further, Tridium's goal is to make this technology available to all, enabling true open solutions as defined by customers of all types.

The software design approach to achieve this goal is known as a "framework", hence the name Niagara Framework™. Lets explore the concept in more detail.

Software Frameworks

If we turn to the dictionary we find the following definitions:

Main Entry: **frame·work**
Pronunciation: 'frAm-"w&rk
Function: *noun*
Date: 1644
1 a : a basic conceptional structure (as of ideas) <the *framework* of the constitution> **b :** a skeletal, or structural frame

1. A structure for supporting or enclosing something else, especially a skeletal support used as the basis for something being constructed.
2. An external work platform; a scaffold.

3. A fundamental structure, as for a written work.
4. A set of assumptions, concepts, values, and practices that constitutes a way of viewing reality.
5. In object-oriented systems, a set of classes that embodies an abstract design for solutions to a number of related problems.

A software framework fits within these definitions, providing a platform (fundamental structure) that allows developers to more easily build (construct) their end-use product offerings. An object-oriented framework is a set of co-operating software components that form an infrastructure for building applications in a given domain. The components of the framework encapsulate the majority of the functions needed to implement the end-use applications, thereby streamlining the development and testing process and shortening the time to market.

Unlike a simple software library, which merely encompass pieces of re-useable code, a framework is designed to address the end-to-end challenges associated with that application space – from communication with diverse devices, to data modeling, to alarming, event flow and security.

As a result of their application-focused design, frameworks also address fundamental usability and installability issues of end products by standardizing key interfaces for system setup and commissioning data visualization and operator interaction. This is vital, as an open system must be as easy to use and as cost effective as a proprietary one.

The Niagara Framework

Niagara is a framework specifically designed to address the challenges associated with managing smart devices and embedded systems.[1] Niagara provides a software infrastructure that integrates diverse systems and devices – regardless of manufacturer, communication protocol or data format – into a unified platform that can be easily managed in real-time over the Internet using a standard web browser. The framework does this by "morphing" all of the data and functionality of the diverse connected systems into a common object model, one that allows equal treatment of all connected devices by all applications.

Niagara technology is currently used by many of the key players in the building automation industry in real products solving real

[1] A smart device is generally defined as any component of equipment or machinery with embedded microchips that has the ability to communicate with other devices. Examples include thermostats, electric metering devices, security systems, medical devices, food processing equipment, consumer electronics, office machines, and Telcom equipment.

applications. Today, over 10,000 instances of Niagara Framework technology are at work, making business run smarter by saving energy, providing comfort, and managing facilities.

With this as a background let's get back to our discussion of "open".

Device Connectivity and Support for Accepted Standard Protocols

As discussed earlier, the key issues are how many devices of importance to my application can a given product or system communicate to, and does the system in question support the "lion's share" of relevant standard communication protocols?

The Niagara Framework provides support for a wide variety of protocols. It includes comprehensive support for BACnet and LonTalk™ (LON) as a standard feature. Other supported protocols, which are typically considered as "open" protocols include: MODBUS, SNMP (Simple Network Management Protocol), OPC (Object Linking and Embedding for Process Control), DDE (Dynamic Data Exchange). As a side note, many of these "open" protocols are, in fact, owned (ModBus by Schneider Electric, LonTalk by Echelon, as examples).

In addition to these open protocols, Niagara directly supports many proprietary protocols used by manufacturers of control systems and other smart devices. While Niagara does not have an interface to every device ever made (no one does), we are constantly developing new communication interfaces to meet the needs of our customers. Today we have working interfaces to well over 600 different devices ranging across the building automation, industrial automation, energy and IT infrastructure markets. Further, any new device that supports any of standard protocols supported by Niagara can be integrated with ease. No additional gateways or custom software is required.

And remember, a framework approach, based upon a common object model, allows the data and control features from any of these devices to be easily used within any system wide application.

All of the major standards, large numbers of legacy systems. . . this is strong evidence of the openness of Niagara.

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Open to the Enterprise and Availability to Independent Developers

The end user owns the data in their system, but effective use of that data is where the value is created. End users need the means to make the information from their systems valuable – to give them the knowledge they need to improve the operation of their facilities. Many systems offer reporting tools to help address these needs. Tridium's Vykon suite, in fact, offers tools for advanced data analysis and reporting. But all facilities are different and in many cases the standard tools offered by any one manufacturer just don't fit the needs of the end user. This is where open access to data comes in. Third party tools are often needed to meet unique data reporting and analysis requirements. Niagara makes access to system data easy and open.

Niagara provides a wide variety of software features to enable robust interfaces with third party software applications. Here are a few key examples:

- Standard Database Support. Niagara supports industry standard databases including: Microsoft SQL Server, Microsoft MSDE, IBM Cloudscape, and Oracle.
- Public APIs' and support for JDBC (Java DataBase Connectivity). Even with the freedom to choose among a number of commercially available databases it may often be necessary to pull data from the database to bring it into other applications. JDBC is a standard method of accessing data in databases and is supported by almost all major commercial databases. For specialized access to other data in the Niagara framework, Niagara provides public (this means open) API's which provide third party programmers a defined, officially supported method of accessing, reading and writing data.
- Sometimes specialized applications require manipulation of data beyond what the public API's offer. Servlets are a tool that allows a third party programmer to do virtually anything they need with Niagara data. In addition to the public API's, Niagara includes sample servlets to help developers quickly implement servlets that meet their unique application needs.

Access to data . . . integration with the Enterprise. Niagara provides the richest choice available in the market.

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Open to Serve the Customer

The end use customer is where the buck stops with open systems – they choose the systems, they pay for them, they live with them. We believe that an open system gives the end user the ultimate freedom of choice. The more open . . . the more freedom.

With Niagara, end users have exceptional choice – the manufacturer of their choice, the protocol of their choice, the local contractor of their choice, the choice to select add-on applications and devices from third party suppliers, and the choice to extend the capabilities of the system through standard software interfaces.

- ✓ ***Manufacturer of choice*** – products using the Niagara Framework are available from many of the most respected names in the industry – Invensys, Honeywell, Staefa, Carrier, Emerson Climate Technologies, and McQuay as examples.
- ✓ ***Protocol of choice*** - BACnet, LonTalk, Modbus, SNMP, OPC, DDE, and many proprietary devices or systems.
- ✓ ***Local contractor of choice*** - products using the Niagara Framework are available from over 400 independent contractors. Chances are the contractor you last employed can supply a Niagara solution.
- ✓ ***Choice to select add-on applications and devices from third party suppliers*** – as discussed earlier over 600 devices and many complimentary applications are available today – ready to serve your needs in a Niagara environment
- ✓ ***Choice to extend the capabilities of the system through standard software interfaces*** – provides a virtual unlimited range of application support. If you can imagine an application that needs data from your facility systems, Niagara can support it.

And once those choices are made, the user gets all of the features and benefits of Niagara: the dynamic display of real time information in a standard web browser, built-in network management tools for LonWorks devices, auto-discovery and database generation for many other protocols, and the ability to integrate with many proprietary legacy systems. And because Niagara is a framework and not a mere protocol, you don't have to commit your future to a single protocol decision. With Niagara you can:

- ✓ Specify a building around BACnet today and decide to expand with LonTalk devices in the future. With Niagara you can do that—or the reverse.
- ✓ Take advantage of devices that utilize the many open industrial protocols.
- ✓ Add devices from third party manufacturers. Niagara includes the software features necessary to install them on the network and manage them.

And perhaps most important, the range of choice comes from the names you know and trust. The companies that offer Niagara-based systems are a virtual who's who of the established players in the automation market. Many now . . . more coming.

Perhaps the key measure of openness, the level of choice provided by Niagara exceeds that offered by all other options available today.

Open for Partners

Tridium is not trying to "go it alone". We know the best solutions come from a collaboration of the best minds. We encourage and welcome partners to build upon our technology. Niagara is open to manufacturers that want to adopt the framework and build their systems or extensions upon it.

Today Niagara is being successfully applied in the building automation and energy services industries by a wide range of partners that include OEM manufacturers, and their associated distribution channels, Value Added Resellers, and their associated distribution channels, and independent systems integrators large and small. Other companies have built applications that reside on top of, or are subordinate to, the Niagara Framework. These partners have several things in common . . . they see the need for a framework solution, and they recognize open.

Tridium is dedicated to making Niagara a pervasive technology, well supported by companies you know and trust.

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An Open Technology
Enabling an Open Market

When evaluated on the measures that matter, Niagara provides industry-leading openness, affording an unequaled range of connectivity, customer choice, and manufacturer and distribution channel flexibility. Derived from future-oriented Internet standards, Niagara provides the solution to cost effectively implement multi-vendor multi-protocol systems . . . in an open environment, with freedom of choice.

Seek out one of our Niagara Framework partners for your next project. New construction or renovation, the Framework will build upon what you have and allow you to move forward… Into Open.

Powered by niagara FRAMEWORK™

Technology that Powers the Brands You Trust.
Created to Solve Open.

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About Tridium
The Inventors of Niagara

Tridium, based in Richmond, VA, was founded in 1996 with a goal of creating an open interoperable framework to solve the challenges associated with "device relationship management". The company has an established and growing revenue base, including offices in the UK to support the European market and Singapore for the Asia Pacific market.

Tridium's main product is the patent-pending *Niagara Framework*^{tm} (or "*Niagara*"), a Java-based framework that provides a software infrastructure that integrates diverse systems and devices - regardless of manufacturer, communication standard or software - into a unified platform that can be easily managed in real time over the Internet using a standard web browser

In addition to Niagara, Tridium develops and markets a suite of products and applications, powered by the *Niagara Framework*™, and sold under the *Vykon*™ brand. This product suite is designed to meet the specific requirements of two key markets served by Tridium – building automation and energy services. *Vykon*^{TM} *Building,* and *Vykon Energy* enable facilities managers, energy service companies and systems integrators to integrate proprietary and otherwise incompatible solutions into a unified enterprise solution, which permits anyone using a standard Web browser to measure, manage and control a wide variety of facilities and energy applications from any location in the world. Customers in these markets (including OEM and reseller partners) have a choice of either developing their own applications utilizing Tridium's software framework or implementing these off-the-shelf *Vykon*™ applications.

Tridium's goal is to make Niagara a major global framework for integrating control and monitoring systems of all types via the Internet. Tridium sees the same need to create a standardizing force in the embedded-systems market as occurred in the personal computer market.

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