

By Andrew Fano and Anatole Gershman

The Future of Business Services in the Age of Ubiquitous Computing

Redefining the key aspects of the business-customer relationship.

UBIQUITOUS COMPUTING WILL CHANGE THE WAY WE *live with technology*. As Mark Weiser stated: “The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it” [3]. We don’t think of pencils or hinges or faucets as technology. They are just simply features of the world we take for granted and shape the way we act in the world. With ubiquitous computing, using information technology will progressively feel more like using these everyday objects than using personal computers.

The trend toward ubiquitous computing does not represent simply a change in the way people access and use information. In the end it will have a profound effect on the way people access and use services, enabling new classes of services that only make sense by virtue of being embedded in the environment. Ultimately these technologies will lead us to a world of ubiquitous commerce. The prospect of ubiquitous computing, therefore, poses a fundamental question to businesses: What will it mean to conduct commerce in a world where our physical environments are teeming with services?

Fundamentally, ubiquitous computing can and will change the way businesses and consumers are able to access each other. Gaining access to customers has been in the past a key challenge for businesses. What if accessing customers disappeared as a problem? Doesn’t the rise of ubiquitous computing promise businesses the ability to deliver the right message to the right person at the right time at extremely low cost? Yet, these new and improved ways of reaching customers raise a whole new set of challenges that in many ways are far more complex than issues of cost. After all, what is the right message? When is the right time? Who is the right person? (If we can even be sure that our customer will be a person.) Beyond simply reaching a customer with a message, what kinds of interactions will become possible? How do we deploy and interact with services in this new world? How will relationships between businesses and their customers evolve? These questions must be

Ubiquitous computing can transform some key characteristics of customer interaction: the role of their location, the scope of the service, and its duration and frequency.

addressed to fully realize the promise of ubiquitous computing, and answering them will become a fundamental challenge for business strategy.

During the e-business boom businesses began to use the Internet to change the ways in which they reach out to their customers. This has primarily been through Web sites people access from PCs at home or at work. The move to ubiquitous computing where we can interact with a service through a product rather than a PC or phone will radically change the nature of customer relationships. As businesses strive to achieve ever more intimate customer relationships, it becomes evident that content and interaction modes appropriate for past channels no longer suffice. If we take seriously the idea of a relationship with a customer, we must heed to the same characteristics that foster relationships in other areas of our lives: *awareness, accessibility* and *responsiveness*.

When you have a relationship with someone, you are highly aware of one another. You know each other's concerns and how they change over time. The deeper the relationship, the greater the awareness. Meanwhile, the less accessible one is in a relationship, the harder it is to maintain that relationship. One can be perfectly aware and accessible, but if he or she doesn't respond in a way that addresses the other's needs, the relationship will fail. Interacting with someone is an investment in time, energy, and trust one makes with the expectation that it will lead to appropriate and desired responses—responses that would not be possible without this investment.

Most current CRM applications focus on identifying and targeting the right customers. Tools exist to help calculate the expected lifetime value of a customer and which products one should strive to cross-sell. But once you know with whom you would like to have a relationship, what comes next? What can be done beyond dedicated call support, self-service Web sites, targeted ads, and other assorted inducements that are the current model of the day?

Emerging technologies associated with ubiquitous computing including the Web, email, mobile phones, wireless PDAs, pagers, instant messaging, collaboration environments, videoconferencing, and kiosks allow us to consider approaches that will expand and alter today's CRM functionality. Simply, they offer

new ways for achieving awareness, new channels for accessibility, and new techniques for responding. Increasingly affordable technologies are capable of sensing the world. The E911 laws will mandate the sale of location-aware mobile phones. Similar capabilities will be found on connected PDAs. Radio Frequency Identification tags (RFID) and tagging technologies increase supply chain efficiency and customer value. As these tags grow in sophistication and drop in price they will enable a variety of new services that provide awareness, access, and new ways of responding. Other technologies are also finding more widespread use. Some will support security concerns, such as biometrics, which will enable us to identify and verify individuals in a variety of situations through fingerprints, voiceprints, signature verification, face recognition, and handprints. To address these questions in terms of their impact on business and strategy we describe the following examples of how ubiquitous computing could transform customer relationships and services.¹

Online Medicine Cabinet. Imagine walking into the bathroom in the morning, beginning to brush your teeth, and as you look into the mirror of your medicine cabinet, hearing a voice suggesting that, since it is a high pollen day, you should take your allergy medicine. The cabinet recognized you and your needs. Reaching for the medicine, you mistakenly choose the wrong drug. The Online Medicine Cabinet gently corrects you and, since you are almost out of pills, orders a refill automatically [2].

Mobile Valet. Imagine entering an electronics store while carrying a wireless-enabled PDA. It recognizes your location and presents you with service categories appropriate for shopping, such as product information, customer service, warranties, financing, and so forth. You choose a product comparison service you've previously found useful and point your device at inkjet printers you're interested in. This gives you a product comparison on your PDA. Unfortunately, with a frustratingly small screen on your PDA, you can't see much information. Mobile Valet allows you to context-shift the service into a nearby kiosk, where you can view the information in far greater

¹The prototypes described here were developed at Accenture Technology Labs.

detail [1]. You then point your PDA to one of the printers and ask a different service provider for product reviews that are also viewed through the kiosk. You check financing and warranty options. You ask your personal customer service provider if the printer is a good choice to use with your digital camera. Within a few moments, a customer service representative from the store arrives to address your remaining questions.

Both examples illustrate the three characteristics—awareness, access, and responsiveness—of a relationship enabled by ubiquitous computing. The services are aware of the customer and his or her needs. They can access the customer and provide easy and natural access to the customer at exactly the right time—when the customer needs it most. The services are responsive to the specific needs of the customer and take advantage of the resources available at the customer's location. The examples also illustrate how ubiquitous computing can transform some key characteristics of customer interaction: the role of their location, the scope of the service, and its duration and frequency.

The location of your customer becomes the location of your business. Technology enables service providers to make the location of their customers the location of their business. This is the fundamental principle of anchoring cyberspace back to a physical context. I can take a cell phone equipped with a barcode scanner to a bookstore, use the store to select the books I like and then buy them from a different store by simply scanning the barcodes on the back cover. My cell phone is thereby transformed into a self-service portable cash register for my favorite online bookstore. But the online and physical worlds do not have to be viewed as adversarial. By creating new and innovative service delivery channels integrated into the locations we inhabit and the accessories we carry, business will be able to meet people on their own terms—in the physical world. The Online Medicine Cabinet is a good example of how a business can take its services directly to the most appropriate location for its customers. The Online Medicine Cabinet also clearly illustrates the competitive importance of physical points of presence.

A physical point of presence wherever your products and services are used will become a competitive necessity. Today, an e-commerce-driven Web site is considered critical for many businesses. Yet, having such a site hardly means you've reached the pinnacle of customer interaction. Consider, for example, two pharmacies. One has the world's greatest e-commerce Web site, featuring easy ordering, wondrously efficient fulfillment, self-service support, order-tracking, advice, account management, and all flavors of personalization. The other pharmacy has this cabinet in

your bathroom. You'll probably never get to that wonderful Web site. Why would you? Accessibility at the point of need to services that are aware of your immediate needs enables a far different class of interactions and consequently customer relationships than dissociated contact points. It would be meaningless even if it were possible, for example, to receive an email message on your laptop hours later that you took the wrong pill.

Businesses will need a point of presence at the location where their customers use products and services. While Web sites are important, and will remain so, they are, in the end, just one of many points of contact with customers. The examples also show that it is not enough for a service to have a physical point of presence: critical elements include awareness, access, and responsiveness at that site. A passive kiosk is not aware of the customer's needs and cannot be very responsive.

Mobile devices and appliances become the eyes and ears of remote service providers. Knowledge of the customer is mostly historical: what the customer has done in the past, not what the customer is doing now. This means businesses can apply a variety of data mining tools to estimate a customer's expected value, select appropriate marketing campaigns, and choose the level of service. But it helps little to enable and improve the service or product provided to the customer at a given moment, because the business doesn't know the customer's current situation. Fire departments don't rely on data mining records from past fires to tell them where to go next. They rely on smoke detectors to tell them what is happening now.

Mobile devices have the promise to provide similar context-sensing capabilities resulting in awareness and responsiveness. Slowly but surely our phones, PDAs, and other more specialized devices (such as digital cameras) will become aware of their surroundings. They will soon know their locations—often a critical indicator of the user's task. For example, if you are at a gas station you are probably buying gas. If you are at the bank you are probably banking, and, if you're in a store you are probably shopping. Furthermore, if a service provider knows something about the specific location, it can deduce what resources are available there. For example, the service provider may know the type of products and services available locally, who else is present, and/or the availability of resources such as kiosks. Finally, as illustrated by the Mobile Valet, the customer can use the mobile device to inform service providers by pointing to objects of interest. This may be a product they would like to buy, a broken appliance they would like to fix, or a house for sale for which they would like more information. The mobile

The challenge, and opportunity, is to transform what is today just a screen in a store to a service channel that can be used by multiple service providers.

device is, in essence, their remote control to the world.

Services we associate with locations become attached to people. To gain competitive advantage remote services must make the best use of the resources available at the customer's location. In the Mobile Valet scenario the customer accesses his service provider, and considers financing and warranty options from several competing sellers. The mobile device, in essence, enables the customer to access and bring with him a veritable army of service providers and information resources. Businesses can no longer prey on customers' ignorance. They can no longer hide the fact that someone else has a cheaper price. Yet, if your customer is in your store you can be in the best position to match the price or sweeten the deal in some other way.

By working with customer's service providers, businesses can offer more responsive and efficient services. Remote service providers face a serious constraint: they are, in the end, *remote*. They probably have no staff at the location, which greatly limits the nature of the service they can deliver. The remote service provider can, however, collaborate with the local staff and together provide a better service that is in both of their interests. With the Mobile Valet, the remote customer service provider can inform the local store which model the customer is interested in, the accessories desired, and the concerns he may have. The store is then in a good position to select the right service person and provide detailed help, increasing the chances for a sale and a satisfied customer. This results in richer interactions in which the staff of the location is made aware of specific customer needs and provided with the opportunity to respond specifically rather than approaching the customer anonymously. The capability to dissociate specific functions such as customer service from a particular location creates new services such as personal service providers that work across locations to support particular needs (such as financing, insurance, technical support, travel, and so forth). This introduces a different kind of customer relationship than one based on a just a specific product or episode.

Services will use the customer's location resources to provide the best possible service. There is a tremendous amount of hype around today's

mobile commerce. But when all is said and done, the current race for m-commerce is a race to deliver services onto what is at any given time the worst display in the room: the customer's phone, or PDA. This limitation prevents the widespread use of m-commerce for many services. The Mobile Valet illustrates an approach that helps reach beyond these limitations by incorporating and exploiting the resources of the customer's location. If the phone is the poorest screen in the room, perhaps we can make a nearby better screen available. This technology allows rapid response to a remote service request by first establishing the customer's context, identifying available service channels such as the customer's mobile device, nearby screens, audio systems, kiosks, and even human staff (through RFIDs)—and then deliver the highest fidelity service through the available channels. This is feasible because the locations we inhabit want customers to succeed and should therefore be motivated to make their resources available. The challenge, and opportunity, is to transform what is today just a screen in a store to a service channel that can be used by multiple service providers.

Service providers must pay continuous attention to their customers. We normally think of medical care as a service we avail ourselves of a few times a year. Yet, through dedicated service appliances like the Online Medicine Cabinet, every visit to the bathroom potentially becomes a visit to your health care service provider. Mobile Valet services have to be always on, knowing where the customer is, and what his or her needs might be and enable any type of service through this awareness. How many companies are ready to offer this level of customer attention today?

Service providers will have to be very selective and precise in their interactions with their customers. We walk by the thermostat in our residences hundreds of times without ever adjusting it. In a similar way, the online medical cabinet will probably be silent most of the time, with only the occasional minor interaction. It is important, however, that our relationship with the service provider has changed from one of a few long, intense interactions (such as checkups) to one characterized by frequent, brief interactions in which "microservices" are delivered. In this world, we are in an almost constant conversation

with the provider. In fact, in many instances, it will be difficult to decide if we are engaged in the use of countless micro services or participating in a single lifetime relationship. Regardless, these developments signal a fundamental change in what constitutes the actual product or service, how it is perceived, and the value it provides the customer.


If we value privacy, someone will sell it to us. Aware and responsive customer relationships require a great deal of knowledge about the customer as well as access to the current customer context. This necessarily creates a need to provide personal information to service providers. The potential scenario of sensors in your bathroom and mobile devices reporting your every move to remote service providers naturally inspires grave privacy concerns. We agree that threats to our privacy are a very real issue, but argue that rumors of the imminent demise of privacy have been exaggerated.

While privacy will be an increasingly important concern, these concerns also present new business opportunities for privacy management services rather than insurmountable obstacles to the kinds of services we describe. Already, a variety of products and services exist in this area, including encryption products enabling secure email to privacy auditing services that certify a company's compliance with their privacy guidelines, and phone services that block telemarketers. Nevertheless, businesses wishing to explore the opportunities by expanding customer relationships must think carefully about the information they collect, who they will share it with, and how they will use it. Social acceptance of the use of personal information will likely grow as the services that use such information collect it and use it in a manner intimately and obviously related to, and necessary for, the service being enabled. When our doctor asks us to remove our shirts during a checkup it is not perceived as a privacy violation. If our real estate agent asked, it would be a serious problem. The difference, of course, is we understand the role it plays in the examination. Privacy concerns can be addressed by a combination of technology, legislation, and business policies.

Customers will not necessarily be human. As the objects around us become more intelligent, they will be capable of making decisions and empowered to act on them. At this point, inanimate objects will become customers. Consider the growing sophistication of toys. Today's popular entertainment robots display impressive behaviors. As we endow them with additional behaviors, how long before they get *commercial* behavior? To demonstrate such possibilities we have developed a prototype doll that literally has a budget and the means to spend it: the doll selects and orders accessories it "wants" based on what it "sees" on other dolls.

While dolls that go shopping seem like a rather fanciful and far-fetched example, we already see examples of objects making what are, in effect, commercial decisions. Your thermostat, for instance, will probably spend a lot of money on your behalf this winter. What if instead of simply telling it desired temperatures, you also communicated the most you wanted to spend and let it negotiate the best deals possible with providers and heat the house as well as it could given the budget? In many instances, the things we use are in a better position to make decisions than we are. Who knows better, for instance, how to spend the next maintenance dollar on your car, you or your car? Once objects become customers the question of what constitutes a customer relationship must be completely reexamined. How do you market to a car? How do you get a house to switch providers? How do you earn loyalty from a doll? These are among the challenges ubiquitous commerce will pose in the years ahead.

Conclusion

Ubiquitous computing enables businesses to redefine the key aspects of their customer relationships. Businesses can become continuously aware of their customers' needs and provide more natural and powerful means of access to their services. By using sensors and local resources, they can become more responsive to their customers. These new capabilities also present competitive challenges: How to extend your services to every location where your products may be used or purchased? How to sense your customer's needs? How to use all the resources available at each location? How to be selective and precise in customer interaction without violating the customer's privacy? These challenges will define the competitive landscape in ubiquitous commerce. 

REFERENCES

1. Fano, A.E. What are a location's "File" and "Edit" menus? *Journal of Personal and Ubiquitous Computing* 5, 1 (Jan. 2001).
2. Wan, D. Magic medicine cabinet: A situated portal for healthcare. In *Proceedings of International Symposium on Handheld and Ubiquitous Computing (HUC'99)*. Karlsruhe, Germany, 1999.
3. Weiser, M. The computer for the 21st Century. *Sci. Am.* 265, 3 (Sept. 1991), 94–104.

ANDREW FANO (andrew.e.fano@accenture.com) is a senior researcher at Accenture Technology Labs in Chicago, IL.

ANATOLE GERSHMAN (anatole.v.gershman@accenture.com) is the director of research at Accenture Technology Labs in Chicago, IL.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, to republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.