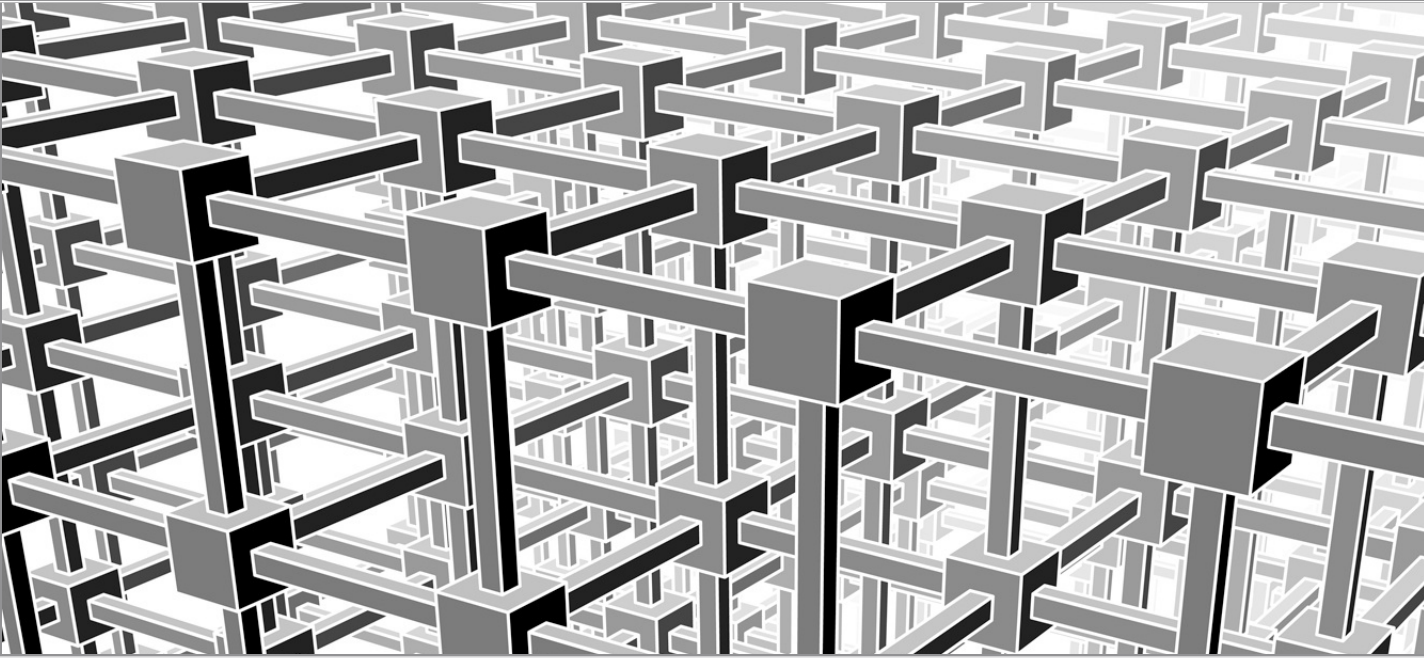


Next Generation Platform Innovation In M2M

WHITE PAPER



New machine-to-machine (M2M) solution platforms need to address the true potential for information-driven service innovation and application development. By embedding support automation directly into the fabric of the solution and providing tools for third party application development, new platform technologies can help product manufacturers leverage the continuously evolving relationship between connected products and customer value. This White Paper and supporting research highlights the expanding value of platform innovation for M2M solutions.

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How Research Was Conducted

From November 2010 through January of 2011, Harbor Research conducted interviews with over 30 product OEMs, integrators, partners and customers in five sectors who are in various stages of adoption and delivery of Smart Services. This White Paper explores technology trends, the benefits and economic impacts arising from the convergence of embedded machine intelligence, communications and cloud computing services.

Many, if not most, “product-driven” businesses are now embracing the concept of growth-creating services around a connected product business model. Wireless carriers have partnered with service delivery platform providers to make their networks more accessible to M2M applications, but the enterprise customer continues to deal with many complexities along the way to building complete end-to-end vertical solutions. The next chapter in the M2M arena will be driven by cloud platforms, intelligent devices and back office systems that seamlessly integrate with one another and thereby unlock the full potential of smart connected devices. Uninformed human activity in customer support will be replaced by embedded intelligence in devices and smart systems. The complexities of disparate networks, devices and hardware will be removed thus reducing time to market and overall costs and risks for custom application development. All of this will be done with enterprise solutions engineered for deployment on the world’s leading wireless networks.

THE ADVENT OF SYSTEMS AWARENESS

What happens these days if your car has a problem - a “check engine” indicator lights up; a navigation system sends you a service alert and plots the route to the repair shop. Once at the shop you speak to what used to be called a mechanic who in reality has now become a “systems diagnostician” who immediately consults a monitor that is wirelessly communicating to the over one hundred microprocessors in your vehicle that knew hours ago to initiate the alert.

After fixing the car you head home and as you pull into the garage and the lights come on automatically and you immediately remember a few years ago when you would come home

and wonder why your children had left all the lights on. Today, not only is your electricity bill managed automatically to give you the best possible rate, but, in fact, lights and appliances turn off and on based on rules you have provided to the system managing them. You are now receiving alerts over your cell phone—remember when you found out you had a leak in your vacation home water heater?

All these ‘visions’ share one common attribute: embedded intelligence and systems awareness. We have entered the age when everyday objects will communicate with, and control, other objects over networks—24/7/365, without human attention or intervention. Manufacturing and farming 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. Futurists have been describing such capabilities for decades, but in the last several years some businesses have started to actually realize the tremendous business benefits of what the pundits have been describing - equipping their remotely located and mobile assets with connectivity for [non-human] monitoring. The return on investment due to truck rolls avoided and down time prevented is indisputable. Whole new business models have sprung up with wireless connectivity at their core - think eReaders and gaming devices.

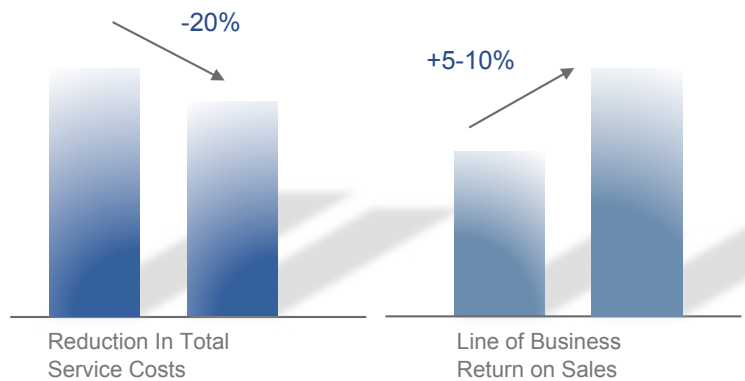
Today, the world’s leading cellular network operators such as Verizon Wireless, AT&T, Vodafone, China Mobile are all actively advancing the use of cellular wireless for Machine to Machine (M2M) communications. The attractions are clear — incremental network traffic for the carrier, new applications for developers, systems integration opportunities for IT players and, most importantly, significant asset efficiency and productivity gains for enterprise customers. While there is still much value that has been “left on the table” and the full measure of connecting assets has not yet been fully realized, remote M2M services have already proven to be an attractive investment for many businesses (see Exhibit I).

For cellular wireless carriers, positioning their M2M solutions as a service line extension to their large portfolios of enterprise customers creates new revenue streams to offset saturation in their handset businesses. Cellular has become the network of choice for smart connected devices in a wide array of applications including automotive telematics, commercial transportation, mobile health, and consumer electronics -- all due to its pervasiveness and ever lower cost.

Our society is at the cusp of a “perfect storm” of network connectivity. This phenomenon is not just about the dichotomy between people communicating with people or machines communicating with machines: it also includes people communicating with machines (e.g. a networked ATM), and machines communicating with people (e.g. automated stock ticker alerts on your PDA).

The concept of network effects states that the value of a network grows exponentially with the number of nodes connected to it. Along with the value, however, so too grows the complexity of managing the equipment and devices on the network, the difficulty of servicing them, and the reliance of people and organizations who are interacting with devices and equipment on new applications designed explicitly for smart systems. The complexities significantly increase when global reach is required, a common business requirement of OEMs and other global players deploying M2M applications in every major vertical industry.

Exhibit 1: Remote Services Impacts On Business Performance



Source: Harbor Research Interviews

THE NEXT BIG THING - M2M PLATFORM INNOVATION

While it has been well established that smarter products and smarter networks can offer extraordinary business advantage to the companies that manufacture devices and the partners that develop applications and deliver systems support, complexities have thwarted wide scale adoption in many if not most instances. In the wireless network arena, CDMA and GSM-based technologies have been incompatible with one another when seen through the eyes of M2M enterprise customers and developers. Globally, GSM has become the technology of choice and yet CDMA-based Verizon Wireless is North America's largest wireless carrier with a strong record for network performance. LTE is on the horizon but this won't solve today's mainstream M2M needs. What most adopters of wireless M2M technology desire is a seamless interface to both network standards that supports a truly global reach and/or duplication in domestic network coverage.

Device OEMs have innovated in many ways, some to the point of extending their own cloud platforms for managing connected devices. Still, enterprise customers have demonstrated

time and again a preference toward maintaining a neutral position with respect to hardware and devices so they can remain agile and flexible and solve the dynamic needs of their businesses.

Cloud platform application providers have developed advanced device management and vertical applications in certain cases, and yet still remain relatively small niche businesses when viewed in the context of the whole global M2M opportunity.

This white paper is about a fundamental break-through driven by innovation in M2M cloud platforms. It was motivated by the upcoming introduction of a new M2M developer program from nPhase called nPhase ONE. This new offering provides advanced M2M capabilities for device OEMs, application developers and enterprise customers that addresses four key innovation objectives:

- 1. Remove Complexities of Disparate Networks, Device Configurations, and Applications:** Platform architecture engineered to remove complexities of disparate systems (such as CDMA and GSM), configurations, and applications which nets simplicity, speed to market, and reduced costs for customers and partners.
- 2. Enable Remote Access To Device & Network Diagnostics:** Tools that extract and store the vast amount of data available through a diagnostic interface on cellular modem chipsets for troubleshooting and analytics coupled with device-side APIs that enable third party on-device applications to enable intelligent connection decisions and to participate in device connectivity diagnostics.
- 3. Simplify and Accelerate Application Development:** Tools for third party application development that simplifies and speeds the design and development of sensor monitoring and reporting applications for physical IO and serial protocols such as Modbus.
- 4. Provide Standards-Compliant Interfaces Engineered Specifically For Developers:** Standards-compliant SOAP XML web services that offer integrators a single, portable and easy-to-use interface across disparate networks and devices providing device controls, session management and device software configuration management, ultimately shielding developers from the underlying complexity of wireless network infrastructures.

The nPhase ONE platform innovation is not an incremental development -- this is a significant step-function change in the way systems and equipment will be managed and applications will be developed in the M2M arena.

Based on our discussions with product OEMs and end customers who have been working with machine-to-machine (M2M) systems, it is an offering perceived as having entirely new value over and above just simple connectivity. The perspective and feedback from constituents is that smart platform innovation will drive new values by optimizing systems

diagnostics and support efficiencies as well as automating business processes and enhancing user experiences (see Exhibit 2).

MANAGING “CONNECTED” COMPLEXITY

The complexities of device communications and networks are often understated - deployments typically involve diverse device types, configurations, and operating systems, that must be supported by different wireless networks. Today's wireless network services represents significant feature enhancements from where the industry was just a few years ago; M2M networking capabilities are finally becoming integral elements that are being delivered by the leading cellular network operators and their associated M2M platform partners.

Imagine an enterprise M2M solution that is global in scope, supports the needs of multiple vertical segments, and therefore multiple device types, configurations and applications, and is deployed across both CDMA and GSM networks. Up until now, implementing such a solution would be tremendously complex and in most instances would fall well short of economic viability. That's all about to change as will be demonstrated at the nPhase booth at CTIA International March 22 - 24, 2011 in Orlando where partners using nPhase ONE will demonstrate such a global solution.

In this demonstration, different M2M application development frameworks will support devices on the Verizon Wireless CDMA network located in North America as well as devices on the Vodafone network located in Europe. Two different applications addressing different vertical market segments, that are both supporting two disparate networks - how is that possible? This is a key area of innovation being advanced by the new nPhase ONE developer program. The nPhase platform abstracts networks, hardware, and device configurations for the customer. The end game is “plug and play” wireless infrastructure where different device types connect onto an advanced M2M cloud platform which is fully integrated and supported by the wireless operators, and where applications and application frameworks have straight-forward integrations.

DRIVING TOWARDS “SMART” AUTOMATED PLATFORMS

Device management today is either purely reactive or blindly proactive. Why is this? For all its sophistication, today's M2M systems are a direct descendent of the traditional cellular telephony model where all the carrier really cares about is the ability to deliver and bill the customer for calls. The model, as it relates to smart [non-telephony] devices, is one that is blind to what is really going on at the device level. Information about use is collected, stored, queried, analyzed, and billed. But little to nothing about the status, health or performance of the device on the network is visible to the systems and people supporting them.

That's a very different thing from feeding the real-time inputs from the device communications technology into systems that continually compare device-states to sets of rules and then do something on that basis. In M2M applications, unlike handsets, there typically is no support person or technician at the device location. Therefore a person is not often available to perform or support troubleshooting processes. So if a device loses its connection to the network, and no one is available at the device location, how does a remote customer service representative know how to diagnose and solve the problem? They don't. Depending on the asset value they may either dispatch a service technician to the device location, which can cost \$500 or more per visit, or ship a replacement unit and cover it under a support contract.

Where does this leave the customer of the asset - unhappy because the product stopped working and no one knew how to fix it.

The challenges increase when considering the M2M revenue model from the cellular operator's perspective. Average Revenue Per Device (ARPD) of M2M connected devices is often significantly lower for a wireless operator than their traditional handset business. Instead of roughly \$50 ARPU per month for a handset, they may be working with an ARPD of \$10 per month for an M2M device. These economics further the business case for advances in remote diagnostics and business process automation.

In short, for connected devices to be smart and really impact how they are managed, the prevailing telephony model for managing smart devices has to change. Much progress has already been made in M2M applications, but the early adopters of these systems are coming to discover that "semi-smart" may mean "semi-dumb," that is, it does not equal a truly "aware system." And what should an "aware" system be capable of?

- Mobile equipment and vehicles that can sense conditions and act on that knowledge automatically.
- Buildings and facilities with "digital nervous systems" that ensure occupant comfort and safety, and even enhance productivity.
- 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.
- Product 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.

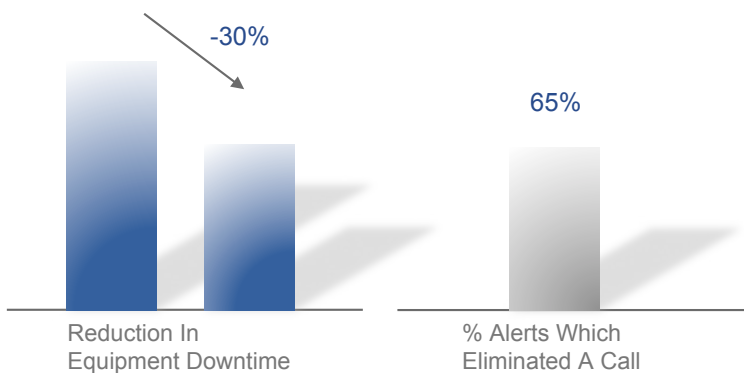
It is within this context that the next nPhase ONE platform innovation resides. At the core of this offering is specialized software that is installed on the device and is integrated with an advanced M2M cloud services platform. Together these systems capture powerful device

and network diagnostic intelligence and deliver this insight to customer support personnel. Or, conversely, customer support personnel can access this intelligence upon request in near real-time. These solutions are built to provide the needed flexibility and automation to solve the complex and dynamic needs of M2M businesses.

Device and network intelligence that drives “real-time awareness” is the new holy grail of M2M. Companies are increasingly learning more automation is required to increase the visibility into how their systems are performing. With real-time connectivity, embedded software, advanced analytics and cloud services, substantial improvements in equipment uptime, support resource scheduling and deployment and supply chain efficiencies are within reach. The potential impacts on businesses as well the economy overall are significant.

The organizations we spoke with to develop this paper believe that embedding additional device intelligence and software support will significantly increase the potential for huge efficiency improvements (See Exhibit 2).

Exhibit 2: Impact of Diagnostics On Systems Performance



Source: Harbor Research Interviews

WHAT ARE THE OPPORTUNITIES FOR PRODUCT OEM?

At the end of the day, awareness implies a total paradigm-shift. It’s a shift from knowing “what happened” to knowing “what is happening”—all the time—and then automatically controlling systems with that knowledge. When products become networked, the environment in which they are utilized shifts to a much more “aware,” and responsive support environment. Eventually, this environment helps product manufacturers and their customers optimize processes, save money, and become significantly more efficient.

According to a managed services provider we spoke with, “smart embedded device automation will create significant value up and down the equipment support chain... It allows cus-

tomers and their equipment vendors to develop “truly new and unique value.” By enhancing support over the network, product suppliers will be able to provide new value-added services. In an “intelligent” network environment, information becomes currency, and can be shared and utilized collaboratively.

The significance of new M2M platform technology is not really their gee-whiz factor, but precisely the opposite: the great convenience and service offered by their near-invisibility. In the long run, such “invisible” machine-to-machine technology will be much more important to business than the dramatic and intrusive services that require human attention to deliver full value.

Our interviews support these conclusions. The CEO of an equipment integrator remarked, “embracing embedded device automation and network management software is a way of guaranteeing new, previously unattainable, levels of visibility, efficiency and performance.” Eliminating the need for human intervention for network and device support has the potential to save manufacturers significant sums of money through reduced technician calls and “truck rolls” (see Exhibit 3).

Exhibit 3: Direct Economic Returns Via Embedded Diagnostics

Technical Field Support Personnel *	Annual Field Support Calls (capacity= 3/day)	Cumulative Support Call Expense (average expense = \$400/call)	Potential Support Call Reduction **	Cumulative Annual Savings Via Reduction In Service Calls
50 Technicians	37,500 Calls/Year	\$15 Million/Year	40%	\$6 Million/Year Reduction
150 Technicians	112,500 Calls/Year	\$45 Million/Year	40%	\$18 Million/Year Reduction
500 Technicians	375,000 Calls Per/Year	\$150 Million/Year	40%	\$60 Million/Year Reduction

* Represents The Range of Field Force Scale From Respondents

** Respondent Estimation of Embedded Device Diagnostics Impact On Field Calls

Source: Harbor Research Interviews

For those product manufacturers with M2M experience, what might have started years ago as an evolving “aftermarket services” view of the opportunity has quickly evolved into a broader understanding of the benefits network-enabled intelligent devices can drive for diverse customers across many industries. In general, the potential benefits highlighted in our interviews include:

- **Improved System Support Knowledge:** Implementation of embedded software will enable improved services on several fronts. Customers, who are accustomed to being “partially blind” to the devices on their networks, can gain increased visibility. With device and network performance data available at any time for service providers and customers alike, OEMs will be able to signal and flag potential problems and be in a

better position to predict possible future failures or to advise on a course of action to save cost or improve performance.

- **Reduced Systems and Network Complexities:** Today, a wide range of devices are becoming network-enabled. The types of devices being connected extend far beyond the laptops and cell phones we have become so accustomed to. New embedded tools will organize many “invisible” functions such as how devices are modeled, how data is secured and transported across networks, and how the intelligence from devices is acted upon thus reducing the growing complexity of device communications.
- **Increased Productivity Through Automated Services:** Combining cloud platform tools and services with embedded device software will enable automatic software updates and loading, configuration changes over the network, and device “wake-ups” -- this is where devices become smarter assets.
- **Agility and Flexibility:** An “aware” networked-device strategy introduces the ability to apply changes almost instantly to equipment and systems. With less need for direct human interactions, updates are now sent over-the-air (OTA) automatically and support changes to intelligent products are deployed much more efficiently.

For product OEMs, their partners and customers, embedded services automation opens the opportunity for new connected support and value adding opportunities to capitalize on and helps to grow the overall market.

APPLICATION SERVICES EXTEND PLATFORM VALUE

Beyond the immediate benefits that arise from “smarter” communications technologies, intelligent networked devices will become portals into other networked resources in which device users will gain utility not only from the devices themselves, but from a variety of value added applications and services.

Today, for most users, these applications are cumbersome and complex to develop. Whether the application is developed by the company deploying it or a third party, they are very custom in nature and often configured for the environment in which they operate—factory, office, hospital, and elsewhere. To put it simply, application development for connected devices today entails a very high level of engineering complexity.

The third platform technology innovation from nPhase ONE - Application Services - intends to reduce a significant percentage of the complexities of application development through new development tools that can be leveraged by diverse developer communities such as device OEMs, application providers, system integrators, and enterprise customers that require integration with back office systems or third party applications. nPhase Application Services abstract the complexities of the network, devices, and hardware associated with the tasks of

monitoring and managing remote assets. By simplifying design and development of sensor monitoring applications, Application Services significantly reduce time to market and overall costs and risks. The total end-to-end M2M solution enabled by nPhase ONE addresses both server-side and device-side functional requirements. Application Services support advanced wireless M2M capabilities such as automatic discovery and distribution of on-device software and configurable sensor data collection interfaces.

Historically, the challenges of developing applications, integrating complex systems and unifying communications in an interoperable manner have been big adoption hurdles. The inability of today's popular enterprise systems to interoperate and perform well with distributed heterogeneous device environments is an obstacle that intelligent service delivery platforms like that from nPhase are finally overcoming.

Integrating smarter equipment systems and workforce management provides a compelling example. Workforce management is a huge area of growth simply because the return on investment is so significant and immediate when companies deploy combinations of smarter equipment systems and smart user devices into the field. A construction equipment manufacturer we interviewed has deployed a mobile application platform which uses a tablet to integrate dealer and service shop information with device and network diagnostics. Their services director put it this way, "these types of applications pay for themselves in a month or two. The payback is big."

These applications, while they appear to users to be very "vertical" in nature are, for the most part, made up of features and functions that are very horizontal and applicable across diverse industries. In its most basic and practical form, the nPhase concept of an M2M service and application delivery platform is really a collection of software tools and cloud services that will evolve to be "80/20" re-useable across diverse application environments -- how devices are modeled, how data is secured, how data is transported and, ultimately, how data is utilized in applications will evolve to be very repeatable.

This new vision of M2M platforms is based on "cloud services integrated with embedded device computing". Combining embedded device software and cloud services technology will help bridge many gaps in today's enterprise systems and drive new value across many industries as application developer communities' rise to meet the vertical needs of customers (See Exhibit 4).

M2M DEVELOPERS: THE CATALYST FOR "HOCKEY STICK" ADOPTION

The old model of custom building complete end-to-end solutions just doesn't hold up anymore. Ask nPhase, that's their old business model. Today, ecosystem players have evolved their respective solutions to a point of specialization where the greatest value to enterprise customers is providing a seamless way for combining "system components" to meet their unique business needs and requirements. This objective represents the fourth innovation objective of nPhase ONE - standards-compliant interfaces engineered specifically for the

Exhibit 4: Evolving Service Delivery Platform Capabilities

Advanced M2M Service Delivery Capabilities	Description
Wireless Network Services	Network services infrastructure, device information database, middleware, and other components that comprise a comprehensive service delivery platform for wireless M2M applications.
Device Performance Services	Collection and access to the vast amount of diagnostics data available through a diagnostic interface on cellular modem chipsets for troubleshooting connectivity and performance issues.
Application Services	Tools that facilitate M2M application development by abstracting out network, device, and hardware complexity to enable monitoring and management of remote assets.

Source: nPhase

needs of M2M developers. Unified Web Services and device-side APIs provide full access to nPhase advanced M2M capabilities which can be integrated into virtually any application platform or back office system.

Ultimately, M2M systems development is entering a new phase of potential based on the new capabilities offered by innovators such as nPhase. Significant new application possibilities will be achieved at unprecedented pace and scale. Think of all the new applications that have been created for handsets with application frameworks like the iPhone and Android. There is no reason why M2M will not follow a similar path enabling new solutions that are orders of magnitude larger.

BACK TO THE FUTURE

Because it is impractical to deploy human beings to gather and analyze the real-time field intelligence required, remote services depend on device and network “intelligence.” As one support engineer we interviewed remarked, “smart systems take invisible activity and makes the state of a business’ assets, costs, and liabilities vastly more visible to managers and to the decision-making process—when decision-makers need or want to know.”

Many of the product manufacturers we have spoken with for this analysis underscored the potential wider impacts of new device-enabled applications will have on their business operations. These customers hint at the opportunity to re-design business processes to take maximum advantage of the new efficiencies created.

Providing customers with valuable information that helps them run their businesses more efficiently will extend the relationship between product provider and customer well beyond the initial product sale. As one equipment manufacturer underscored, “mutual, shared un-

derstanding of customer systems allows knowledge gained on either side to be continuously leveraged.”

One interviewee that sells and services consumer electronics summed it up this way: “Over the last several years, the role of digital information technology in business has evolved from being first a luxury, then a mainstay, and finally what it is today—nothing less than the core value of the business itself.. We are presently undergoing a shift from manual break-fix systems to continuous customer enhancement. The data generated by connected devices will soon become the very air that business breathes.”

PUSHING THE PLATFORM ENVELOPE?

Networks are now handling equipment and systems of increasing breadth and diversity. Many business processes are becoming automated, such as asset tracking, supply chain management, and procurement. The next chapter in the M2M arena will be driven by platforms and solutions that realize the full value of the connected device, stripping out unnecessary costs in customer support, replacing uninformed human activity with embedded intelligence in devices and developing new applications value via cloud computing.

With the rise of true networked applications, smart intelligent devices will become visible to the network and platforms managing them. All of this illustrates that as more and more processes, systems, and devices become dependent on smarter networks and application delivery platforms, the ability to see failure before it happens and the ability to leverage third party “specialists” for application development will need to increase dramatically.

The adoption of M2M systems has been challenged with many unforeseen barriers. The nPhase ONE developer program holds the potential to change the entire structure of value delivery, alter long-standing business models, and prompt all participants to consider how to design new modes of service delivery and build new relationships with customers and with developers.

About nPhase

nPhase, a 50/50 joint venture between Qualcomm (NASDAQ: QCOM) and Verizon, provides advanced Machine to Machine (M2M) cloud platform services to the world’s leading wireless operators such as Verizon and Vodafone, and enterprise customers with the most demanding needs for data reliability, coverage, security and innovation in M2M. Industries served include consumer electronics, transportation/ construction, utilities, healthcare, retail, industrial, financial services and government. nPhase leverages the global leadership in advanced connectivity technologies provided by Qualcomm, the industry leading network and channel provided by Verizon Wireless, and ten years experience as an M2M pioneer, to lead in the advancement of M2M.

About Harbor Research

Founded in 1983, 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. Harbor works with emerging technology ventures, diversified product and services companies, global IT & network infrastructure players and capital market constituents.