



HORIZON REPORT

2009 ECONOMIC DEVELOPMENT EDITION

The New Media Consortium

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EXECUTIVE SUMMARY

The New Media Consortium's Horizon Project is an ongoing research project that seeks to identify and describe emerging technologies likely to have a large impact in education and other industries around the world over a five-year time period. The chief products of the project are the *Horizon Reports*, an annual series of publications that describe promising emerging technologies and highlight their relevance. This special edition, the *Horizon Report: 2009 Economic Development Edition*, explores the landscape of emerging technologies as it pertains to small to medium-sized businesses.

Like the *Horizon Report* itself, this special edition follows a specific format to describe six technologies or practices that will impact businesses within three adoption horizons over the next five years. Each topic opens with an overview describing the technology at hand, followed by a discussion of its relevant applications for small to medium businesses. Examples of how the technology is currently employed, or how it could be applied to commerce, illustrate its potential. Finally, an annotated list of materials for further reading is provided for those who would like to explore a topic in greater depth.

In selecting the six topics, the project draws on an ongoing conversation among leaders in the fields of business, industry, and education, informed by a review of published resources, by current research and practice, and by the expertise of business communities in California, the United States, and around the world. The report is guided by the Horizon Project's Economic Development Advisory Board, a body of experts representing a range of perspectives in business and industry. The Advisory Board engages in a discussion framed by a set of research questions that are intended to uncover significant trends and challenges and to identify a broad field of potential technologies for the report. The process by which the Advisory Board arrives at consensus about the final six topics presented in the *Horizon Report* is detailed in the methodology section, which follows the discussion of the topic areas.

Key Trends

In addition to identifying areas of emerging technology, the Advisory Board reviewed key trends, examining current articles, papers, interviews, and published research to discover patterns that are affecting business and industry. The Advisory Board listed the five trends described here as those most likely to have a significant impact on small to medium businesses over the next five years. They are presented in priority order as ranked by the Advisory Board.

- *Employees increasingly expect to be able to work flexible hours and to work from locations other than an office building.* In today's global marketplace, colleagues and customers may be located anywhere in the world, and round-the-clock service is a requirement for any international organization. A central office is not necessary in many industries; knowledge workers simply require reliable Internet access and a computer, both of which can be established at home or even on the road. This shift in business practice, supported by communications technologies and the Internet, is leading to increased choice for employees when it comes to where and when they work.
- *Modern consumers expect that the content in which they are interested will be available in a variety of different forms.* The transaction between consumer and producer does not end when a purchase is made. Whether the item is a toy, a book, a movie, an appliance, or a piece of clothing, consumers are buying not only the physical item itself but also a spot in the community of that item, including content on the Internet, television, mobile devices, and even in other products. A child interested in the Transformers looks for them in all of these places: on websites, on his phone, in his games, and on his lunchbox and clothing. Marketers

must be ready to create webs of content that support the consumer's interest.

- *Gaming is an increasingly universal phenomenon among those entering the workforce.* In a 2008 survey of youth ages 12-17 by the Pew Internet and American Life Project (http://www.pewinternet.org/PPF/r/263/report_display.asp), it was found that young people have a great deal of experience with gaming. Further, this experience is rich and varied, and includes opportunities for social interaction and civic engagement. Understanding the kinds of experiences that young people are having through playing games is crucial to designing work environments in which they feel empowered and can excel.
- *Increasing globalization continues to affect the way we work, collaborate, and communicate.* As noted above, the flattening world is changing business practice. Similarly, globalization is altering our interactions at every level: communication with friends, family, coworkers, and clients; the ways we collaborate with others; and the ways we manage our personal workflow. From almost-instant turnaround on questions through email and mobile devices, to jointly-authored proposals hosted in the cloud, we have almost immediate access to the people and files we work with, wherever they may be located.
- *Technology is increasingly a means for empowering employees, a method for communication and socializing, and a ubiquitous, transparent part of their lives.* For many employees, and especially for knowledge workers, technology mediates both social and business relationships and facilitates time management. Gradually, attitudes are changing; organizations that once blocked communications technologies such as Twitter, Facebook, YouTube, and instant messaging services are beginning to appreciate the role of such services in maintaining employee productivity. Technology

tools give employees the ability to find answers, do research, consult with their peers, and keep abreast of current trends.

Critical Challenges

Likewise, the Advisory Board noted many challenges facing small and medium-sized businesses. The five listed below are those selected as most likely to impact business and industry over the next five years. Although it is not explicitly named below, one challenge that was present as an undercurrent in every dialog among the Advisory Board has been the effect of recent events in the global financial markets. While these events and their continuing consequences are not discussed here, they remain in the background as the challenges and trends noted here unfold.

- *Students are not being educated in a culture of innovation and creativity.* Today's workers are expected to be problem solvers, to tackle challenges proactively, and to think creatively, but these skills are not taught in schools. The culture in most schools still reflects values that were key in the industrial age — values that prepared students for jobs on the assembly line. Innovation and creativity are skills that can, and should, be cultivated while students are still in school.
- *There is a growing need for formal instruction in key new skills, including information literacy, visual literacy, and technological literacy.* We live in a media-rich world; young people, especially, are surrounded by stimuli in a variety of formats. It is often wrongly assumed that the skills for interpreting and creating media-rich messages come naturally to students simply because they encounter such content so frequently. In order for young people to become fluent in the language of media — a skill that is vital for many careers, and one that will enhance the quality of life no matter what occupation is chosen — these new skills must be formally taught alongside written, spoken, and information literacy skills.

- *Small companies are not embracing technologies that could give them a real competitive advantage.* Even though it is often easier for small to medium-sized businesses to adopt and implement new technologies than for larger companies, many have not yet embraced technologies that could give them an edge. Smaller companies appear to have more difficulty researching and evaluating technology solutions than larger companies or individuals do. Ironically, the need for small businesses to focus on customer service and the bottom line may be getting in the way of adopting emerging technologies that could help them do so more effectively.
- *Boundaries are disappearing between work, play and general living.* Workplaces have become mutable spaces. Whether an employee works at home, on the road, or in an office, the boundaries between work, life, and play are very fuzzy. It is no longer possible, as it once was, to completely separate family life, social life, and work life: our relationships and activities are mediated by technology to such an extent that they overlap and coincide in countless ways. The challenge is to establish and maintain satisfying, successful relationships in all our spheres, while still keeping the commitments that come with each.
- *Traditional intellectual property laws and practices are increasingly irrelevant in today's world.* The failure of copyright and patent law to reflect current realities of media capture and transfer, and the failure of business to develop successful new models for maintaining the value of intellectual property threaten the success of the creative industries. Technology often blurs the boundaries between the owner, the producer, and the consumer of content, causing a shift in who controls the content. This is especially true in the music, motion picture, and publishing industries.

The trends and challenges noted here frame any discussion of the six technologies described below.

They surround and infuse the environment in which these technologies exist and are put to use, and they inform the way we pursue activities related to business and industry. The Advisory Board acknowledges that understanding is only the first step toward incorporating any emerging technology into practice and recognizes that the factors described here influence our decisions and actions on a daily basis.

Technologies to Watch

The six technologies detailed in the *Horizon Report: 2009 Economic Development Edition* are placed along three adoption horizons that indicate likely timeframes for their widespread adoption by small to medium businesses — defined here as penetration rates of greater than 16-20% both within and among organizations. The first adoption horizon assumes the likelihood of broad adoption within the next year; the second, adoption within two to three years; and the third, adoption within four to five years.

Both technologies on the near horizon are in common use among consumers, even if they have not fully penetrated smaller businesses as yet. *Cloud computing* already underlies many of our online transactions, whether we are aware of it or not. *Mobiles* are carried by employees and customers alike, and their use for business transactions is growing. Those in the middle horizon, *augmented reality* and *location-based services*, are in use by leading businesses and in other sectors. Those on the four-to-five year horizon, *semantic-aware applications* and *smart objects*, have naturally been the least adopted and are still in the early stages of deployment. In the case of all of these technologies, business opportunities exist both in offering these services and in putting them to use internally.

Specific examples of each technology are included in the body of the report, but these become rarer and more experimental as we move out along the horizons toward the far term. The research of the Advisory Board indicates that each of these six featured areas will have significant impact on small to medium-sized businesses within the next five years.

- **Cloud Computing** The promise of cloud computing is that it will free workers and consumers from the need to maintain files and applications on a private computer. With almost infinitely flexible storage and processing capacity, the cloud is ideal for hosting services, documents, records and data.
- **Mobiles** Handheld devices of all kinds, from specialized tools to mobile phones, allow us to work, socialize, and keep up with daily tasks anywhere we may be. Applications designed for mobile devices range from games to applications for organization and productivity, providing a host of ways to get things done while on the go.
- **Augmented Reality** There are myriad ways to layer digital information onto the real world, from complete immersion to the most subtle of virtual annotations. Virtual realities, technologies that enhance our view of the physical world, and applications for handheld devices that increase our understanding of our physical location are all forms of augmented reality.
- **Location-Based Services** Increasingly, consumers are interested in services targeted at their current location and interests. From environmental advertising to applications that suggest discounts, venues, and activities in the immediate area, location-based services supply a growing demand for personalized service.
- **Semantic-Aware Applications** Relationships between concepts, people, and events are embedded in the wealth of content on the web, but they are not always easy to see. Semantic-aware applications assist us in seeing those relationships by determining the context in which information exists; such applications can aggregate related information much more quickly than it could be done by hand.
- **Smart Objects** The “Internet of things,” or the idea that physical objects can be connected to one another and to information, is supported by

the proliferation of smart objects. Smart objects can sense one another and their surroundings and can reveal information such as where they have been and what environmental conditions exist around them. Some smart objects can also take action based on their measurements or on commands issued remotely.

These six key emerging technologies were selected by the Advisory Board from over sixty technologies and practices identified during the process of preparing this report. They are presented here as they appear within the context of business practice, particularly in California, but also in other markets.

About the Horizon Project

The Horizon Project is a long-running research project that since 2002 has continuously examined new and emerging technologies and the trends and issues accompanying them, and produced an ongoing series of reports, wikis, discussions, papers and other resources related to this work. The annual *Horizon Report*, the project’s flagship effort, is released each January and is currently published in six languages. That report looks at the applications of key new technologies to teaching, learning, and critical inquiry from a global perspective, and reaches hundreds of thousands of educators worldwide.

Throughout the year, a series of related editions are released that reflect the project’s work in specific economic sectors and geographic regions. This report, the Economic Development Edition, is part of that effort, which also includes an annual K12 Edition and an annual Australia-New Zealand Edition as well as a series of high-level discussions within the museum community. The Economic Development Edition is a special report focused on the needs of small and medium-sized businesses, especially in light of the current economic climate.

Like the umbrella efforts from which it sprung, the Economic Development Edition used qualitative research methods to identify the technologies selected for inclusion in the report. The process

began with a survey of the work of other organizations and a review of the literature with an eye to spotting interesting emerging technologies. When the cycle started, little was known, or even could be known, about the appropriateness or efficacy of many of the emerging technologies for these purposes, as the Horizon Project expressly focuses on technologies not currently in widespread use. For the current report, more than sixty of these were initially considered by the members of the project's Advisory Board.

The 29 members of this year's Advisory Board were purposely chosen to represent a broad cross section of business and industry, as well as key writers and thinkers from education and other fields. They engaged in a comprehensive review and analysis of

research, articles, papers, and interviews; discussed existing applications, and brainstormed new ones; and ultimately ranked the items on the list of candidate technologies for their potential relevance to small to medium businesses. This work took place in a single face-to-face meeting and in a special online forum in July and August 2009, using a variety of tools specially purposed for the project. All of the work was captured and may be reviewed on the project wiki, at <http://biz.wiki.nmc.org/>.

For additional background on the Economic Development project and specifics about the research methodology, please see the section on Methodology at the end of this report.

CLOUD COMPUTING

Time-to-Adoption Horizon: One Year or Less

The rise of cloud computing represents a turning point in the way we view storage, processing, and applications. Previously, these services were tethered to a personal computer; without access to that particular computer, we had no access to our information and tools. With cloud computing, applications and files are stored elsewhere and are accessible from any computer on the Internet. Resources in the cloud are allocated as needed, scaling up or down according to demand. Content hosted on cloud systems can be accessed by multiple users, facilitating collaboration and document sharing. Storage and processing are available very cheaply in large quantities, and pricing for these services can be very flexible. Many commonly-used services run in the cloud today, enabling small businesses to rapidly deploy and scale their products without sinking capital into expensive hardware and its associated maintenance and support costs.

Overview

Systems of networked computers that dynamically allocate storage space, processing time, and application resources are known as clouds. Cloud computing is the practice of using such systems to develop or host software and store files. The cloud itself is invisible to the end user; it is simply the platform that supports everyday activities like email, photo storage and sharing, collaborative work, and specialized tasks like billing and accounting services or disaster-recovery backups. Cloud applications can often be accessed through a web browser, meaning that no additional software needs to be installed on the user's personal computer. Additionally, some businesses develop and offer cloud-based services that other companies subscribe to.

Cloud systems are very stable because resources and applications are shared across multiple machines. If one goes down, another can pick up the load. Resources and storage space in the cloud are allocated as needed and scale in response to the level of demand at any given time. This elasticity of resources means that companies using the cloud to support complex computing demands, storage, and media streaming need not worry about over- or under-provisioning of resources, since the available resources contract and expand in real time in response to local demand. Cloud applications can keep both software and user files on these networked machines, meaning that any software updates are

automatically applied; the user always sees the most recent version of the software, and never needs to download or install updates or patches.

Cloud applications are currently used for a variety of purposes, including social networking (think Twitter or Facebook), shared productivity software (like Google Apps or Microsoft Office Web), and administrative tasks like billing (Zuora is one example), payroll, accounting, and even on-demand shipping and inventory management. Because cloud applications can be accessed from anywhere and from a variety of devices — laptops, desktop computers, mobile devices — cloud applications open the door to working with talent that isn't local. Even small companies can easily work with employees all over the globe.

Nonetheless, some businesses have been slow to adopt cloud computing, for a variety of reasons. Many companies, particularly larger ones, have already invested significant time and money in existing systems and are reluctant to change. As a solution for everyday business needs, cloud computing is still somewhat new, and some companies are unaware of the concept or unsure as to how cloud computing could be helpful to them. A survey of small and mid-sized businesses in the US and the UK sponsored by Rackspace Hosting and released in January 2009 indicated that small businesses are generally uninformed about cloud applications; compared to mid-sized businesses, small companies make very

little use of cloud services (see <http://www.rackspace.com/downloads/surveys/CloudAwarenessSurvey.pdf>).

For other companies, cloud applications present risks that are difficult to overcome. The fact that data and files are stored in the cloud, as well as the software used to access them, raises questions about security and privacy of information — particularly sensitive information such as employee records, health-related or legal information, and other confidential data. Some companies are not comfortable giving up control of the physical machines on which such data is stored, even if the data is encrypted and the machines are securely protected.

Relevant Applications for Small to Medium Businesses

Cloud computing provides opportunities for rapid expansion, especially for small businesses, without the attendant costs of obtaining, installing, and maintaining hardware and software. Instead, cloud computing enables businesses to employ a pay-as-you-go model for services that have traditionally required substantial capital outlay.

Businesses can either use or offer cloud services (or both). Businesses that use cloud services find them helpful for a variety of activities from file storage, backup and archiving to outsourcing administrative and other tasks. Cloud-based data storage and delivery services allow small companies to look like big ones. Cloud resources can facilitate business planning and remote collaborative workgroups; offload cost-intensive information technology infrastructure, such as server space and customer communication databases; provide free or low-cost productivity software; and support a mobile workforce as well as mobile sales.

FreshBooks (<http://www.freshbooks.com>), for instance, helps companies keep track of clients, projects, and contractors, generating timesheets and invoices automatically. Invoices can be mailed to clients directly from FreshBooks via either email

or postal mail, and contractors can use their own FreshBooks accounts to track and bill their hours for company work. Another service, Zuora (<http://www.zuora.com>), offers online services for subscription billing and recurring payments. LotusLive (<https://www.lotuslive.com/>) provides a suite of services, including email, social networking, collaborative workspaces, and online conferencing.

A growing trend is for businesses to regard customer relations as building a fan base of sorts. Many cloud-based applications facilitate this view and enable customers to market their favorite businesses through online word of mouth. Services like GetSatisfaction.com, iContact, Constant Contact, Facebook, and Twitter all give customers a place to ask questions, make suggestions, register complaints, or give praise — in a public and searchable forum. User communities offer support to novices (at no expense to the business!) and give advanced users a place to swap tips.

As these examples show, cloud computing is changing the dynamics of companies who use cloud services. Just as important, it is creating opportunities for new forms of business services to emerge. Companies that offer cloud computing services are growing rapidly. Following in the footsteps of giants like Amazon.com, other large companies are taking advantage of excess storage and computing power by renting it out with a usage-based fee structure. Smaller companies are able to offer scalable services for hundreds or thousands of clients using cloud-based applications to manage and deploy their products.

A sampling of applications of cloud computing across industries includes the following:

- **Accounting** Services like Bill.com allow small and mid-sized business owners to automate billing and filing. Many companies, from doctors' offices to convenience stores, are using this service to reduce accounting time substantially.
- **Bioinformatics** Several California-based biotech research companies are looking toward

cloud computing as a faster, more cost-effective way to examine genetic sequencing. In 2008, the cost of genome sequencing was \$50,000. In 2009, it has dropped to \$5,000, in large part because of the relatively inexpensive yet powerful computing capacity afforded by the cloud.

- **Sales** Increasingly, companies are turning to cloud solutions like those offered by Salesforce.com for customer relationship management, customer service, and other tasks. Using cloud-based applications like these, companies can focus on sales and service and leave the maintenance and development of software systems to others.

Cloud Computing in Practice

The following links provide examples of cloud computing in business settings.

California Agency Embraces Mobility, Cloud Computing

http://www.informationweek.com/news/services/hosted_apps/showArticle.jhtml?articleID=217600212

(Charles Babcock, *InformationWeek*, 20 May 2009.) Cloud computing enables the remote workers of The California Public Utility Commission to stay connected, whether they are dispatched to the Sierra Nevada peaks, or California's back-country desert.

Central Desktop

<http://www.centraldesktop.com/solutions-smb>

This cloud computing company specializes in serving small and mid-sized businesses. Among the benefits they offer: the ability to direct a worldwide team remotely; manage email; provide instant access to files, including those too large to send via email; make available an online forum for editing large documents; and the capability to train employees using online sites.

Cloud Based Business Phone System

By RingCentral

<http://smallbiztrends.com/2009/07/cloud-based-business-phone-system-by-ringcentral.html>

(Press Release, *Small Business Trends*, 20 July 2009.) A complete, cloud computing-based telephone system — the first of its kind — is now available to small businesses for a flat monthly fee. By using cloud computing, California's RingCentral is able to provide services that would normally cost thousands to implement.

Real-Time Web Sites

<http://www.salesforce.com/platform/cloud-platform/sites.jsp>

Salesforce.com offers a cloud-based platform that hosts websites. Create a website quickly and easily, and rest assured that high traffic won't be a problem (the Starbucks volunteer site received over one million hits in the first few days).

Technology: When the Forecast Calls for Cloud Computing

<http://www.inc.com/magazine/20090101/technology-when-the-forecast-calls-for-clouds.html>

(Michael Fitzgerald, *Inc.*, 1 January 2009.) This article offers several examples of California small businesses that are currently benefiting from cloud computing.

What Are the Advantages of Web-Based Software?

<http://www.37signals.com/webbased>

One cloud computing company, 37 Signals, provides clear, tech-free explanations about the benefits of cloud computing. 37 Signals offers a suite of services, allowing each client to match a product to his specific needs. This link will help determine if this technology might be right for your business.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about cloud computing.

Cloud Computing Highlighted as an Emissions Reduction Strategy

<http://www.greenercomputing.com/news/2009/07/15/cloud-computing-highlighted-emissions-reduction-strategy>

(*Greener Computing*, 15 July 2009.) In addition to saving money on software, companies who outsource data storage via cloud computing save thousands of dollars in energy costs.

Cloud Computing: Hot Technology for 2009

<http://www.networkworld.com/supp/2009/outlook/hottech/010509-nine-hot-techs-cloud-computing.html>

(Neal Weinberg, *Network World*, 5 January 2009.) Several of the benefits of cloud computing to a small business include pay-as-you-go, or paying only for services you use, and eliminating the up-front fees of setting up a new tech system.

Do You Need Capacity Planning For Cloud Computing?

<http://broadcast.oreilly.com/2009/07/do-you-need-capacity-planning.html>

(David Collier-Brown, *O'Reilly*, 12 July 2009.) If your product-based company experiences extreme fluctuations in sales (around the holidays, for example, or when the 49ers win the Super Bowl), a cloud-based sales system may suit your needs.

Egnyte Survey Reveals Fear of Flying Among Small Business Owners Adopting Cloud Computing Solutions

<http://eon.businesswire.com/news/eon/20090630005208/en>

(*Enhanced Online News*, 30 June 2009.) Egnyte, located in Mountain View, California,

has developed a hybrid product to ease the concerns of small business owners regarding loss of Internet connection and cloud computing. The product, Egnyte Local Cloud, offers the benefits of both online and offline services.

Eli Lilly On What's Next In Cloud Computing

http://www.informationweek.com/cloud-computing/blog/archives/2009/01/whats_next_in_t.html

(John Foley, *InformationWeek*, 14 January 2009.) Eli Lilly, currently using Amazon Web Services as its cloud, sees the need for an intermediary between the pharmaceutical company and several cloud-hosting sites. So far, one of the greatest benefits of cloud computing to Eli Lilly has been the speed of setting up new servers.

How to Explain Cloud Computing to Your CFO

http://www.cio.com/article/459819/How_to_Explain_Cloud_Computing_to_Your_CFO

(Bernard Golden, *CIO.com*, 5 November 2008.) This article explains the cost-benefits of using cloud computing. It also discusses why outsourcing some storage behooves a company's IT staff.

Delicious: Cloud Computing

<http://delicious.com/tag/hz09biz+cloudcomputing>

Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report*. To add to this list, simply tag resources with "hz09biz" and "cloudcomputing" when you save them to *Delicious*.

MOBILES

Time-to-Adoption Horizon: One Year or Less

Mobile devices of all kinds offer alternatives to traditional ways of working, shopping, communicating, and socializing. From handheld scanners carried by customers in retail stores to specialized devices used in manufacturing and industry, mobiles assist in all kinds of tasks. Consumers around the globe commonly carry some form of mobile device nearly all the time, and they are increasingly interested in services that can be accessed on demand when they wish it. Everything from banking and finances to grocery shopping to physical fitness can be managed, tracked, recorded, and shared while on the go. Access to services, customer support, loyalty programs, coupons and discounts, and more are available from mobile devices — essentially, a business with a mobile presence accompanies its customers wherever they go.

Overview

In recent years, mobiles have evolved from pint-sized telephones into miniature computers. Innovative interfaces, GPS and wifi capability, and support for third-party applications give mobiles the ability to offer specialized services of all kinds. As a Gartner report predicted in late 2008 (*Mobile Internet Devices*, December 2008), the winning combination for mobile devices is a blend of communications support, a high level of personalization, and the ability to serve Internet-driven applications. That revolution is here: mobile devices now combine communication, customization, and connectivity.

Mobile technology is affecting business on many fronts: performance all along the supply chain, the way people communicate and do business, the length of the business day, and the retail experience are all changing as a result of mobile access. As devices become smaller, faster, and more feature-rich, the boundaries of the workplace are blurring. Managing relationships, supervising activity, instantly accessing customers, employees, and contractors, and much of the day-to-day work that once required “seat time” at a desk can now be done on the train, in airport terminals, at a business lunch, or waiting in line for a coffee. Mobiles are ideal for social applications, too; people can keep in touch with one another using social networking services while out and about without having to make phone calls.

Specialized mobile devices other than phones are already in use in many fields. Delivery services like

UPS, FedEx, and the US Postal Service employ devices that track shipments and deliveries and capture signatures, relaying information about the whereabouts of packages almost in real time to a central system. Bloom grocery stores (<http://www.shopbloom.com>) provide handheld scanners to customers, who scan items as they are placed into their shopping bags or carts. The shopper scans a label at checkout that transmits the list to the central computer, then scans his or her loyalty card and finally swipes a credit card for payment.

Multimobile services — a term coined by Alan Livingston to describe services that can respond to user requests in a variety of forms such as SMS, email, phone menus, and the web — can provide links between customers and businesses without tying up staff time. A business can set up multimobile services that respond to customer requests for order tracking information, customer account data, up-to-the-minute inventory reports, and more, via the customer’s preferred method of communication from a mobile device.

More and more, people are taking care of email and tasks, keeping up with family and friends, shopping, and doing other routine tasks on the go. Increasingly, mobiles are the portals that allow these things to happen. Mobiles have even changed the perception of network news around the world: it is now common to see invitations for cell video submissions on major news stations. The people using the mobiles are

also the ones making many consumer purchasing decisions: in 2008, 37% of mobile subscribers were between the ages of 35-54 years. A tremendous opportunity exists to reach this market with services and information, anytime and anywhere.

Relevant Applications for Small to Medium Businesses

Not long ago, Internet connectivity belonged to homes, offices, and the occasional café. Today, people expect the Internet to be available everywhere. This migration of expectations about the Internet experience is having a direct impact on small and medium businesses. Business products and services need to be found anytime and anywhere, and communication handled in, or near, real-time. As expectations about the mobile experience have changed, voice alone is no longer enough. Businesses can take advantage of this by establishing a mobile presence that makes them available to customers wherever they may be.

The earliest mobile applications delivered services for socializing, entertainment, games, travel, and leisure activities. Now, emerging business-oriented applications are available to assist with productivity, organization, time and information management, and access to all kinds of real-time data. The mobile counterpart of the Salesforce.com website, for instance, delivers customer relationship management into the palm of a salesperson's hand, allowing him or her to review key clients, the products they own and are interested in, problems and resolutions, and next steps just before walking into a meeting. Roambi (<http://www.roambi.com>) is a data visualization tool for the iPhone that displays the contents of a spreadsheet as interactive charts and graphs.

The convergence of mobiles and Internet access is also opening up possibilities for the development of new revenue streams. The advent of venues for mobile application delivery has created a market for delivering software under a micro-payment model; a typical iPhone application costs the user under a dollar in Apple's App Store, with many applications offered free of charge. Similar venues exist for

users of Nokia, Vodafone, Blackberry, and Android products. Many cloud-based subscription services provide mobile counterparts at no cost, increasing customer access; many free cloud-based services do the same. These include personal planning software such as Nozbe (<http://www.nozbe.com>), travel tools like TripIt (<http://www.tripit.com>), financial management programs like Wesabe (<http://www.wesabe.com>), and many others.

Two significant changes are imminent in the mobile and mobile apps area. First, during the summer of 2009, the first Flash-capable Android device was launched (the HTC Hero). This opens the mobile platform to products and services created by the Flash developer community, including those that are already in place online. Second, the trend towards cloud computing includes mobiles as well as desktop systems; mobile access to cloud applications will bring many more capabilities to the devices in the near future.

A sampling of applications of mobiles across industries includes the following:

- **Health Care** Sybase iAnywhere is a mobile platform designed for healthcare organizations. The suite of services provides a secure system for caregivers to access and review patient information, keep records of diagnoses and billing information, consult reference materials, and synchronize data with central systems from a variety of mobile devices wherever they happen to be working.
- **Marketing** JetBlue posts deeply discounted flights on its Twitter account, JetBlueCheeps, along with a text messaging (SMS) address. Mobile customers send a text to the address for complete information about the sales. Ashley Furniture has run 12-hour private sales, advertising them solely through email and SMS, and sponsored contests that customers enter by texting keywords to a certain address.
- **Real Estate** The real estate website Zillow.com offers a free mobile app for the iPhone that

allows clients to view information on a home as they walk through or drive by it. Zillow pin-points the location of the phone (or accepts an address) and displays information including a home's square footage, current value, and value over time. Listing agents or homeowners can be contacted through the application as well.

Mobiles in Practice

The following links provide examples of mobiles in business settings.

Instant Mobilizer™ from Dotmobi

<http://www.domainmonster.com/mobil/mobilizer-faq>

Designed for small and mid-sized businesses, this service converts a company's website to a mobile-accessible site. The mobile site automatically updates with changes to the main website.

Intuit Unveils Mobile Phone Credit Card Processing

<http://mobiles.techie-buzz.com/intuit-unveils-mobile-phone-credit-card-processing.html>

(*Mobile Buzz*, 22 May 2009.) A new product from Intuit allows merchants to process credit cards from their mobiles, enter the information into QuickBooks, and print a receipt.

Learn the Basics of Social Media

<http://www.entrepreneur.com/techadvisor/article198860.html>

(Jennifer Shaheen, *Entrepreneur*, 25 November 2008.) Social marketing is ideal for small businesses which are already focused on personal service. Decide which avenue of social networking is right for your business.

Mobile Phones: A Pocketful of Marketing

http://smallbusiness.aol.com/verizon/_a/mobile-phones-a-pocketful-of-marketing/20070412151909990003

(Leigh Buchanan, Max Chafkin, Ryan McCarthy, *AOL Small Business*.) There are several ways to use mobile phones in marketing your small business. Learn how to market, what to expect cost-wise, and where the technology is headed.

Square iPhone Payment System Turns Your Phone into Credit Card Reader

<http://www.engadget.com/2009/08/03/square-iphone-payment-system-turns-your-phone-into-credit-card-r>

(Vladislav Savov, *engadget*, 3 August 2009.)

The tiny Square credit card reader plugs into the headphone jack of an iPhone or iPod Touch. After you swipe your card, the seller enters the purchase amount on the phone and you sign on the touch screen, generating a geotagged receipt that is emailed to you.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about mobiles.

Critical Mass: The Worldwide State of the Mobile Web

<http://www.nielsenmobile.com/documents/CriticalMass.pdf>

(Dave Caolo, *TUAW: The Unofficial Apple Weblog*, 10 June 2009.) Using an iPhone on your next business trip can eliminate paper clutter. In addition to organizing travel arrangements and local maps, users can store flight confirmations, hotel information, and more.

How Windows Mobile Can Help Your Small Business

<http://www.microsoft.com/windowsmobile/en-us/business/solutions/windowsmobile-helps-small-business.mspx>

(Tyson Greer, Windows Mobile.) Check emails, do time tracking, update a contacts list on-the-fly, and more with Windows Mobile, Microsoft's version of smart phone technology. Easily sync your smart phone to your PC to keep your schedule up to date.

A Mobile Future

<http://www.entrepreneur.com/techadvisor/article191420.html>

(Steve Cooper, *Entrepreneur*, 17 March 2008.)
The advancement of smart phones offers a huge opportunity to the small and mid-sized business owner. Many examples of innovative technology accessible to a mobile phone are discussed.

Small Business Labs: 2009 Top Ten Small Business Trends

http://genylabs.typepad.com/small_biz_labs/2008/12/2009-top-10-small-business-trends.html

(Small Business Labs, 29 December 2008.)
Mobile computing, online marketing, and cloud computing are among the top ten trends predicted for this year. More small businesses are turning to mobile computing to save money on tech resources.

Delicious: Mobiles

<http://delicious.com/tag/hz09biz+mobile>

Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report*. To add to this list, simply tag resources with “hz09biz” and “mobile” when you save them to *Delicious*.

AUGMENTED REALITY

Time-to-Adoption Horizon: Two to Three Years

Augmented reality — the overlaying of digital information to enhance the viewer's understanding of the real world — makes it possible to see and even interact with information that is not part of the physical space. The technology underlying augmented reality can be as simple as an ordinary desktop computer or even a mobile device, and the level of immersion can vary from almost completely virtual experiences to mostly real-world experiences that include minimal amounts of additional digital information. As the supporting technology has become smaller and cheaper, applications of augmented reality are emerging in the consumer sector, especially around games, entertainment, and marketing. In the coming years, it will become more common to superimpose digital information onto the real world for everyday purposes.

Overview

Hold a Topps 3D Live baseball trading card up to a camera attached to your computer, and a miniature hologram of the featured player will step up, tap the bat, and take a swing. In the same way, a software developer's business card, with the usual contact details on one side and a curious barcode on the other, calls up a video of the developer explaining more about his background and skills. On an urban street, a shopper holds up her mobile phone, looks at the screen, and sees reviews and customer ratings overlaid onto the restaurants and boutiques in front of her. Each of these applications of augmented reality is an actual example of how the technology is being used today.

Augmented reality — the overlaying of digital information onto some part of the real world — takes many forms, from room-sized displays that a user can actually enter and interact with to applications for mobile devices. The ability to describe real objects with virtual annotations is a powerful tool. While the technology has historically been prohibitively expensive for consumer applications, new advances are relatively inexpensive; the Topps trading cards, for instance, require only a Flash application to deliver the experience, and only a webcam and the Flash plug-in to receive it. Naturally, more sophisticated uses of augmented reality such as medical equipment, avionics simulations, and engineering tools are examples of higher-end technology requiring more expensive support.

The use of augmented reality is growing in the commercial sector as marketers take advantage of its ability to turn any object into an advertisement. Augmented reality has also been in use in fields such as medicine, engineering, the sciences, and archaeology for some time. The technology that enables augmented reality applications to be created and perceived is becoming smaller and cheaper, leading to new ways to interact with and understand information from schematics to games.

Relevant Applications for Small to Medium Businesses

Forward-thinking companies are blending digital information with physical products and environments to create new markets and opportunities, especially in marketing and customer relations, business communication, and entertainment. Additional uses of augmented reality show promise for industrial design, including visualizing products from concept to manufacture, exploring innovative uses for existing products through virtual integration of products into new contexts, and bringing interactive 3D into the real world.

In LEGO retail stores, customers hold a boxed kit up to a kiosk equipped with a camera and a display. The display mirrors the scene in the store, with the addition of a life-size model of the completed kit resting on the surface of the box. The customer turns the box to view the model from different angles. Information

embedded in the package design is picked up by the camera and decoded to determine which model to show and where to place it. A similar experience is offered by Zugara, an interactive marketing and advertising company. Zugara has launched a system for clothing retailers that allows website shoppers to virtually try on clothes. The shopper stands in front of the webcam and sees each outfit superimposed on his or her body. Controls for cycling through items and styles and for adding choices to a shopping cart are operated by arm gestures, without needing to touch the mouse or keyboard.

Augmented reality applications for mobile devices help commuters find public transport stations. Nearest Tube (http://www.acrossair.com/apps_nearesttube.htm) first mapped the London tube system, giving urbanites and tourists alike a quick way to identify the station nearest them, the directions of lines under their feet, and stations further away, all using the video feature on their iPhones. Similar applications have been released for San Francisco and New York. Business meetings are another venue where augmented reality is used. Cisco Systems is working on developments in teleconferencing that will provide a holographic-like ability to bring people into meetings. Virtual worlds, another form of augmented reality, are commonly used for meetings, conferences, and social gatherings as well.

Advances in the technology are leading to interesting opportunities; at the University of Washington, for instance, researchers have embedded electronic components into a contact lens as a first step toward creating lenses that can overlay digital images onto a person's vision. Although the prototype is limited in functionality and difficult to manufacture, proof-of-concept projects like this one hint at future applications for augmented reality.

A sampling of applications of augmented reality across industries includes the following:

- **Advertising** Specially marked bags of Doritos Late Night chips reveal a three-dimensional concert performed by blink-182 and Big Boi.

Moving the bag in front of the computer's webcam changes the performance, delivering multiple concerts.

- **Armed Forces** Vuzix manufactures military glasses that overlay enemy combatant positions onto the real environment in front of a soldier. He or she sees the distance to the enemy, a small aerial map of the area, and more.
- **Manufacturing** With augmented reality glasses, BMW mechanics see virtually animated components, as well as the tools they will need to complete a job, overlaid on an engine as they work.

Augmented Reality in Practice

The following links provide examples of augmented reality in business settings.

Augmented Reality Injects Life Into the Business Card

<http://www.fastcompany.com/blog/kit-eaton/technomix/augmented-reality-demo-injects-life-physical-business-card>

(Kit Eaton, *FastCompany.com*, 17 July 2009.)

This article describes an augmented reality business card created by software developer James Alliban. A video demonstration is available.

Japan's DoCoMo, KDDI Show Augmented Reality Prototypes

http://www.pcworld.com/businesscenter/article/168900/japans_docomo_kddi_show_augmented_reality_prototypes.html

(Martyn Williams, IDG News Service, PCW Business Center, 23 July 2009.) Two of Japan's cellular carriers demonstrated augmented reality features on cell phones. Using the phone's GPS, they overlaid Japan's railway system, as well as nearby restaurants, on the mobile display.

Magazine Cover Ads, Subtle and Less So

<http://www.nytimes.com/2009/06/12/business/media/12adco.html?scp=2&sq=augmented%20reality&st=cse>

(Stephanie Clifford, *The New York Times*, 11 June 2009.) Hold the cover of this issue of Popular Science up to a webcam to see a holographic advertisement. This article explains augmented reality as it applies to advertisements.

Mattel Launches Industry's First Toy Line Featuring Augmented Reality Technology

<http://www.foxbusiness.com/story/markets/industries/retail/mattel-launches-industrys-toy-line-featuring-augmented-reality-technology-comic>

(Mattel, Inc. Press Release, *FoxBusiness.com*, 17 July 2009.) A line of augmented reality toys — action figures based on Disney's new movie, *Avatar* — will debut at this year's San Diego ComicCon. Attached to each toy is a special tag (called an iTag) that enables the customer to virtually interact with the object when the iTag is held in front of a webcam. The toys can act out a short scene and even interact with one another.

Papa John's Debuts Groundbreaking Augmented Reality Feature Online

<http://online.wsj.com/article/PR-CO-20090526-903170.html>

(Press Release from Business Wire, *The Wall Street Journal*, 26 May 2009.) Papa John's pizza boxes engage customers in a virtual road trip in which printable coupons appear as billboards along the road.

Sportvision: Changing the Game

<http://www.sportvision.com>

This Mountain View, California-based company has enhanced viewer satisfaction at sporting events by providing augmented reality services during telecasting. One of the most well-known is the 1st & ten line on the football field (the yellow line superimposed on the playing field).

For Further Reading

The following articles and resources are recommended for those who wish to learn more about augmented reality.

Kicking Reality Up a Notch

http://www.nytimes.com/2009/07/12/business/12proto.html?_r=1

(Leslie Berlin, *The New York Times*, 11 July 2009.) Augmented reality is becoming more accessible and mainstream. AR technology will apply to many professions, from advertising and healthcare to gaming.

Make Books 'Pop' With New Augmented Reality Tech

<http://www.wired.com/gadgetlab/2008/10/im-in-yur-physi>

(Jose Feroso, *Wired*, 28 October 2008.) New technology combines children's books with three-dimensional figures. Industrial planning firms are also interested in these advancements.

'Mixed Reality' Gives Business a New Dimension

http://www.internetevolution.com/author.asp?section_id=709&pidl_msgid=186091&doc_id=178248

(Michael Mascioni, *Internet Revolution*, 19 June 2009.) Augmented reality has implications for many fields, but these stand out: aerospace and defense, energy, industrial manufacturing, healthcare, and education. This article explains why.

Professor Brian Blake's Augmented Reality Goggles

<http://www1.georgetown.edu/college/research/14989.html>

(*Georgetown College Research News*.) Augmented reality goggles, which combine virtual reality with the real world, have promise for assembly-line inspections, such as in the automotive industry.

Total Immersion Unveils First Augmented Reality Slot Machine, Created for Nike 6.0

<http://www.allbusiness.com/marketing-advertising/marketing-advertising-agencies/12374434-1.html>

(All Business, *Business Wire*, 25 June 2009.)

A scratch-off card provided to each guest at a convention activated a virtual slot machine. The winners received Nike products.

Zagat Survey and lastminute.com Launch nru

<http://www.entrepreneur.com/PRNewswire/release/161150.html>

(Zagat Survey, LLC, *Entrepreneur*, 27 May 2009.) Zagat Survey and lastminute.com offer a free mobile phone app called nru (“near you”).

The app, which works on Google’s Android, uses 360 degree GPS technology to show users local hotspots, including Zagat’s rating and cost estimate.

Delicious: Augmented Reality

<http://delicious.com/tag/hz09biz+augmentedreality>

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LOCATION-BASED SERVICES

Time-to-Adoption Horizon: Two to Three Years

It is becoming possible to direct specialized services to millions of consumers exactly when they want them. The trigger for this is the consumer's location, which is known to a device commonly carried by nearly everyone with purchasing power: the mobile phone. Mobiles with the ability to run third-party applications can locate goods and services, find information about discounts and sales relevant to the time and place, and track deliveries and even people. It is already common for businesses to be found by such services; the next step, the one that is still a couple of years from mainstream use, is to provide customized location-based applications that empower consumers by taking advantage of where they are at a given moment. Already we are seeing the beginnings of such services, and their value to customers is tremendous.

Overview

With the advent of easily accessible GPS technology, especially embedded in mobile devices, location-based services are on the rise. Early applications focused on marketing, advertising, and social networking: consumers could discover retailers and venues near them offering services of interest, as well as find friends and colleagues in the area. Location-specific data can be displayed in a variety of ways: photographs, videos, or text overlaid on maps, photos, or live views of the area, for instance, or listed by location name and address. Contextual information can include historical data, weather reports, locations of nearby people, objects, and places, and so on. Location-based information is not hard to access, and it is becoming easier to create and distribute, as well.

There are three ways that location can be discerned, at decreasing levels of resolution: geolocation, cell tower triangulation, and wireless Internet access points. Tools for developers are lowering the bar to creating location-based applications; while programming chops are still required, systems like TransGo by TransFormat (<http://www.location-based-media.de>) enable rapid development of location-based applications using GPS, RFID, network triangulation, and other technologies. Digital resources can be connected with physical locations and objects very easily, so that once location is established, tools can direct consumers to businesses in a particular area that offer products and services needed at

that moment. Social applications are common — BrightKite (<http://www.brightkite.com>), for instance, shows nearby friends, places of interest, and people who might be worth meeting based on the user's physical location and favorite activities. Yelp (<http://www.yelp.com>) allows users to search for restaurants and other businesses, displaying community reviews to assist consumers in deciding which to visit.

Location-based services make it possible to engage in a deeper level of interactivity with customers. Creative businesses are taking advantage of applications that, on the surface, are tools for social networking. For example, FourSquare (<http://playfoursquare.com>) is a mobile application that determines the user's location, suggests a list of nearby places, and awards points to users that check in from those and other venues. Users can add "to-do" items related to places they visit. By earning the most points in a single location, a person can become the "mayor" of that venue. A number of innovative businesses are using FourSquare to their advantage by offering discounts on products and services to the current "mayor" and by creating to-do items that lead customers to their location in order to win the points associated with completing the activity.

Relevant Applications for Small to Medium Businesses

In an August 12, 2009 press release, the Gartner research company indicated that although mobile

device sales are down 6% overall from a year ago, sales of smart phone-type devices are up 27% (<http://www.gartner.com/it/page.jsp?id=1126812>). Gartner also expects the consumer location-based services market — as represented by smart phone owners — to more than double in 2009 compared to 2008 (Mobile Internet Devices, December 2008), from 41.0 million units sold in 2008 to 95.7 million for 2009. Revenue, too, is expected to increase from \$998.3 million (2008) to \$2.2 billion in 2009.

The opportunity for business is clear. With more GPS-enabled devices in the hands of consumers — consumers with the resources to own a smart phone — the market for location-based applications is growing. From helping customers find their storefront to providing customized contextual services, businesses now have the means to reach consumers when and where they are ready to make a purchase or transaction. Some services support multiple businesses, like Yowza!! (<http://www.getyowza.com>), which works with merchants to offer coupons to mobile users. The application lists nearby restaurants and retailers (with address and phone number) that are advertising sales or offering coupons and tracks how many times each coupon is used, when it has expired or been used up, and how much was saved by using the coupons. Another application, Where, assists travelers and locals with a host of information, such as the lowest gas prices nearby, weather information, local news, and a Starbucks locator. The application also allows users to search for a type of business or item (“drug store,” “lamp,” “Mexican food,” “car repair”) and see retailers near them who offer the goods and services desired.

For businesses themselves, location-based services can help manage resources, ensure the accuracy of information such as time and mileage data, and save time that once was spent in data entry. Applications like Loopt (<http://www.loopt.com>) and Glympse (<http://www.glympse.com>) can be used to track field employees; they allow a user to invite others to receive information about where he or she is at a given time. Other solutions capture time, mileage, and distance

traveled and export the information in a way that can be imported into accounting systems like QuickBooks, eliminating the need for employees to first record and then enter such information by hand.

A sampling of applications of location-based services across industries includes the following:

- **Deliveries** Flare is a tracking system geared toward small business owners who need to keep tabs on employees such as pizza delivery personnel. The business owner can track the delivery route, as can the customer. The tracking number expires at the end of the shift to ensure the delivery person’s privacy.
- **Consumer Services** Geolife is a service that enhances the traditional to-do list with location-specific information. For example, your mobile will alert you as you pass the grocery store that one of your tasks for the day is to pick up a gallon of milk. Another service, Locale, automatically senses where you are — at the office, in court, at home, at the movies — and adjusts your ring tone accordingly, silencing it when necessary.
- **Urban Planning** Location-based services like Google Maps display traffic patterns and identify areas of congestion, which can assist engineers and city planners as new routes of travel are developed.

Location-Based Media in Practice

The following links provide examples of location-based services in business settings.

Acuity Mobile Marketing Services

http://www.acuitymobile.com/solutions/marketing_services.php

Acuity Mobile delivers mobile-based marketing solutions for businesses. They offer a variety of marketing techniques, several of which include location-aware technology.

Brands Run Cross-Platform Location-Based Ads with 1020 Placecast

<http://www.mobilemarketer.com/cms/news/ad-networks/3115.html>

(Dan Butcher, *Mobile Marketer*, 27 April 2009.) Placecast combines location-awareness with other data, like demographics of commercial and business zones, to take full advantage of location-based advertising.

Compass and Camera Used in Location-Based Apps

<http://www.wired.com/gadgetlab/2009/02/compass-and-cam>

Businesses geared toward hospitality and tourism can benefit from apps like nru ('near you'), which shows either a bird's eye view of the surroundings or detailed information on a particular building or structure, depending on how the mobile device is held.

Layar

<http://layar.eu>

Layar helps users locate clubs, restaurants, theaters, and more by layering digital information over the image on a mobile's camera, showing where to find venues nearby.

Location-Based Digital Media Poised for Growth in 2009

http://www.mediapost.com/publications/?fa=Articles.showArticle&art_aid=99238

(Cory Treffiletti, *mediapost.com*, 28 January 2009.) Location-based digital media – the screens displaying digital information at the bus stop, in coffee shops, and outside the bank – reach customers without the use of a mobile device.

NearbyNow: Find Products Near You

http://www.nearbynow.com/home/San+Francisco%2C+CA?clinkid=frontpage_frontpage

Using their mobile telephones or the Internet, shoppers search the inventory of surrounding stores to find the best price. Consumers have the ability to put items on hold with a single click.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about location-based services.

2009: The Year of LBS (Location-Based Services)

http://www.readwriteweb.com/archives/2009_the_year_of_lbs_location-based_services.php

(Sarah Perez, *ReadWriteWeb*, 7 July 2009.)

From finding the nearest coffee shop to tracking your children, location-based services offer a host of solutions to everyday problems.

Developer's Guide to In-Application Advertising

<http://www.skyhookwireless.com/developers/developersguide.pdf>

(*Skyhookwireless*, 2009.) This guide includes examples of mobile advertisements, discusses issues of development and deployment, and describes the major players in this space.

LBx Journal: Location in the Language of Business

<http://www.lbxjournal.com/index.php>

(Natasha Leger, *Editor, LBx Journal*, May 2009 to present.) This online journal is dedicated to exploring location-based technology. The objective of the publication is to advance businesses by taking full advantage of location awareness.

Location Based Services Boost Productivity: Q&A with Melanie Kreh of Cbeyond

http://www.readwriteweb.com/archives/2009_the_year_of_lbs_location-based_services.php

(Benjamin Tomkins, *bMighty.com*, 7 May 2009.) This interview discusses different ways that location-based services assist with fleet management, customer service, managing a mobile workforce, and more.

Location Based Services: Why Smartphone Apps Will Pay Off for Advertisers, Carriers, Application Providers

<http://blog.compete.com/2009/06/02/location-based-services-applications-carriers-advertisers>

(Andy deGaravilla, *Compete*, 2 June 2009.) Research indicates that while most location-based services are currently used for navigation and checking the weather, consumers have an ever-increasing interest in receiving offers and special coupons from local retailers. Extensive research is compiled into informative charts in this article.

Using Location-Based Technology to Attract Customers, Track Employees

<http://smallbusiness.dnb.com/media-telecommunications/telecommunications/11809001-1.html>

(*D&B Small Business Solutions*.) This article offers a few examples of how location-based services can help small businesses. Several companies providing location-based services are mentioned.

Delicious: Location-Based Services

<http://delicious.com/tag/hz09biz+locationmedia>

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SEMANTIC-AWARE APPLICATIONS

Time-to-Adoption Horizon: Four to Five Years

Sir Tim Berners-Lee envisioned the semantic web as a tool to assist in solving difficult problems by making connections between people, concepts, events, and things that seem unrelated, or that are documented in a range of different locations or forms. Such connections are difficult or time-consuming for people to perceive, even with the help of search engines; non-semantic methods of searching rely mainly on keywords and are poorly suited to interpret contextual information. Semantic search, on the other hand, makes it possible to determine relationships that are not explicitly identified. For example, consider the query “Compare Ford and Toyota market capitalization.” A traditional search engine returns links to web pages describing each company or discussing market capitalization, and the searcher must then select and read some of the pages to find the answer to the query while sifting through unrelated data. A semantic search engine parses the question and uses contextual clues to return the actual answer: Ford, US\$23.93 billion; Toyota Motor, US\$131.6 billion. Wolfram|Alpha even graphs the comparison.

Overview

Semantics refers to the meaning of language. While it is very easy for a human to understand the meaning of phrases and questions, it is very difficult for a machine to do the same thing; machines excel at pattern matching, but not at contextual interpretation. Semantic-aware applications are those that enable computers to work with data according to its context and meaning. Such applications are generally designed for searching and finding, or for organizing data or relationships and presenting it to the user in a meaningful way.

Semantic-aware applications have been in development for some time. Early methods of dealing with the computer’s inability to contextualize information employed tagging — marking up information by hand, specifying which bits of data referred to addresses, which to names, occupations, and so forth — to indicate context. Tagging places the load on the content creator and can introduce errors. Another approach, and one that is being successfully employed by semantic search engines and other semantic-aware applications, is to “train” the application to infer context by analyzing the information that appears alongside the data in question.

Semantic search is changing the way we find information in large data spaces such as the web.

Humans are conditioned to use simple keyword searches when using computers. With advances in the area of semantic-aware computing, “smart” search engines such as TrueKnowledge (<http://trueknowledge.com>), Hakia (<http://www.hakia.com>), Powerset (<http://www.powerset.com>), and Wolfram|Alpha (<http://www.wolframalpha.com>) are beginning to answer questions posed in natural human language instead. These tools are still in development, and the data to which they have access are limited, but they do show promise.

Other semantic-aware applications focus on organizing data and relationships in ways that are easy to understand and use. Triplt (<http://www.tripit.com>) uses semantic approaches to gather and display travel data. Travelers simply forward confirmation emails from airlines, hotels, ticketing agencies, and other venues to an email address at Triplt. The service automatically pulls out relevant information and creates a day-by-day itinerary including flight information, hotel locations and check in times, maps of areas to be visited, and other events. Triplt’s ability to understand the context of information it receives — determining which parts of an email contain airline names, flight and seat numbers, and departure times, for example — allows the service to aggregate information from multiple sources and

display it in an organized, meaningful way, much more quickly than a person could.

Semantic approaches are also being employed in developing software tools that surface connections between people and information in our own personal networks. Calais (<http://www.opencalais.com>) provides a suite of tools for integrating semantic functionality into web content such as blogs. Tagaroo, from Calais, and Zemanta (<http://www.zemanta.com>) are semantic tools for bloggers that suggest tags, Flickr images, and related web content as the author composes a post, based on what the post says. Xobni (<http://www.xobni.com>) is a plug-in for Outlook that interprets data already embedded in a user's email, using it to present a summary for each contact, including phone numbers, associates, conversations, and documents exchanged, all in a panel alongside the email inbox.

The promise of semantic-aware applications is to make it easier to see connections that already exist, embedded in the context of the information on web, but that cannot be found using current search algorithms. Many of the semantic-aware applications described here are still in early development, but as tools like these are further explored, we will see significant advances in this area.

Relevant Applications for Small to Medium Businesses

Semantic-aware applications offer promise for businesses seeking to develop new kinds of services, especially those that can connect people or information using details that are available in different forms or locations. In addition to developing tools for semantic search, some companies are creating business applications for marketing, advertising, personalization services, scientific visualization, publishing, mobile tagging, health care, finance, and security.

Dynamic advertising uses contextual information about either the content being viewed, or the viewer him- or herself (or both), to deliver ads that are relevant

at that moment. Tools like Dapper MashupAds (<http://www.dapper.net>) make it easy to offer advertising that appeals to a user, even when the content being viewed is dynamic. Another service, BooRah (<http://boorah.com>), gathers restaurant reviews from all over the web, assessing the context of those reviews to determine whether the feeling is positive (rah!) or negative (boo!) overall. On each restaurant detail page, BooRah includes pertinent information and maps as well as local links, ads, and recommendations based on where the venue is located.

Companies are developing semantic-aware applications to assist customers in finding not only information and goods, but also people. Bintro (<http://bintro.com>) is a service that matches people and businesses with others who meet their needs. For instance, job seekers and employers can find each other, as can volunteers and charities; investors can describe what kinds of things they would like to invest in, and those seeking capital can describe their proposals. Bintro then uses the context of the descriptions, which are written in natural or technical language, and suggests potential matches.

Semantic-aware applications make it possible to use, extract, and recombine content in useful ways. Networks organized around topics of interest are easy to create and find using services like Twine (<http://www.twine.com>) that pick up on clues scattered around the web to build profiles and suggest items of interest to users. Semantic-aware applications are just beginning to move from research and development into the consumer sector, where they represent an opportunity for business development.

A sampling of applications of semantic-aware applications across industries includes the following:

- **Leisure** Glue, a browser plug-in by AdaptiveBlue, shows reviews and recommendations from friends as a user looks at websites for movies, games, restaurants, and more. The user can see which friends also looked at the same items as well as finding out what they thought.

- **Music** Products like Pandora and Fanalytics analyze music and musical tastes to recommend specific music to a relevant fan base. Pandora provides a personalized Internet radio experience, while Fanalytics seeks to match artists with likely fans. MediaUnbound performs a similar service for other kinds of media.
- **Tourism** Mondeca, a French company, provides semantic-aware applications to support researching, selecting options, and booking for the tourist industry. The company's services also extend to using semantic technology to deliver online catalogs of offerings for consumers.

Semantic-Aware Applications in Practice

The following links provide examples of semantic-aware applications in business settings.

iPhone's Next Phase: 'How Can I Help You?'

<http://www.internetnews.com/mobility/article.php/3825416/iPhones+Next+Phase+How+Can+I+Help+You.htm>

Using the iPhone's GPS, the digital personal assistant known as Siri will make dinner reservations or find local show times at the theatre. Siri asks questions to become acquainted with the user, and makes appropriate recommendations accordingly. Siri will tell you when the next flight out of San Francisco departs and, given a credit card number, will book the ticket.

Intelligent Applications Based on Search

<http://www.altsearchengines.com/2009/08/05/intelligent-applications-based-on-search>

(Dmitri Souboton, *AltSearchEngines.com*, 5 August 2009.) Bloggers and publishers can use semantic web applications to automatically tag written content. These tags make web searches more relevant and ubiquitous.

Powerset.com

<http://www.powerset.com>

Watch the demo video from Powerset to learn how this new technology extrapolates relevant information from a variety of sources to present a dossier of information on the subject of a search.

Swotti: A Semantic Opinions Aggregator

http://www.readwriteweb.com/archives/swotti_a_semantic_opinions_aggregator.php

(Sarah Perez, *ReadWriteWeb*, 21 March 2008.) Offered in both English and Spanish, Swotti is a new semantic search engine that compiles consumer product reviews from hundreds of sites. The data can be arranged according to preference; say, best reviews first. Colorful graphs and pie charts display information for easy assimilation.

Trovix: Personalized Job Search

<http://www.trovix.com>

Trovix can dissect resumes, find key words, cross-check applicants against a database of job listings, and make relevant recommendations in a fraction of the time a traditional job search would take. The service focuses on matching employers with the most suitable applicant.

UpTake: Your First Step to a Great Trip

<http://www.uptake.com>

This semantic website searches five thousand other sites to provide a single location for travel planning. Search for a vacation package or hotel based on your needs: a business trip, a family or romantic getaway, pet-friendly accommodations, and more.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about semantic-aware applications.

10 More Semantic Apps to Watch

http://www.readwriteweb.com/archives/10_more_semantic_apps_to_watch.php

(Alex Wright, *The New York Times*, 22 February 2009.) Semantic websites can extrapolate user intent to enhance web searches, reaching hidden stores of data that may otherwise go unnoticed.

An Introduction to the Semantic Web

<http://www.youtube.com/watch?v=OGg8A2zfWKg>

(Manu Sporny, *YouTube*, December 2007.) Watch a brief video to learn about semantic web applications. This clip offers an introduction to the technology.

Semantic Web Patterns: A Guide to Semantic Technologies

http://www.readwriteweb.com/archives/semantic_web_patterns.php

(Alex Iskold, *ReadWriteWeb*, 25 March 2008.) This article explains the basics of semantic web technology, including the differences between bottom-up and top-down searches. Applications for businesses are discussed.

Semantic Web Wish List 2009

http://www.readwriteweb.com/archives/semantic_web_wish_list_2009.php

(Richard MacManus, *ReadWriteWeb*, 7 January 2009.) While semantic web searches are becoming more frequent, listed here are several things that will improve the technology. With an eye toward enterprise and consumer applications, ReadWriteWeb has many articles regarding semantic-aware applications.

Two New Improvements to Google Results Page

<http://googleblog.blogspot.com/2009/03/two-new-improvements-to-google-results.html>

(Ori Allon and Ken Wilder, *The Official Google Blog*, 24 March 2009.) Google search results now use semantic approaches to suggest related terms and show longer results when context is important.

Delicious: Semantic-Aware Applications

<http://delicious.com/tag/hz09biz+semanticweb>

Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report*. To add to this list, simply tag resources with “hz09biz” and “semanticweb” when you save them to *Delicious*.

SMART OBJECTS

Time-to-Adoption Horizon: Four to Five Years

Smart objects provide a link between physical objects and information about those objects or their surroundings. Smart objects are supported by a variety of underlying technologies and have been in use in the consumer world for some time, especially in their simpler forms such as QR codes and RFID tags. More sophisticated smart objects rely on microprocessors and sensors that are becoming smaller and cheaper, enabling their use in a wider range of physical objects. Networks of smart objects communicate information about the environment, people, goods, and services that facilitates resource management in a number of industries, including shipping and delivery services, medicine, food services, and transportation.

Overview

A smart object is a physical thing that is connected to electronic information or capable of making contact with other objects because it contains supporting technology that, minimally, includes an identifier. The supporting technology can be nothing more than an attached or embedded tag like a barcode, a quick response (QR) code, or an RFID tag; or it can be as complex as a microcomputer built into the object. Increasingly tiny and flexible sensors can be designed into everyday objects like pens or key fobs.

Smart objects that employ attached tags have been in common use for a long time; although they are not themselves new, we are seeing emerging applications that enable consumers to interact with and manage such objects in new ways at home. Using a webcam to scan the barcode on a book, video or CD, consumers can automatically add new purchases to a personal inventory using software that looks up the title based on the ISBN. Posters advertising upcoming concerts sometimes include QR codes that lead to detailed information on the web about the performers — an interested passerby need only take a quick photo using a mobile device, and the information is there at his or her fingertips.

More complex types of smart objects hold greater promise for changing the way we interact with the physical world. Those that can sense and communicate with other smart objects and report their own history and status can be used to collect marketing information, to monitor medical patients

remotely, or to keep an eye on conditions in a home or office building that affect energy usage. It is already possible to monitor home power consumption remotely with Tweet-a-Watt, or to receive a report on road conditions from a smart tire. Smart labels in clothing and other products allow consumers to verify the authenticity of their purchases as well as to engage with the brand in online spaces.

A key factor in the realization of widespread adoption and use of smart objects will be the standard for assigning unique identifiers. In order to distinguish your smart mop or tire or appliance from your neighbor's, an enormous number of unique identifiers is required. Likewise, in order for software tools to be able to access and work with the IDs of smart objects you own, the system for assigning those numbers must be understood and adhered to by the producers of both the objects and the tools. Organizations such as the Internet Protocol for Smart Objects Alliance (IPSO) are promoting one particular standard, Internet protocol (IP), as the one to be used for tracking smart objects. Some fifty companies, including Cisco, Intel, Sun, and others, have joined IPSO since its inception in January 2009.

IPSO is also working toward the general implementation of the next version of Internet protocol, IP version 6 (IPv6). The Internet today is supported by IPv4, and although the organization recognizes that interoperability with IPv4 is important, IPSO takes the position that additional features of IPv6

such as increased address space and address auto-configuration present a strong case for its adoption.

Relevant Applications for Small to Medium Businesses

One opportunity for business development around smart objects lies in the development of integrated smart systems that communicate with the environment — and with other smart systems — to assist in the day-to-day activities of living, research and education, work, and play. From the most basic smart objects that simply communicate something about themselves, such as smart packaging that “knows” where it is going and what it contains, all the way up to products with embedded technology that can communicate with one another, networks of smart objects have the potential to make a wide range of information readily, and remotely, available.

Energy management systems, environmental sensor networks, and medical devices already make use of smart object technology for remote monitoring. Utility companies in California, including Southern California Edison (SCE), San Diego Gas and Electric (SDG&E), and Pacific Gas and Electric (PG&E) have begun to explore smart metering to measure and control utility consumption. Wireless sensor networks measure bridge stability after earthquakes and monitor floods and wildfires. In the field of medicine, cardio monitors and other smart technologies take measurements and report vital statistics to remote medical professionals.

Smart objects can provide information that helps workers perform more efficiently. Smart packaging, used to indicate whether products have been exposed to unsafe conditions during transit, enables personnel at supermarkets to quickly assess whether perishable shipments are safe for sale by checking a temperature sensor on the outside of the box. The Swedish company Cypak (<http://www.cypak.com>) produces smart packaging for medical products, including a special tamper-evident seal for sensitive pharmaceuticals that also monitors environmental conditions such as heat and humidity during

transportation and storage so that medical personnel and consumers know that the products are in good shape upon arrival. SafeTScribe’s smart ink (<http://www.safetscribe.com>) performs a similar function, changing color if exposed to temperature extremes.

Consumer products are also beginning to appear that make use of smart object technology for home use and hobbies. Schlage’s keyless lock system, LiNK (<http://link.schlage.com>), enables homeowners to remotely monitor when kids arrive home, change thermostat settings, turn lamps on and off, and more. SafePlug electrical outlets (<http://www.safeplugs.com>), designed for home or business use, read safety information embedded in tagged device plugs and turn off the power to outlets when they are unused or when a fire hazard is detected.

Tikitag (<http://www.tikitag.com>) and Violet’s Mir:ror (<http://www.violet.net>) include attractive, relatively inexpensive kits for creating smart objects at home using stick-on tags, USB tag readers, and easy-to-use interfaces for programming certain functions on a home computer that happen when the tag is scanned. Such systems are used to keep track of personal collections, to play certain music when an object is scanned, or to create simple controls for launching programs, such as starting a child’s favorite computer game when a certain toy is placed on the scanner. No particular technical expertise is required to use these kits, making smart object technology approachable and accessible at the consumer level.

A sampling of applications of smart objects across industries includes the following:

- **Agriculture and Food Safety** TraceTracker, developed in Norway, is a system for tracking every aspect of food production, from the feed given to dairy and meat animals to individual components in processed and packaged foods. TraceTracker is being implemented widely in China as part of a government-mandated program to improve food safety and accountability for food producers.

■ **Hospitality** Using smart technology, China's Hangzhou Dragon Hotel has teamed with IBM to create a high-tech, luxury experience. Among the services offered: each hotel room will automatically adjust to provide media in a guest's national language; preferences for temperature, brightness, and humidity will be pre-arranged to mimic an at-home environment; and guests will be able to check themselves in at self-service kiosks.

■ **Viticulture** A number of Napa Valley vineyards use smart technology on their labels to assure consumers of authenticity. Prooftag, Kodak Traceless, and Certilogo are among the companies offering products to eliminate risk of counterfeit bottles being put into circulation.

Smart Objects in Practice

The following links provide examples of smart objects in business settings.

Active Tire Pressure and Temperature Monitoring
<http://www.smartire.com>

Smart Tire's wireless monitoring system alerts users of problems regarding a tire's integrity before it becomes dangerous.

Certilogo
<http://www.certilogo.com/company/business-solutions?cl=en>

Using radio-frequency identification tags (RFIDs) and barcodes, Certilogo provides several services to merchants, including fraud protection and in-the-moment market trends.

Engineer Creates 'Smart' Bandage to Test Cholesterol
<http://www.sciencecentric.com/news/article.php?q=08051501>

(*Science Centric*, 15 May 2008.) A smart bandage replaces the need for a needle. The adhesive bandage reads a person's biochemistry through the skin, so those fearful of needles needn't avoid important medical tests.

First Wi-Fi Pacemaker in US Gives Patient Freedom
<http://www.reuters.com/article/newsOne/idUSTRE5790AK20090810>

(Ben Gruber, *Reuters*, 10 August 2009.) A wireless pacemaker that collects data and communicates over the Internet will immediately alert a patient and her doctor of an abnormal cardiac event.

HarvestMark
<http://www.harvestmark.com>

HarvestMark is a system that allows growers, shippers, sellers, and consumers to trace produce. By entering a code from the product's label on the HarvestMark website, the tracker can learn about the variety of crop, location of harvest, food safety information, path in transit, and more.

Siftables: Making the Digital Physical
<http://www.siftables.com>

Siftables are smart objects with a digital display that can sense location, orientation, and proximity to other Siftables. Like children's blocks, Siftables can be moved and stacked; but they can also be juxtaposed in different patterns to spell, create music, solve math problems, and communicate with one another.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about smart objects.

EPoSS Strategic Research Agenda 2009
<http://www.smart-systems-integration.org/public/news-events/news/eposs-strategic-research-agenda-2009-published>

(EPoSS, 10 March 2009.) This comprehensive report from the European Technology Platform on Smart Systems describes the use of smart objects in a variety of industries, including automotive, healthcare, aerospace, and more.

Food Safety at the Crossroads

http://www.foodengineeringmag.com/Articles/Article_Rotation/BNP_GUID_9-5-2006_A_1000000000000539226

(Wayne Labs, *FoodEngineering*, 1 March 2009.) Smart labels expedite the ability to recall tainted foods. This article describes the process and illustrates it with case studies.

IP for Smart Objects

<http://www.sics.se/~adam/dunkels08ipso.pdf>

(Adam Dunkels, JP Vasseur, for IPSO Alliance, September 2008.) According to the authors, Internet Protocol (IP), already a prevalent form of technological communication, is poised to lead the way in making the “Internet of things” a reality. Interconnectivity of electronic devices via IP is discussed.

MPedigree’s Rx for Counterfeit Drugs

http://www.businessweek.com/globalbiz/content/dec2008/gb2008123_027994.htm?chan=globalbiz_special+report++tech+pioneers+of+2009_special+report++tech+pioneers+of+2009

(Jennifer L. Schenker, *BusinessWeek*, 3 December 2008.) To counteract the sale of counterfeit prescription drugs, mPedigree offers a built-in security system which lets consumers check online the authenticity of their medication.

Power Smart Grid

<http://www.lbxjournal.com/node/260011>

(Jay Stinson, *LBx Journal*, 20 July 2009.) In environmentally progressive states (like California), using a smart grid to monitor and curb energy output not only makes sound financial sense, it helps businesses comply with the law. This article describes the smart grid and how it saves money for the business owner.

Product Managers & Marketers: What the Internet of Things Means For You

http://www.readwriteweb.com/archives/product_managers_marketers_internet_of_things.php

(Richard MacManus, *ReadWriteWeb*, 11 August 2009.) Smart objects and the ubiquitous nature of the Internet hold myriad possibilities for targeted consumer marketing and customer satisfaction. This article offers several examples of how the “Internet of things” will benefit businesses.

Delicious: Smart Objects

<http://delicious.com/tag/hz09biz+smartobject>

Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report*. To add to this list, simply tag resources with “hz09biz” and “smartobject” when you save them to *Delicious*.

METHODOLOGY

Every edition of the *Horizon Report* is produced using a carefully calibrated process that is informed by both primary and secondary research. Nearly a hundred technologies, as well as dozens of meaningful trends and challenges are examined for possible inclusion in the report each year; an internationally renowned Advisory Board examines each topic in progressively more detail, reducing the set until the final listing of technologies, trends, and challenges is selected. The entire process takes place online and documentation for this edition can be found at <http://biz.wiki.nmc.org/>.

About half of the thirty to forty members of an Advisory Board are newly chosen each year, and the board as a whole is designed to represent a wide range of backgrounds, nationalities, and interests. To date, more than 300 internationally recognized practitioners and experts have participated on one or more of the Horizon Project Advisory Boards.

Once the Advisory Board is constituted, their work begins with a systematic review of the literature — press clippings, reports, essays, and other materials — that pertain to emerging technology. Advisory Board members are provided with an extensive set of background materials when the project begins, and then are asked to comment, identify those which seem particularly worthwhile, and add to the set. A key criterion for this edition was the potential relevance of the topics to business practices in marketing, collaboration, customer service, and productivity. A carefully selected collection of RSS feeds from some 50 leading publications ensures that these resources stay current as the project progresses, and they are used to inform the thinking of the participants through the process.

Following the review of the literature, the Advisory Board engages in the process of addressing the five research questions that are at the core of the Horizon Project. These questions are designed to elicit a comprehensive listing of interesting technologies, challenges, and trends from the Advisory Board,

and are the same within each of the various Horizon Project research areas so as to facilitate longitudinal analyses. The questions used for the Economic Development Edition are:

- 1 *What would you list among the established technologies that growth-focused small to medium businesses should all be using broadly today to support or enhance business practices in marketing, collaboration, customer service, and productivity?*
- 2 *What technologies that have a solid user base in other industries should small to medium businesses be actively looking for ways to apply?*
- 3 *What are the key emerging technologies you see developing to the point that small to medium businesses should begin to take notice during the next three to five years? What organizations or companies are the leaders in these technologies?*
- 4 *What do you see as the critical challenges related to innovation and development that small to medium businesses will face during the next five years?*
- 5 *What trends do you expect to have a significant impact on the ways in which small to medium businesses approach their core practices in marketing, collaboration, customer service, and productivity?*

One of the Advisory Board's most important tasks is to answer these five questions as systematically and broadly as possible, so as to generate a large number of potential topics to consider. The regional and sector-based reports add one additional step as a way to seed the responses: the topics from the short lists of the global and other regional editions for the current year are included in the list of topics to consider. Once this work is done, usually within just a few days, the Advisory Board moves to a unique

consensus-building process that uses an iterative Delphi-based methodology.

In the first step of this approach, the responses to the research questions are systematically ranked and placed into adoption horizons by each Advisory Board member using a multi-vote system that allows members to weight their selections. Each member is asked to also identify the timeframe during which they feel the technology would enter mainstream use — defined for the purpose of the project as about 20% of organizations adopting it within the period discussed. (This figure is based on the research of Geoffrey A. Moore and refers to the critical mass of adoptions needed for a technology to have a chance of entering broad use.) These rankings are compiled into a collective set of responses, and inevitably, the ones around which there is the most agreement are quickly apparent.

Each of the twelve semi-finalist topics is then written up in the format of the Horizon Report. With the benefit of the full picture of how the topic would look in the report, the “short list” is then ranked yet again, this time with a reverse ranking approach. The six technologies and applications that emerged at the

top of the rankings — two per adoption horizon — are detailed in the preceding sections along with the challenges and trends also selected by the advisory board.

To anchor the report in a stream of timely and relevant information about the topics highlighted here, an ongoing component of the project generates an expanding set of web links, tagged on Delicious.com, which has been established to help extend the findings of the project and allow new information to be shared within the community. The Delicious.com tags used for the project are listed under the “Further Reading” section of each of the six topic areas, and readers are invited to view not only the resources that were listed in the report, but many others that were used in our research as well. Readers are further encouraged to add their own examples and readings to these dynamic lists by tagging them for inclusion in each category.

For additional detail on the project methodology or to review the actual instrumentation, the ranking, and the interim products behind the report, please visit <http://biz.wiki.nmc.org/>.

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Lynda Weinman
Founder
lynda.com

The New Media Consortium
sparkling innovative learning & creativity

6101 West Courtyard Drive
Building One, Suite 100
Austin, TX 78730
t 512 445-4200 f 512 445-4205
www.nmc.org

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