Chapter

1

The Need for Enterprise Innovation

"Computing is rapidly approaching an inflection point where science fiction writers' predictions of helpful, ubiquitous and seamless technology will become a reality."

—Richard Rashid, Senior Vice President, Microsoft Research

Underlying trends both within the business world and the software industry are driving us toward the need to extend the radar, to focus on emerging and disruptive technologies as the next source for growth and competitive advantage within the enterprise.

In fact, the need to extend the radar for competitive advantage will cause mainstream businesses to become more like the pioneers and early adopters of technology innovation. Over time, this may even reshape the classical technology adoption lifecycle—the current model for how businesses adopt new technologies. Rather than following the bell-shaped curve with the "chasm" or delay in adoption between the pioneers and early adopters and the mainstream business, the chasm will be pushed later down the curve between the mainstream business and the laggards. By extending the radar and acting on those radar signals as an early warning system, the mainstream business will effectively pull itself into the domain of the pioneers and early adopters and be able to gain the same level of competitive advantage by acting not necessarily as a first mover but as a smart mover.

This smart-mover approach will require much more than simply evaluating and implementing new software or "me too"-style technology adoption. It will require the mainstream business to rethink how it identifies and prioritizes emerging and disruptive technologies and how it applies them. It will require changes within both information technology departments and within business units in order to intelligently apply the right technologies to the right business challenges and opportunities at the right time.

In addition to looking at the trends and changes within the business world and within the software industry, we'll also take an advance look at some of the key application areas where these technologies can be applied, and at some of the key vendors who provide these solutions and hold the keys to the enabling technologies of the future. The software industry is transforming itself by moving from packaged software products to software as a service on the network. This transformation will have a profound effect on both the software industry itself and on many industries who rely on software for the delivery and exchange of value with employees, customers, and business partners.

Business and IT Trends

General trends within the corporate enterprise, on both the business and information technology sides, are numerous. On the business side, they have included increased uncertainty in terms of future business scenarios and economic outlook, an emphasis on "back-to-basics" operations for cost reduction and productivity enhancements, and a focus on improved business resiliency via the application of enhanced security. On the information technology side, there has been a focus on improved business management of IT in order to extract the most value from existing resources, and a general realignment of business and IT priorities from those of previous years.

Today's businesses are focused on defending and safeguarding their existing market positions in addition to targeting market growth. Cost-constrained businesses are generally focused on achieving more from the same amount of resources in terms of people, knowledge, and systems, and in optimizing their existing operations

and business processes. As an example, within the supply chain, businesses are attempting to optimize their interactions with other supply chain participants in order to increase visibility of information and transactions and reduce the "bull-whip" effect on inventory due to changes in supply and demand. Any new initiatives have to have strong business cases in terms of the return on investment and the short-term and long-term benefits.

Increased Uncertainty

More than anything else, the year 2002 and beyond represent an age of increased uncertainty in the global business and economic arena. In the current economic climate and in light of recent world events, companies are focusing on a back-to-basics approach where the major emphasis is on taking care of existing customers, increasing resiliency of operations, and controlling costs within the enterprise. In addition, many businesses are focused on survival rather than expansion. Companies are trying to optimize their returns from investments in existing assets and resources rather than placing huge amounts of new investment in the "next big thing." All this means, at least in the short term, that new initiatives need to be very carefully planned and executed and a smaller number will be funded in the upcoming years than has been the case over the past three or four years.

Due to this increased uncertainty, businesses are proceeding cautiously and monitoring events both internally and externally. The vacuum created by the lull in business activity has created an excellent window of opportunity for businesses to reassess and realign priorities and strategic plans for moving forward. Even analyst firms are advising business clients to plan for multiple scenarios including best-case and worst-case outlooks for their business over the next 12 to 24 months.

Productivity

One of the many debates around technology in the business community has been the question of the extent to which technology has actually improved productivity, both within individual businesses and on a macroeconomic basis. An important point to bear in mind is that new technology affects the economy only when it has been broadly adopted and utilized. For example, the innovations in electric power took 40 years, from the 1880s to the 1920s, to be fully realized and

leveraged effectively by businesses. Computing technologies have been with us since the 1950s, but it has been only within the last two decades that these innovations have been fully leveraged within the business sector in the form of networking technologies, low cost personal computers and servers, and enterprise software. Internet technologies, while with us since the 1970s in the form of networking protocols, have been fully adopted by the business community only over the past five years. Thus, in the software sector, we can expect the next 20 years to be just as eventful as the last, if not more so, as we enter an era where computing moves into everyday objects via embedded chips such as radio frequency identification (RFID) tags, and software becomes truly pervasive in our society.

Despite the fact that these are early days for the software industry, the U.S. economy has seen considerable increases in productivity over the past decade that have corresponded with increased investments in technology. According to the U.S. Bureau of Labor Statistics, nonfarm business productivity, measured in terms of output per hour, has grown by an average of 2.7 percent each year from 1995 to 2000. There are still substantial productivity improvements to be gained as computing becomes ever more pervasive. It is estimated that the adoption of computing into everyday objects such as consumer and industrial products will create a total savings of $70 billion in the United States and $155 billion internationally. The cost savings will come from areas such as improved visibility into the supply chain, theft reduction, and improved operations.

Security

On the security front, companies are reassessing their exposure and performing risk assessments to uncover vulnerabilities. Once risk assessments have been conducted, companies can formulate appropriate strategies to implement the required processes and procedures in order to safeguard their people, physical assets, and IT systems. The events of recent cyber-attacks and even of September 11th have meant that the cost/benefit equation for enterprise security has been forever altered. The risks are much higher and enterprises must now invest larger sums in order to protect themselves as much as possible from the consequences of a variety of natural and man-made disasters. Of course, it is impossible to have complete security, and the costs to

even approach this limit are astronomical, but enterprises can invest enough to give themselves an adequate level of protection for most common scenarios based upon the degree of risk they can tolerate.

Business disruption can not only cause problems in communications and business activities, it can also adversely affect a company's stock price and reputation with customers and suppliers. It is now more important than ever for companies to have well-rehearsed and frequently updated processes and procedures to account for a variety of adverse scenarios. These may include Internet email and denial-of-service attacks from worms and viruses, physical attacks on property, loss of communications, loss of documents, and information theft. With companies increasingly opening up their networks and applications to customers, partners and suppliers, and using an ever more diverse set of computing devices and networks, it is important to have the appropriate levels of authentication, access control, and encryption in place. These three forms of security help to ensure that only authorized individuals can gain access to the corporate network, that they have access to only those applications for which they are entitled, and that information cannot be understood and altered while in transit. In Chapter 7, we take a detailed look at some of the new techniques for authentication, access control, and encryption, including a number of biometric authentication systems and intrusion detection systems. We also look at security from the perspective of prevention, detection, and reaction.

Business Management of IT

Business executives and chief information officers are also placing more emphasis on the business management of information technology i.e., placing more controls on how information technology departments are managed and which initiatives get funded. With large percentages of organizations' capital and recurring expenditures going into computing infrastructure and applications, information technology departments are increasingly required to justify each and every investment and maximize their returns. During the last half of the 1990s, U.S. corporations spent an average of $365 billion a year on technology, about 70 percent more than in the first half of the decade.

To run IT departments like businesses, chief information officers need to know what they have in place already in terms of people and

technology resources, and they need to minimize their cost of ownership. They need to understand usage patterns to determine how existing applications are being utilized and the value that is being extracted on an ongoing basis. They also need to be aware of underutilized assets and to develop strategies for improving their utilization and overall effectiveness across the corporation.

Keeping track of IT assets is becoming increasingly difficult as the number and variety of computing devices and applications proliferate. Employees now utilize a variety of devices including personal computers, laptops, personal digital assistants, cell phones, and pagers. Many of these are owned by employees themselves, but as these devices are standardized upon and become corporate-issued tools for mobile employees, they need to be carefully secured, controlled, and managed. Devices must be accurately inventoried and their usage patterns need to be tracked in order to report on the total cost of computing and return on investment for various application initiatives.

Companies such as mFormation Technologies provide wireless infrastructure management software to control and manage rapidly growing worldwide populations of wireless users, applications, and devices. Their *Enterprise Manager* software product helps companies maintain an up-to-date view of their wireless assets and how they are being used. It includes end-to-end, real-time performance management and fault localization capabilities to enable help desk and IT support staff to quickly pinpoint and resolve user, network, and device problems. This type of solution represents the next generation of software that we can expect to see in the infrastructure management space. It brings the same level of management to wireless infrastructure as IT departments have over the rest of their IT infrastructure. As the business management of IT becomes more of a discipline, these vendors will help to provide the tools necessary for IT staff to get a handle on their infrastructure and manage resources on a real-time basis.

IT Priorities

As business priorities change, information technology priorities are being changed accordingly. An *Internet Week* survey of 268 IT managers, shown in Table 1-1, found that the top e-business priorities for 2002 were improving customer service and reducing costs. Other priorities included increasing online sales to business customers, improving online communications with suppliers, developing and expanding

electronic supply chains, and developing new Internet sales channels. The survey also found that 42 percent of participants stated that their top management was willing to invest in e-business but was more skeptical and scrupulous about return on investment.

Table 1-1 Companies' Top E-Business Priorities for 2002. Source: *Internet Week*.

Rank	Feature	Percentage
1	Improving customer service	68%
2	Reducing costs	60%
3	Increasing online sales to business customers	24%
4	Improving online communications with suppliers	24%
5	Developing/expanding electronic supply chain	21%
6	Developing new Internet sales channels	21%
7	Increasing market share via the Web	20%
8	Launching/expanding online procurement	19%
9	Increasing online sales to consumers	18%
10	Participating in an Internet exchange	11%
11	Other	15%

According to the same *Internet Week* survey, the main challenges facing companies' e-business efforts included cost and tight budgets, security, measuring return on investment, Web-to-legacy integration, data and content management, customer or partner resistance, and complexity of technology. The most important group targeted for e-business initiatives in 2002 were customers at 67 percent, followed by internal employees at 17 percent, and suppliers and dealers/resellers both at eight percent, according to the survey. Information technology priorities undoubtedly will change from year to year or even from month to month, but the numbers help to illustrate the renewed focus on the basics such as improving customer service and reducing costs.

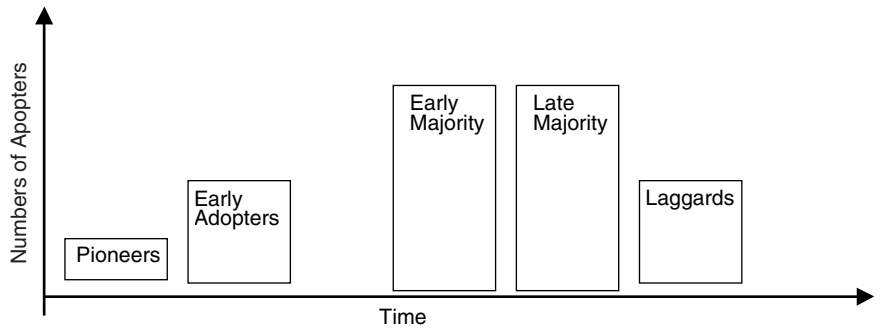
Emerging Technology as the Next Competitive Advantage

Within this context of the back-to-basics approach, emerging technologies can be applied as an enabler of cost reduction, increased resil-

iency and security, and competitive advantage. They can be applied within the business for both offense and defense. Emerging technologies provide new ways to deliver value and can dramatically reshape business processes. Disruptive technologies can reshape entire industries. They effectively allow us to rewrite the rule book and define new forms of value creation and value exchange. They can empower corporate planners and strategists to go beyond traditional, linear business development strategies and to explore new directions and new business models for their organizations. Despite the demise of the dot-com economy, software is the main engine for innovation across almost all business processes from design and production to fulfillment. The bursting of the dot-com bubble merely illustrated that not all businesses can be executed in terms of pure-play dot-com models. Moreover, the Internet should be viewed as an additional channel rather than as a replacement for traditional channels to consumers and business partners.

The New Technology Adoption Lifecycle. The need to extend the radar will cause mainstream businesses to become more like pioneers and early adopters and over time may even reshape the classical technology adoption lifecycle which is shown in Figure 1-1. This adoption lifecycle was first developed during the technology diffusion studies of rural sociologists in the 1940s. The researchers were looking at the adoption rates of hybrid seed among Iowa farmers.

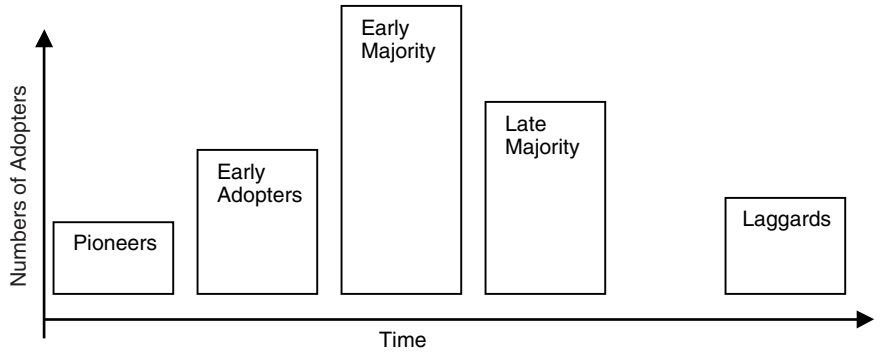
Figure 1-1 Traditional Technology Adoption Lifecycle.



While the classical adoption lifecycle and its symmetric bell-shaped curve have held true and have been extensible to the software industry and business adoption of new technologies, this is no longer the case. The traditional curve took shape because communication channels were constrained and even the innovations themselves were not immediately widespread or accessible. Today, with the ability to communicate globally via the Internet and with the immediate accessibility of software innovations to those enterprises who are extending their radars, the diffusion and adoption of innovation can occur at a more rapid pace and via a skewed adoption curve. Figure 1-2 shows this new form of the technology adoption lifecycle.

When contrasted with the traditional technology adoption lifecycle, this new model illustrates how the chasm, or gap in the timing of further adoption, will be pushed back between the late majority and the laggards instead of between the early adopters and the early majority. While there will be a shift in the distribution of the adoption lifecycle in terms of the number of businesses adopting new technologies over different periods of time, there will still be a considerable time lag between the early adopters and the laggards. This is because certain innovations are not production ready upon initial discovery. It often takes time for the surrounding ecosystem of companies and products to create the mass market for the solution and to establish a baseline level of confidence and trust among the adopters.

Figure 1-2 New Technology Adoption Lifecycle.



Adoption of emerging and disruptive technologies is a high-risk, high-reward proposition. Those who enter early and intelligently stand to gain considerable advantages but also expose themselves to an increased level of risk. Correct timing of market entry in terms of identification, prioritization, and adoption is critical. One of the benefits of extending the radar is that businesses will have more time to make these business-critical decisions since they can identify opportunity earlier. According to Charles Marinello, Director of Corporate Strategy at Texas Instruments, this is like having a more powerful missile detection system. Early warning of incoming threats can help provide more time to make decisions and to launch countermeasures in response.

The new technology adoption lifecycle is really a call to action for the business executive. You should plan to extend your radar, reshape your adoption curve in terms of how you identify, prioritize, and implement new technologies, and become a smart mover around new technologies and solutions. Chapter 8 presents some process steps for implementing this call to action to extend the radar.

Enterprise Software Trends

Return of the Major Players

On the supply side of the equation, within the independent software vendor arena, 2002 and beyond could well see the return to prominence of the major players—companies such as IBM, Microsoft, Oracle, SAP, and Sun Microsystems. Over the past three years, during the Internet boom, hundreds of startups came to power in a wide variety of market niches, stole some visibility and market share from these major players, and gained large market capitalization in the process. With the slowdown in business spending, many of these newer companies have been struggling for survival as revenues become scarce. Additionally, with stock levels and corresponding market capitalizations back to more normal levels, venture capitalists and private equity investors are becoming more selective in their investments, focusing much more effort on their existing portfolio investments, and are giving out lower valuations for those new companies they do decide to invest in.

The major players are now coming back to the table and are often leading in terms of innovation where previously in the Internet era they had occasionally fallen behind or had appeared to have fallen behind. The next wave of emerging technology innovation is being led by these major players who have the funds and resources to keep the industry advancing. Examples include Intel's peer-to-peer initiatives, Microsoft's .Net initiative, Sun's Open Network Environment (ONE) initiative, and Texas Instruments' work in the RFID area. Additionally, IBM's work in the Web services area, in conjunction with Microsoft and others, is helping to develop the core standards that serve as the foundation for Web services. These include standards such as Simple Object Access Protocol (SOAP), Universal Description, Discovery, and Integration (UDDI), and Web Services Description Language (WSDL). For those readers interested in learning more about these standards, Chapter 2 discusses the evolution of Web services from these first standards to the present and the creation of organizations such as the Web Services Interoperability Organization known as WS-I. An awareness of the major players and standards behind these changes in software industry direction can help businesses more fully exploit the potential of the technology. Web services is a megatrend that is reshaping the software industry and has great potential for reshaping many other industries as it evolves.

In addition to the re-emergence of the major players in terms of visibility and innovation, many other trends are shaping the software industry. Categories of software are becoming increasingly blurred and many appear to be converging. Even the concept of software is moving from a product-centric model to a service-centric model. Rather than a one-time event of purchase and installation, software is now becoming transformed into an ongoing service provided in a variety of pricing models for business customers to utilize. While application service providers suffered considerably over the past several years due to incomplete offerings, incorrectly priced services, and lack of acceptance of the outsourced model at the time, their fundamental business model—providing software services over networks such as the Internet for businesses to subscribe to—was accurate. The software-as-a-service movement (SaaS), which encompasses the application service provider model and several other models, means that software companies need to re-engineer themselves in terms of how they deliver value to businesses and how they monetize that value. The entire spectrum of software licensing needs to be redesigned to accom-

modate a variety of pricing models and new ways of packaging software elements into valuable business functions exposed as a service.

Wireless Middleware Market. The wireless middleware software market serves as a good example of the return of the major players into niches that were previously filled by startups and specialty vendors. This market showed great promise a couple of years ago but now has too many vendors chasing too few opportunities among enterprise buyers. The wireless application middleware market is still here and is a large growth market, but too many vendors are aiming for dominance. At one time, there were over 100 vendors in the space including major public software companies, public wireless specialists, and private wireless specialists. These companies all aim to serve business by providing software infrastructure to support enterprise mobility via cell phones, personal digital assistants, and pagers. They aim to extend existing applications to any device over any wireless network and to move information and transactions to the point of business activity. They achieve this by transforming content from the typical desktop-sized displays to the much smaller formats and varied user interface designs found on wireless devices.

Today major companies such as IBM, Microsoft, Oracle, and Sybase are moving in to challenge public and privately held specialists such as 724 Solutions, Aether Systems, Air2Web, AvantGo, Brience, InfoWave, Research In Motion, and Wireless Knowledge. With technologies such as wireless and mobile enablement locked in early adopter status within the business due to tight IT budgets, many of the wireless specialists are hurting for revenues. The major software vendors can acquire these wireless specialists at extremely low valuations and effectively absorb their technology into their own portfolio. Companies that are not acquired are going out of business as they run out of cash reserves. Recent examples have included NetMorf and 2Roam. Both were companies with solid technology, management teams, and major customers, but due to market timing they unfortunately ran through their funds and were unable to raise subsequent rounds.

Enterprise buyers are also opting for safe bets by choosing solutions from vendors they know will be around in a year or more. Thus, in this example, technologies such as Mobile Information Server from Microsoft and WebSphere Everyplace Suite from IBM are seeing increased traction in terms of enterprise adoption in the wireless mid-

dleware arena. Those private and public wireless and mobile specialists that are still in the game are pursuing a variety of options for strengthening their positions in the market. These options include global expansion to chase immediate revenues outside the United States; increased marketing activity to better position their offerings for enterprise return on investment as opposed to technical feature lists; increased focus on partnerships for channel sales through original equipment manufacturers (OEMs), resellers, and systems integrators; diversification of their core technologies into other related software categories; and deeper specialization within certain industry verticals.

This process of natural selection and evolution plays itself out in many categories of software. First movers come in and help develop the market, many go out of business or are acquired, and the fast followers come in to dominate the market once the demand has been ignited and the best practices and most effective value propositions have been determined.

Convergence of Software Categories

Another trend occurring in the independent software vendor arena, in addition to the return of the major players, is the convergence of software categories. As the number of software vendors increased over the past couple of years, so did the number of categories of software. In addition to core categories such as enterprise resource planning, customer relationship management, and supply chain management, we now have software for partner relationship management, customer experience management, enterprise interaction management, and the list goes on.

With the slowdown in the economy, however, these categories have naturally started to converge at a faster rate as the larger companies acquire these additional capabilities in order to extend their own core offerings for their customers. Supply chain management vendors have added collaborative commerce capabilities, application server vendors have added wireless middleware capabilities, and enterprise application integration vendors have added Web services capabilities. Additionally, the various players in the larger software industry value chain are taking on new roles: Systems integrators are adding managed service and business process outsourcing capabilities, independent software vendors are adding application service provider

capabilities, and application service providers are adding systems integration capabilities.

This convergence of software categories is part of a process of natural evolution for the software industry. New categories spring up and the most promising become embedded into the core offerings of the strongest players as they build out their platform functionality. There is always a battle between those vendors aiming at platform dominance with a suite of software functionality for the enterprise and those aiming at being best-of-breed within a particular software application niche. Examples include IBM, Oracle, and Microsoft, who provide platform solutions and companies such as BEA and I2, who focus on being specialists in areas such as application servers and supply chain management.

Software as a Service (SaaS)

One of the major trends in the software industry at the present time is the rise of software as a service, or SaaS. This approach to delivering and running software functionality over the network has been in practice for several years by many vendors such as Intuit and McAfee but is now becoming an option for most of the industry. The most well-known approach for software as a service is the application service provider or ASP. Other models, which may or may not differ slightly based upon the business models of the various companies, include application infrastructure provider (AIP), business service provider (BSP), and solutions service provider (SSP).

Software as a service represents a much larger trend in the software industry than the initial application service provider model that we have witnessed over the past several years. While ASPs have had their ups and downs in recent times, the longer term trend of software as a service stands to reshape the entire industry and to have a major impact on how the enterprise purchases and exploits software in the future.

The SaaS model delivers software functionality over the network, including Internet, intranet, local area network, and virtual private network delivery options, and helps software companies avoid the costly process of producing and distributing shrink-wrapped CD-ROMs to their customers. Additionally, software vendors can charge for their software services via ongoing subscription models instead of

one-time license fees and annual support fees. This can help to smooth out revenue bumps associated with traditional one-time license fees and can open up a wider business audience for the vendor, thanks to the Internet delivery model. One of the challenges with shared services such as the application service provider model, however, is the determination of usage and pricing per customer. Today's electronic business applications are so complex that it is often hard to determine which customers are consuming the most amount of computing resources and to charge accordingly.

In certain cases, software vendors can take advantage of dynamic pricing and vary their pricing based upon enterprise or consumer demand at key points in time. Upgrades to software are also a lot easier for the software vendor to implement using software as a service: One change made on the network is cascaded to all users. Under the old paradigm, vendors had to ship upgrades and new product releases via shrink-wrapped software to each of their customers.

For the enterprise, one of the future benefits of this model includes the ability to combine multiple externally provided software services to form more complete solutions to its business problems. It can take the best-of-breed approach and combine elements of functionality from different vendors over the network—even down to the individual software component level. At least this is one of the goals of the software as a service movement.

One of the barriers to this end goal is that the software standards are still being defined. Making software components from different vendors talk to one another is still far from complete, but as we shall discover in our section on Web services, this is becoming far more possible today than it ever has been historically. We are on the verge of a monumental breakthrough in software interoperability where the holy grail of software interoperability and business process discovery is within sight. Software components written in different programming languages and running on different operating system platforms can now discover one another over the network and interoperate with one another, in effect, creating applications upon demand. Today, much of this integration is achieved with prearranged business partners. Tomorrow, the ad hoc assembly of business processes with new partners may also be within reach, assuming that trust issues and other fundamental business relationship factors can be resolved.

The SaaS movement is also subject to all the pros and cons of the outsourcing model. Typically, enterprise IT managers will outsource only certain aspects of application functionality in order to save time and lower cost for nonstrategic and noncore competency IT functions. They will outsource those elements that they feel comfortable placing in the hands of others, and, in so doing, will sacrifice some control and security over the content and applications. Typically, elements that may be outsourced include news and information feeds, data storage and backups, alerts and notifications, email functionality, desktop productivity enhancements, security upgrades, utilities, and, in the consumer market, entertainment and education. An example of software as a service in the consumer space is the relationship between Exent Technologies, an application infrastructure provider, and Bell Canada, a broadband service provider, for delivering subscription-based games-on-demand to Bell Canada's DSL subscribers.

SaaS Value Chain. The SaaS value chain is composed of hardware providers, software infrastructure providers, network service providers (NSPs), independent software vendors (ISVs), business process outsourcers (BPOs), and application service providers (ASPs). One or many of these providers may combine to provide the final software as a service solution to the end user. The end user can be a large enterprise, small or medium sized business, or consumer.

Figure 1-3 shows the software as a service value chain. Included within this value chain is the entire range of xSPs, including application infrastructure providers and application service providers.

Figure 1-3 SaaS Value Chain.

Key Emerging Technology Vendors

Table 1-2 shows some of the key emerging technology vendors in the various enterprise software categories that are the focus of this

book. In most areas, the categories contain a mixture of public and private software companies ranging from those with multibillion-dollar market capitalizations such as IBM, Microsoft, Oracle, and Sun to small startups with 10s or 100s of millions of dollars in financing. These smaller vendors have a strong vision for where the industry is heading within their disciplines and have been gaining traction within the Fortune 500 enterprise. In addition to the major players, vendors such as Bowstreet and Grand Central Communications have been highly visible in the Web services arena. The same is true for Groove Networks in the peer services arena and KnowNow in the real-time enterprise arena. In business process management, Intalio and Fuego have been some of the early pioneers. Likewise, mFormation Technologies has been one of the early players in the wireless infrastructure management space. Many of these companies will be profiled later in the book within their respective chapters.

Table 1-2 shows a snapshot of some of the current players on the radar who are helping to move the industry forward within these software categories. The list is by no means all-inclusive but highlights some of the more visible players within each category.

Table 1-2 Key Emerging Technology Vendors.

Web Services	Peer Services and Collaboration	Real-Time Computing
- Asera	- Advanced Reality	- Bang Networks
- Avinon	- Autonomy	- CommerceEvents
- Bowstreet	- Cahoots	- DemandTec
- Cape Clear	- Endeavors Technology	- FineGround Networks
- Grand Central Communications	- Groove Networks	- IBM
- HP	- Intel	- KnowNow
- IBM	- Jabber	- Nonstop Solutions
- Kenamea	- McAfee AsaP	- OpenDesign
- Microsoft	- Microsoft "Hailstorm"	- PowerMarket
- Oracle	- NextPage	- Rapt
- Sun	- Oculus Technologies	- Savi Technology
		- SeeBeyond

Table 1-2 *(continued)*

Web Services	Peer Services and Collaboration	Real-Time Computing
- Talaris - UDICO	- OpenCola - Sun Microsystems	- SeeCommerce - Sun Microsystems - Tibco - Tilion - Vigilance - Vitria - WebMethods - WorldChain
Business Process Management	**Mobile Business**	**Enterprise Security**
- ATG - Asera - BEA - BMC Software - Bowstreet - Commerce One - CrossWorlds - Epicentric - Excelon - Exigen - Extricity - FileNet - Fuego - HP - IBM - Intalio - Intraspect - Jamcracker - Level 8 - Mercator - PeopleSoft	**Wireless Infrastructure Management** - mFormation Technologies Inc. **Mobile Commerce** - Nokia **Embedded Systems** - Intrinsyc Location-Based Services - Autodesk - Cell-Loc - SignalSoft - Vindigo - Webraska **Telematics** - Wingcast **Electronic Tagging** - Alien Technology - Infineon - Phillips Semiconductor	- Check Point Software - Cisco Systems - Computer Associates - Network Associates - Nokia - RSA Security - Symantec Corporation - Tripwire - Vigilinx - Viisage - Visionics

Table 1-2 *(continued)*

Business Process Management	Mobile Business	Enterprise Security
- Rational - SAP - SeeBeyond - SilverStream - Sterling Commerce - Sun Microsystems - Sybase - Systar - Taviz - Tibco Software - Vignette - Vitria - webMethods - Zaplet	- STMicroelectronics - Texas Instruments	

Key Applications

It is important to explore some of the fundamentals and business benefits behind the main technology categories and disciplines under investigation: Web services, peer services, real-time computing, business process management, mobile business, and enterprise security. These categories are all infrastructure areas that cut across multiple industries and multiple enterprise user constituencies; each can be applied to specific business processes and application areas for employees, customers, and partners. While enterprise security is not necessarily an emerging technology, it is included here since it is an increasingly important subject for businesses as they seek not only to create new forms of competitive advantage, but also to protect the competitive advantage and assets that they already have in place. As we shall see in the following section,

these software categories and disciplines together represent a refocus on infrastructure that will create a new generation of enterprise software applications and new opportunities for enhancing enterprise value.

The business benefits of this next class of applications are perhaps stronger than the previous wave of applications that we saw in the original e-business era of the late 1990s. While e-business helped to connect humans to information and applications, the next evolution of software and the Internet will help to connect applications and business processes together, both intraenterprise and interenterprise. E-business will move from a mostly human-to-machine interaction to an entirely new universe of machine-to-machine and object-to-object interactions, setting the stage for ubiquitous computing. Web services, peer services, real-time computing, business process management, and mobile business will all serve as enablers for this next generation of business applications and for the ubiquitous computing vision to become a reality.

Refocus on Infrastructure

The software industry tends to move in waves, or cycles, as it evolves and matures. While the mid- to late 1990s were focused on packaged applications for functional areas such as enterprise resource planning, customer relationship management, and supply chain management, the next wave for the industry is a refocus on infrastructure: the horizontal or platform software capabilities that serve as enablers for all of these functional application areas.

This infrastructure software can be considered the building blocks, or behind-the-scenes components, that help to make everything run smoothly and transparently. To use a race car analogy, the infrastructure comprises all the components and processes that help to operate the car and relay vital information back to the pits, which are, for the most part, unseen by the driver. The driver, of course, monitors this infrastructure via communications with the pits and via his own dashboard. Along with a skilled driver, this infrastructure can make the difference between winning and losing.

When the Internet became a new infrastructure platform for the deployment of enterprise software applications, pushing many client/server applications into the history books, software vendors rushed in to develop and sell vertical software applications for specific industries and functional areas. The basic Internet infrastructure in terms

of protocols and standards was fairly unsophisticated at the time, and still is, but software companies managed to enhance the session-less request/response paradigm of the Internet and offer compelling applications for business users that maintained the state of the users' session. This was achieved by using client- and server-side scripts and software components such as Java applets and ActiveX controls. As we all know, the Internet and the Web were originally designed for simple email, document exchange, and the display of static content, not for sophisticated and dynamic business applications that require access to back-end systems and databases.

Despite the limitations of the earlier Internet protocols and standards, these new vendor applications retained an acceptable level of user experience while using the compelling benefits of the Internet in terms of ease of development and deployment. Client/server applications had historically been very difficult to distribute to end users due to their "thick-client" nature, i.e., software and drivers had to be installed on each individual PC or laptop client in order to run the applications. In the client/server days, application releases, bug fixes, and upgrades were notoriously difficult and time consuming.

Into the Internet II Era

Now that the software industry has built out the functional application side for the enterprise, it is turning its attention back to the infrastructure layer and looking for ways to essentially build an Internet II—a new, more intelligent layer of infrastructure software between applications and the network that can significantly enhance business value.

There is, in fact, an Internet2 consortium made up of "over 190 universities working in partnership with industry and government to develop and deploy advanced network applications and technologies, accelerating the creation of tomorrow's Internet." The consortium works closely with the National Science Foundation (NSF) and other U.S. Federal Government research agencies. The Internet2 community is working on advances in applications, middleware, and networks and plans to offer 10-gigabit capacity by 2003.

The term Internet II is used loosely here, however, and is unrelated to the Internet2 consortium. The former term merely seeks to illustrate how the vendors are aiming to build enhanced capabilities on top of the basic infrastructure of the Internet and in so doing are opening up new possibilities for the enterprise decision-maker to extract business value. Extensible Markup Language or XML, as you

might expect, is also playing a key role as an enabling technology for these solutions. Basically, the standards are maturing and becoming more open and interoperable, allowing more powerful business applications to be constructed on top of the underlying infrastructure.

Web services and peer services are two perfect examples. Both represent innovations that are reshaping the realm of possibilities for the business to create and deploy superior Internet-centric applications on both a technical level and a business level. We'll continue by looking at these two application areas and then move on to other exciting and overlapping areas, including real-time computing and business process management.

Web Services

Web services are perhaps one of the most exciting new areas within the emerging technology landscape. They truly have the potential to reshape entire industries and are closely connected with the SaaS movement.

Web services allow enterprises to communicate with one another in a business-to-business scenario by exposing their services programmatically over the Internet. Other enterprises may then search for, discover, and integrate with these services in an automated machine-to-machine manner. Ultimately, Web services presents the "holy grail" for business-to-business integration: business process discovery among business partners. Instead of publishing static content on the Internet, or dynamic, database-driven content for end users to interact with, companies are now able to publish entire transactional business processes via software. These business processes can be executed in a fully automated manner via the systems of customers and business partners without requiring those customers or business partners to know about the services ahead of time.

Web services can also be applied inside the corporate firewall in order to streamline enterprise application integration initiatives or even for enterprise portal development initiatives. The current evolution of Web services is expected to progress from internal application integration, to business-to-business integration with prearranged business partners, and finally to true business-to-business integration with dynamically discovered business partners. The latter will most likely gain adoption only in niche, commoditized areas where business trust issues related to dealing with unknown companies do not present a substantial business risk.

Electronic data interchange, or EDI, as a technique for integration between companies has been around since the mid-70s, but Web services promise to make enterprise application integration far more flexible and interoperable. They can help applications talk to one another independent of programming language or operating system by making the communication more loosely coupled and standardized. Additionally, a host of new business models can be created by combining Web services from a variety of business partners into powerful new offerings.

The research firm IDC expects the global market for Web services to triple from $22 billion in 2000 to $69 billion in 2005. All major software companies, including IBM (WebSphere), Microsoft (.Net), Oracle (Web Services Framework) and Sun (ONE), have announced strategies and platforms to support this emerging technology. In fact, Microsoft has already made an initial $5 billion investment on .Net, their Web services initiative. Additional new entrants in the Web services arena include companies such as Asera, Avinon, Bowstreet, Cape Clear, Grand Central Communications, Kenamea, Talaris, and UDICO. WS-I, announced in early 2002, was another milestone for the overall movement and will help ensure that Web services from different vendors stand the best chances for interoperability. The Web services value chain includes infrastructure services, platform services, directory services, aggregation and portal services, and, finally, business and consumer services. The value chain is being assembled and driven by the software industry, but the benefits for business users are compelling.

The business benefits of Web services include cost reduction via reduced IT expenses for enterprise application integration software and services and increased revenue opportunities via software as a service providing automated links with business partners for transaction fees and referral fees. Web services also help the enterprise move closer to the concept of the virtual enterprise by allowing core business functions to be published as Web services and other noncore business functions to be outsourced and subscribed to as Web services. As businesses start to unbundle their business functions and digitize them into software, Web services provide them with a new mechanism for exposing these services in an interoperable and accessible manner. For example, a company moving to an IT shared services model can use Web services to expose application functionality

for other operating companies to use within the same organization. It can then assess charge-backs for use of these services.

An example of a company already gaining an advantage from Web services is Dollar Rent-A-Car. The company used Web services technology from Microsoft to integrate its online booking system with the Southwest Airlines Web site. The company expects to save hundreds of thousands of dollars by routing bookings through automated airline sites versus through travel agent networks. In this scenario, Web services technology is automating business-to-business transactions and disintermediating traditional aggregators of services. The ability to more easily connect systems between business partners has reduced the need for third parties to serve as brokers for the transactions. As another example of Web services, DuPont Performance Coatings used Web services technology from Bowstreet to create a customer portal for distributors and body shops in the automotive industry. The solution yielded increased business rule flexibility, end-user management, and mass customization of the portal when compared to more traditional development environments for constructing Web portals.

Peer Services

The concept of peer-to-peer computing was popularized by companies such as Napster in the consumer space with their controversial file-sharing community for the exchange of media files. The peer-to-peer concept has actually been around for decades and was used extensively in the early days of corporate networking in local area network products such as Microsoft Windows for Workgroups, Novell Personal NetWare, and IBM peer-to-peer Systems Network Architecture (SNA) networks.

Peer-to-peer computing is now becoming an increasingly important technology within the business community. Peer-to-peer basically leverages computers on the network "edge" (desktops) instead of centralized servers for performing various content, collaborative, and resource-sharing functions between client, or peer, computers on the network.

One of the major players in this field is Groove Networks, a company whose product lets groups create workspaces to share files, use message boards, mark up virtual whiteboards, engage in instant-mes-

saging, have voice chat sessions, and much more. Groove Networks was founded in 1997 by Ray Ozzie, one of the original creators of Lotus Notes in the mid-1980s. Peer-to-peer computing goes beyond person-to-person collaboration for knowledge management purposes and also includes distributed content management and distributed computing cycles. Examples of its application for distributed computing cycles include the Intel Philanthropic Peer-to-Peer Program which focuses on a variety of scientific research efforts, including cancer research, and the SETI@home program which focuses on processing data from the radio telescope in Arecibo, Puerto Rico. SETI, or the Search for Extraterrestrial Intelligence, is a scientific program seeking to detect signs of intelligent life outside the planet Earth.

The analysts anticipate a strong market for peer-to-peer technologies within the business community due to the solid business benefits they enable. The Aberdeen Group and AMR Research expect corporate spending on collaboration software to triple from $10.6 billion in 2001 to $33.2 billion by 2004. The analyst firm IDC estimates that Fortune 500 corporations will lose $31.5 billion by 2003 due to rework and the inability to find information. Likewise, Meta Group states that workers spend approximately 25 to 35 percent of their time searching for the information they need, rather than working on strategic projects and business opportunities. Peer-to-peer computing has the potential to address many of these pain points within the business by opening up all computing resources for the searching and sharing of business information and for richer forms of collaboration.

Current initiatives in the world of peer-to-peer computing include Intel's Peer-to-Peer Working Group and Peer-to-Peer Trusted Library, and Sun's Project Juxtapose (JXTA). These initiatives aim to help build standards, protocols, and best practices so that corporate developers can focus on business applications for peer-to-peer technologies rather than building the infrastructure themselves. Some of the issues which these initiatives are currently addressing include the increased requirements for security, management, and interoperability that peer-to-peer computing requires, as opposed to the standard client/server model. Business users are understandably nervous about opening up their personal computers for resource sharing and for others to search and access. Some of the vendors and products in the peer-to-peer space include Groove Networks, NextPage, OpenCola, Advanced Reality, Microsoft Messenger, Yahoo Messenger and Groups, and Intranets.com.

One of the business benefits of peer services is improved employee productivity through the use of peer-to-peer collaborative platforms. These platforms allow groups to conduct business processes in a far richer collaborative environment than the simple email, phone, and fax interactions typical today when collaborating with business partners and customers. According to Groove, the technology helps people in different companies or different divisions reduce their "cost of connection" in collaborating with one another and performing their work. Business processes that can be enhanced and extended through the use of peer-to-peer collaborative platforms include purchasing, inventory control, distribution, exchanges and auctions, channel and partner relationship management, and customer care and support. Additional benefits of peer-to-peer computing include the ability to better utilize computing cycles on workstations across the business and the ability to better search and share content residing on knowledge worker desktops. Intel's NetBatch initiative, started in 1990, enabled the company to save hundreds of millions of dollars by using existing workstations on a global basis for large processing tasks related to their Engineering Design Application (EDA) environment and other initiatives.

Real-Time Computing

Real-time computing aims to enhance enterprise value by speeding business processes. In this manner, the enterprise can speed operations and sense and react to changes in its internal and external environment more quickly than its competitors, thus decreasing cycle times, reducing costs, and improving productivity.

There are many areas within the business that can benefit from real-time computing. These include interactions with employees, customers, and partners. One of the challenges for the business is to determine which business processes are capable of this change, which will actually benefit from this change, and which will yield the most favorable return on investment for real-time enablement. To determine this return, the business should generally look at the amount of cost takeout that can be achieved via real-time enablement and understand the amount of process change that needs to occur and the associated costs in implementing this change. Some business processes have natural frequencies that cannot be streamlined, while others are ripe for optimization. An area that has gained considerable attention

recently is the reporting of financial results to the investment community. This is an area that can be improved considerably and may help to take some of the surprises out of financial reporting for both management and investors if it is moved to a more frequent timeframe. Homeland security is obviously another key area where real-time intelligence and information dissemination are critical.

The real-time arena has a natural overlap with mobile business technology since, for business processes to move closer to real-time scenarios, information and transactions need to be able to move from source to destination regardless of location. Human approval processes may also be a part of a larger business process that is being streamlined, so real-time computing requires mobile business techniques in order to reach key employees at any time and any place.

Software vendors in the real-time computing arena include KnowNow, Bang Networks, FineGround Networks, and OpenDesign. Many vendors in this space position their technology as an alternative to costly enterprise application integration (EAI) initiatives and state that real-time computing helps to move EAI functionality to the network. The technology usually aims to implement a two-way communication mechanism between various applications and uses Internet protocols such as the Hypertext Transfer Protocol, the communication protocol between browsers and Web servers, as the transport vehicle for the communication to take place. Real-time computing enables powerful and flexible methods for controlling data flow, aggregation, and analysis, acting in some ways like a hardware router in moving information to the appropriate systems.

One of the additional benefits of real-time computing is that it forces the business to focus on key performance indicators and key metrics and can help employees focus on the work activities that matter the most. When business processes are energized in this way, real-time computing can also help expose and correct weaknesses in data quality and process bottlenecks, or simply bad processes, that were less apparent under the former processes and procedures.

Business Process Management

Business process management, or BPM, is affecting enterprise application deployments on a number of levels. As an evolution of traditional enterprise application integration, it is helping to force a top-down

view of the world from a business perspective rather than a bottom-up view from an IT perspective in order to solve business problems. Traditionally, a business requirement has been implemented via software by connecting databases together or by connecting applications together. Business process management views the world from a process orchestration perspective where business processes need to be created, executed, and managed. Business process management also allows business processes to be rapidly redesigned in order to meet changing business requirements. Business processes are allowed to span applications, devices, and people as discrete nodes within the overall set of process steps.

Software vendors in the business process management space include companies such as Fuego, Intalio, and Systar which focus exclusively on business services orchestration, business process management, and business process performance management, respectively. These companies target industry verticals such as telecommunications, energy, and financial services in functional areas such as customer relationship management, enterprise resource planning, and supply chain management. Additionally, most integration middleware vendors such as BEA, Vitria, and webMethods are beginning to support BPM functionality as a core product feature.

The business benefits for business process management include increased flexibility, reduction of complexity, decreased cost of ownership, and faster return on investment. One of the advantages of the process view ingrained into the BPM paradigm is that it helps the enterprise take a holistic view of its business transactions. It crosses internal and external boundaries in terms of data, applications, and people. It also helps to cross the conceptual boundaries between wired and wireless transactions which are really just different modes of connection to the network. Finally, BPM helps to focus the enterprise and IT operations on business processes and metrics and not IT metrics. In many enterprise scenarios, business metrics can fail even when IT metrics are satisfactory. For example, server uptime is independent of whether or not a key business customer has placed an expected order or whether or not a financial transaction has been settled in time in order to avoid financial penalties.

Business process management is an important set of functionality that can help to speed integration of applications and empower end

users to play a more vital role in the overall modeling and orchestration of their business processes.

Mobile Business

Mobile business is another area that cuts across numerous industry verticals and numerous functional and horizontal areas; it can be applied to functional application areas such as customer relationship management and field force automation, and also to horizontal application areas such as corporate email, personal information management, executive dashboards for the aggregation of business-critical information, and business intelligence applications.

Mobile business represents an opportunity to move information and transactions to the point of business activity and to remove former process bottlenecks for mobile employees. It represents a way to increase the reach and value of technology within one's business by extending it to any employee, any customer, and any partner, anywhere and any time. The opportunity exists both to refine existing processes and to create entirely new ones.

Mobile employees now have the ability to leverage technology just as if they were in the office. Improvements in devices, applications, networks, and standards over the past few years have made this far more practical than it was when first introduced. The drivers for adoption are finally starting to outweigh the barriers. For example, major vendors such as IBM, Microsoft, Oracle, and Sybase are all playing a larger role and taking a larger interest in mobile business than they had previously. These vendors all have mature, proven offerings for enterprise mobility. Additionally, the wireless carriers are rolling out "2.5G" and "3G Lite" networks such as General Packet Radio Service (GPRS) in the United States that enable higher bandwidths for wireless data. Devices are making strong strides forward in terms of usability and features. Microsoft's Pocket PC 2002 is a notable example of one of the latest operating systems. Standards such as Extensible HTML (XHTML), Binary Runtime Environment for Wireless (BREW), Java 2 Platform Micro Edition (J2ME), and Wireless Application Protocol (WAP) 2.0 are all having an impact as well. They are helping to make mobile business easier for both developers and end users by enriching the functionality available on mobile devices.

Mobile business technology helps to extend the corporation out to its edges in areas such as sales force automation, field force automation, and enterprise operations. Benefits can include improved data accuracy, reduced costs, increased productivity, increased revenues, and improved customer service. Beyond being an additional channel for communications, mobile business enables the enterprise to think about the powerful combination of business process, e-business, and wireless communications. Instead of being at the intersection of e-business and wireless communications, it often helps to think of mobile business as being a superset of e-business and wireless that also includes business process.

In *Business Agility*, I took an in-depth look at mobile business and how it can be applied for competitive advantage within the enterprise. In *Business Innovation and Disruptive Technology*, we'll extend the radar further and look at upcoming areas within the field of mobile business, including mobile commerce, location-based services, telematics, and electronic tagging. These are all interesting subcategories within mobile business that open up new opportunities for mobility beyond simple employee applications. Embedded computing and electronic tagging are especially interesting because they extend wireless and mobile technologies not just to humans but also to a wide range of objects such as consumer and industrial products. These products can gain intelligence via electronic product codes, which are a potential replacement for universal product code (UPC) barcodes, and via RFID tags with two-way communication capabilities.

Enterprise Security

Enterprise security is an area that is perhaps the most fundamental and yet the most critical of all the technologies and disciplines for the business to have squarely in place in order to execute on its business strategy. Without solid enterprise security processes and procedures, none of the other technologies can be reliably applied for business advantage. Security is no longer just a luxury. Today it is a business imperative. Business disruption can be not only an inconvenience for business users and their customers and partners, it can also cost millions of dollars in lost revenues or lost market capitalization. But the business cost of inadequate security does not stop at simply inconvenience and loss of revenues or market valuation. It can even force a business out of existence. One of the earliest examples of this was the

case in early 2002 for British Internet service provider CloudNine Communications, which was the victim of a distributed denial-of-service (DDOS) attack that forced the company to close operations and to eventually transfer over 2,500 customers to a rival organization. While emerging technologies can help a company to gain competitive advantage and market share, lack of security can have the opposite effect, causing profitable companies to lose market share or even their entire business within hours or days of an attack.

Fortunately, the security arms race in terms of attacks and prevention measures is not all one-sided. As hackers exploit vulnerabilities, so software companies and enterprise security specialists continue to close the gaps and find new solutions and approaches to secure enterprise operations and data. One of the challenges facing enterprise security is that it is often very difficult to know when enterprise networks and applications have been attacked or are in the process of being attacked. Because of this, security measures within emerging solutions are becoming increasingly proactive. Instead of simply responding once a business system has been compromised, businesses are moving toward real-time proactive monitoring of their operations and employing intrusion detection tools that can help to spot illegal or unusual activity on the network. With these tools in place, activities that would have gone hitherto unnoticed are detected while they are in progress and can either be instantly blocked or have their actions immediately reported to enterprise security administrators or law enforcement for rapid response.

Some of the categories of software and services in the enterprise security arena include biometrics, intrusion detection, encryption, vulnerability assessment, managed security services, and general security management. Security management typically includes functions for what is termed "3A": administration, authorization, and authentication. The analyst firm IDC estimates that the total IT security market will grow from over $14 billion in 2000 to $46 billion by 2005. This market estimate includes security software, hardware, and services. It expects the security software market alone to reach over $14 billion by 2005 and be comprised of security "3As," firewalls, antiviral software, and encryption technologies. Companies in the security hardware, software, and services arena include well-established vendors such as Computer Associates, Cisco Systems, Symantec Corporation, Network Associates, Check Point Software, Nokia, and RSA Security, together with newcomers such as Tripwire, Vigilinx, Viisage, and Visionics.

Business benefits in deploying the latest advances in security technologies include the cost avoidance of greater disruptions without such technologies, together with increases in productivity of employees due to coordinated approaches for administration, authorization, and authentication. As the number of applications and modes of access to the network increases within the business, the importance of single sign-on technologies and efficient management of security profiles cannot be underestimated. An additional business benefit related to security is compliance. In many industries such as health care and financial services, businesses face government regulations which require consumer privacy protection. An example is the Health Insurance Portability and Accountability Act (HIPAA) within the health care industry where techniques such as encryption can help protect stored or transmitted data from unauthorized viewing or alteration.

Summary

This new wave of technology innovation will cause massive changes in the way that business can be conducted, opening up the business world to the world of ubiquitous computing. The next phase of the software and Internet evolution will start to merge bits with atoms—a concept promoted by the M.I.T. Auto-ID Center, which focuses its research on electronic tagging of physical objects. The physical world and the virtual world will become increasingly connected as computing devices and physical objects of all kinds gain intelligence and the ability to communicate with the network via wired and wireless technologies and intelligent identification techniques such as electronic product codes and RFID systems. Web services and peer services will allow objects and applications increasingly to communicate with one another in an interoperable manner. Real-time computing will create business benefits from improved efficiencies and reduced cycle times. Mobile business will keep people connected to the network and will allow devices to be tracked and monitored. Business process management will enable nontechnical end users to manage their business processes across multiple organizations and do so in a language they can understand. Enterprise security will help strengthen business resiliency and will serve as an enabler for these new forms of interaction to occur in a safe, trusted environment.

In the following chapters, we take a detailed look at each of these emerging and disruptive technology categories. Within each chapter we will explore the market, the technology, and industry scenarios and benefits related to each emerging technology. The market section will cover the drivers for adoption; the recent history in terms of standards, applications, and vendors; the value chain that is being assembled in order to deliver end-to-end business solutions within this category; and profiles of some of the major vendors in the space. The technology section will briefly cover some of the concepts and fundamentals that are important for executives to understand when assessing these technologies for their business. Finally, the industry scenarios section will describe typical industry situations where these technologies can be applied and the business benefits that can be realized.

Extending the Radar Lessons

- Enterprise business trends include increased economic uncertainty, focus on productivity and cost takeout, focus on security and resiliency, and the business management of information technology.
- Within enterprise IT departments, the need to extend the radar and look for new forms of competitive advantage will cause mainstream enterprises to become more like pioneers and early adopters of emerging technology. Over time, this effect may even reshape the classical technology adoption lifecycle.
- Enterprise software trends include the movement to SaaS, the return of the major players, a re-emphasis on infrastructure services, and the convergence of software categories.
- Emerging and disruptive technologies include Web services, peer services, real-time computing, business process management, mobile business, and enterprise security. Security is a key defensive measure to support the baseline operation and resiliency of the business as it pursues these new business enablers.

- These emerging technologies will cause massive changes in the way that business can be conducted, opening up the business world to the world of ubiquitous computing where "bits and atoms are merged."
- The physical world and the virtual world will become increasingly connected as computing devices and physical objects of all kinds gain intelligence and the ability to communicate with one another.