

new integration
platform
disrupts the
internet of things

n.io drives
the shift to truly
ubiquitous systems



Harbor Research was recently given the opportunity to examine a new integration and data management platform that takes a radically innovative approach to integrating data and inputs from diverse devices, people, systems and the physical world. The new n.io platform jumps ahead of all the current noise and clutter about the Internet of Things by providing a truly 'neutral' software platform that enables interoperable applied intelligence and automation to any asset, signal, event, message, feed or stream from any source without the requirement of data storage. Their core innovation has been to invent a highly adaptive real time signal processing platform that enables universal – systemic – distributed intelligence, control, and automation.

technology
innovator
perspective

Harbor
Research

The world is racing towards “sensorization” and Smart Systems. In its simplest form, Smart Systems is a concept in which inputs—from machines, people, sensors, video streams, maps, newsfeeds and more—are digitized and placed onto networks. These inputs are integrated into systems that connect people, things, processes, and knowledge to enable collective awareness, creativity and better decision-making. However, the information technology tools we are working with today to build “smart systems” were not designed to handle the scope of new capabilities, the diversity of devices and the massive volume of data-points generated from device interactions. These challenges are diluting the ability of organizations to efficiently and effectively manage development. The outdated and outmoded nature of software offerings available today makes it extremely difficult, if not impossible, to realize the promise of the Internet of Things and People. This paper describes an important new platform offering from people who are thinking in terms of the scope and scale that Smart Systems deserves: n.io. In our years of work on the Internet of Things phenomenon, we have not encountered very many compelling visions about the complete integration of things, people, systems and the real-time world. The n.io team of innovators understands that the tools we are working with today fall far short of what’s needed.

IT'S VITALLY IMPORTANT THAT BUSINESS LEADERS UNDERSTAND THE FUTURE OF INFORMATION TECHNOLOGY

discontinuous futures

We're trying to build a future on inadequate structures from the past. For all the silicon-based "intelligence" permeating every aspect our lives, we still live in a brutally dumb world. That dumbness is starting to cost us dearly. Every day, executives valiantly try to conduct smart business in a dumb world of wretchedly inadequate information and antiquated communications. It's as if we're wandering through the uncharted jungles of the 21st century with reconnaissance reports and walkie-talkies from about 20 years ago.

Today a rapidly expanding range of devices and things have the capability to automatically transmit information about status, performance and usage and can interact with people and other systems anywhere in real time. This fact points to the increasing complexity of smart systems and services solutions.

The number of connected devices on the planet is surpassing the number of people: more than seven billion. Depending on your definition of a sensor, there are already two or three times more sensors on Earth than people. A single large oil refinery produces more

data in a day than the New York Stock Exchange and AMEX combined.

The astronomical growth of networked devices, data types, and functions within and among connected device systems pushes the bounds of what software designers ever had in mind.

Some basic principles must be put in place to guide the development of smart, connected systems. We must design not only devices and networks, but also information systems, in ways not addressed by current IT technologies.

The reader may ask: Don't we already have a vast number of software platforms to address these challenges? Don't we have real-time Internet of Things integration tools and technologies? And aren't these technologies working together today quite handsomely?

Almost everyone will answer with a resounding "Yes!" But consider this analogy from Buckminster Fuller: Suppose you are traveling on an ocean liner that suddenly begins to sink. If you rip the lid off the grand piano in the ballroom, throw it overboard, and jump on it, the floating piano lid may well save your life. But if, under normal circumstances, you set about

about n.io

n.io is an IP and software innovation start-up that is developing a whole new generation of information tools for managing rich, real-time streams of meaningful data to create transformational applications and services.

n.io's core innovations are focused on providing B2B and B2C developers, partners and customers with tools to facilitate data and events from anywhere, at anytime, in any format. n.io's platform addresses transactions, application development and collaboration for smart connected systems as a unified challenge that can be addressed by a single, scalable solution.

For more information visit <http://n.io>

THE INTERNET OF THINGS IS REALLY HERE NOW; BUT IS IT?

to design the best possible life preserver, are you going to come up with anything resembling the lid of a grand piano?

The growing scale of interactions between feature-rich devices is the rapidly rising ocean, and the antiquated IT tools available today to develop them are like that piano lid. In a period of great change and tumult, the tools worked—in the sense that they kept us afloat. But that does not make them the best possible design, or qualify them to be something that we should plan to live with forever.

Whatever we chose to call this new wave of technology—“Smart Systems” or “Pervasive Computing” or “The Internet of Things”—we are referring to digital microprocessors and sensors embedded in everyday objects. But even this makes too many assumptions about what the smart systems phenomenon will be. Encoded information in physical objects is also smart—even without intrinsic computing ability. Seen in this way, a printed bar code, a house key, or even the pages of a technical manual can have the status of an “information device” on a network.

But very few people are thinking about smart, connected systems on that level. Current IT and telecom technologists are operating with outdated models of data, networking and information management that were conceived in the mainframe and client-server eras and cannot meet the needs of a truly connected world.

“Smart Systems” should automatically be understood as “real-time networked information and computation”—but it isn’t. The Internet’s most profound potential lies in the integration of machines, information systems and people—its ability to connect billions upon billions of smart sensors, devices, and ordinary products into a “digital nervous system” that will smoothly interact with individuals and systems. The nature and behavior of a truly distributed global information system are concerns that have yet to really take center stage—not only in business communities, but in most technology communities, too.

But I might be getting ahead of myself. . .

TODAY’S IoT CHALLENGES

Our research and experience verifies that existing entrenched systems and applications are designed largely to existing IT architecture and models that continue to proliferate data storage, hardware, networks, software capital expense and function within IT system walled gardens. This architecture and systems design bias is an innovation killer!

- Proprietary & Disparate Signals: limited interoperability
- Architectural Constraints: requirements for a complete ‘system’
- Latency: wide-ranging definitions and delivery of “real-time”
- Performance: adaptable to the full spectrum of volume, rate, size
- Broad Functionality: cannot be another “hammer to a nail”
- High and Tightly Encumbered: high cost and adoption barriers
- Bias to Legacy Architectures: high capital investment in data generation, storage, and network

THE TOOLS WE ARE WORKING WITH TO ANALYZE “SMART” MACHINES WERE NOT DESIGNED FOR TODAY’S DATA VOLUME AND COMPLEXITY

classic IT technology only addresses part of the story

From a technology perspective, today’s corporate IT function is a direct descendent of the company mainframe, and works on the same “batched computing” model—an archival model, yielding a historian’s perspective. Information about events is collected, stored, queried, analyzed, and reported upon. But all after the fact.

That’s a very different thing from feeding the real-time inputs of billions of tiny “state machines” into systems that continually compare machine-states to sets of rules and then do something on that basis. In short, for connected devices to mean anything in business, the prevailing corporate IT model has to change.

The convergence of innovations in sensors; software architectures; back-room data center operations; wireless and broadband communications; and smaller, more powerful client devices connected to personal, local and wide-area networks—these are all part of the next cycle of technology

and systems development in the smart systems and Internet of Things arena, which is supposed to be setting the stage for a multi-year wave of growth. But is it?

obstacles abound today

When it comes to preparing for the global information economy of the 21st century, most people assume that “the IT and telco technologists are taking care of it.” They take it on faith that large corporations and centralized authorities will produce the best possible designs for the future of connected things, people, systems and information. But those are big, unfounded assumptions. In fact, most of today’s entrenched players are showing little appetite for radical departures from current practice. Yet current practice will not serve the needs of a genuinely connected world. What are the major obstacles that need to be overcome?

Smart Systems Intelligence and Automation: The inability of today’s enterprise IT systems to interoperate and perform well with distributed heterogeneous device environments

CURRENT PRACTICES WILL NOT SERVE A TRULY CONNECTED WORLD - DIVERSE DEVICES, INPUTS AND DATA REQUIRES A WHOLE NEW CLEAN SHEET APPROACH

is a significant obstacle. The focus must shift from simple device monitoring to a model where device data, along with all other signals and inputs, is aggregated into new applications to achieve true systemic intelligence and automation.

Optimizing All The Things, Systems and People In Real Time: The task of optimizing the value of financial assets, physical assets and human assets requires new technologies that will integrate diverse asset information in unprecedented ways to solve more complex business problems in true real time.

Truly Agile Systems: Today's IT systems enforce severe limitations on the functions you want most in a global, pervasive-era information system: scalability; interoperability; and seamless integration of state-based, real-time or event-driven data. The client-server model underlying today's IT architecture and the web greatly compounds the problem.

What is needed is a truly "neutral" software platform that enables interoperable intelligence and automation to any asset, signal, event, message, feed,

or stream from any source. "Internet of Things", "convergence", "semantic web", "M2M", and "Smart" are just words—unless an enabling capability connects and integrates the trillions of disparate "things" without bias toward pre-determined technologies, applications, or today's IT systems.

Some things that look easy turn out to be hard. That's part of the strange saga of the Internet of Things and its perpetual attempts to get itself off the ground. But some things that should be kept simple are allowed to get unnecessarily complex, and that's the other part of the story. The drive to develop technology can inspire grandiose visions that make simple thinking seem somehow embarrassing or not worthwhile. That's not a good thing when one is trying to define and deploy real-world technology to deliver innovation. This is where the new values of the n.io platform really come into focus.

KEY N.IO FEATURES

- **Neutrality:** ANY signal – message – event – feed – stream – data
- **Communication:** efficient application of publish and subscribe
- **Data Ambivalence:** Asynchronous stream and/or data processing
- **Infinite Contextual Configuration:** temporal and/or spatial and/or state
- **Robust Functions:** filtering and/or enrichment and/or actions
- **Small Footprint (Embeddable):** chip to cloud distributed architecture
- **Very High Performance:** true real-time!
- **Linear Scalability:** without "Big Iron" requirements (bias)
- **Compatibility:** Any OS - web standard APIs – SOA
- **Self-Contained and Self-Aware:** providing TOTAL systemic intelligence and/or closed/open loop control functionality

DIVERSE DEVICES, INPUTS AND DATA REQUIRES A WHOLE NEW CLEAN SHEET APPROACH

platform futures - can technology save us from technology

Customers expect evolving software tools to be functional, ubiquitous, and easy to use. However, the first two expectations run counter to the third. In order to achieve all three, a new approach is required: a unified development, integration and data management framework for smart, connected systems.

Such an approach would have to be:

- » **Interoperable:** smart systems need to be designed without biases and dependencies that cause integration pain.
- » **Asynchronous:** software that can enable asynchronous integration of any combination of signals (message/feed/stream/data/etc.).
- » **Database-Independent:** real-time stream processing that provides complete independence from traditional databasing schemas; processing that enables users to filter and enrich at the “edge” and forget about pushing gargantuan amounts of data to

warehouses and repositories.

- » **Adaptable:** software to enable computation and logic exactly where it’s needed—on a chip, on a device, on a server, in the cloud, or a hybrid system architecture.
- » **Real-time & Scalable:** software that enables true real-time visibility of what is happening now and that does not constrain application requirements and scalability.

In sum, we need a software platform that facilitates data and events from anywhere, at anytime, in any format, in real time—and that has a small footprint and is agile. We need new tools that will allow us to migrate enterprise IT systems to an anywhere, anytime, any-format world.

enter the n.io platform

n.io is a software innovation and IP development start-up founded by Doug Standley, a clever visionary and technology and solution architect who came out of Deloitte Consulting. Doug was the founder of Deloitte’s Innovation Strategy

THE SHEER DIVERSITY OF APPLICATIONS IS OVERWHELMING: AUTOMATING ASSET HEALTH IN INDUSTRIAL AUTOMATION AND ANALYZING STREAMING CONTENT DURING THE SUPER BOWL

practice, but probably more importantly, worked with diverse clients applying emerging technologies including RFID, wireless sensors, mobility, telematics, user experience, and pervasive computing.

Much of this experience and innovation has now found its way into n.io's platform and tools. Doug and his team are really creating a global information architecture designed for every person, every thing and every conceivable kind of data, with the scalability and information-freedom needed by the pervasive-computing era.

What the n.io team really understands is that today's tools are really a poor patchwork of technologies that cannot meet the requirements for an Internet of Things and People. Hence, they saw the opportunity to take a truly discontinuous approach to integrating the potentially infinite interactions from smart devices, people, systems and the physical world. n.io moves beyond today's platforms and technology by viewing core transactions, application development and collaboration for smart connected systems as a unified

challenge that can be addressed by a single, scalable solution that is completely "neutral" to whatever data type or signal is involved. The n.io software platform takes on the toughest challenges of interoperability, latency, database dependency and user complexity. It enables adaptable, real-time intelligence and automation to empower users and developers to exploit the vast potential of technology and the Internet. The n.io platform's key design and architectural features include:

- Asynchronous Processing:** No other platform can process and apply full context (temporal-spatial-state), including automation and actions, to multiple content types and sources including:
- » Physical sensors, actuators, devices, etc.
 - » Data Repositories: Data could be a "soft sensor" input from repositories like the USPTO database, API, SEC filing, PRNews, or virtually any content producer;
 - » Streams: Twitter, Facebook, Google+, Reddit or whatever streams are available.

Pre-Warehouse/Storage Data Processing: No other platform

N.IO DEMONSTRATES ITS TECHNOLOGY -- THE BIG GAME

n.io enables real-time, database-independent content discovery, filtering, enrichment and publishing. It provides insight into what the Internet is really saying about any topic while the conversation is actually happening.

To validate the features and functions inherent in its platform offering, n.io staged a demonstration of its media and content aggregation and tracking application during the Super Bowl.

If you didn't tune in, it's too late to watch The Big Game reactions stream in real time, but below is a peek into some of what n.io saw:

- » 11.4 million posts during the game;
- » from 42 different sources;
- » utilizing 3240 contextual parameters and 5 filters.

The bottom line is that the n.io platform filters, contextualizes and delivers content from across the Internet to see how brands stack up, see reactions to team behavior, and more—all in true real-time.

N.IO IS A TRULY UBIQUITOUS INTELLIGENCE AND AUTOMATION PLATFORM

is ambivalent to data storage. All processing is at the stream/feed/message/API level:

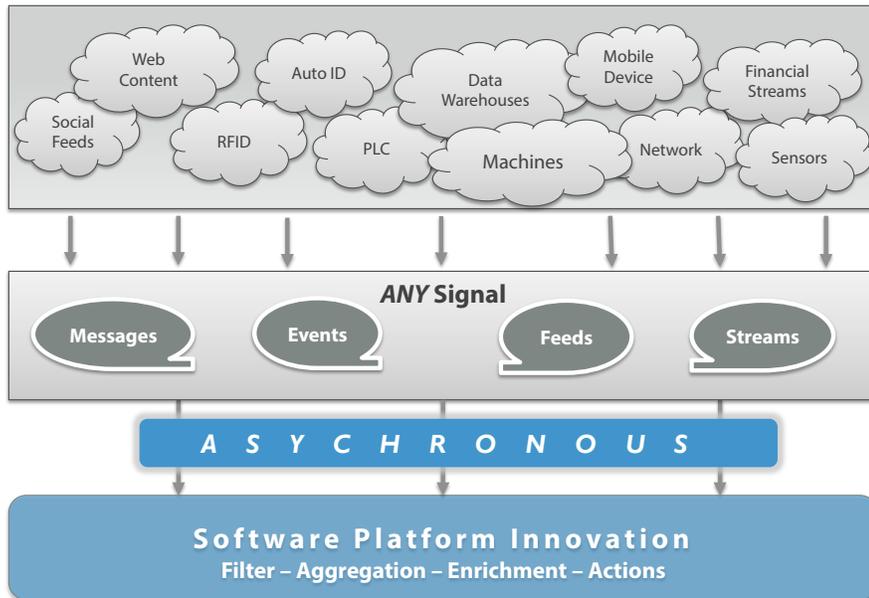
- » True real-time: no data exhaust to filter and analyze;
- » Low overhead: store only the relevant context (optional).

And finally, n.io is a truly distributed architecture with virtually no

constraints on how it gets deployed in a device, server, cloud, or hybrid architecture. The unbiased neutrality of n.io will potentially create broad use and diverse market opportunities, including:

- » Mobile devices and applications
- » Auto-ID and RFID
- » Wearable technology

n.io™ is a software platform that enables transformational interoperability, intelligence and automation



n.io's platform solution is a highly adaptive signal and data processing software platform that enables:

- » Transformational interoperability
- » Universal | Systemic | Distributed Solution Architecture
- » Complete contextual enrichment (including temporal-spatial-state)
- » User configurable intelligence and/or control and/or automation
- » Unlimited asynchronous in-stream processing (without DB dependencies)
- » Linear scalability accommodates unlimited demand

CUSTOMERS EXPECT EVOLVING SOFTWARE TOOLS TO BE FUNCTIONAL, UBIQUITOUS, AND EASY-TO-USE

- » Home and industrial automation
- » Telematics
- » Security and surveillance
- » Social media
- » Location-based services
- » Web content management
- » Advertising

n.io has filed four patents, with more to come. The company is piloting the platform in an industrial automation application and a sports media content aggregation application, and is also working with a large global silicon manufacturer on an embedded [system-on-a-chip] deployment. As n.io comes out of its “stealth” mode, we anticipate many more discussions with a broad range of large tech players.

n.io drives business model innovation

Radical new thinking about information technology must begin at the most basic levels, with new conceptions about the interactions of information with people, systems and devices. The n.io team is future-proofing their innovations by making the fewest possible assumptions about the nature of networked objects and the data they produce,

carry or process - the company takes a much broader, all-encompassing view of information. Ultimately, this type of platform solution will alter traditional business models and change how new applications are realized.

Since everything we are describing is a radical departure from current platform offerings and business practices, and is driven by a very unique set of needs, it stands to reason that this type of solution does not fall within the narrow specialties of the existing players. In fact, the platform being described is probably best viewed as an entirely new market category. This is particularly true given the disjointed patchwork of platform solutions presently in place and the apparent lack of vision from existing players of what’s required in the future.

The opportunity to lead in developing and shaping this market looks wide open to players like n.io. We believe n.io’s vision succeeds because it is a “return to first principles”. By creating an architecture that makes the fewest possible assumptions about devices and data and how they will interact and be used in the future, n.io underscores the need to build simple, extensible foundations for intense complexity.

ABOUT HARBOR RESEARCH

Founded in 1984, Harbor Research Inc. has more than twenty five years of experience in providing strategic consulting and research services that enable our clients to understand and capitalize on emergent and disruptive opportunities driven by information and communications technology. The firm has established a unique competence in developing business models and strategy for the convergence of pervasive computing, global networking and smart systems.