wireless sensor platform enables new customer value

Synapse Wireless Drives Internet of Things Innovation

Intelligent sensor networking is the next big thing in smart connected systems and information technology. It will enable the transition from dumb products to smart systems that become "portals" into a whole new world of customer value-creation. A new generation of wireless sensor platforms are unleashing an age of continuous "always-on" connectivity and awareness that is fostering entirely new modes of customer interaction and service delivery. To realize the full potential of this opportunity, customers will need new partners, tools and technologies for effective development and deployment.

technology innovator perspective

Harbor Research

The term "convergence" implies unification, but you wouldn't know it from today's sensor networking technology market—a fragmented landscape full of narrow point-solutions, time-sink products, and software incompatibility. Amid all the noise and clutter, a new platform from Synapse Wireless finally takes a "pervasive" approach to digital tools for sensor integration and data management. Synapse's SNAP® network operating system and Portal® platform enables users and customers to integrate sensors for remote monitoring, control and data analytics with a wide range of applications. It treats user concerns—from machine health, to business process efficiency to safety and compliance—as challenges that can be addressed by a single, scalable solution. In taking this perspective, Synapse Wireless is jumping ahead of the current market's noise and confusion about wireless connectivity and Big Data and is re-defining how value is created from sensors and data.

IT'S VITALLY IMPORTANT THAT BUSINESS LEADERS UNDERSTAND THE INTERNET OF THINGS PHENOMENON

Internet of Things Has Arrived

We have now entered the age when everyday objects will communicate with, and control, other objects over a global data network—24/7/365. That network is the Internet. The objects are everything from consumer appliances to the elevator you've been waiting for. It's not "the future," it's now. Therefore, it is vitally important that business leaders understand this phenomenon, its effects on their business, and what they should do right now to position themselves for opportunities that are literally just around the corner:

» Manufacturing equipment, elevators and escalators, appliances and vehicles that know exactly when and why they will fail, and then alert you or your service organization before the failure occurs—or even, in some cases, fix themselves.

» Buildings and facilities with "digital nervous systems" that ensure occupant comfort and safety, lower energy and operating costs and even enhance productivity.

» Retailers and distributors who know exactly where every piece of inventory is at any moment, and under what conditions it arrived.

» Industrial customers who save a fortune on energy by being able to see, in real time, exactly how they're using it.

» OEMs that are not "disintermediated" at the point of sale, but stay connected to end-customers via a steady stream of status/usage/performance data.

» Healthcare facilities where accurate, up-to-the-minute patient information is always available because every piece of equipment, from digital thermometers to life-support machines, is networked and associated with a patient ID and health delivery professionals.

And on, and on, and on. Science fiction? Not anymore.

Smart connected devices are a global and economic phenomenon of unprecedented scale - potentially billions if not trillions of nodes. Soon, any device that is not networked will rapidly decrease in value, creating even greater pressure to be online. Devices will blend into every venue and vast opportunities will arise for companies

Wireless Technology Drives Internet of Things Innovation

We strongly believe that the wireless sensor networking market opportunity is reaching its tipping point for growth; there is now substantially greater recognition of the technological capabilities and the potential benefits of connecting devices to the Internet, particularly sensors and related intelligent edge devices.

» *Overall the Internet of Things (IoT) market has four main network platforms that need to be addressed -- WPAN, WLAN, WWAN and Wireline.*

» *Wireless connectivity overall is forecast to comprise over 80% of the intelligent device connectivity market by 2018; wireless sensor networks are essential for the success of the IoT.*

» *The IoT market requires a unified solution for sensor integration that integrates an approach to monitor devices, and optimizes device power usage while providing significantly greater network visibility.*

THE INTERNET'S MOST PROFOUND POTENTIAL LIES IN THE INTEGRATION OF SENSORS, DATA, PEOPLE, PROCESSES AND SYSTEMS TO ENABLE AWARENESS AND BETTER DECISIONS

delivering, managing and responding to the rich data being generated.

Consider the following:

» Today, the number of connected devices on the planet has surpassed the number of people - 7.2 billion.

» Depending on your definition of a sensor, there are already more sensors on earth than people.

» In the long run, the potential number of smart machine-to-machine (M2M) connected things could increase to a scale that is two orders of magnitude larger than the population - traditional IT and telephony devices will become a very small portion of the connected world.

» Smart devices will enable new services such as status monitoring, control, usage tracking, consumable replenishment, automated repair, and new modes of comfort and convenience whose value together could reach beyond $500 billion in value-added revenues by 2015.

As Moore's law persists and the price of integrating intelligence and sensor connectivity into products continues to fall, networked devices will push further and further into the mainstream. This process is self-reinforcing as low prices are driven by high quantities, and vice versa, making intelligent sensors and machines increasingly prevalent in our lives and businesses.

We strongly believe that the wireless sensor opportunity is reaching a new level of maturity. There is now substantially greater recognition of the technological capabilities and the potential benefits of connecting sensors and machines to the Internet than there was even 2 years ago.

Enter Synapse Wireless

This paper is about an important new wireless sensor networking platform and data management offering from people who are thinking about the scope and on the scale that sensors and machine data deserve — Synapse Wireless.

The Synapse team of innovators understand that the tools we are working with today to integrate wireless sensors and analyze sensor data were not designed to really address the deployment, integration and operational

EXISTING TECHNOLOGY HAS PROVEN CUMBERSOME DRIVING THE NEED FOR NEW INNOVATION

challenges associated with sensor integration.

Synapse understands that customers expect evolving software tools to be functional, ubiquitous, and easy-to-use. Within this construct, however, the first two expectations run counter to the third. In order to achieve all three, a new approach is required -- a unified development framework and platform for smart sensing combined with software development tools that work together seamlessly, securely and safely across diverse sensor applications and a network architecture that is truly scalable.

The Synapse Wireless SNAP platform is setting the stage for a new chapter in smart connected systems, but before delving into the new thinking that makes this story possible, let's talk about why it's necessary at all.

Connecting "The Last Inch"

Visions of wireless sensors have been in abundant supply for several years now. Deployment, however, has been slower than expected due to a wide range of technical constraints and commercial limitations that have inhibited integrating devices at the edge of networks... what we like to call the "last inch" of intelligent device integration.

Existing technology has proven cumbersome and costly to apply with many conflicting protocols and incomplete component-based solutions.

We believe some basic design principles must be put in place to guide the development of smart connected sensors and devices. Realization of wireless sensor network value demands that we design not only sensors and networks, but also data management of sensor inputs in ways not well addressed by current technologies.

The reader may ask, don't we already have a vast number of software products to address these challenges? Don't we have network operating systems and development tools? And aren't these technologies working together today?

Most managers, and some technologists, are likely to answer with an emphatic "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 circumstanc-

What Executives Need To Know About Wireless Sensor Innovation

Understanding new technology is critical to leveraging its value; what should executives understand about wireless sensing innovations:

» **Real Time Systems:** *Connecting operations technology (OT) to information technology (IT) requires real time platforms acting as the "glue" between the physical world and the virtual world.*

» **Leverage Existing Systems:** *Wireless sensing, for most applications, leverages existing machines and equipment by simply retrofitting more sensors and intelligence into installed systems.*

» **Future Proof Technology:** *Wireless sensing communications technologies need to be flexible enough to allow future expansion and extensibility.*

WE ARE REACHING A CRITICAL JUNCTURE IN MARKET DEVELOPMENT WHERE ORGANIZATIONS WILL SOON BE CRYING OUT FOR A COMPLETELY NEW APPROACH

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

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

Sensor Networking Innovation - What's Required?

Today's tools for connecting sensors to networks were not designed to handle the diversity of devices growing from miniaturization of electronics, the scope of new capabilities, the need to carefully manage power requirements, and the massive volume of data-points generated from device interactions. These challenges are diluting the ability of technical organizations to efficiently and effectively manage application development. The fragmented nature of wireless sensor network offerings available today make it extremely difficult, if not impossible, to design, deploy and scale solutions across different applications, devices and domains.

The Internet of Things, in many ways, presupposes the existence of a zero-infrastructure, ad-hoc network that makes seamless peer-to-peer physical connections possible. Obviously, billions of devices of wildly varying types cannot each receive individual attention and configuration by humans, or conform to elaborate prior specifications. If it literally takes a trained network engineer to install a smart light bulb, the Internet of Things is never going to work - users must be able to do this without even realizing there is a network there at all.

Many schemes and 'standards' for device connectivity already exist. But of course, all those 'solutions' add up to one big problem. Users don't want many standards; they want one solution. In the end, they just want it all to work seamlessly and therein lies the challenge - networks of this scale and this application diversity have never been successfully assembled before.

We are reaching a critical juncture in market development where engineering organizations will soon be crying out for a completely new approach - one where the network operating

Synapse Wireless Core Technology Innovation

Wireless network solutions to connect machines and sensors to each other and the internet:

- *Runs on tiny, inexpensive, wireless computer chips*
- *Modern wireless mesh network architecture that auto heals*
- *Create applications in minimal time*
- *Routing happens over any available media*
- *Encryption for security*
- *Long range radios*
- *Can support any frequency radio required*
- *Can run on top of other networks (TCP/IP, PLC, …)*
- *Can add new processor technology seamlessly*
- *Easily connects to internet*

SYNAPSE'S APPROACH REPRESENTS A TRUE SHIFT IN THINKING ABOUT HOW SENSOR NETWORKS WILL BE UTILIZED IN BUSINESS

system and its components can be utilized again and again across an ever broader spectrum of devices, applications and business processes.

When telephones first came into existence, all calls were routed through switchboards and had to be connected by a live operator. It was long ago forecast that if telephone traffic continued to grow in this way, soon everybody in the world would have to be a switchboard operator. Of course that has not happened, because automation was built into the systems to handle common tasks like connecting calls.

We are quickly approaching analogous circumstances with the proliferation of smart connected sensors and devices. Each new device requires too much customization and maintenance just to perform the same basic tasks.

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 defining and deploying real-world technology to deliver innovation. This is where the new values of Synapse's SNAP platform and their innovative business model really come into focus.

Synapse Business Model Innovation

Synapse's sensor integration and data management platform is not an incremental improvement or new flavor of existing wireless sensor network tools. Their development represents a true shift in thinking about how sensor networks and machine data will be utilized for re-designed business processes and intelligence.

The company understands that the dynamics surrounding deployment of wireless sensors and IoT solutions are incredibly complex. Basic enablement, network connectivity, systems integration, value-added services, and other device integration and management functions are all needs that generally must be addressed when customers seek to connect intelligent devices.

Until now, wireless sensor technology adoption has largely been driven by product OEMs outfitting their prod-

Business Model Innovation

What will be required of technology developers and services providers?

» **Enhanced Delivery Platforms:** *Managed services delivery platforms have emerged as a critical tool that can help address sensor integration, configuration, provisioning and device management and asset-related application services.*

» **Application Delivery:** *M2M application development, to date, has focused primarily on developing better infrastructure technology for connecting and provisioning devices. Today users need better application development tools and cloud-based application services delivery - this is real-time and state based.*

» **Vertical Industry Expertise:** *Because application requirements tend to be unique to an industry, crafting the right combination of expertise, system elements and partners to address these challenges requires deep understanding of different industry segments and their unique challenges.*

SYNAPSE IS AN INNOVATOR IN DEVELOPING AND APPLYING WIRELESS SENSOR AND IOT TECHNOLOGY - PARTICULARLY FOR END CUSTOMERS AND PARTICULARLY FOCUSED ON BUSINESS PROCESS INNOVATION AND INTEGRATION

ucts with networks and taking them to end customer domains. Adoption of smart systems solutions has largely been the focus of equipment OEMs and "specialist" value-added services players. We believe the market has entered a phase where planning, specification, justification and deployment of systems will shift to end use segments and customers who are seeing a wider array of applications and business benefits than any single product OEM recognizes.

Synapse has discovered that addressing sensor innovation from an end customer point of view — not a product OEM's perspective — reveals many more opportunities to use these tools for new business innovation.

When viewed through the lens of an end customer, applying new wireless sensor capabilities can enable many new applications with real-time situational awareness. This can lead to many new innovations such as re-design and automation a wide range of business processes for greater efficiency, safety or validated compliance.

As a result, technology moves beyond just proposing task solutions – such as executing a work or sales order – to sensing what is happening in the world around it, analyzing this new information for risks and possibilities, presenting alternatives, and taking actions. They understand that the many "nodes" of a network may not be very "smart" in themselves, but if they are networked in a way that allows them to connect effortlessly and interoperate seamlessly, they begin to give rise to complex, system-wide behavior. This allows an entirely new order of intelligence to emerge from the system as a whole—an intelligence that could not have been predicted by looking at any of the nodes individually. What's required is to shift the focus from simple device monitoring to a model where device data is aggregated into new analytics applications to achieve true systems intelligence.

Synapse is driving an entirely new business model based on a managed services approach that embodies user centered experience as the driving force underlying its competitive differentiation.

Synapse's business model is a unique innovation in its own right based on combining sensor network technology, end user application focus and providing an end-to-end managed services approach. The intersection of these three elements has created an opportunity for Synapse to evolve its offering, and drive a differentiated

Wireless Technology Drives Energy Innovation

Synapse Wireless has enhanced the energy industry through the deployment of innovative Internet of Things solar solutions. By integrating intelligent sensors into Balance of Systems market leader Shoals Technologies' solar combiner boxes, they've significantly reduced in-field labor and cabling costs, while simultaneously creating a platform for real-time field monitoring down to the string level. Operators gain new insights into field performance, and farms can be commissioned in less time and cost than a wired monitored field.

Each SNAP node is a small computer that automatically communicates with similar nodes via the patented SNAP IoT OS. The resulting network utilizes a high-performance, low-power, small-memory-footprint stack that is self-forming, instant-on, and self-healing. Every node in the field acts as a means of communication for other nodes. If one fails, others route around it, providing a constant flow of operational information to a cloud based data warehouse, and allowing field operators to monitor individual string currents, busbar voltage and temperature in real-time.

SYNAPSE UNDERSTANDS THAT THERE IS A NATURAL EVOLUTION FROM ANALYTICS AND SENSOR INTEGRATION TO DATA MANAGEMENT AND COMPLETE END-TO-END MANAGED SERVICES

business model. The three dimensions are interwoven and mutually supportive, and underscore that success will go to the player that effectively utilizes their combined potential.

Choosing The Right Partner

We are on the cusp of a transformation in the Internet of Things marketplace. Over the next several years we will see a dramatic breakthrough in sensor and machine networking applications as organizations recognize the potential they represent for reducing operating costs, generating revenue and improving customer satisfaction.

Smart sensor and device enabled applications are highly specialized. Embedding connectivity into the next generation of devices, ensuring they are deployed profitably and that new services delivery capabilities can scale across multiple applications and industries are challenging tasks.

Integrating the physical and virtual systems will require expert application knowledge as well as a deep understanding how these systems will work. Choosing the right partner, one that fully understands the different elements involved and that is financially stable, and correctly aligned with delivery infrastructure partners will be critical to successful deployments. Working with solution providers, like Synapse Wireless, that have a deep rooted understanding of the complexities of large global deployments will ensure that the solution is successfully delivered. A new chapter in the story of wireless sensor networks, M2M applications and IoT solutions has begun.

What we are describing is a radical departure from current technology offerings and business practices, driven by a very unique set of needs. The solution does not fall within the narrow specialties of the mainstream players. Given the disjointed patchwork of present device solutions and the apparent lack of vision from existing players, the market model described here is best viewed as an entirely new category. This is particularly true given the disjointed patchwork of device solutions presently in place and the apparent lack of vision from existing players of what's required in the future. The opportunity for players like Synapse Wireless to lead in developing and shaping this market looks wide open.

ABOUT SYNAPSE WIRELESS

With the billions of devices that will be connected to the Internet, and to each other in the next few years, it's no longer just about M2M or the Internet of Things. Welcome to the Internet of Everything. Synapse delivers flexible and scalable solutions that distribute intelligence to the edge of your network, enabling real-time big data and analytics that drive speed and efficiency into your organization.

www.synapse-wireless.com

ABOUT HARBOR RESEARCH

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