CONNECTING TO YOUR FUTURE: THE NETWORKING OF EVERY MANUFACTURED THING

Harbor Research's new study is aimed directly at the challenges faced by manufacturers as they move to adopt the next-generation technologies of the real-time enterprise. The study offers the fullest available portrayal of the adoption climate, technology issues, business models, and opportunities arising from the convergence of device networking, wireless sensors, machine-to-machine (M2M) communication, and the Internet.

RESEARCH STUDY OVERVIEW

Harbor Research, Inc.
BOSTON | SAN FRANCISCO

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Manufacturers will embrace Internet-based device networking because it promises actionable, global "living intelligence" that will streamline operations and enable new services-based business models,with the potential to drive unprecedented growth. This means that the generation, storage, and interpretation of device data will become inseparable from the enterprise of the future. The choice of suppliers and strategic partners will be as important as any decision executives will make in this decade. Harbor's new study is aimed directly at the challenges faced by product companies as they move to adopt the new technologies of the real-time enterprise.

THE VISION OF THE PERVASIVE INTERNET

We are now feeling the first tremors of the most profound technological disruption in the history of humanity: networked, embedded intelligence in the most ordinary objects of the manufactured world—even objects implanted in the human body itself. Ultimately, this phenomenon will change civilization more than electrification, the telephone, the train, the automobile, the airplane, and the World Wide Web all put together.

In fact, the effects of this phenomenon will so completely permeate human affairs that calling it "technological" is misleading. It will manifest itself not as technology per se (which will be largely invisible), but as social, cultural, and economic transformation.

Until very recently, "computers" and "the real world" have remained two distinct realms. The bridge between those realms has been the human user of computers, and we have seen very little genuine "cybernetic" automation. Obviously, this is a transitional state of affairs. The convergence of those two worlds—the world of information represented as bits and the world of physical things made of atoms—is the future that is now beginning to take shape.

For some years now, Harbor Research has used the term "Pervasive Internet" to describe the convergence of pervasive computing and global data networking, and the profound business opportunities that this convergence represents.

Underlying the Pervasive Internet is an overarching vision of "smart things" and system automation that has been explored by futurists since at least the 1950s.

If you applied this vision in a practical way to business, it might simply be called

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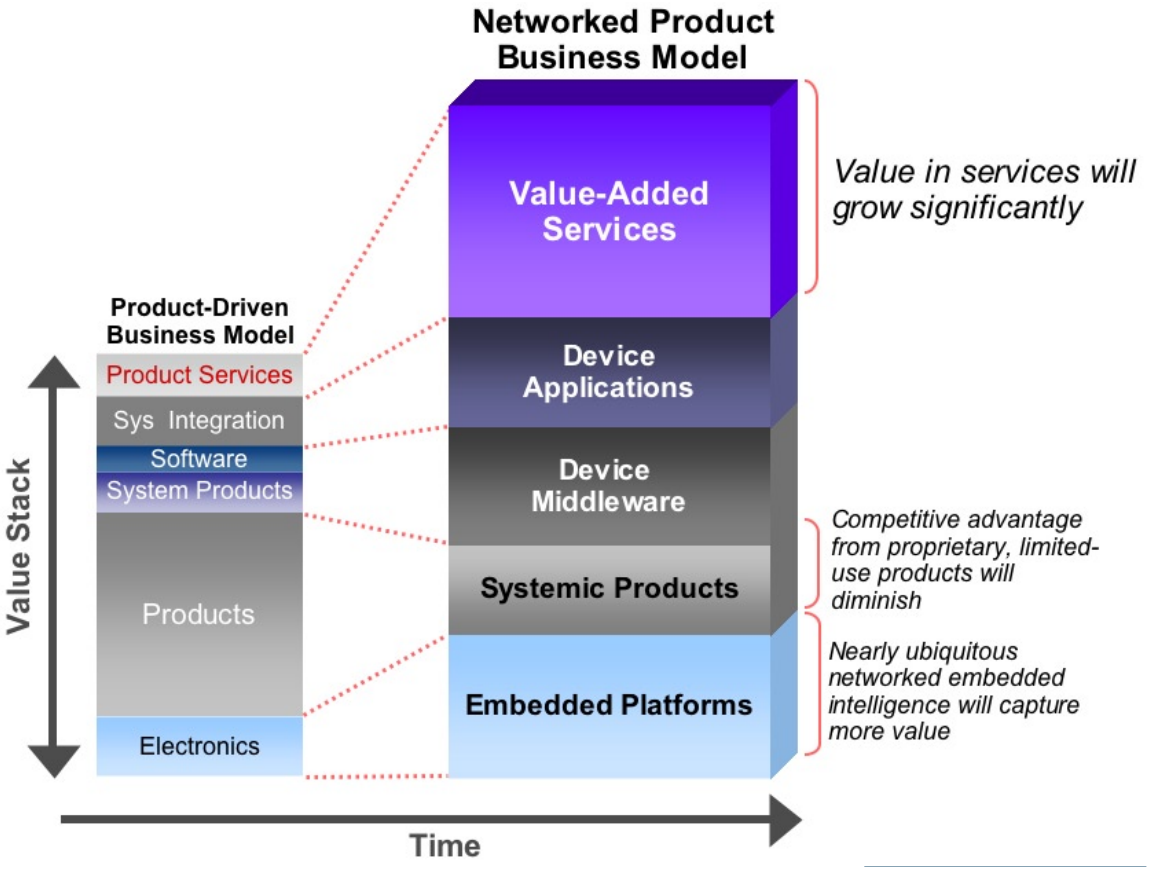
"electronic commerce." But not the oft-discussed e-commerce of the dot-com era. We have that today, and even in the business world it's not much more than "e-shopping"—simple mechanisms that make certain B2C and B2B transactions, *performed by human beings*, somewhat easier, somewhat more convenient. The dot-com era took a tiny first step toward global business automation...and then stopped.

Genuine e-commerce re-thinks the whole relationship of people and devices to business systems. It must be built upon true, across-the-board digital automation, accomplished by enabling everyday electronic devices to communicate with and control each other.

THE DOT-COM ERA TOOK A TINY FIRST STEP TOWARD GLOBAL BUSINESS AUTOMATION... AND STOPPED.

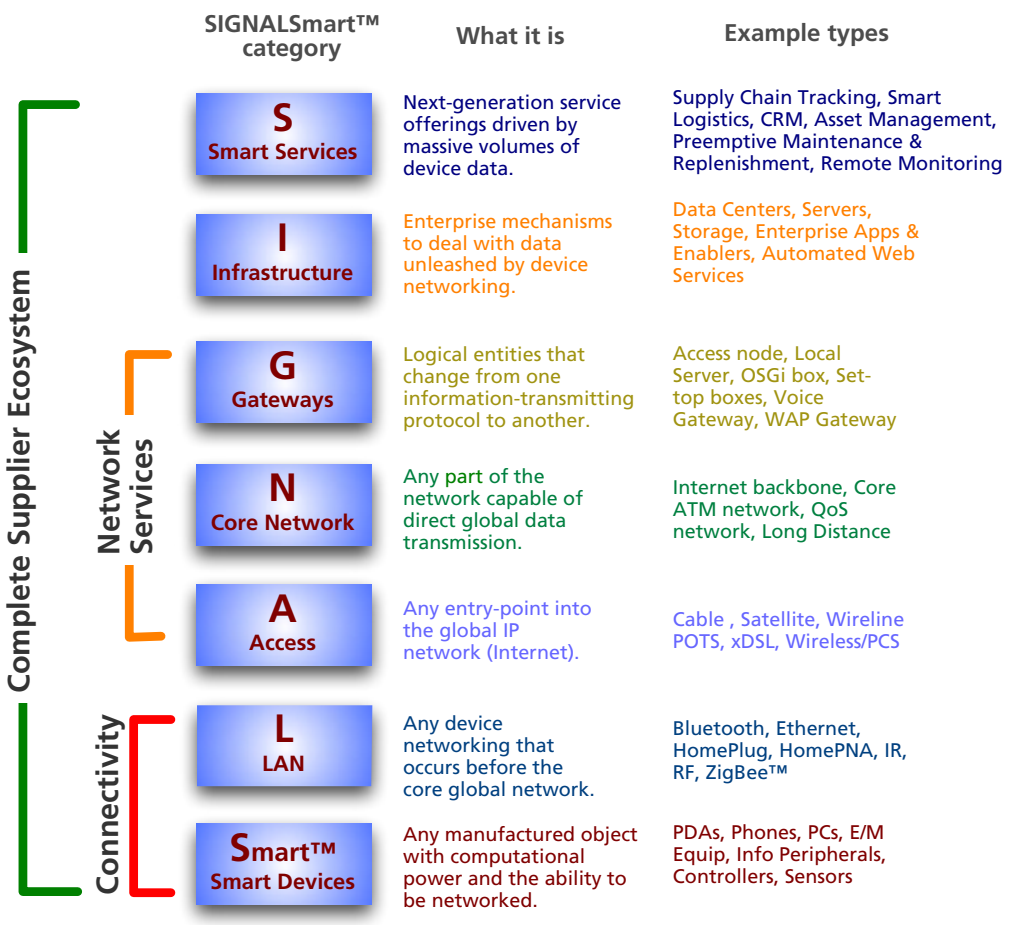
Leading technologists have repeatedly demonstrated that the well-designed mechanisms and protocols of the Internet are not simply good for creating a Web browsed by human beings. They are also an ideal way

The Value-Add Opportunity and Impact of Networked Products Connected to the Internet



Source: Harbor Research, Inc.

Harbor's SIGNALSmart™ Framework Portrays the Technology Path to Full Business Solutions



SIGNALSmart™ segmentation helps adopters understand how technology offerings from various vendors combine to create a real-world, "real-time enterprise" solution.

Source: Harbor Research, Inc.

to achieve automated device connectivity on a global scale. From this use of the Internet for device networking will emerge a new generation of information tools for managing the vast, ongoing streams of device-generated data, and for extracting meaningful business intelligence from them.

The goal is to network devices into electronic commerce systems that are self-sensing, self-controlling, and self-optimizing—automatically, without human intervention. It would not be far-fetched to call such systems "self-aware."

They will represent, among many other things, an entirely new life for the IT and telecom industries—one that will literally dwarf their previous starring role in the "dot-com" era.

THE "NETWORK EFFECT"

By 2010, the Pervasive Internet could drive a total opportunity in the hundreds of billions of dollars for the companies involved in device enablement, device monitoring, and new services driven by device-generated data. The largest opportunity will exist for value-added services providers, and thus access to device information will become a de facto part of most service or sales contracts.

Large opportunities are developing for companies handling the data being generated. Because the Pervasive Internet is a circle of device feedback rather than an old-fashioned "value chain," the opportunity to add service value will exist for both technology suppliers and adopters, as well as for third parties.

THE ONE WITH THE MOST NETWORKED STUFF WINS

Why should an OEM step up to the plate and network-enable its manufactured objects now? Because in any given market, the first players to do so will own the information feedback loop to the customer, and it will be very hard for competitors to pull customers out of that loop.

Inside this "information circle," a whole world of new, attractive, and more profitable services will take shape. Because those next-generation services cannot be offered without device information, and because even traditional service relationships will be made vastly more efficient inside the information circle, channel partners can no longer cut an OEM out of the services action.

In fact, the real-time enterprise turns "disintermediation" completely on its head. When a company decides to make a smart product that sends out its "heartbeat," the company owns access to that heartbeat, and thus access to the customer. Now, no third party can sell profitable services to the manufacturer's customer without making some arrangement with the manufacturer for access to the diagnostic or status data coming from the networked product or device.

As we leave the human-centric PC era, the new rules of the game are abundantly clear: The one with the most networked stuff wins.

CLEAR FIRST-MOVER ADVANTAGES FOR ADOPTERS

Some companies have already launched new businesses enabled by networked devices, and many others have made their decisions and started the process of designing their connected products and their new business models. The move to the Pervasive Internet is happening, and the pace of adoption is accelerating. It is not only possible, it is here.

We have seen evidence of first-mover advantages in industrial asset management, vehicle telematics, industrial gases, networked building systems, energy monitoring, and medical imaging systems. Early adopters have not only brought their connected offerings to market, but may already have locked down lasting dominant positions in their respective industries. The following are only the most obvious impacts:

- Break-out "double digit" top line growth in traditionally GDP-driven businesses.
- Line-of-business ROS increases in the 5-10% range.
- Service force productivity improvements of 20-35%.

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- Dramatic, quantifiable customer retention improvements.

At the same time, technology suppliers have ensured that the tools for device connectivity are largely in place. Except in the least developed parts of the world, where there may still be infrastructure issues, there is no place on earth where a connected product cannot be deployed to the advantage of both its manufacturer and its users.

THERE IS NO PLACE ON EARTH WHERE A CONNECTED PRODUCT CANNOT BE DEPLOYED TO THE ADVANTAGE OF BOTH ITS MANUFACTURER AND ITS USERS.

THE BIG RISK IS DELAYED ACTION, NOT TECHNOLOGY

Yet many companies will fail to make the shift. Is it because the technology is immature and not to be trusted? In some areas of the technology value chain, the pieces may not be mature. Certainly, it will be some time before the losing suppliers have been shaken out and the remaining winners can be counted on to supply the quality products and complete services required to minimize risk for adopters. Yet even today, robust systems can be—and are being—built with existing offerings, and what remains of technological risk pales next to the risk of delayed action.

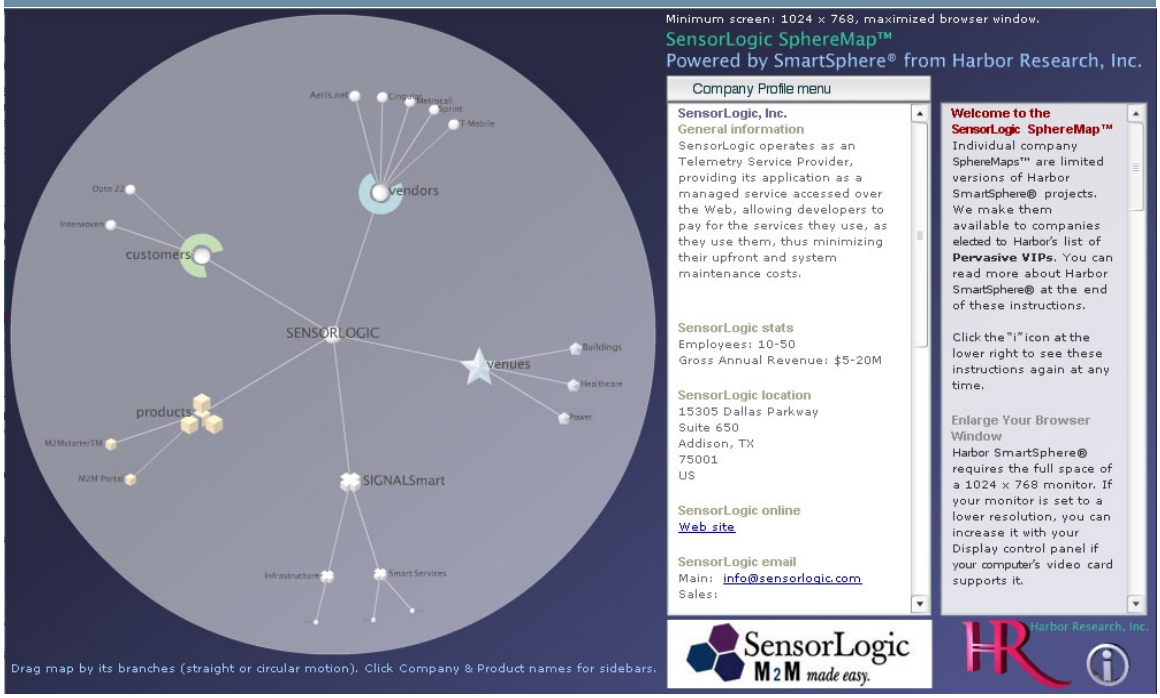
M2M IN BUSINESS REPRESENTS A RADICAL PARADIGM-SHIFT

The key word is risk. The leadership in many manufacturing companies is not accustomed to the volatile, high-stakes world of business driven by networked devices, and it is this transition, not the technological shift, that many will fail to make. Many changes in thinking will have to take place for companies to succeed in networking their devices and updating their organizations for the next era of information technology.

These changes come in many areas:

- In **internal leadership**, we have already seen and expect to see more cases where many members of organizations have a clear view of where the company needs to go, yet are unable to present the business case for change in a compelling manner.
- In **planning**, companies may not know whom to invite to the planning table, let alone what to do when everybody's there. They may have strategic planning processes in place that are ill-equipped to deal with major paradigm shifts.
- In **business execution**, manufacturers may have little understanding of the nature of a new, information-intensive offering, or of the needs of a market that will be trained by the companies that have made the shift successfully. Such customers will be far more demanding than in the past.
- In **organization**, companies may fail to understand that the new skills, shifting alliances, and new customer bases that can come with the Pervasive Internet may demand radically new organizational structures.

Harbor SmartSphere® Company Profiling, Tracking, and Business Ecosystem Visualization Tool



Each purchase of *Connecting to Your Future* includes one year of departmental or business-unit access to Harbor's SmartSphere® project on Pervasive Internet technology suppliers and their business ecosystems—an online, continually updated resource that provides a "living appendix" to the study.

Source: Harbor Research, Inc.

NETWORKED DEVICE INFORMATION CHANGES EVERYTHING

In short, many companies will fail due to the inadequacies of their leadership. Many companies will be hampered in their thinking by a tendency to assume that the company after networking will be the same company and in the same business as before networking. This is a safe assumption in almost no case.

Most changes brought about when information becomes central have the effect of moving a company toward a services-based business model.

This is a simple proposition, but not an easy one. The fact that information makes services move to the fore is not hard to grasp. But in practice, "services" represents a business paradigm so foreign to many manufacturers that they cannot understand, let alone implement, the changes necessary to make the shift successfully.

INFORMATION MOVES SERVICES TO THE FORE, BUT MANY COMPANIES WILL NOT MAKE THE SHIFT SUCCESSFULLY.

In fact, the phrase "shift to information-driven services," though accurate, could be dangerously misleading if it makes the required corporate culture and business model changes sound almost tame. They aren't. The era of near-perfect, near-real-

time information about physical assets and customer behavior is looming like a tanker coming out of the fog. Any degree of complacency about it will be deadly.

NEW BUSINESS AND REVENUE MODELS

Connecting to Your Future: The Networking of Every Manufactured Thing is the first study aimed directly at the challenges faced by product companies as they move to adopt the new technologies of the Pervasive Internet. And it offers a clear portrayal of the opportunities, including the new business models that these technologies will enable.

Network-enabling a formerly standalone product and connecting it to the Internet represents a much more profound change than any enhancement of the product's design or feature set. In fact, it will transform product businesses much more radically than did the human-oriented World Wide Web.

After the adoption of device networking, no company will be in precisely the same business it was in before, because galaxies of device-generated product data will enable entirely new modes of customer relationship, and therefore new business and revenue models.

A COMPANY MUST UNDERSTAND WHAT KIND OF BUSINESS IT WILL BE AFTER IT CONNECTS ITS PRODUCTS, BECAUSE IT WILL NOT BE THE BUSINESS IT WAS BEFORE.

Connecting to Your Future defines these four primary new models:

- Embedded Innovator
- Aggregator
- Solutionist
- Synergist (requires an Aggregator)

The study explains each of them in depth, with detailed real-world examples. We also explore variations within each of the main models, and possible combinations of the models in varying business settings.

SCOPE OF RESEARCH

Across all major verticals, *Connecting to Your Future* addresses these fundamental questions:

- What applications and devices are driving Internet device networking? Who's connected? Who's connecting? What will be the impact of wireless sensors and devices and the expected penetration?
- What scenarios could develop based on the variables of technology, customer, competition and socio-economic forces?
- What factors are driving adopters? How are they segmented? How will adopters succeed? What skills will they need?
- What opportunities have developed by vertical market?
- What's required to make progress?

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- What's the size and growth rate of the opportunity?
- What are the "killer applications"?
- What's the impact on business models? How will companies make money?
- What do suppliers need to do to be successful and exceed the needs of adopters?

AREAS OF RESEARCH

The Pervasive Internet is an all-encompassing phenomenon that could involve most electronic devices in operation today. In *Connecting to Your Future*, we have built a perspective that accounts for the differences in diverse device venues (e.g., in the home, office, factory) but that also explains how common applications (e.g., condition monitoring of devices, asset tracking, energy management, etc.) could be applied to any device in any venue.

Capturing the many nuances required that we profile device demographics and their Internet-enablement adoption rates, as well as the evolving business models being used to prosecute new opportunities.

To accomplish this, we interviewed hundreds of technology suppliers, device OEMs, service providers, experts and users, and we analyzed the following areas of opportunity:

- **Buildings / Facilities**: Office Equipment, HVAC /Environmental Systems, Access Controls
- **Healthcare / Medical**: Medical Devices
- **Home / Consumer**: White Goods / Appliances, Game Systems, Consumer Electronics
- **Industrial**: Automation & Control Equipment, Capital Equipment
- **Power/Utility**: Meters, Distributed Generators, Electricity Grid and Pipelines
- **Retail**: Scanners & Registers, Lighting & Refrigeration Systems
- **Transportation**: Vehicles, Airplanes, & Intermodal Transport
- **Government/Security**: Homeland Security

How to Obtain More Information on the Study

On the Web:
http://harborresearch.com/connecting2004/

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About Harbor Research, Inc.

Founded in 1983, Harbor Research Inc. has been providing strategic consulting and research services to clients for more than twenty years. With a reputation as specialists in understanding emergent and disruptive opportunities in high technology, Harbor Research works with clients who seek to establish strategic advantage in changing markets.

Harbor's groundbreaking Pervasive Internet research is widely regarded as the definitive work on the business impact of integrating networked devices into business processes.

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