

GROWTH OPPORTUNITIES AND BUSINESS MODELS FOR THE PERVASIVE INTERNET

How Companies Will Make Money with
Networked Products and Services

A HARBOR WHITE PAPER

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2

Growth Opportunities and Business Models for the Pervasive Internet

Not long ago, we heard that “the Internet changes everything.” While some major changes did occur in the “first wave,” in fact not everything was altered. For many manufacturers, little or nothing changed except that workers and executives now use email. The result may be complacency, a sigh of relief, and a look forward to several decades more of business as usual. Yet hardly any error could be more costly than to underestimate the magnitude, or mistake the nature, of the change that will come as devices, having already outnumbered people as internet users, continue to connect at an increasing rate.

It's not just numbers, not just the magnitude of the change that manufacturers need to understand. It's the fundamental changes to business models that will accompany every company's—or a competitor's—decision to connect its products to the Pervasive Internet.

Simply put, the new world is one in which every connected product turns its manufacturer, and in many cases others along the value chain, into a new kind of service business. It's a paradigm shift that will open bright futures for those who can make the shift, and doom those who cannot.

The New World Is Here

While the foregoing sentences are largely in the future tense, that is only because many of this paper's readers will be those who have not yet made the shift. Others have launched their new businesses, and many others have already 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.

The first movers in vehicle telematics, industrial gases, and medical imaging systems have not only brought their connected offerings to market, but may already have locked down lasting dominant positions in their respective industries. At the same time, technology suppliers have ensured that the tools for device connectivity are in place. Except in the least developed countries, where there may still be infrastructure issues, there is no place on earth where a connected product cannot be

Growth Opportunities and Business Models for the Pervasive Internet

How Companies Will Make Money with Networked Products and Services

3

deployed to the advantage of both its manufacturer and its users. As all of Harbor's recent client interactions make clear, the shift to connectivity is at the doorsteps of most industries, and in some venues is already far advanced.

LEADERSHIP, NOT PLUMBING, IS THE ISSUE

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 Harbor's SIGNALSmart™ framework, which maps the world of technology suppliers, 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 built out of existing pieces, and what remains of technological risk pales next to the risk of delayed action.

The key word is risk. The leadership in many manufacturing companies has not been accustomed to the volatile, high-stakes world of business on the Internet, and it is this transition, not the technological shift, that many will fail to make. This paper will detail the many changes in thinking that will have to take place for companies to succeed in networking their devices and updating their organizations for the future.

These changes come in many areas.

In **strategic 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 pervasive computing may demand radically new organizational structures.

In short, many companies will fail due to the inadequacies of their leadership.

Service at the Center

Inevitably, companies will fail to understand the disruptive threat inherent in the Pervasive Internet, and a merely defensive justification to network a product may not succeed in moving management.



4

Fortunately, a simple construct of three types of cost-justifications, which we will present at the end of this paper, will allow most companies to think through the advantages of connecting, and will allow many to find the required motivation.

Still, 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.

The first fact about a networked product, which is so obvious that no one needs to be told, is that it will capture and convey data. The second fact, not quite so obvious, is that these new data become a core asset. The third fact, not an obvious leap for many managers, is that information as an asset makes for fundamental changes in a company's business. The fourth fact, which makes things simple but by no means easy, is that most changes brought about when information becomes central have the effect of moving a company toward a service business model.

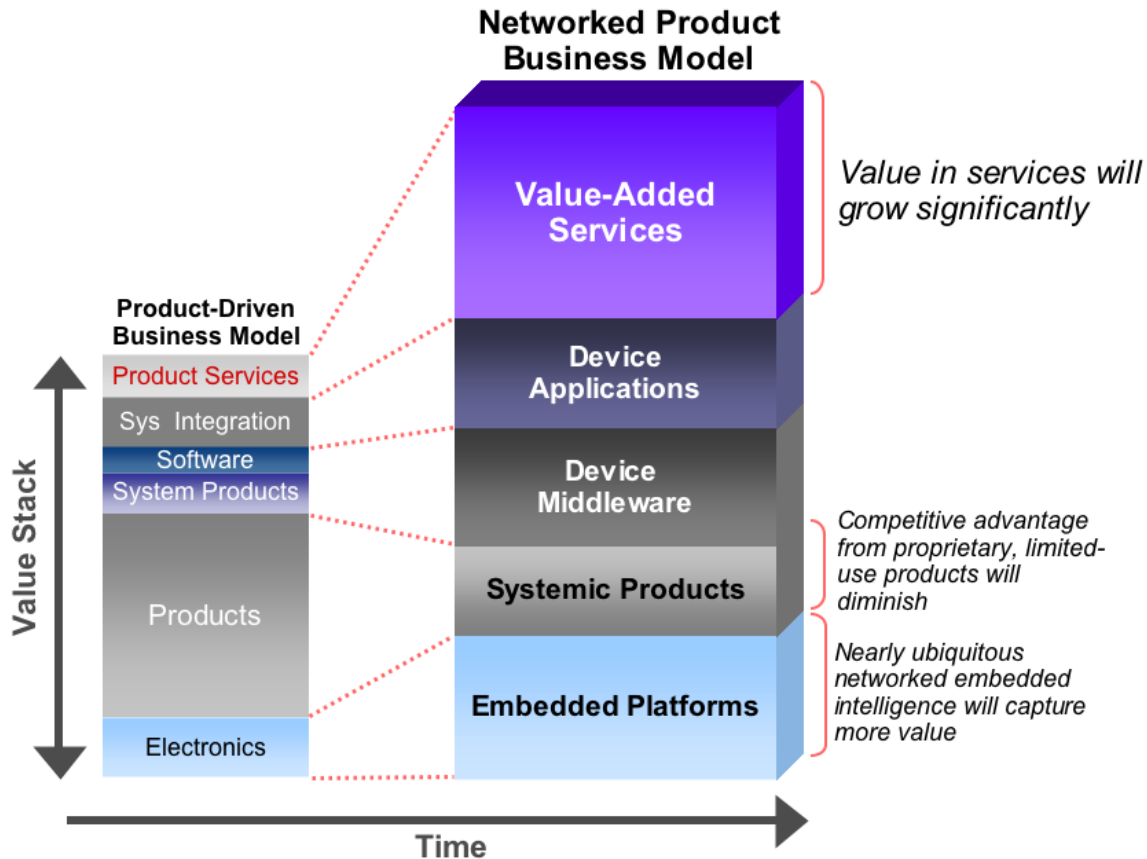
We say this is simple but not easy, because while the fact that service moves to the fore is not hard to grasp, in practice service is a paradigm so foreign to many manufacturers that they cannot understand, let alone implement, the changes necessary to make the shift successfully.

Growth Opportunities and Business Models for the Pervasive Internet

How Companies Will Make Money with Networked Products and Services

Exhibit 1: What Is the Value-Add Opportunity and Impact?

5



Source: Harbor Research, Inc.

The Pervasive Internet Creates New Business Models

First, though, a company needs to think through its decision whether or not to adopt Pervasive Internet technology. The next few sections will detail the kinds of new business models that accompany connectivity, and the strategic planning process that helps successful companies think through their own implementations of online-product business.

Two “Families” of Opportunities

Thinking about the business opportunity associated with a connected product is a highly creative process. Often there are no cut-and-dried markets to identify and size. Rather, there are whole new markets that *might* develop as networked products are brought to market. The trick is in knowing how to think about how those markets might develop. The easiest place to start is with the customer, and a great deal of progress will be made by asking just three questions about the customer:



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6

1. What are the activities the customer engages in, in order to procure, own, use, and dispose of our product?
2. For each of these activities, what else is the customer close to or in contact with when performing the activity?
3. What other activities precede and follow the activities uncovered by question #1?

The first question leads to what we call “Life Cycle Opportunities,” while the second and third lead to “Adjacency Opportunities.”

LOOKING AT THE LIFE CYCLE

We have already said that service is at the center of most Pervasive Internet opportunities. This is because a connected device gives its manufacturer a superior position to help the customer with various activities. The first question we have asked involves those activities that are directly connected with owning and using the product. The obvious activity that a connected product can streamline, while at the same time allowing the manufacturer to intervene, assist, and reap benefits, is maintenance. When a product can detect that one of its parts is approaching failure, and can alert the manufacturer of the fact, the company is in a perfect position both to benefit the customer and to own the opportunity to deliver the benefit.

Let’s get concrete with a very simple example: it’s well known that the profit in printers is in the replenishables, the toner cartridges. But there are clones of most cartridges, and these eat at both the revenue and the margin in a printer manufacturer’s toner sales. HP has seen a tremendous opportunity in adding a very simple bit of connectivity to a printer: it can detect when its toner is low and can initiate a just-in-time order for new toner. By this simple new function, HP has retaken ownership of a high-profit transaction in which it had suffered encroachment.

There are many activities that are involved in owning and using a product. They include:

- ✦ Determining requirements and justifying purchase of the product
- ✦ Finding a product supplier
- ✦ Financing the purchase
- ✦ Installing the product
- ✦ Modifying other products or processes to work with the product
- ✦ Adapting the product to its environment or to a specific use
- ✦ Maintaining the product and replacing parts
- ✦ Replenishing materials (e.g. paper and toner for a copier)
- ✦ Training personnel to use the product

Growth Opportunities and Business Models for the Pervasive Internet

How Companies Will Make Money with Networked Products and Services

7

- + Using the product
- + Upgrading the product
- + Disposing of waste from the product
- + Disposing of the product

Each of these activities in the life cycle of a product may or may not be an opportunity.

PERIPHERAL VISION: ADJACENCY OPPORTUNITIES

Having looked at the customer's activities in the life cycle of the product, it's time to look at them again. Our first glance at the life cycle was focused on our own product. Our second look will be through the lens of our second and third questions: For each of these activities, what else is the customer close to or in contact with when performing the activity? And, what other activities precede and follow the activities uncovered by question #1?

The purpose of these questions is to find opportunities that aren't necessarily connected with our own product, but are somehow adjacent, so that our product might be a gateway to those opportunities. One example is a digital camera. Nearly all cameras need some form of connectivity to a computer, where the photos are viewed, judged, sorted, edited, and stored. Kodak has found an opportunity in those activities which follow using the camera, by closely integrating its software, both on-camera and PC, to those follow-on activities and beyond. "Beyond" includes the high-value activity of producing quality prints of photos, which is done by specialty service providers, with whom Kodak has partnered.

STEPPING BACK: PERSPECTIVE ON THE WHOLE OPPORTUNITY

So far, we've been discussing how to look for opportunities, but, to be precise, we have seen how to look for *elements* of an overall business opportunity. For example, in thinking about adding connectivity to an MRI scanner, we might find that connectivity will help us in several ways. It might enable the just-in-time ordering of replenishable materials, alert us to maintenance needs and so allow us to lock in service contracts, and to perform calibration and validation, functions previously performed by hospital personnel, for which we can now receive separate compensation. Each of these services is an opportunity, but is only an element in the overall business opportunity. In order to understand Pervasive business models, we must look at this aggregate level: the overall business opportunity.

Between the two examples we just used, HP and Kodak, there is a difference that is almost hidden, but is actually rather important. In the case of the HP printer, a single product made by a single company was the sole gateway to the opportunity. In fact, other players in the space are effectively cut out of their positions by HP's move. In the other case, Kodak has tapped an opportunity in



8

which it needs partners, who will supply expertise in user interfaces and presence in photo processing.

This difference points to what is in fact a correlation between opportunity elements and overall business opportunities. If an opportunity is primarily or completely made up of elements that are uncovered by our question #1 (those which attach directly to our product's life cycle), then it is likely that we'll be able to tap the opportunity alone. However, if the elements of an opportunity are mainly adjacencies, we'll probably have to partner in order to get on board.

SOLO AND TEAM OPPORTUNITIES

While looking for and identifying the elements of opportunities is essential for knowing what might happen in our world and who (hopefully it's we ourselves) might make it happen, it's the difference we've just identified, the difference at the level of the overall business opportunity, that determines our Pervasive business model, or in other words, what kind of business we'll be after connecting our product. Simply put, the overall opportunity can be a solo opportunity, one we can seize alone, or a team opportunity, which we will in one way or another have to share with others.

Four New Models

Within each category of opportunities, solo and team, there are two business models. Within each category, what business model a company molds itself to depends on a second criterion that relates to the opportunity. That second criterion is unique to each category, so we'll uncover them one at a time.

TWO SOLO-OPPORTUNITY MODELS

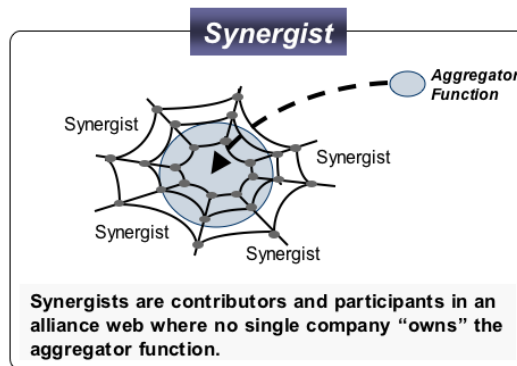
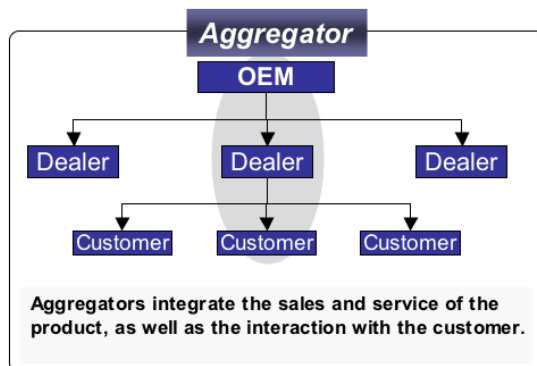
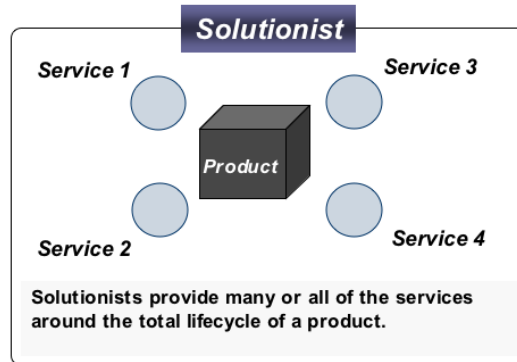
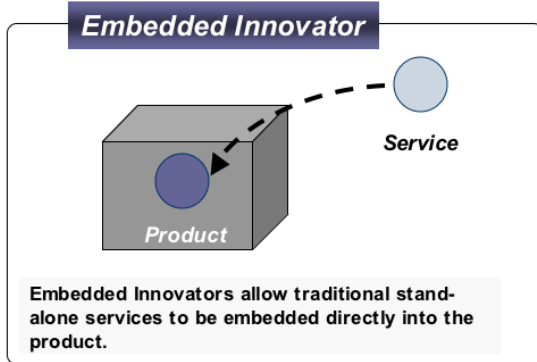
In a solo opportunity, a single product is the dominant gateway to the opportunity. The two business models within this solo-opportunity category are differentiated by the scope of activities which make up the economic value of the overall opportunity. Where the scope is low, we call the company an embedded innovator. Where it is high, the company is a Solutionist.

Growth Opportunities and Business Models for the Pervasive Internet

How Companies Will Make Money with Networked Products and Services

9

Exhibit 2: What Are the Business Models?



Source: Harbor Research, Inc.

Let's look at two examples at the extreme ends of the scale:

Where the scope of high-value activities associated with the product is broad, there are many services that can be made part of the business model. An extreme case is an MRI scanner. The activities associated with this product's life cycle include:

1. Determining requirements and whether having a scanner is justified
2. Financing the scanner
3. Installing
4. Testing, calibration, validation
5. Maintenance and replacement of parts
6. Replenishment of materials (gases and image media)
7. Training personnel to use the scanner
8. Determining the need for a scan (preliminary diagnosis)
9. Preparing the patient for a scan
10. Scanning the patient



10

11. Interpreting the scan
12. Updating software (firmware)
13. Upgrading the hardware

Because of the high value, complexity, and cost of MRI scanning, nearly all of these activities represent an opportunity for the scanner manufacturer. All are of high value, and only 8, 9, 10, and 11 are primarily medical matters and thus cannot be the province of the manufacturer. This leaves nine activities that are economic opportunities for the manufacturer.

GE Healthcare has stepped into just this situation and positioned itself as a complete solution provider, or Solutionist.

At the other end of the scope-of-opportunity scale is the case of a small-scale laser printer, which we have already looked at.

While there are many activities that are associated with a laser printer, there are few that represent an economic opportunity for the manufacturer. Some activities might have high economic value but simply be too peripheral to the printer to be an opportunity. For example, the purchase of paper has considerable economic value, but the printer holds too little paper to be the keeper of a user's inventory information, and the PC or the telephone are perfectly good ways to order the paper.

Some activities may be very directly associated with the printer and yet not have enough economic impact to be attractive opportunities. Let's take two activities we listed for the MRI scanner: the decision to buy, and financing, and apply them to the printer. The decision to buy (both whether to buy and what to buy) is not a major one and it is hardly worth the manufacturer's while to provide an hour of a printer consultant's time to help the decision-maker, except at the high end of the product line or for a large institutional buyer. And small printers are seldom sold in such large lots that it makes sense for a specialized manufacturer to set up a financing arm. Even where these two activities are of high value, a printer in use has little role to play in them, so the printer's connectivity is not a route to the opportunity.

The opportunity presented by adding connectivity to a laser printer is fairly narrow, and HP found it. They decided that a printer could detect toner levels and could initiate a just-in-time order for more toner. In developing a printer with this capability, HP was stepping into an Embedded Innovator model.

So, between HP with its printers and GE Healthcare with its MRI scanners, there is a world of difference in the scope of services that could be offered with or through the connected device. What they both had in common was that there was an opportunity in which the device was the dominant player in the activity chain; in each case it was a solo opportunity.

Growth Opportunities and Business Models for the Pervasive Internet

How Companies Will Make Money with Networked Products and Services

11

In HP's case, the change amounted to little more than a product improvement. The change in business model was incremental; the company remained a manufacturer of printers and toner cartridges, and made money by selling these things. Connectivity simply gave them a lock on the toner sales, which is where the profit is.

For GE, the new model is far from that of a simple manufacturer and seller of products. The connected scanner opens up many service opportunities, and to tap these, GE must build a large, well-tooled and complex service infrastructure.

As noted above, what GE and HP have in common in these examples is that the opportunity they found and tapped was one dominated by their own device. Data from other devices did not play a major role in developing, defining or tapping the opportunity, and thus the companies were not very dependent on partnerships, although they could certainly use them, and in GE's case, certainly do.

TEAM OPPORTUNITIES MAKE TWO AGGREGATION MODELS

The other two models are those in which the opportunity cannot be tapped by a single device and a single vendor. There are situations in which a device may collect valuable data, but not valuable enough in and of itself to create the opportunity. Instead, several disparate devices work within an environment, and only by connecting all or most of them is a body of data created that is of high value. An extreme example of this is a simple table lamp in a home. It can be enabled to sense and to communicate such data as when it is on and when off, the wattage flowing through it, perhaps even the age of the bulb or bulbs it is burning. This body of data may be of various kinds of interest, but not of economic interest because none of it is of high economic impact. Even if a table lamp burns a 100-watt bulb constantly in an empty room, the wasted electricity will hardly break most families, and if it would they would probably not need the lamp to tell them the waste is occurring.

The body of data becomes valuable in combination with data from other devices. If all the electrical devices in a home collect data, then that aggregated body of data can be of high value. The sum of all electricity that might be wasted in a home is worth a homeowner's attention, and so an application that collects and deploys all that data may be of enough value to represent an economic opportunity. Further, there is value in a lamp's not only sending data to an aggregating application, but also in its being controllable by that application. Here again, to make a single lamp remote-controllable is of questionable value, but to make all the electrical devices in a building controllable by a system that collects, aggregates, and processes data (in other words, that reads and understands a lot of indicators), can be of very high value.

Where a system aggregates and processes data from a number of devices, there are two roles for a device to play in such a system: it can be central or peripheral; the hub or a spoke; the brains of the operation or an eye, an arm, or a finger; the team captain or a role player.



12

This last variable defines our third and fourth business models. When an aggregating system is required in order to define and tap an opportunity, then there will be an Aggregator, who controls the application's data aggregation and central processing power, and there will be Synergists, whose devices contribute valuable data and/or functionality which is controlled by the application.

There are other situations which are team opportunities, but are not characterized by multiple disparate devices. Rather, they are team opportunities because multiple vendors, most of whom are service providers, must be available to completely tap the opportunity. If there is a single device vendor whose device is the gateway to the provision of multiple services, that company is in a sweet position, as most of the partnering service providers will pay for access to the customer.

Thus we have four models that may be arrayed in a simple matrix.

Exhibit 3: Four Business Models

		Scope of Customer Activity	
		Narrow	Broad
One-device, One-Company Opportunity	Multi-device, Multi-Company Opportunity	Embedded Innovator (HP printers)	Solutionist (GE Healthcare)
		Aggregator (Eaton in the home)	Synergist (requires an Aggregator)
		Own	Don't Own
		Ownership of Central Aggregation & Processing Function	

Source: Harbor Research, Inc.



A Look at Some Other Cases

Having laid out the four basic business models, it may help to discuss a few more illustrative cases.

COMMERCIAL KITCHEN EQUIPMENT

Sometimes an opportunity arises suddenly due to the most unexpected changes in the business environment. One such change has been the emergence of mad cow disease. While it seems unlikely that humans can contract a prion disease from eating contaminated beef, safety is far from certain. For this and other reasons, Europe is deciding that it is important to know, in a good degree of detail, where food comes from. This may represent an enormous opportunity, and one leading manufacturer of commercial food processing equipment is seizing it.

This company is in a very good position to take the hill, for two reasons: their pre-existing leadership in commercial food service equipment, and their being already well advanced in planning for connected products.

Mad cow disease is not the only danger that might possibly lurk in a fast-food hamburger. *E coli* was never considered a threat before a couple of decades ago, and new strains of other formerly innocuous bacteria may emerge at any time. There may be dangers, as well, in other parts of the burger: the bun, the sesame seeds, the condiments. While the likelihood of danger in any of the meal's parts is extremely low, society may reach consensus that it is worthwhile to trace every part of every meal served in every kind of restaurant.

This will take a long time to achieve, but an important beachhead for pursuit of this goal is the restaurant itself. If every food item that comes into the kitchen has a batch identifier, equipment can be designed to keep track of which batches of ingredients go into every finished product. This is easiest with fast food, where recipes are few and highly standardized, and machinery specialized. The company that is taking the lead has a great advantage through its enormous leadership in the fast food market. The company can then use expertise gained in that market to move to less standardized processes in other kinds of food services, and from there integrate the entire food-tracking process all the way back to the specific cow and vegetable plot.

Food-tracking, and by extension product-pedigree generally, will probably emerge as one of the killer apps on the Pervasive Internet. This case is interesting not only for that reason, but also because it potentially involves multiple business models.

For as long as the company keeps its application at the level of the restaurant, it will probably be a Solutionist. Already, the company offers complete maintenance contracts which are of greater value than its one-time product sales, and is only a few small steps away from not selling equipment, but "cookage." However, if this killer app matures in such a way that the company can become the



collector and owner of pedigree information farther back, many other devices will become involved in an aggregated system. The company will then be the aggregator (unless someone else usurps) by virtue of having moved first and by virtue of having a large number of devices involved in the overall system.

ONSTAR™

OnStar™, launched by GM, is an excellent example of an Aggregator. The opportunity tapped by OnStar is a team opportunity, but not one in which many devices are required to make up aggregate value, but one in which many services are offered through the one device. OnStar provides for many activities only peripherally related to the car, such as concierge services, but of value.

Aggregators' positions are often claimed by first movers, and this was the case with GM and OnStar. There are important economies of scale involved, which are a barrier to later entrants. While Harbor Research stresses the importance for all companies of moving quickly toward connected products, this is especially important when there is an aggregation opportunity involved.

SPECIALTY CHEMICALS

A distinctive aspect of specialty chemicals is that, in many cases, they require special handling in their conveyance, delivery, and use. This is especially true where the chemicals are delivered as fluids and gases. In fact, one could say that a company selling gases might be more a fulfillment company than a manufacturer. After all, a considerable part of the market for gases is for those that are by-products of other processes and are not made by the company that will sell the gases to the end customer. CO₂ and NO₂, for example, are both important gases but are also by-products which other companies make in abundance. Why would anyone make CO₂ when Archer Daniels Midland ships it out in rail tankers for tens of dollars a ton?

The leading companies in specialty chemicals will become Solutionists when they fully adopt pervasive technology. And this industry makes an interesting point about the Solutionist model: for many companies it won't be a radical change in business model. This is because, for many companies, there were already so many high-value activities in the product life cycle that the companies were already deeply involved in services. This is true in specialty chemicals, as well as for G.E. Healthcare. The two leading suppliers of industrial gases, Air Products and Air Liquide, have long had service consultants on-site with customers, putting them already in a near-Solutionist role. Connectivity helps them go a step farther: they are installing gas-management and gas-production facilities on customer premises, and in many cases take complete responsibility for running those plants. Of course, this is made not only feasible but highly profitable by device connectivity and centralized monitoring and management.

Similarly, while the Pervasive Internet helps GE Healthcare implement a Solutionist model, the company has already been in the position of doing financing and maintenance for its customers,

Growth Opportunities and Business Models for the Pervasive Internet

How Companies Will Make Money with Networked Products and Services

15

Exhibit 4: Pervasive Internet Application Examples		
APPLICATION	BUSINESS CHALLENGE	BENEFITS TO BUSINESS
Oil Well	Logistical costs - remote	Accurate production analysis
	Maximizing pump efficiency	Early ID of problems before they occur... reducing downtime
	Monitoring/maximizing yields	Improved operating efficiency
	Potential catastrophic failures	Use central / remote expertise
Chemical Tank	Delivering just-in-time	Optimized supply chains
	Supply chain inefficiencies where chemical level is not known	Fast response to problems
	Minimize unnecessary field-service trips	Reduce costs - minimize trip times
	Ensure tank is never empty	Reduce the number of field-service trips
Sewage Monitoring	Daily statutory reporting	Reduced maintenance costs
	High cost of manual data collection and reporting	Fast response to fault conditions
	Rapid detection of faults	Automatic agency reporting
	Reducing unplanned maintenance	Ease of diagnostics
HVAC	Quality (air, pollution, cooler temperatures)	Consistent quality
	Minimizing energy usage	Fast response to problems
	Reducing downtime	Reduced energy costs
	Optimizing power quality	New service-based opportunities
Elevators and Escalators	Health and safety issues	Reduced service interruptions
	Fast response to alarms	Dramatic reduction in downtime
	Optimize "no use" lift parking	Fast service response
	Minimize energy usage	Early detection of faults
	Minimize downtime	Increased customer service
Gaming Machines	New game performance	Increase accuracy and maximize revenues
	Detection of fraudulent usage	Easier maintenance, minimizing downtime
	Networked gaming and jackpots	Less loss from fraud & cash shrinkage
	New regulations	Reducing unplanned downtime
Photocopiers	Manual data collection	Early fault detection minimizes downtime
	Accurate reporting and billing	Increased reliability through known usage reduces costs
	Consumable usage	Maximize consumable sales & prevent substitutions
	Detect fraudulent usage	Reduce costs
	Minimize downtime	Increase staff efficiency
Environmental Monitoring	Costly manual data collection	Reduced cost of data collection
	Environment quality	Instantaneous pollution alarming
	Early detection and rectification of pollution	Rapid identification of polluter
	Identify polluters	Remove human error

Source: Harbor Research, Inc.



and probably helped heavily in purchase decisions. Thus GE, along with the specialty chemical suppliers, were in Solutionist roles independent of device connectivity. Connectivity simply expands the opportunity and strengthens the hold on the customer.

SNACK VENDING

Recently in an East Asian country, vending machines were introduced that would allow snacks to be purchased using the customer's cellular phone. In the US as well, vending companies are rolling out machines that use device connectivity to achieve a number of desirable ends. We discuss one such case in the next section of this paper, but for our present purposes, a single aspect of snack vending is of interest: the question of who is the customer helps determine the business model. For example, if your customer is the buyer of the machine, you might have an opportunity to move into a Solutionist role, providing more completely the service of "vending" to customers who want "vending" on their premises. On the other hand, if you own all your machines, and place rather than sell them, then your customer is the person who buys a soda or candy bar, and you're closer to the Embedded Innovator model. In this case, the scope of value-adding activities is small, and you're really a distributor; you haven't added connectivity to the thing sold but to the delivery system.

HOME AWARENESS

Eaton, with its launch of a system for monitoring devices in the home, is well on the way to being an effective Aggregator. It is worth noting that the nature of Eaton's products, being involved with safety and control, gives them a better beachhead in the home than the makers of lighting or white goods. These two value areas, safety and control, are both possible beachheads, and a company might be able to claim a significant piece of the market having a presence in only one, although it is better to have a presence in both. To clarify what we mean by safety and control, thermostats are control but not safety, an ozone detector is safety but not control—although that could change with the next generation—and circuit breakers, while rather simple, are both. It is also worth noting that these beachheads are no guarantee against an encroacher who is good at data management and user interfaces. Microsoft could well take over the smart home. By contrast, the leader in food-tracking appliances, being able to build a high-value food-pedigree system without too much partnering, is much safer from that kind of encroachment than is the maker of a home-management system.

The Ascending Scale of Business Cases

This study has explored in some detail the business and revenue models for companies making connected devices. Before leaving the subject, there is one more important topic to consider, which is how managers in manufacturing companies can move their enterprises to make the shift to device connectivity.



The first hurdle facing change champions at the companies that need to make the shift is that of making the business case for change in their organizations. Harbor Research has observed many companies that have successfully made the shift, and we have observed that, while business cases may vary greatly in their details, in the most basic level, that of cost justification, there are only three variables that matter. In other words, companies will see that the cost and effort of connecting their products are repaid in three ways:

Cost Savings: Connecting the product may result in cost savings. This may occur as devices send home better information about inventory, required maintenance, or needed supplies, and as support processes are accordingly streamlined.

Service Enhancement: Frequently, a connected product will either deliver improved service in and of itself, or may enable the manufacturer to increase the level of extrinsic service the company provides. Even if it does not result in additional revenue, this enhanced service can engender customer loyalty, or increase the product's stickiness in other ways.

Revenue Boost: There may be many ways to make the connected product deliver increased revenue.

These three types of cost-justification may be viewed as an ascending scale, in two ways. First, they are listed from easiest to hardest in terms of the ease with which the justification can be foreseen; cost savings are often easiest to see, and revenue boosts may be the hardest. Second, within most companies, these three routes to ROI have increasing value as cost-justifiers. Cost savings are nice, but are often not dramatic enough to offset adoption costs or overcome perceived technology risk. Enhanced service levels, since they are often added to cost savings, may make the case more compelling. But revenue boosts, which are usually added over and above the others, are frequently what moves management.

This ascending scale of justifications is clearly illustrated in the case of a leading manufacturer and manager of soft drink and snack vending machines. The change champions within this company knew it was important to network-enable their machines, but needed to convince top management. Their first step was to consider how a connected machine might result in cost savings.

Possibilities in this area were not hard to see. A machine that reported every sale to a central data warehouse would be giving the company's distribution system a clear, up-to-the-minute view of its restocking needs. There would be no guesswork involved in loading and dispatching delivery vehicles, and here alone would be a significant cost saving.

Management was not convinced. The potential cost savings looked good, but not good enough for a "go" decision in the face of uncertainty about the cost of implementing the system.

The change champions went back to thinking about how a connected machine could benefit the company. It soon became apparent that such a machine could deliver better service to the hungry

Growth Opportunities and Business Models for the Pervasive Internet

How Companies Will Make Money with Networked Products and Services

18

and thirsty. A soft drink machine could, for example, be designed to contain an increased variety of drinks, and make a different menu of drinks available depending on the time of day. After all, people prefer fruit juices for breakfast and soda later in the day. By reporting its sales, it could rely on centralized processing power to make the wisest decision as to when “breakfast time” began and ended for the population using a particular machine. Similar decisions could be made with snack foods, and the improvement in service levels would be significant. Even without a revenue increase, the better service would be a significant selling point to the people who decide whose vending machines will be placed in a given location. Connected machines would engender greater loyalty and be stickier.

Still, management was not convinced that enhanced service was enough to justify making the change. It seemed likely that better service would not only increase stickiness but also, by making product availability better match demand by time of day, would also increase revenue per machine. If only that increase had been quantified, the new business case might have been compelling. But it was hard to quantify, since it was hard to know just how strong the demand shift by time of day was.

Aware of this, the change champions began a search for other, more measurable ways the connected machine could increase revenue. They soon realized that, even if they could quantify the additional revenue that a time-of-day product shift would result in, it was not the only way that revenue could be increased. Then they thought of non-cash sales, and they knew they had found the answer.

Who has never had the experience of being within two feet of a cold, potentially refreshing soda, but being unable to buy it because of a lack of the right combination of bills and coins? Who has never had to forego the much-desired candy bar because the nearby change machine is not working? Who has never wished there were a convenience store open near the soda machine to change a twenty? The experience is common since, after all, the very reason for a vending machine is to sell product at times and in places where it makes no sense to staff a cash register. But what if the machine could take your Visa card? What if, when you’ve just arrived at 2 AM at your hotel, and have no change, the soda machine could read your room card and charge the drink to your room bill? You’d be satisfied, the hotel would be glad it had a happy guest, and the company would have made money that, in the pre-connected days, would have eluded it.

With a clear revenue boost added to enhanced service on top of cost savings, the company’s top management now had no trouble deciding to network its machines. The likelihood of a solid return on investment was clear.



THE "EASY" BUSINESS CASE: SAVING YOUR LIFE

For all the thought and effort that went into building this vending company's business case, for many companies there ought to be an easier way to justify getting onto the Pervasive Internet. That easier case, simply put, is that it may be the only way to save your company's life.

In certain cases, the Pervasive Internet will reshape the entire competitive arena in favor of the first mover. Yet this may not become clear even to the first mover until after the device has been connected and one or more permutations of new business models have been tried. In these cases, although it cannot be seen ahead of time, there is enormous loss to those who waited.

This is illustrated by the case of OnStar™, GM's in-car connectivity offering. Originally conceived as simply another feature of the company's top-line cars, OnStar™ soon came to be seen as a platform for the selling of numerous lucrative add-on services. Far from being simply a new feature that could boost the ticket price at the dealership, OnStar™ was the sluice gate for a tremendous flow of subscription revenues.

However, a problem showed itself early in the process: OnStar™, which included a suite of sensors and controllers within the car (for example, based upon a properly validated telephone request, OnStar™ can unlock your car door for you remotely), was rather expensive to install. As a simple feature of the car, it probably would have failed. Even as the doorway to a subscription service, its up-front cost was high enough to keep many buyers away. In order to reach an installed base large enough to pay for the service infrastructure, the installed equipment had to be sold at a loss, and even at that, restricting OnStar™ to the parent company's own make of cars meant a low likelihood that economies of scale would be realized. GM wisely cut OnStar™ loose to forge its own future. No longer wedded to a single make of car, OnStar™ could be installed in any vehicle, enormous scale would be achieved, and perhaps most importantly, it would be much harder for any other manufacturer to create its own device and infrastructure and catch up. OnStar™ is now positioned to dictate, within reason, the terms on which any auto maker offers networked services. As the service becomes common and expected by upscale car buyers, OnStar™ will eat a portion of every auto maker's lunch, and the resultant edge may be enough, combined with the other stresses that always beset players in the auto industry, to bring some laggards to their knees.

Yet, when GM first implemented the OnStar™ service, it did not understand the scale economics nor the possibilities for dominance inherent in what it was doing. In hindsight, you might say it was simply lucky that they took the gamble on the Pervasive Internet, which was inevitably going to come to the automotive world, and made the move. With the advantage of OnStar™'s example, companies can now decide that, even if they cannot foresee it, a competitor's networked product may be such a killer that a pre-emptive move to connectivity may be necessary. Even if cost savings, service enhancements, and revenue boosts may seem unclear in the fog of the future, companies may do well just to claim the beachhead from which dominance will later be achieved.

Growth Opportunities and Business Models for the Pervasive Internet

How Companies Will Make Money with Networked Products and Services

20

About Harbor Research, Inc.

Harbor Research Inc. has more than twenty years of experience in providing strategic consulting and research services to high technology clients. Harbor's business development work is organized around emergent and disruptive opportunities, with a unique focus on the impact of the Pervasive Internet—the use of the Internet to accomplish global device networking that will revolutionize business by unleashing entirely new modes of system optimization, customer relationships, and service delivery.

Harbor Research's clients are leaders in communications, computing, control, and content. Harbor Research has built extended relationships with larger multi-line companies including AT&T, ABB, Agilent, General Electric, Danaher, Eaton, Emerson, Hewlett Packard, Hitachi, Honeywell, Hughes, IBM, Intel, Invensys, Lucent, Motorola, Rockwell, Siemens, and Texas Instruments, as well as with growth companies such as EMC, Cadence Design, Conexant and Qualcomm.

We also work with a broad array of emergent start-ups and pre-IPO technology ventures. We have built relationships with a number of significant Pervasive Internet players, including Ember Corporation, Qestra Corporation, Xsilog, DataSweep, and Dust Networks, to name a few.

