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# Smart Computing Drives The New Era Of IT Growth

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for Vendor Strategy Professionals

## THREE REASONS WHY THE TECH MARKET WILL BOOM BETWEEN 2010 AND 2016

We believe that the tech market in the US — and by extension, other countries — is poised for a multi-year run of strong growth and innovation. While the 2008 to 2009 financial crisis muddies this prediction, there are three reasons why we expect that the coming tech boom has been delayed, not cancelled altogether:

1. **History says we are due for a fourth wave of tech innovation and growth.** Three times since the 1950s the US tech market has gone through a 16- to 20-year cycle of rapid and then slowing growth. In each case, the introduction of a new technology spurs an eight- to 10-year period when tech investment grows twice as fast as the economy, followed by a similar-length period when tech investment grows at the same rate as the economy. The last wave of tech innovation growth started in 1992 and was due to end in 2008. Based on historical patterns, the US should experience another wave of tech innovation and growth, starting around 2008.

2. **Tech purchases started to grow much faster in 2008 until the financial crisis hit.** The US Department of Commerce data on business investment in technology shows that US tech investment (starting in Q4 2007 and through the first two quarters of 2008) averaged 8.4%, almost twice the average growth rate for nominal GDP of 4.6%. While the financial crisis and resulting recession killed that growth spurt, the relatively strong growth in IT investment in late 2007 and early 2008 suggests that there is a lot of pent-up demand for technology goods that will resurface as soon as the recession passes.

3. **A new generation of technology — Smart Computing — is taking shape.** History repeats if conditions repeat, and we see those conditions in tech innovation surrounding us again. The convergence of innovations in software architectures; back-room data center operations; wireless and broadband communications; and smaller, powerful, and numerous client devices connected to the network lets technology work together in unprecedented ways to solve smarter and more complex business problems that the last generation of computing could not address. The seeds of this new technology lie in innovations by tech vendors of new, industry-focused products that combine elements of hardware, software, and communications to solve those business problems. For example, utilities encourage energy conversation and avoid investments in new generating plants, or hospitals use electronic patient records to provide better treatment with higher utilization of resources.

We call this new generation of technology "Smart Computing." Why? It adds to existing technologies new capabilities of real-time situational awareness and automated analysis. As a result, technology moves beyond just proposing task solutions — such as executing a sales order — to sensing what is happening in the world around it, analyzing that new information for risks and possibilities, presenting alternatives, and taking actions. Smart Computing is:

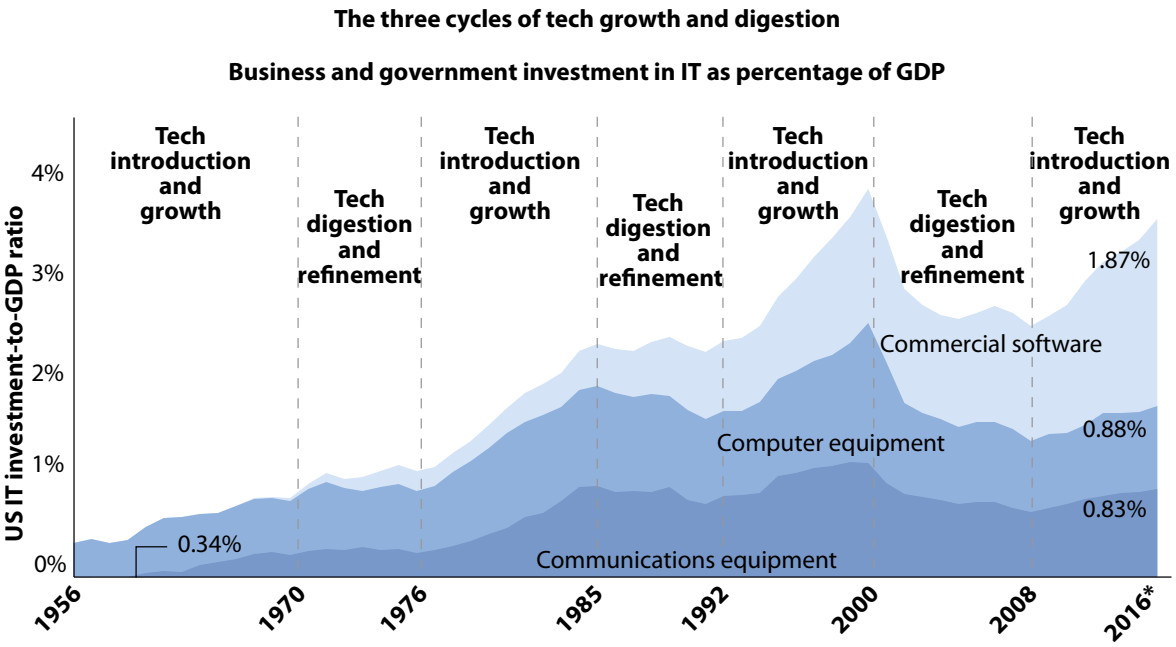
*a new generation of integrated hardware, software, and network technologies that provide IT systems with real-time awareness of the real world and advanced analytics to help people make more intelligent decisions about alternatives and actions that will optimize business processes and business balance sheet results.*

While what we are calling "Smart Computing" is still a long way from the intelligence in *Star Trek* computers, we still see it as a seismic shift in capabilities from the technology of 2000 to 2001. However, Smart Computing is not a brand new creation; it is an evolution as well as an extension of three generations of computing. Similar to how Isaac Newton spoke of his own accomplishments, Smart Computing's achievements will rest on the shoulders of the technologies that came before.

## THE TECH MARKET MOVES IN CYCLES OF TECH GROWTH AND TECH DIGESTION

Our study of the history of information technology since the 1950s shows that there have been three cycles of new technology introduction and adoption (see Figure 1). This historical treatment is focused on the US where historic data on tech investment is deep and long, but the other industrial countries show similar patterns.

**Figure 1** The US Has Seen Three Cycles Of Tech Introduction And Digestion Since 1960




Source: US Commerce Department for 1956 to 2008; Forrester Research forecasts for 2009 to 2016
*Forrester forecasts

55157 Source: Forrester Research, Inc.

Each of these cycles has had the following four characteristics:

1. **A new form of information technology comes to market and gains adoption.** The new technology, which had been under development with experimental adoption in earlier years, suddenly starts to gain rapid and wide adoption because of its ability to solve critical business challenges. New competitive offerings come to market, helping reduce solution costs and accelerate purchases by more firms. This period of growth and innovation generally lasts eight to 10 years, with a shift toward shorter periods in more recent decades.

2. **The ratio of IT investment to GDP (IT-to-GDP ratio) rises during this period.** With investment in this new technology growing more rapidly than the economy, the ratio of business and government investment in this technology as a percentage of revenue goes up. Businesses and governments buy the new technology, seeing it as a way to quickly and easily transform operations. Tech investment on average grows twice as fast as the overall economy grows, causing the IT-to-GDP ratio to rise for eight to 10 years.

3. **After eight years or so, growth in new technology slows as companies focus on absorbing it.** Technology by itself does not change how business gets done; business processes and organizations need to change to take advantage in practice of what technology can do in principle. Businesses and governments thus slow the pace of new technology acquisition and focus instead on the business process changes that are needed to achieve better business results. Vendors, responding to this skepticism, shift focus from new products creation to making products that are easier to use and implement. This tech digestion and refinement period lasts six to eight years, with a shift toward longer periods in more recent decades.

4. **During the tech digestion period, the IT ratio stays flat — or declines.** As a result of buyer cutbacks and vendor focus on cutting solution costs, the growth in technology investment slows to about the same rate as growth in the economy, or even slower. The IT-to-GDP ratio then becomes stable and, in recent periods, has declined.[1]

## The US Has Seen Three Cycles Of Tech Introduction And Digestion From 1960 To 2008

This cycle of tech innovation and growth, followed by tech refinement and digestion, has occurred three times since the 1950s, with three generations of computer technology:

- **Mainframe computing from 1960 to 1976 automated frequent, standardized transactions.** In 1960, the first computer sales registered in the US Department of Commerce's GDP data on business investment in information technology (even though computers like ENIAC, UNIVAC, and the first IBM mainframes had been sold since the late 1940s).[2] Over the next nine years, IBM mainframes and DEC, HP, and Data General minicomputers gained rapid adoption in government, airlines, banks, utilities, and insurance companies. Vendors created software that ran on these computers to handle specific industry processes with standardized transactions that

occurred frequently — like government benefit payments and airline reservations. Computer investment rose from nothing in 1959 to 0.26% of GDP in 1969, with growth also in software purchases pushing the total IT-to-GDP ratio to 0 .93% in those 10 years (see Figure 2-1). Then, from 1969 to 1976, the computer-investment-to-GDP ratio edged up and down before hitting 0.27% in 1976, and the total IT-to-GDP ratio inched up to 1.1%, mostly due to wider adoption of mainframe software products.

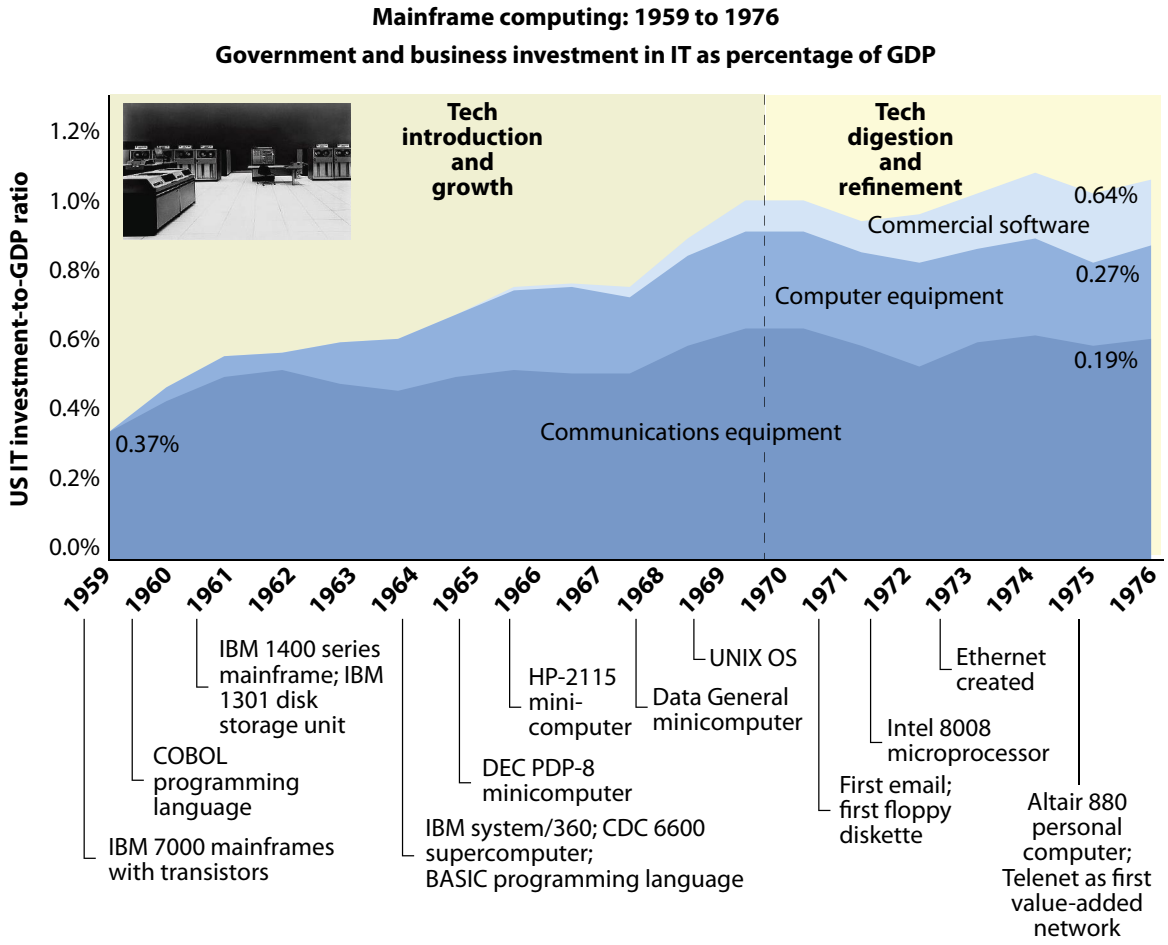
- **Personal computing from 1976 to 1992 moved computing to white collar workers.** The personal computer was the center of the next wave of tech expansion — starting in 1976 with the Apple-1 personal computer and the Wang 1200 word processor. From 1976 to 1985, a series of innovations in PCs occurred, including the first IBM PC with a Microsoft MS-DOS operating system; the Osborne 1 portable PC; WordStar, VisiCalc, and Lotus 1-2-3 software for PCs; and the Apple Macintosh. These hardware and software products gained rapid adoption, with both contributing to the total IT-to-GDP ratio reaching 2.33% in 1985, double the 1.1% ratio in 1976 (see Figure 2-2). Why? PCs came to market when the US economy was shifting from a manufacturing to a services economy — with white collar office workers representing a growing portion of the workforce. Companies needed personal computing to help workers prepare reports; do analysis; and make sales, marketing, or strategy presentations. It was not enough to put PCs in front of employees. Changes in business processes or organizations had to occur as well, such as getting employees to type their own memos rather than dictating them to secretaries. This transition took time, so after 1984, the pace of innovation in personal computing slowed, with vendors concentrating on making word processing, spreadsheet, and desktop publishing tools easier to use and computers cheaper to buy — and investment in IT was basically flat from 1985 to 1992.

- **Networked computing from 1992 to 2008 drove process automation.** The third wave of computing was launched with the arrival of SAP's R/3 enterprise resource planning (ERP) software in 1992.[3] Coinciding with the business process reengineering trend, SAP's ERP suite and those from rivals Oracle, Baan, and PeopleSoft took off from 1992 to 1996 as firms aggressively redesigned their business processes to lower costs. Customer relationship management (CRM) software from Siebel; supply chain management (SCM) software from i2 and Manugistics; and product life-cycle management (PLM) from Parametric Technology Corporation (PTC), Unigraphics (now Siemens PLM Software), and Dassault Systemes followed to automate these business processes. Then, the Internet took off, powered by the browser wars between Microsoft's Internet Explorer and Netscape Navigator. New eCommerce sales software from ATG and BroadVision and eProcurement and eSourcing software from Ariba and Commerce One pushed enterprise applications into sales and purchase processes over the Internet. As a result, IT-to-GDP ratio shot up from 2.36% in 1992 to 3.88% in 2000 — with the Y2K frenzy adding about a half a percentage point of IT investment (see Figure 2-3). But the tech bubble burst in 2001, and the resulting recession in the overall economy led to big drops in tech investment in 2001 to 2003, followed by four years in which tech investment grew at about the same rate as the overall economy.

**Figure 2** Milestones Of Mainframe, Personal, And Network Computing

A spreadsheet with additional data is available online.

**2-1 Mainframe computing growth and digestion**




Source for photo: IBM

55157 Source: Forrester Research, Inc.

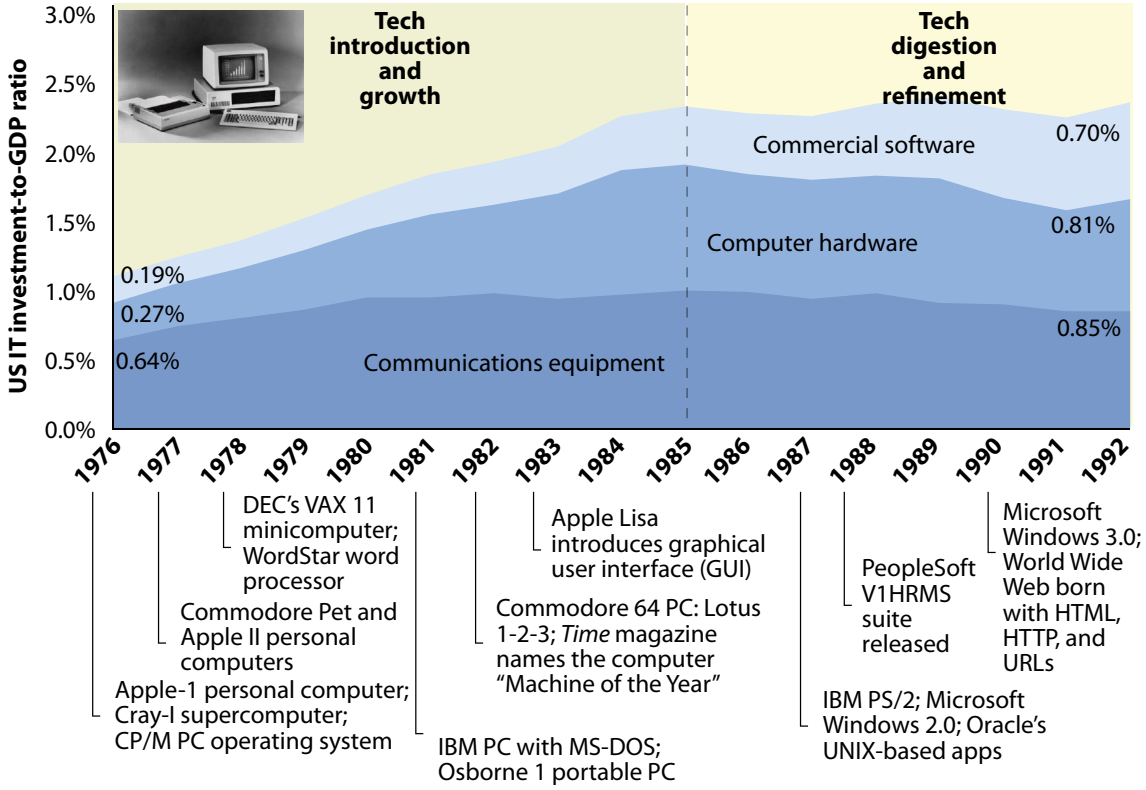
**Figure 2** Milestones Of Mainframe, Personal, And Network Computing (Cont.)

A spreadsheet with additional data is available online.

**2-2 Personal computing growth and digestion**

**Personal computing: 1976 to 1992**

**Government and business investment in IT as a percentage of GDP**




Source for photo: IBM

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**Figure 2** Milestones Of Mainframe, Personal, And Network Computing (Cont.)



55157 Source: Forrester Research, Inc.

## SMART COMPUTING, LATEST CYCLE OF TECH INNOVATION AND GROWTH, BEGAN IN 2008

Why does this history of technology since 1960 matter today? Because cycles of tech adoption and digestion that occur with this regularity have a high likelihood of repeating themselves. Of course, as financial investment literature always points out, past history is no guarantee of future results. Still, cycles of booms, recessions, and recoveries have been a persistent feature of the world of economics — and every time that optimists have predicted the end of economic cycles, a recession has brutally thrown cold water on these hopes. We expect similar cycles in the world of technology.

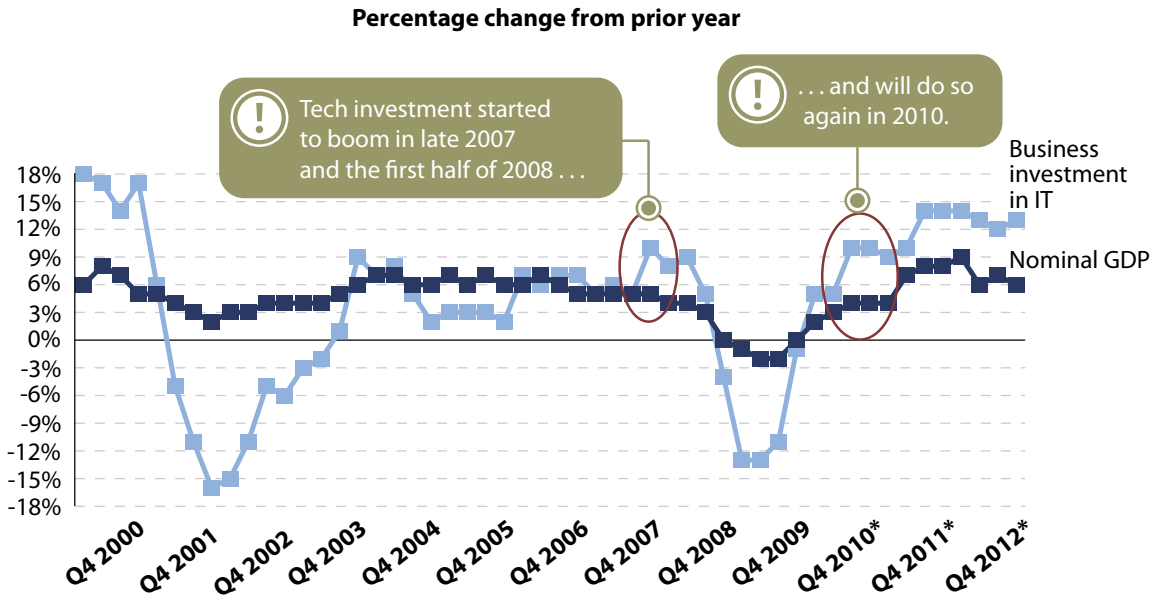
 

Using this logic, the innovation and growth phase of the next tech cycle should have started in 2008, eight years after the peak of the last cycle and after eight years of tech digestion and refinement. Did it? Yes, for two reasons. First, the data shows that tech investment in 2008 started to grow significantly faster than the economy — at least until the financial crisis in the late third quarter and fourth quarter threw that trend into reverse. Second, a review of the technology landscape shows a convergence of innovation in four domains of technology (software applications, data center operations, client devices, and network systems) that together represents a new generation of technology — Smart Computing.

## Tech Investment Started To Outpace GDP Growth Until The September 2008 Financial Crisis

Apart from a five-quarter period from Q4 2004 to Q4 2005 when growth in business investment in computer equipment, communications equipment, and software lagged nominal GDP growth, the growth rates in these two metrics were more or less the same from 2004 through Q3 2007. Then, starting in Q4 2007, while nominal GDP growth slowed as the US moved into a recession, IT investment growth increased to 10% in Q4 2007, 8% in Q1 2008, and 9% in Q2 2008, before slipping to a still positive 5% in Q3 2008 when the financial crisis hit the US and other countries (see Figure 3). In each of these four quarters, tech investment growth was almost twice the growth in nominal GDP. Despite the weakening of the US economy in late 2007 and the first three quarters of 2008, US businesses were starting to invest heavily in technology.

**Figure 3** Tech Investment Grew Much Faster Than GDP In 2008 — Until The Financial Crisis Hit




Source: US Commerce Department, Bureau of Economic Analysis through Q3 2009; Forrester Research for forecasts for 2009 to 2012
*Forrester forecast

55157 Source: Forrester Research, Inc.

What were businesses buying in this period? Certainly not servers or PCs from the largest vendors, where the average growth rates for the four quarters through Q3 2008 were negative (-12% for servers; -1% for PCs). Nor did vendors of storage equipment, computer peripherals, and software operating systems see much growth, with average growth rates of 1% to 3%. Instead, the growth was occurring in:

- **Special-purpose computer equipment.** Traditional servers, PCs, and even storage experienced declining sales from Q4 2007 to Q4 2008. Bucking that trend were industry-specific computer devices such as smart meters for utilities, network-connected sensors in highways and pipelines, computer chips for airplanes and automobiles, or computer systems designed for physicians offices to handle electronic patient records and digital images. For example, Texas Instruments' embedded devices unit, which provides chips for cars, medical imaging equipment, and other industry devices, reported revenue growth of 6% in Q4 2007, 11% in Q1 2008, and 12% in Q2 2008, before plunging in both Q3 and Q4 of 2008 as target industries like automotive crashed (see Figure 4-1). Smart meter vendors like Elster Group and Landis+Gyr, although they don't report quarterly revenue growth, did report good revenue growth for 2008 as a whole compared with 2007.

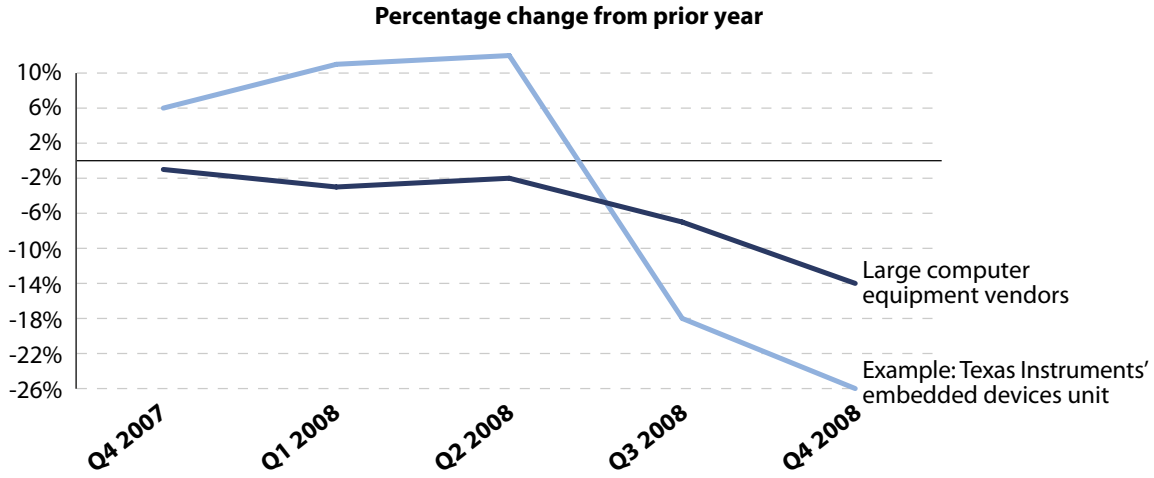
- **Videoconferencing, unified communications, and mobile telecom equipment.** Routers, switches, and other telco equipment had a very strong Q4 2007 and modestly positive growth through Q3 2009. Smartphones from Research In Motion (RIM) and Apple also had good growth (although at the expense of traditional cell phones and mobile devices). But videoconferencing equipment and unified communications equipment did far better. The big telco equipment vendors like Alcatel-Lucent, Cisco, Ericsson, and Nokia Siemens Networks sell this equipment, but the results are buried in their total revenues. The strong growth in demand is clear in results of specialist vendors like TANDBERG in videoconferencing (now being acquired by Cisco) and Interactive Intelligence in unified communications, which both had growth in excess of 10% in the US through Q2 2008 and continued to show positive (or at least flat) growth in the rest of the year at a time when the US revenues of the large vendors were dropping substantially (see Figure 4-2).

- **SOA infrastructure and business intelligence (BI) and analytical software.** Software in general had positive growth in late 2007 and also saw positive growth the first three quarters of 2008. But sellers of application servers and service-oriented architecture (SOA) infrastructure grew much faster, as did sellers of BI and analysis software. With the exception of pure-play BI public companies like MicroStrategy and Actuate, all the big sellers of BI software are either parts of larger software vendor or private companies; so it is difficult to track quarterly demand in that area.[4] However, anecdotally, the vendors did report strong revenue growth in that period.[5] In application servers and SOA, IBM WebSphere and TIBCO Software have quarterly reported revenues that showed much stronger growth in early 2008 — although both got caught in the downturn in software investment after Q3 2008 (see Figure 4-3).

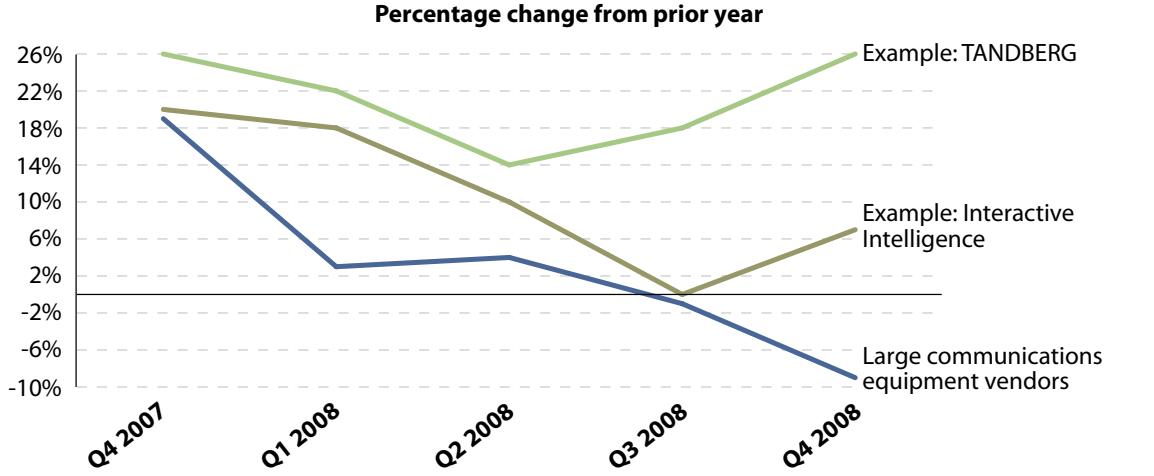
 

**Figure 4** Tech Investment Started To Take O In Late 2007 But Not In Old Tech Categories

**4-1 Specialized industry devices were still growing when PCs and servers fell**



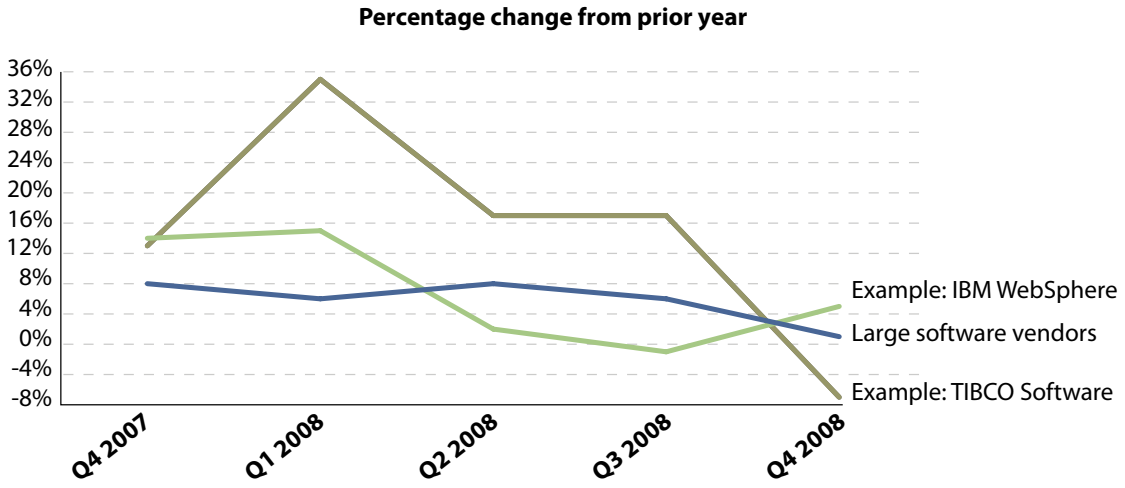

**4-2 Videoconferencing and unified communications boomed while routers and switches started to fall**




55157 Source: Forrester Research, Inc.

**Figure 4** Tech Investment Started To Take O In Late 2007 But Not In Old Tech Categories (Cont.)

**4-3 SOA and businesses intelligence outpaced ERP and infrastructure software**

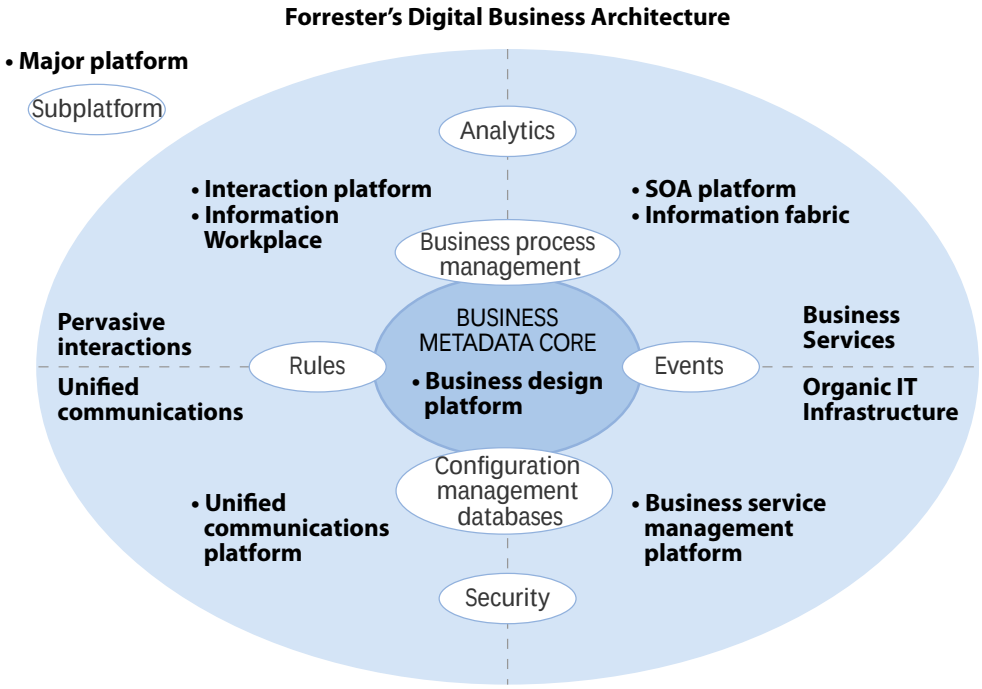



55157 Source: Forrester Research, Inc.

This pattern of IT purchases in late 2007 and early 2008 shows the emergence of a new generation of technology — Digital Business Architecture — introduced by Forrester Vice President and Principal Analyst Randy Heffner.[6] This new generation of technology is more than just new computer hardware and software as was the case with mainframe computing, personal computing, and network computing. It is more than a movement to a new tier of computing, as occurred with the transition from one-tier architectures of mainframe and personal computing to the two-tier client-server and three-tier architectures of network computing. Digital Business Architecture represents innovations in four domains of technology: 1) business services software; 2) Organic IT server-based computing; 3) unified communications in network technologies; and 4) pervasive interaction from client devices (see Figure 5).

**Figure 5** Digital Business Architecture Is The Convergence of All Tech Domains




Source: July 3, 2007, "A Taxonomy Of Platforms For Your Digital Business" Forrester report

55157 Source: Forrester Research, Inc.

## THE FIVE A'S OF SMART COMPUTING

What is important in these technology innovations is the combined impact. While there is standalone value in each of the innovations in software systems, server infrastructure, network infrastructure, and client devices, it is the combination of all these innovations that will allow computing technologies to become smarter. Smart Computing can do this because it combines five key functions of intelligence — what we call the five A's of Smart Computing.

If we think about any concept of smart behavior or smart actions, these consist of five stages of activity. Smart Computing uses digital business architecture technologies, either brand new ones or new deployments of existing technologies, to support each of these five stages of intelligent activity (see Figure 6):

- **Awareness.** New technologies for pervasive interactions such as radio frequency identification (RFID), sensors, video cameras, global positioning system (GPS) chips, smart cards, and other tools will capture data on the identity, status, condition, and/or location of people and physical

assets — data that indicates anomalies that present a business opportunity, activity, threat, or risk.[7] Unified communications technologies such as third-generation (3G) wireless networks will transport this data from these client devices back to central servers for analysis.

- **Analysis.** Business intelligence and specialized analytical software such as data mining and predictive analytics, video image analysis, pattern recognition, and artificial intelligence algorithms will determine whether businesses or governments should act on or ignore a pattern or an anomaly. Businesses and governments have already been using these analytical tools for making sense of historical data, as well as for starting to make predictions about what may happen next. But now, they will be deployed against the real-time data being transmitted from the new awareness devices. Analyzing and storing the massive amounts of data that will be received is only possible with the more flexible and adaptable servers and storage devices enabled by server virtualization, data center automation, and storage life-cycle management — as well as the potential for more flexible processing expansion and storage capacity through cloud computing. Expect more of the basic processing that sifts out meaningful information from background noise to happen at the fringes of the unified wireline and wireless broadband networks that connect to the awareness devices. For this analysis to have business value, though, it will need to present alternatives.

- **Alternatives.** Rules engines and workflow are the existing technologies for deciding which alternative courses to pursue, either automatically through the application of a rule that says "if this happens, do this," or through human review based on workflow engines that route the anomaly and alternative courses to the right person to make a decision.[8] The basic function of rules engines and workflow will stay constant — seismic leaps will be necessary in the data flow and analytical inputs in a world of vastly expanded real-time awareness. For example, rules engines will need to adapt and change their rules on the fly (based on new analysis of what the best alternatives should be), and workflow engines will need to change rapidly what alternatives should be presented to which people based on the seriousness of the issue. In either case, once a human being or a rules engine makes a decision on what to do, that decision should trigger the requisite actions.

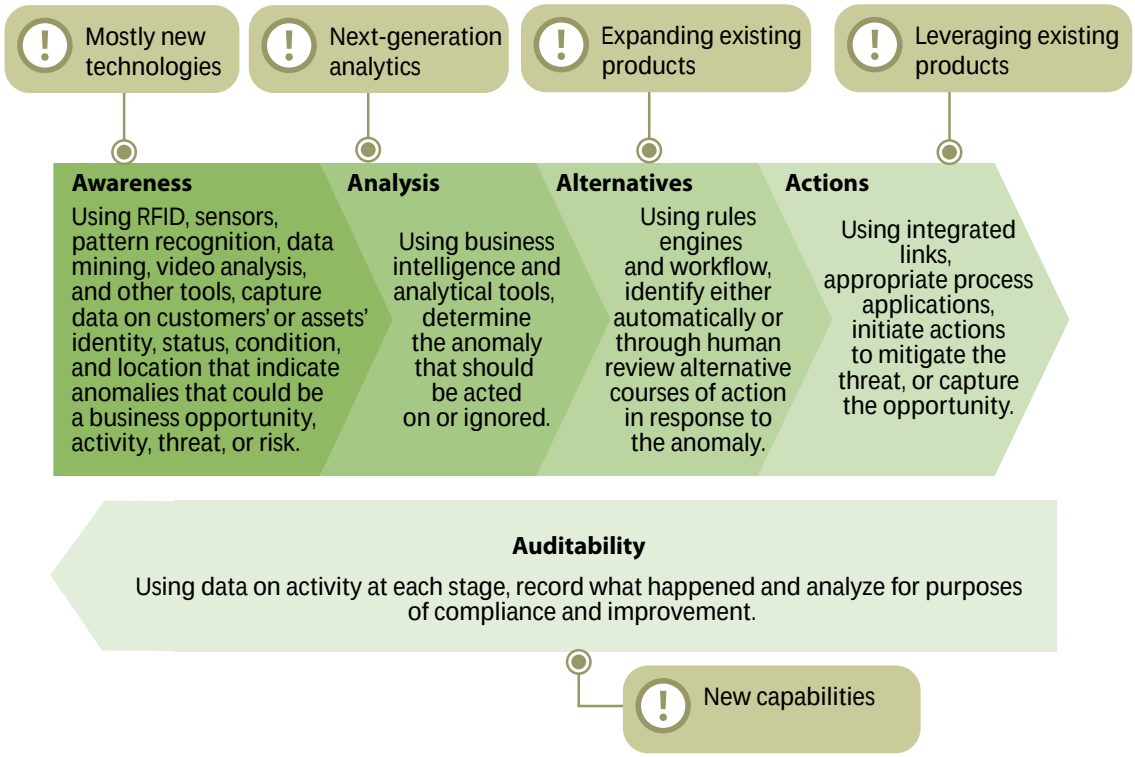
- **Actions.** The action may be as simple as quoting a different price, placing a new order, making a new offer to a customer, or initiating a customer service contact. Or the action may be as complex as adjusting thermostats in tens of thousands of households and businesses to avoid an electricity brownout. These actions will be executed through integrated links to the appropriate process applications. The spreading conversion of process apps to service-oriented architectures will allow these process apps to be adapted to business scenarios, with specific app components pushed down to the awareness devices where they can execute that action, whether that is alerting a citizen on her smartphone to the updated arrival time of a bus that was stuck in traffic, notifying a doctor on a tablet device about the drug allergies of a patient he is about to

see, or directing the thermostat in an individual home to raise the temperature by turning up the air conditioner by three degrees. But whether the right action was actually taken can only be determined if there is auditability.

- **Auditability.** Tracking all steps in the process to aid in regulatory compliance, compliance with company policies and goals, and improvement opportunities is critical. Any definition of "smartness" includes elements of monitoring activity and learning how to do it better. Technology needs to capture, track, and analyze information on each stage of this cycle to make sure that the right actions were taken and to learn how to improve the analysis and identify better alternatives.

**Figure 6** The Five A's Of Smart Computing




55157 Source: Forrester Research, Inc.

### Innovations In Awareness Will Have The Most Revolutionary Impact

Of all these A's, the most profound changes are coming in the area of awareness. There is a recent consumer example of this from satellite navigation systems, highlighted in a recent "Technology Quarterly" article in *The Economist*.[9] Today, satellite navigation systems use pre-loaded maps and a GPS signal to the device to plot a car's location and trigger guidance on what course to follow. That guidance lacks any awareness or knowledge of current road conditions or traffic loads, happily guiding a driver to the expressway that is now jammed thanks to a three-car pileup six exits down the road. However, the cell phone that the driver is carrying, or the satellite navigation device itself, sends signals about the car's location at any time. These signals can now provide the satellite navigation provider with awareness of the location and movement — or lack thereof — of many of the cars on the road.

Improved analytical tools can then use this awareness data to identify locations where traffic is slowing or a traffic jam is starting to clear, presenting the driver with alternatives as to whether it will be better to take the next exit or stay on the road because traffic will soon be moving. And the driver can now take the appropriate action — or perhaps in the future the car's autopilot will do so. Businesses and government regulators can audit each of these activities to make sure the provider (for example) is not discriminating in its presentation of alternatives (e.g., all drivers of BMWs get the best information, while those driving Dodges get the bad advice) and to improve the quality of the analysis. But without the awareness of traffic conditions (created by the growing ubiquity of cells phones and satellite navigation systems that provide real-time data on location), the rest of the A's in this scenario would not be possible.

## WHY SMART COMPUTING WILL DRIVE A NEW WAVE OF TECH INVESTMENT

Like all of the prior waves of new computing technology, Smart Computing will not gain adoption because it is new or cool, nor will it drive rapid growth in tech investment if it is simply cheaper or better at solving existing problems. New technology leads to rapid growth in tech investment only when that new technology helps solve problems that could not be solved before. Smart Computing will meet this test because it allows businesses, governments, and nonprofits to tackle previously unsolvable critical problems. Other highly publicized new technologies — notably cloud computing — do not and so are not nearly as significant (see Figure 7).

What are these critical problems that prior technologies have not been able to solve? Look back at the three prior waves of technology, and the answer starts to become clear through a process of elimination (see Figure 8). Remember:

- **Mainframe computing helped automate high-frequency transactions.** High-frequency transactions include booking an airline reservation, making a bank deposit or payment, generating a utility or telephone bill, underwriting an insurance policy or processing a claim, or paying a government benefit. So, that problem has been largely solved.

- **Personal computing helped automate individual transactions.** Individual transactions include writing a letter, memo, or report; analyzing financial data in a spreadsheet; or preparing a presentation for an audience of managers, employees, or customers. So, that problem has largely been solved.

- **Network computing helped automate key business processes.** Business processes include paying a supplier, billing a customer, taking an order, buying from a supplier, hiring and paying an employee, and manufacturing a product or designing one. While opportunities still exist to automate other processes (for example, generating a contract or creating a sales proposal) as well as to link related processes, most of the big efficiency gains from process efficiency have already been realized.

**Figure 7** What About Cloud Computing?

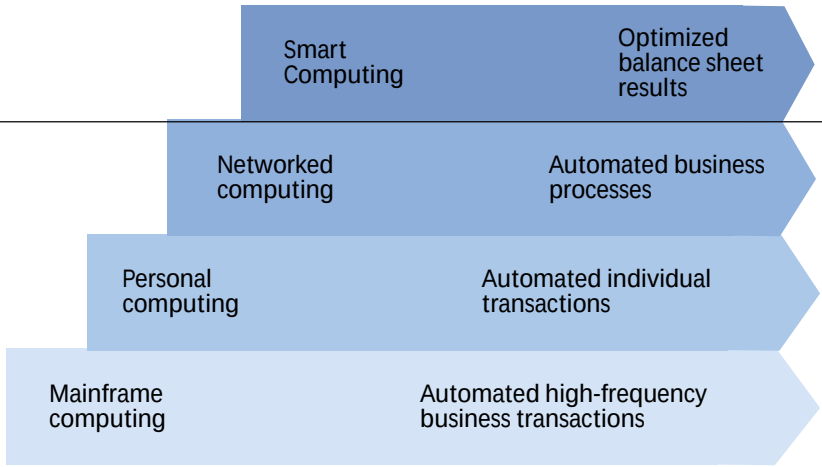
**C**loud computing in all its layers (infrastructure-as-a-service, platform-as-a-service, and software-as-a-service) is one of the underpinnings of smart computing. It will have more impact on how IT operates than it will on how businesses use IT.

**I**n terms of the limits of cloud's transformative potential, remember that cloud computing is essentially a rental option to the classic ownership model for technology. It provides an alternative payment method (pay on a usage or subscription basis) and an alternative delivery model ("we manage the technology for you") to buying technology up front and running it in your own environment. But, the pros and cons of owning something instead of leasing or renting it have not changed.

**F**or IT departments, cloud computing in its various permutations is important because it creates a rental option in an area where only an ownership option existed before (apart from a limited degree of computer equipment leasing). The availability of this option means that cloud computing will grow at the expense of classic purchase technology, as CIOs and IT departments start to take advantage of being able to rent technology where it makes sense to do so. But owned technology will not disappear, just as home ownership and purchases of cars still persist — and in some instances it will actually grow.

55157 Source: Forrester Research, Inc.

**Figure 8** Smart Computing Will Help Solve Balance Sheet Business Problems




55157 Source: Forrester Research, Inc.

These three waves of technology have mostly had a business impact on the income statement. They reduced expenses through efficiencies that reduced the role of people and paper, eliminated errors and re-work, and shortened cycle times. Or they increased revenues by improving customer acquisition and retention, removing barriers to purchase, opening up new sales channels, and shortening cycle times.

There are of course big income statement challenges that still need the right technology solution. New business processes are arising to take advantage of what technology can enable, such as customer-driven product innovation; crowd-based problem solving; and contract-driven pricing, quoting, configuration, or services. And while many business processes have become more efficient (thanks to network computing technologies), there is still room for making them more effective by applying rules engines, workflow, analytics, and business process management to help processes deliver better, more optimal results. These are all areas where Smart Computing solutions can deliver real value to the business, through the introduction of Smart Computing process applications based on the design principles that Forrester has called Dynamic Business Applications.[10]

Still, the next big business challenge lies more in the balance sheet — in optimizing the value of and the returns on assets and minimizing the costs and risks from liabilities. New tools will provide businesses and governments with far better real-time awareness of the status of their assets and liabilities, as well as vastly improved analysis of how to maximize the returns from the assets and the costs and risks from their liability. Today, companies and governments have awareness and analysis of their financial assets and liabilities (although these areas still have ample room for improvement). In the next phase, awareness and analysis of the balance sheet will focus on

physical assets and liabilities, such as cars, trucks, airplanes, office buildings, hospitals, transmitters, pipelines, equipment, and machinery. And awareness and analysis technologies will quickly spread to intangible assets like intellectual property, brand, customer or supplier contracts, or knowledge workers in a workforce.

The abilities of Smart Computing to optimize the management of the balance sheet will meet a ready audience because the current recession has heightened CEO awareness of the importance of the balance sheet. The 2008 to 2009 recession was in many ways a balance-sheet-driven downturn. The housing crisis that was the trigger for the downturn was the result of consumer mortgage liabilities getting way ahead of the sustainable value of the home assets that consumers borrowed against. Similarly, the financial crisis that pushed the global economy to the brink of a depression occurred because of major imbalances between bank liabilities and assets — imbalances that had to be closed through massive infusions of government support. CEOs understand that they need to pay much more attention to the balance sheet, and the risks and opportunities that lurk in it, and not just the income statement of revenues and costs.

## Getting Concrete: Three Examples Of Smart Computing Today

Better technology generates more revenues when it allows businesses and governments to do new things with technology by addressing and solving problems that older technology could not solve. Examples of that kind of better technology come from combinations of these technologies:

- **Real estate performance management systems.** Until 2004, Accruent was a software vendor selling a real estate contract management product, a focused application that about 300 clients use to track and manage their real estate contracts. However, when Edward Lampert bought Kmart in 2003 and then Sears Roebuck in late 2004 on the basis of their undervalued real estate assets, other retailers suddenly realized that they were sitting on portfolios of real estate assets that they knew nothing about. Seizing on this market opportunity, Accruent repositioned its product in July 2006 as a real estate performance management solution specifically for retailers. It could provide retailers with awareness of their real estate contracts, the location of their properties, and the demographics of their property markets. It helps retailers analyze where their properties were located in relation to competitors' properties and to customers, and it linked this analysis to application modules for lease administration, facilities management, project management, and site selection. While Accruent may not have provided retailers with real-time awareness of property status and condition (although it could be added), simply consolidating existing data about properties has been a distinct improvement for retailers in optimizing the value of their real estate assets and has allowed Accruent to double its price point for its solutions.[11]

- **Smart meter and smart grid systems for utilities.** Smart meter systems use small computer chips to capture real-time electricity usage in homes and businesses, with that information relayed via wireless networks to central servers at the utilities. Smart grids put sensors

throughout the electric distribution networks that provide utilities with much better awareness of end-customer demand and traffic through their power grids. Utilities then analyze that data to detect heavy use patterns, make predictions about the future, and take corrective actions in the form of sending instructions back to the home or businesses to shut off non-critical equipment (such as a dishwasher) for a period of time or adjust thermostats up or down a few degrees. Within the grid, power can be diverted into storage systems (such as pumping water up to the top of a reservoir) or drawn from storage. Many vendors are active in this arena — including smart meter vendors like Elster, Itron, and Landis+Gyr; power generation equipment vendors like GE and Siemens; network equipment vendors like Cisco; existing software vendors like Oracle and SAP or startups like GridPoint and Silver Spring Networks; and IT services vendors like IBM and HP/EDS. Utilities like Pacific Gas & Electric in California, Hydro One in Canada, and Enel in Italy are already seeing benefits.[12]

- **Healthcare and patient records management systems**. The healthcare industry, especially in the US, has been slow to adopt technology. True, most major hospitals have hospital management systems; invest in expensive computed tomography (CT) and magnetic resonance imaging (MRI) technologies; and equip doctors, nurses, and technicians with PCs and increasingly tablet computers. However, with some conspicuous exceptions, electronic patient records are still few and far between, and many physicians and smaller hospitals have only the most basic of computer equipment. Denmark has an electronic health records system that covers virtually the entire population, creating awareness of all current and past treatments, medications, and patient histories that physicians and nurses can access at the time of treatment. The US Veterans Health Administration and Kaiser Permanente in the Western US provide such a system as well. Once awareness of patient records and treatment has been established, then analysis can be done across many patients to determine which treatments have been most effective with the lowest cost, leading to better healthcare delivery and improved economics. However, the challenges are significant, especially getting physicians, nurses, and other healthcare providers to use the systems and reassuring patients that their records will be kept private. For example, the UK's project to convert the National Health Service to electronic records is behind schedule and well over budget, with mixed results so far.[13] Still, dozens of tech vendors are pursuing this market, including Accenture, Cerner, GE, IBM, Siemens, and many others.

These are just a few examples of Smart Computing solutions that are emerging. Other examples include solutions for transportation, such as improved traffic management like the London congestion charging system that imposes variable fees for autos entering Central London, and smart bridges like the I-35 bridge in Minneapolis, Minnesota, that contains more than 300 sensors to track the effects of corrosion, temperature, and icing on bridges.[14] In the future, we expectSmart Computing solutions will emerge for education (combining display devices like smart boards, student laptops, and video systems with online learning tools to help students learn at their own pace, work collaboratively, and access the teachings of peers or remote teachers) and for professional

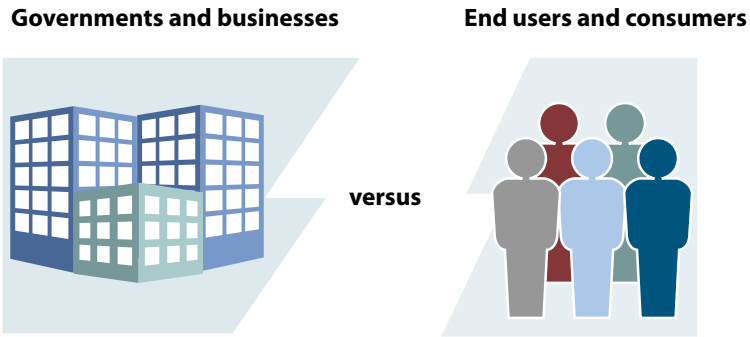
 

services industries (new tools for knowledge capture and knowledge sharing; collaboration on projects; and improved project definition and project management to help legal, consulting, accounting, engineering, or research firms optimize the returns from their human assets).

As these examples suggest, the benefits of Smart Computing for business will be real and substantial. But the risks and obstacles are just as real and substantial. Apart from issues of security, standards, and interoperability, as well as the process and organizational changes that accompany any new technology, Smart Computing will raise some very troubling issues of customer data privacy. As utilities start to gain awareness of how end customers are using electricity and natural gas, as healthcare providers start to build awareness of the disease and treatment history of their patients, and as GPS vendors gain insight into the location of the cars using their systems, the temptation of these companies will be to use this information for their own benefit. That way conjures up images of an Orwellian Big Brother (whether Big Brother is government or corporate giants). Addressing up front the question of who controls and gains from Smart Computing will be key to its public acceptance and thus to the success of its adoption by business (see Figure 9).

**Figure 9** But Who Will Control Smart Computing?

With Smart Computing looming on the horizon, it is critical to recognize that end users and consumers will only accept it if they get control of the results. Rather than utilities using the data on end consumer electricity use to try to control that use from their end, they will need to provide this information to consumers to allow them to make their own decisions about usage. Experiments that IBM has done with providing consumers graphical data on their energy users has shown that informed users will take steps to cut their own usage. Similarly, *The Economist* has argued persuasively in its survey of healthcare and information technology about the need to give patients control over their own electronic records if they are going to accept this technology.




And, in the GPS example cited previously, it actually makes more sense to pass the information about looming tra□c jams to individual drivers to let them make their own decisions, rather than having highway authorities posting electronic alerts to all drivers. After all, the best way to deal with an impending tra□c jam is to get 10% to 15% of drivers on their own shift to an alternative route, rather than having 100% of drivers do so, thereby creating a new tra□c jam.

55157 Source: Forrester Research, Inc.

## SMART COMPUTING WILL HAVE BIGGEST IMPACT AS VERTICALS 3.0 INDUSTRY SOLUTIONS

The business examples that we've cited demonstrate another characteristic of Smart Computing — a very high degree of vertical industry focus. As we noted, businesses will adopt Smart Computing technologies because they help them address the key challenge of optimizing the value of their balance sheets, allowing them to move beyond financial assets and liabilities to their physical assets and liabilities (like electric grids or hospitals) and then to their intangible assets and liabilities (like a skilled workforce or brand). Assets and liabilities tend to be very industry-specific, even more so than processes that may be common across industries. And the task of optimizing the value of these assets and liabilities is definitely industry-specific because what optimization means will vary dramatically from industry to industry. For example:

- **Financial services firms focus on financial assets and liabilities.** A financial services company will place most emphasis on optimizing the value of its financial assets and liabilities, a medium emphasis on optimizing the value of its human assets, and a low value on optimizing the value of its physical assets.

- **Utilities, telecommunications, and transportation firms emphasize physical assets.** Companies in these industries rely on vast quantities of physical assets, which require large capital investment. Business returns in these industries depend heavily on how extensively these assets are leveraged, as well as how firms can predict, minimize, and manage breakdowns in these physical assets more effectively when they do happen.

- **Professional services firms value human assets the most.** A professional services firm that does primarily consulting will place most emphasis on optimizing the value of human assets, medium on financial assets, and lig wciedium on financial assets, and lt(i)1(c)-3n3(s)5(s)-8(ets, a)9(n)4(d lt(i)1(cz91

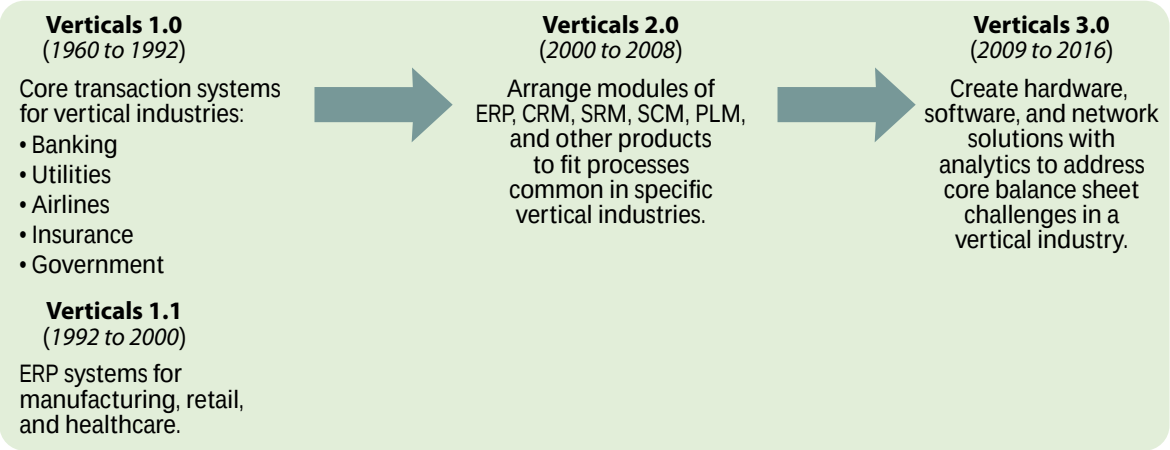
 

insurance carriers, and government agencies. The second release of verticals 1.0 (V1.1, as it were) came in the early days of network computing when ERP vendors like Baan, Oracle, and SAP built core manufacturing management systems for manufacturers. Similarly, vendors like Retek (acquired by Oracle in 2005) and JDA Software built similar systems for retailers, while Cerner, Shared Medical Systems (acquired by Siemens in 2000), HBO & Company (acquired by McKesson in 2000), and IDX (acquired by GE in 2006) created healthcare management systems for hospitals.

- **Verticals 2.0 shuffled process app modules appropriate for different industries.** This version of verticals started to surface in the 2000s as the large app vendors like Oracle and SAP started to show how clients in different vertical industries could arrange modules of their ERP, CRM, supplier relationship management (SRM), SCM, PLM, and other products to fit processes common to those industries. SAP took this approach the furthest, creating process maps for dozens of different industries. This approach allowed the vendors to eat the slices of vertical solutions while still retaining the cake of horizontal process applications.[15]

- **Verticals 3.0 will address core balance sheet problems in an industry.** As discussed above, verticals 3.0 will create solutions that combine elements of industry-specialized hardware devices, vertical industry software, and industry-focused wireless/wired networks with industry-oriented analytics to address core balance sheet challenges in a vertical industry. Some current examples moving in this direction include Aptify for association management systems, Blackbaud for nonprofit associations, Cúram Software for government social service agencies, CygNet for oil and gas pipeline optimization software, and SunGard Higher Education for universities.

**Figure 10** Verticals 3.0 Di□ers From Verticals 1.0 And 2.0



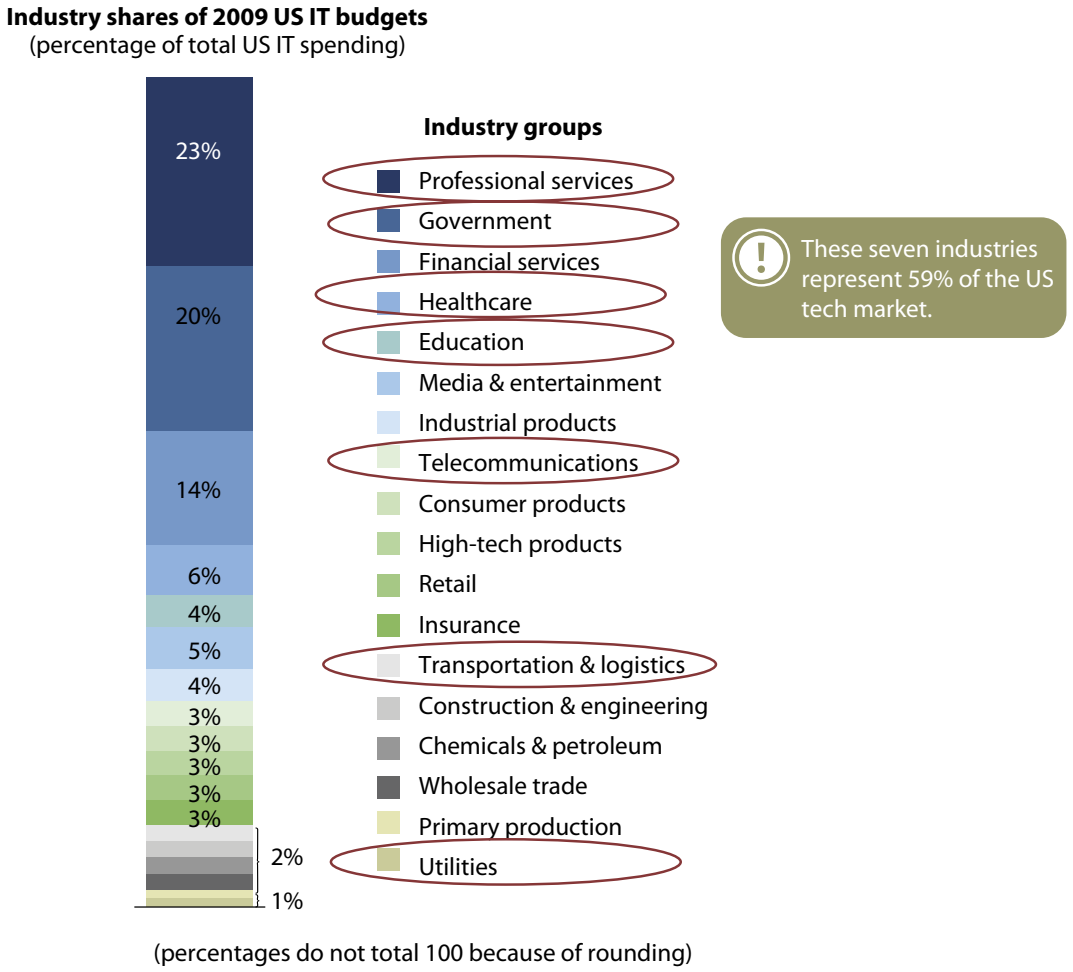

55157 Source: Forrester Research, Inc.

## The Seven Most Important Verticals In 2009 To 2016

Since the era of mainframe computing ended, IT vendors have preferred to pursue horizontal tech markets where they believe they have the most opportunity to sell a product to all firms across industries. This is the model set by the personal computing era, and it continued largely unchanged through the era of network computing. And it continues to be the dominant mindset at most tech vendors.

However, vendors need to understand that tech purchases are not evenly distributed across industries. In fact, our analysis of tech spending by industries shows that the seven industries that can benefit the most from Smart Computing (healthcare, education, government, professional services, transportation and logistics, telecommunications, and utilities) represent 60% of total US IT spending.[16] These are all industries where balance sheet optimization is more important than process efficiency and where the need for Smart Computing technologies is critical (see Figure 11).

**Figure 11** Asset-Intensive Industries That Benefit From Smart Computing Are Big IT Spenders




Source: May 7, 2009, "US Enterprise Versus SMB IT Budgets In 2009" Forrester report

55157 Source: Forrester Research, Inc.

Remember, also, that these industries are major beneficiaries of the economic stimulus program in the US.[17] So, they have funds to invest in Smart Computing technologies (see Figure 12).

In short, vendors that choose to build Smart Computing solutions that focus on vertical industries —

## PLAYING THE ANGLES: WHERE THE OPPORTUNITIES IN SMART COMPUTING WILL LIE

Where will tech dollars flow in the next seven to eight years? It may seem that the answer is all into Smart Computing technologies. But technology markets don't work that way. Existing technologies — servers, PCs, routers, switches, database management systems, ERP software, etc. — don't go away. Indeed, well-established, mature tech products will continue to represent the bulk of technology purchases even eight years from now. The problem is that revenues from these products won't grow by much. Instead, almost all of the growth will occur in three areas:

- **The Smart Computing foundation technologies.** These next-generation technologies of unified communications, microcomputing devices, virtualized computers and storage devices, and SOA software infrastructure provide the foundation for Smart Computing. In the next one to three years, vendors of these product categories can expect to see a 17% compound annual growth rate (CAGR) as companies purchase these technologies both to capture their immediate cost savings and to get prepared for Smart Computing. However, growth will be strongest in the first few years and then slow as the infrastructure gets fleshed out.

- **Smart Computing process applications.** Based on the design principles articulated in Forrester's definition of Dynamic Business Applications, these new software products will help to automate untouched processes (e.g., contract management, marketing automation, sales proposal generation, strategic plan development, complex services fulfillment), link existing process applications (e.g., demand chains with supply chains), and improve the business results from existing processes. Also included in this category will be the Information Workplace technologies for improving employee collaboration.[18] Current specialist vendors like Pegasystems, Oracle Fusion Applications, and Epicor Software will be joined by IBM, Microsoft, and SAP (among others) in creating these products that will provide a second wind for Smart Computing in the two- to six-year time frame. Collectively, we think revenue for these technologies will grow at a CAGR of 50% between 2008 and 2016 (see Figure 13).

- **Smart Computing vertical industry solutions.** Solutions aimed at helping companies optimize the returns from their balance sheets in the healthcare, utilities, government, telecommunications, transportation, and, ultimately, the education and professional services industries will be the other growth engine for the tech industry. Revenues will come from a combination of software, hardware, and network products sales tied together as a single bundled solution with support services. We think these vertically focused industry solutions will generate revenue growth for tech vendors of 27% CAGR from 2008 to 2016.

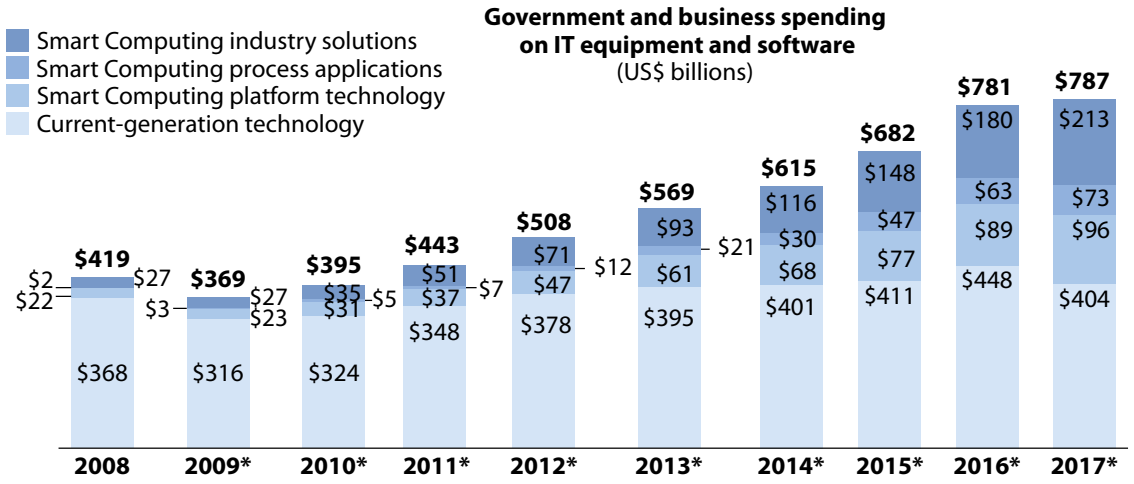
Growth rates aside, we think that the total revenue from industry-focused solutions will outstrip the revenues from Smart Computing foundation technologies by two to one and that they will exceed the revenues from Smart Computing process applications by almost three to one. By 2016, we predict that Smart Computing industry vertical solutions will equal 0.86% of GDP, while Smart Computing foundation technologies will equal 0.42%, and Smart Computing process applications

will be at 0.30% (see Figure 14). Over this eight-year period, we expect that Smart Computing industry vertical solutions will increase their share of the IT market from the 6% that they represent in 2008 to 23% by 2016.

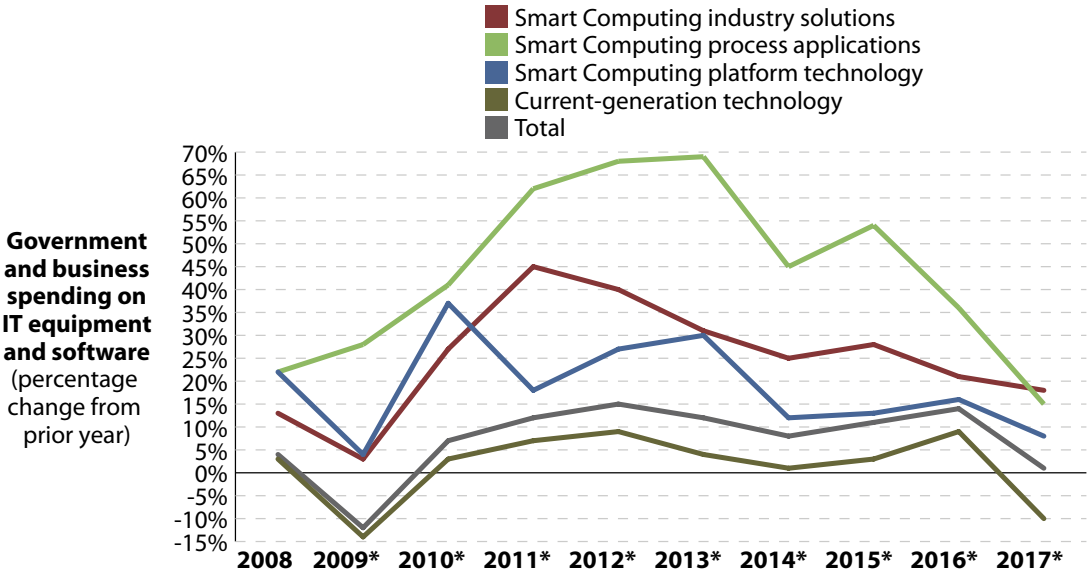
**Figure 13** US Investment In Current-Generation Versus Smart Computing Technologies

**13-1 Current-generation technology will remain much larger than Smart Computing technologies or industry-specific technologies . . .**




**13-2 . . . but Smart Computing and industry-specific technologies will grow much faster**

A spreadsheet with additional data is available online.




*Forrester forecast

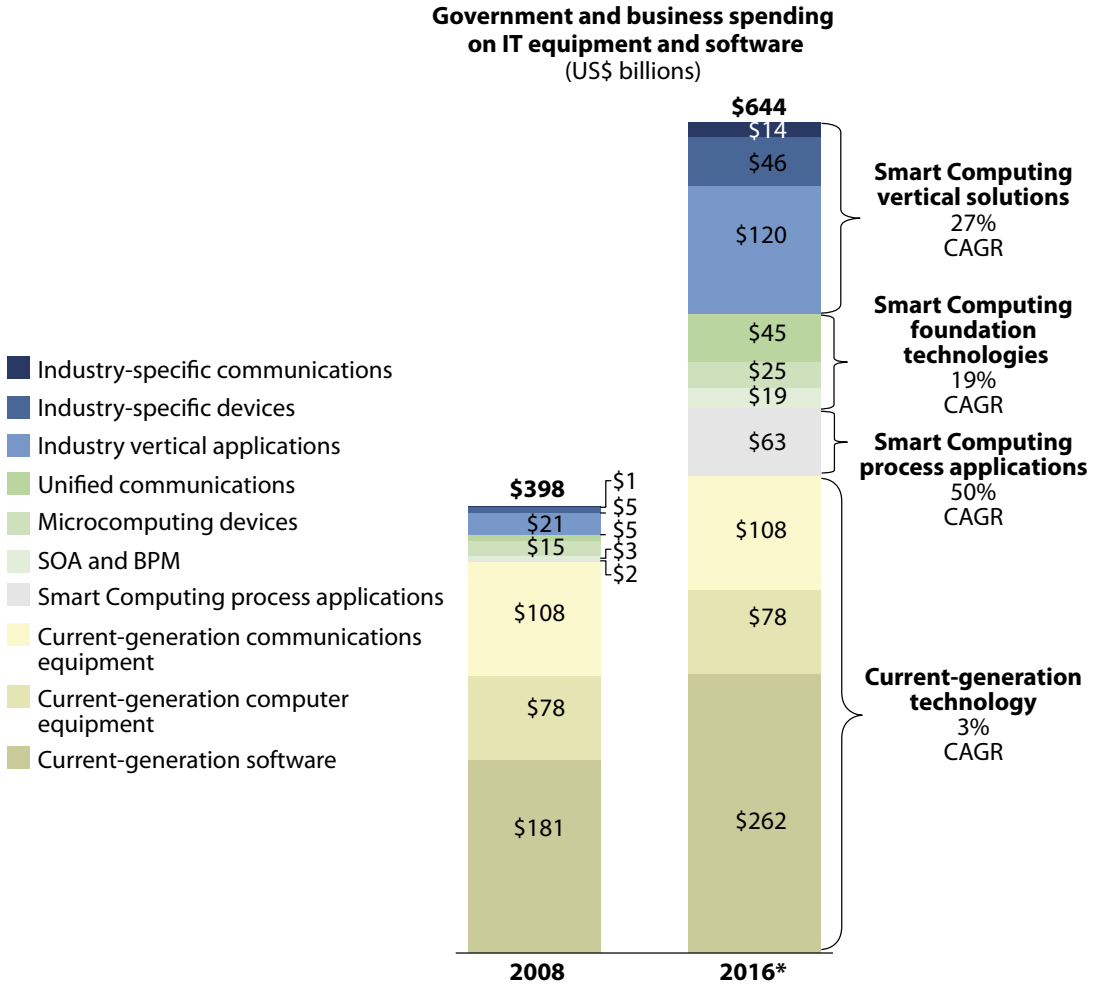
55157 Source: Forrester Research, Inc.

**Figure 13** US Investment In Current-Generation Versus Smart Computing Technologies (Cont.)

**13-3 Unified communications, Smart Computing process applications, and vertical business apps will be the largest of the new technologies**

A spreadsheet with additional data is available online.



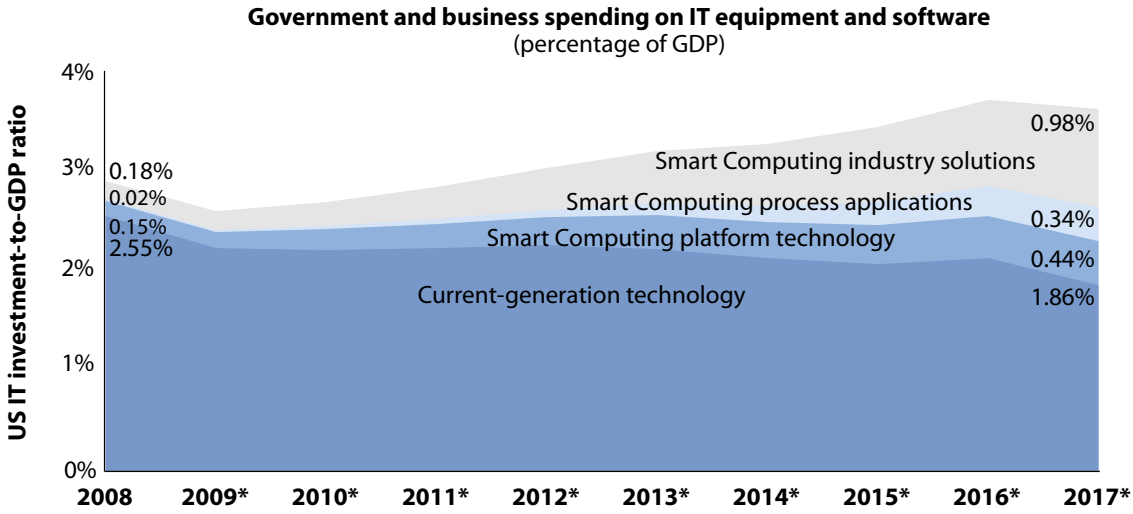

*Forrester forecast

55157 Source: Forrester Research, Inc.

**Figure 14** Current-Gen Technologies Shrink, New Technologies Rise As Percentage Of GDP

**14-1 Smart Computing process applications and vertical industry solutions will drive the expansion of IT's role in the economy**




*Forrester forecasts

**14-2 Smart technologies will expand their shares of the US economy, while current-generation technologies will lose share**

**Government and business spending on IT equipment and software**
(percentage of GDP)

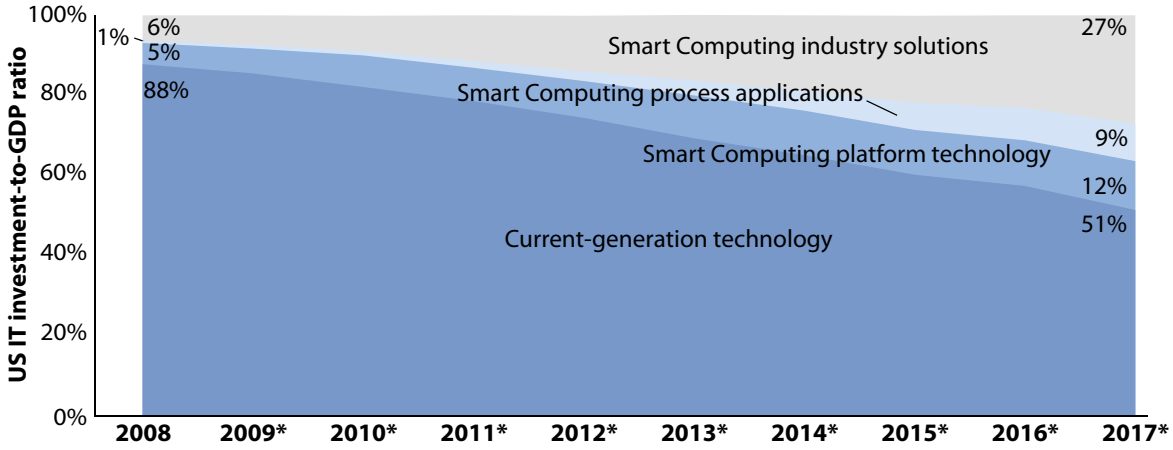
| | 2008 | 2009* | 2010* | 2011* | 2012* | 2013* | 2014* | 2015* | 2016* | 2017* |
|---|---|---|---|---|---|---|---|---|---|---|
| Industry-specific communications | 0.00% | 0.01% | 0.01% | 0.02% | 0.03% | 0.04% | 0.05% | 0.06% | 0.07% | 0.07% |
| Industry-specific devices | 0.03% | 0.04% | 0.07% | 0.10% | 0.12% | 0.15% | 0.17% | 0.20% | 0.22% | 0.25% |
| Industry vertical applications | 0.15% | 0.14% | 0.15% | 0.21% | 0.28% | 0.34% | 0.40% | 0.49% | 0.57% | 0.66% |
| Unified communications | 0.03% | 0.03% | 0.04% | 0.05% | 0.07% | 0.12% | 0.14% | 0.18% | 0.21% | 0.24% |
| Microcomputing devices | 0.10% | 0.10% | 0.14% | 0.14% | 0.15% | 0.15% | 0.14% | 0.13% | 0.12% | 0.11% |
| SOA and BPM | 0.02% | 0.02% | 0.03% | 0.04% | 0.06% | 0.07% | 0.08% | 0.08% | 0.09% | 0.10% |
| Smart Computing process applications | 0.02% | 0.02% | 0.03% | 0.05% | 0.07% | 0.12% | 0.16% | 0.23% | 0.30% | 0.34% |
| Current-generation communications equipment | 0.75% | 0.65% | 0.64% | 0.62% | 0.63% | 0.62% | 0.57% | 0.53% | 0.51% | 0.45% |
| Current-generation computer equipment | 0.54% | 0.43% | 0.39% | 0.37% | 0.39% | 0.34% | 0.36% | 0.36% | 0.37% | 0.34% |
| Current-generation software | 1.25% | 1.15% | 1.19% | 1.23% | 1.25% | 1.25% | 1.21% | 1.18% | 1.24% | 1.06% |
| **Total** | **2.90%** | **2.60%** | **2.70%** | **2.83%** | **3.04%** | **3.20%** | **3.28%** | **3.43%** | **3.71%** | **3.62%** |

55157 Source: Forrester Research, Inc.

**Figure 14** Current-Gen Technologies Shrink, New Technologies Rise As Percentage Of GDP (Cont.)

**14-3 Vertical industry solutions will expand from 6% of the US tech market in 2009 to 27% by 2017**

**Government and business spending on IT equipment and software**
(percentage of technology purchases)




**14-4 The tech market will become more complex as new technologies take share from, but co-exist with, older ones**

**Government and business spending on IT equipment and software**
(percentage of total technology investments)

| | 2008 | 2009* | 2010* | 2011* | 2012* | 2013* | 2014* | 2015* | 2016* | 2017* |
|---|---|---|---|---|---|---|---|---|---|---|
| Industry-specific communications | 0% | 0% | 0% | 1% | 1% | 1% | 1% | 2% | 2% | 2% |
| Industry-specific devices | 1% | 2% | 3% | 3% | 4% | 5% | 5% | 6% | 6% | 7% |
| Industry vertical applications | 5% | 5% | 6% | 7% | 9% | 11% | 12% | 14% | 15% | 18% |
| Unified communications | 1% | 1% | 2% | 2% | 2% | 4% | 4% | 5% | 6% | 7% |
| Microcomputing devices | 4% | 4% | 5% | 5% | 5% | 5% | 4% | 4% | 3% | 3% |
| SOA and BPM | 1% | 1% | 1% | 2% | 2% | 2% | 2% | 2% | 2% | 3% |
| Smart Computing process applications | 1% | 1% | 1% | 2% | 2% | 4% | 5% | 7% | 8% | 9% |
| Current-generation communications equipment | 26% | 25% | 24% | 22% | 21% | 20% | 17% | 15% | 14% | 13% |
| Current-generation computer equipment | 19% | 17% | 14% | 13% | 13% | 11% | 11% | 10% | 10% | 9% |
| Current-generation software | 43% | 44% | 44% | 43% | 41% | 39% | 37% | 34% | 34% | 29% |
| **Total** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** |

*Forrester forecast

55157 Source: Forrester Research, Inc.

For today's technology vendors, the challenge will be how to play this market shift.

- **"Stick to your knitting" will only work for a few scale players.** For most vendors, selling existing servers, PCs, storage devices, and enterprise applications will be a recipe for shrinking revenues, given the impacts of cloud computing on these product markets. But demand for these purchased technologies will not disappear. A few vendors that focus on being the consolidators of these shrinking but still large product markets will be able to survive and even thrive.

- **A feeding frenzy will go after the Smart Computing horizontal technologies.** Vendors that are committed to a horizontal sales model will view the projected growth rates for Smart Computing technologies — whether for platform technologies or for new process applications based on Dynamic Business Application principles — as their opportunity to escape the prospect of commoditized current products with lousy growth rates. The problem is that many other vendors will also be pursuing the same market opportunity. Lots of vendors fighting for the same market will mean a few winners and many losers.

- **Vertically focused vendors will thrive or struggle as their verticals do.** The biggest opportunity will be in Smart Computing vertical solutions to help companies in specific industries optimize the returns from their balance sheets. But, this is by no means a risk-free strategy. Focusing on some verticals means giving up potential opportunities in others. Focusing on very narrow verticals with no leverage to other verticals puts a cap on growth. Focusing on a vertical that goes into a steep economic decline (think of the auto industry or banking in 2008 and 2009) means that you suffer as that vertical suffers. Yet, there are many verticals — and even more microverticals — and each will be willing to pay a lot of money for technologies that can get it significantly better returns from assets and liabilities.

## The Role Of IT Consulting And Outsourcing In Smart Computing

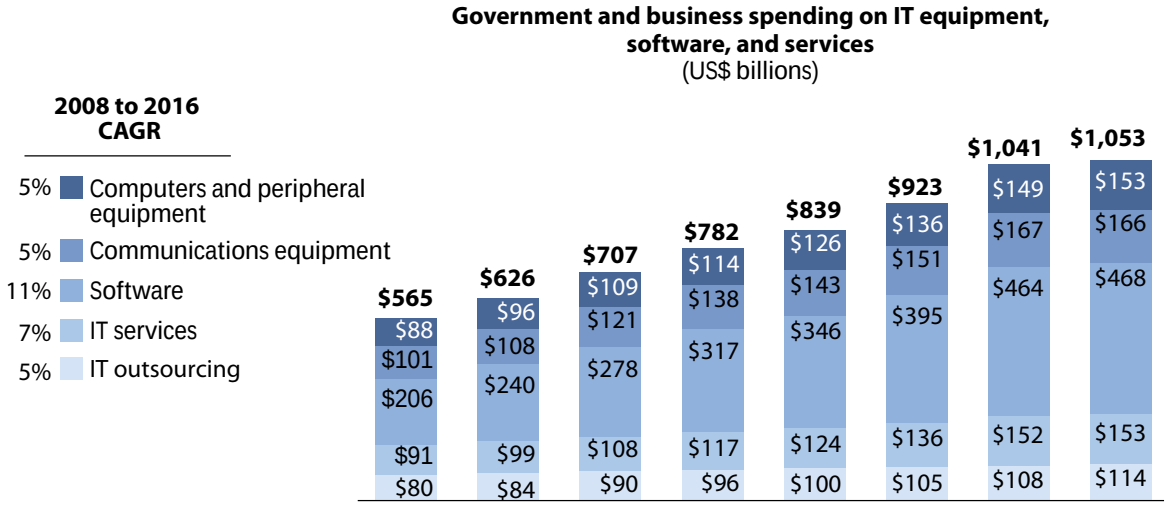
The analysis so far has largely focused on vendors that sell tech goods — hardware and software. What does Smart Computing hold for vendors that sell tech services, such as IT consulting and systems integration work or IT outsourcing?

- **IT consulting and systems integration vendors have a mixed outlook.** In the short run, companies will need consulting help to plan strategies for SOA, unified communications, and the emerging Smart Computing solutions. Systems integration (SI) projects will also do well in 2010 as companies revive their postponed capital investment plans for CRM, ERP, SCM, SRM, and other stalled applications. However, the emergence of Smart Computing solutions for different verticals will present challenges for IT services vendors. The goal of many vendors will be to create semi-turnkey solutions that pull together all the software and hardware needed: for example, a smart meter solution for utilities or a healthcare records management offering for hospitals, not a collection of different products from many different vendors that an SI would assemble as a general contractor on a custom project basis. To the degree that this becomes a

reality, and admittedly it will take a few years before these offerings get productized this way, it will make them much more affordable to clients and speed adoption. But it will also steal revenues from the consultants. So, the consulting firms will need to build out their own software capabilities to compete. As a result, we expect IT consulting and services revenues to track at lower levels then the growth rates in software revenues (see Figure 15).

**Figure 15** IT Services And IT Outsourcing Will Lag Software In This Generation Of Technology

A spreadsheet with additional data is available online.




| % change from prior year | 2010* | 2011* | 2012* | 2013* | 2014* | 2015* | 2016* | 2017* |
|---|---|---|---|---|---|---|---|---|
| Computer and peripheral equipment | 8% | 8% | 14% | 4% | 10% | 8% | 10% | 2% |
| Communications equipment | 3% | 7% | 12% | 14% | 3% | 6% | 10% | -1% |
| Software | 8% | 16% | 16% | 14% | 9% | 14% | 17% | 1% |
| IT services | 11% | 9% | 10% | 8% | 6% | 9% | 12% | 1% |
| IT outsourcing | 4% | 6% | 7% | 6% | 4% | 5% | 3% | 5% |
| **Total IT purchases** | **7%** | **11%** | **13%** | **11%** | **7%** | **10%** | **13%** | **1%** |

*Forrester forecast

55157 Source: Forrester Research, Inc.

- **IT outsourcing vendors have less promise in the next seven years.** Certainly, outsourcing of the last generation of technology will continue because it is common for companies to turn the running and management of mature technologies that provide no competitive advantage over to specialists who can run it more effectively. However, cloud computing will provide an alternative to traditional IT outsourcing; so, some of the tendencies to turn existing technologies over to IT outsourcing will get diverted into acquiring these capabilities as a cloud service. More significantly, the new technologies will be resistant to outsourcing for a while. Whenever a new technology comes along, the last thing that companies want to do is outsource it. Instead, they want to assess it themselves and learn. This is hard to do with an outsourced technology, where the IT outsource vendor controls it, sets terms and conditions for its use, moves at its own pace, and limits adaptation to preserve its own efficiencies and scale economies. As a result, we expect that IT outsourcing will grow at a steady but slow rate of 4% to 6% over the next six or seven years.

## WHICH VENDORS WILL WIN IN SMART COMPUTING?

Vendor success in the era of Smart Computing will depend on four factors:

1. **Ability to pull together the hardware, software, and network elements of Smart Computing.** These solutions will not work if they are a collection of separate hardware, software, and network products from different vendors unless, and until, there are clear standards and protocols that define how each part works with the others. Those standards and protocols for interoperability, security, and performance will come in time. But, for now, vendors that can provide all the elements of a full solution, and can do so as a product that can be sold to many clients, will have the edge over consultants who stitch these pieces together as custom consulting projects or over single-product vendors.

2. **Expertise in the skills and technologies that will be differentiators in Smart Computing.** While Smart Computing involves combining different technology elements, not all elements are equal. Of the five A's of Smart Computing, it is awareness and analysis technologies that will be the differentiators for vendors initially, with technologies for determining the right alternatives coming to the fore in the future. For vendors that go after vertical industry solutions, asset management software (especially IT asset management tools that are connected to networks and have automatic asset discovery and management) and contract life-cycle management (to track and manage the contracts related to these assets and liabilities) will be key technologies. And successful vendors will need to have employees with statistical analysis skills, who can design and set up the systems to create awareness of asset status, structure the analysis of this data, define rules and workflow, and identify the right applications to initiate the appropriate actions.

3. **Ability to play the angles between horizontal and vertical solutions.** In a period when horizontal technologies make up the bulk of IT purchases but grow slowly if at all (and vertical technologies provide much of the growth, but still are only one-quarter of the market), solving

this dilemma will be the biggest challenge that many vendors face. Large vendors with dominant shares and scale economies in horizontal technologies can add elements of cloud computing and consolidation to outpace their stagnating market segments. Small vendors and new entrants can easily prosper in new vertical niches. But everyone else will need to carefully pick the horizontal technologies that they want to master and/or the verticals that they want to dominate and give up the others.

4. **In-depth understanding of the balance sheet issues facing specific industries.** For those vendors that pursue a vertical industry strategy, choosing which verticals to go after will be a key success factor. Because balance sheet challenges tend to be unique to an industry, crafting the right combination of Smart Computing elements to address these challenges requires deep understanding of that industry and those challenges. Shallow understanding of all industries will not cut it. So, vendors will have to focus on some verticals, or even microverticals, and forgo others.

To find a good example of a vendor today that has combined hardware, software, and network elements to create a compelling solution, you have to look outside the world of business IT and look instead at consumer technology. That example is Apple Computer and its nexus of iTunes, iPod, and iPhone products. Like Smart Computing solutions, the Apple product family combines servers and server hardware (at Apple) with mid-client hardware (iTunes software for Macs and PCs) with end client hardware (the iPod or the iPhone) running downloadable, reprogrammable software, linked through generally available network systems. Apple has been adding analytics of user purchases of music and apps to make recommendations for other music or apps that the user might want. Apple's success where other providers of digital music downloads have failed is largely due to its providing a total solution with a well-designed and constantly improving user experience. While Apple initially owned and controlled all aspects of the iPod/iTunes (with iTunes only deployed on Apple Mac computers), it has relaxed that control in non-critical areas, such as allowing iTunes to run on Microsoft Windows computers, allowing independent software developers to offer apps at the App Store, and allowing different wireless carriers to offer iPhones.

Of course, Apple is primarily a consumer-focused tech vendor, with no need for vertical industry capabilities. It hasn't had to face the challenges that a vendor creating Smart Computing solutions for the business world will face. Still, Apple provides a model for creating a Smart Computing solution that pulls together technologies from multiple domains and packages that solution in a way that wins buyer acceptance.

## The Vendors That Will Win In Smart Computing

In the much larger and more complex world of business and government technology, there is no vendor that has the clear leadership position that Apple has in consumer Smart Computing. Here is how we handicap the largest vendors in the race for Smart Computing leadership in the business world (see Figure 16):

- **IBM has a lead position but needs to add apps and overcome its consulting services bias.** IBM already owns many of the hardware, software, and network elements of Smart Computing. Its Smarter Planet marketing initiative shows that it understands that balance sheet issues in key verticals are the biggest opportunities, and it has built enough success cases in these verticals to speak credibly to business executives in these industries. It is creating software frameworks in these industries that combine IBM and partner products to provide solutions. But it will need to acquire client device technologies and key software apps if it is to offer Apple-like product consistency that speaks directly to the client desire for an easy-to-purchase-and-use solution.

- **Oracle has many Smart Computing elements but only a nascent vertical strategy.** Oracle has the apps that IBM lacks, comparable analytics and SOA platform software products, and a presence in hardware through its acquisition of Sun Microsystems. And, it has the potential to offer separately branded vertical solutions as the result of acquiring many vendors and sustaining their brands through its Applications Unlimited policy. Sun puts Oracle at the wrong end of the hardware market, selling servers when virtualization and cloud computing is eroding demand, and so it lacks the client devices needed for true Smart Computing solutions. Most importantly, its vertical strategy is still stuck in verticals 2.0; it has made no clear commitment to making its different brands truly vertical brands, and its understanding of verticals is shallow.

- **Microsoft has to choose between competing with Apple in consumer tech or IBM in business.** Microsoft has the size and resources to compete with IBM and Oracle in Smart Computing, as well as the analytical, SOA platform, and application software products to provide credible solutions in services industries like education and professional services. Its Xbox and Zune offerings, as well as years of working with PC and smartphone vendors, provide experience in client devices. But Microsoft derives too much of its revenues from horizontal technologies like Windows and Office to be able to pivot toward primarily vertical solutions. Above all, Microsoft is as much a consumer tech vendor as it is a business tech vendor. Given the competition that it faces in the consumer market from Apple and Google (among others), Microsoft may not have the appetite to compete with IBM and Oracle in vertical Smart Computing solutions outside of industries like professional services, where the dominant small and medium-size businesses (SMBs) are natural targets for Microsoft Dynamics and Office-based products.

- **GE and Siemens use their strength in key verticals to move into Smart Computing.** Most people don't think of GE or Siemens as IT vendors that compete in the same space as IBM, Oracle, or Microsoft. That is changing. In key verticals like healthcare, GE and Siemens are already providing core software products, as well as selling core medical technology equipment that represents some of the core assets of hospitals and healthcare providers. Both are major providers of power generation and transportation equipment (where they are leaders in adding the sensors and analytical software for tracking the performance and condition of these assets).

They still need to add the software applications and analytical tools to provide full Smart Computing solutions and may never be a factor in most industries. But in healthcare, utilities, and transportation — three verticals that IBM has targeted in its Smarter Planet initiative — they can give IBM a run for its money.

- **SAP is stuck in verticals 2.0 and process automation.** Like Oracle, SAP has both the apps and the analytical engines to put into Smart Computing solutions. However, its SOA platform lags behind IBM's and Oracle's, and it lacks any hardware products to evolve into client device offerings. Perhaps most critically, it seems to be stuck in a verticals 2.0 mindset. The launch of its SAP Business Suite 7 was all about the meta-processes common to all industries, with analytics applied to improve the efficiency and effectiveness of processes. SAP, of course, understands that balance sheet issues do matter, and its product suite can be, and has been, used to address these issues in some industries. But perhaps because SAP's product mindset is shaped by the manufacturing and other goods-producing industries like wholesale that are all about processes, it does not see how critical balance sheet issues are in the services industries where demand for verticals 3.0 will be greatest.

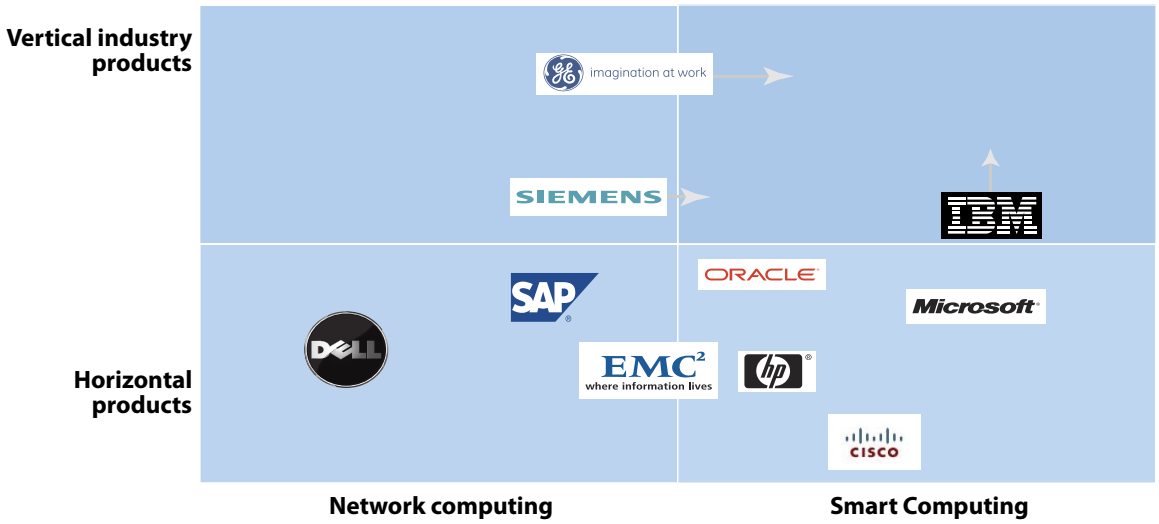
- **Cisco has aspirations to play in Smart Computing but has to overcome its network gear bias.** Network technologies are key elements of Smart Computing solutions, and Cisco has been making acquisitions to strengthen its offerings in the enterprise and other markets. It also has been developing software and client hardware capabilities that in principle could allow it to provide awareness and analytical capabilities at the edge of the network in areas like video analysis. But Cisco is just starting to develop a vertical industry focus, still has major gaps in its software offering, and still tends to think and act like a network gear vendor rather than a Smart Computing solution provider.

- **HP and EMC are still in the horizontal tech space and slow to embrace Smart Computing.** While both vendors have made acquisitions of software vendors, and HP has added EDS, neither has the portfolio of analytical tools and applications needed to offer smart solutions on their own. EDS does bring HP some experience in smart meter systems and other industry solutions, and HP has IT asset management tools and other middleware capabilities that put it slightly ahead of EMC of Smart Computing capabilities. But at this stage, both look more likely to try to dominate their horizontal technology domains then to play in vertical solutions.

- **Dell makes a small move into verticals.** Dell is still primarily a horizontal tech vendor, concentrated in the commoditizing hardware categories of PCs and servers. Combining low costs with high quality has historically allowed Dell to gain share in these markets, and that will probably continue to be its play. However, its acquisition of Perot Systems and its partnership with Wal-Mart to sell healthcare management systems to doctors are signs that it could become a factor in creating vertical solutions in industries like healthcare (or in retail) that have many small businesses.

**Figure 16** Which Vendors Are Best Positioned For Success In Smart Computing?




55157 Source: Forrester Research, Inc.

RECOMMENDATIONS

## SMART COMPUTING WILL FORCE VENDORS AT ALL LEVELS TO RETHINK STRATEGIES

The good news for vendors in this forecast is that the tech market will experience strong growth through 2016, similar in magnitude to the growth from 1992 to 2000. But the engines of growth will be fundamentally di□erent from the past eight years.

- **App software strategists should focus on Dynamic Business Applications or on verticals.** Vendors that sell ERP, SRM, SCM, or other current-generation process apps will still have a few more years of good growth, especially in 2010 and 2011 as recession-delayed projects get revived. But software-as-a-solution (SaaS) solutions will eat into revenues, especially as the large vendors move into the SMB market where SaaS vendors are already present. The best strategy will be to treat these legacy apps as cash cows and concentrate R&D on new niche apps for untapped microprocesses, Dynamic Business Applications, or on vertical solutions.
- **Middleware vendor strategists will be torn between verticals or Smart Computing tools.** For 2010 to 2012, SOA and the rebound from the 2009 recession will keep the order books full for middleware vendors — especially app servers, business process management (BPM), and IT management vendors. After that, growth will start to slow as platform-as-a-service, commoditization, and open source drives prices down. One growth path will be pushing into improved tools linking awareness to analytics, analytics to alternatives, alternatives to

actions, and auditing all these steps, which can be embedded in Smart Computing solutions provided by other vendors. Alternatively, vendors can push upward into the apps and analytics space and create microvertical solutions.

- **Computer and communications hardware vendor strategists will mostly stay horizontal.** While software will become more vertical, hardware will tend to stay horizontal. There are exceptions, such as retail point-of-sale products or physician hardware systems, and there will be even more examples in the future. But the most value will come from providing the full industry solution, not pieces, so hardware vendors that want to provide microvertical solutions will need to beef up their software portfolio. Otherwise, vendors that want to stay in these stagnating horizontal product categories will need to be low-cost providers that drive consolidation to grow.
- **Telecommunication service vendor strategists need to partner.** Wireless, broadband telecom services will be key parts of many smart industry solutions. In some cases, there will be opportunities for telcos to build special networks for machine-to-machine interactions, especially in industries with unique security or deployment challenges. But, in general, telecom services will be the most commoditized parts of the solutions, with limited room for vendors to differentiate themselves. And telcos have not had a stellar track record as systems integrators. Their best course of action is to partner with the top providers of Smart Computing solutions, contributing the network component, delivering leads, and sharing in the profits.
- **Chip vendors should stay horizontal, with selective forays into vertical products.** Of all the tech vendor categories, chip vendors are the most likely to remain horizontal vendors. Similarly, the strategies of chip vendors are the least likely to change. But even here, there will be selective opportunities for chip vendors like Intel, Texas Instruments, and Qualcomm to create vertical variations on their core products and sell these as end client devices. Texas Instruments and Qualcomm have already had successes using this approach. These vertical chips results may represent no more than 10% of the volume that these vendors sell, but they could well be the most profitable segment.

WHAT IT MEANS

## SMART COMPUTING WILL BE A 16-YEAR CYCLE OF GLOBAL TECHNOLOGY CHANGE

This report has focused on the US tech market, and the next seven- to eight-year period. But Smart Computing will of course be a global phenomenon, and historical precedent shows that it will include both the eight-year period of introduction and growth described here and the subsequent eight-year period of tech digestion and refinement. From this broader context, here are three examples of what Smart Computing will mean:

- **Other countries will follow the US with shorter, longer, or no lags.** The US is still the largest IT market in the world, the most advanced, and has the widest adoption of technology across all industries and sizes of companies. However, there are other countries that have similar levels of technology adoption, and, in specific areas, they could well take the lead over the US. We have called these countries the Tech Twelve (they include, in addition to the US, Australia, Canada, Denmark, Finland, Israel, The Netherlands, New Zealand, Singapore, Sweden, Switzerland, and the UK), because their ratios of IT purchases to GDP are 3% or more.[19] China, Korea, Japan, France, and Germany are also likely to be early adopters of certain elements of Smart Computing, with Brazil, Chile, India, and South Africa being fast followers.
- **The journey to Smart Computing will be long, with both hype and disappointments.** Today, we are at the start of a cycle, where the market is filled more with custom-built solutions for single clients, partial solutions, and vendor promises of what their o□erings will be. Inevitably, there is a fair amount of marketing hype, with more to come. Even as Smart Computing o□erings become more productized and more substantive, the fine print about the need for process and organizational change to accompany a new technology will get lost in client desires for a simple technology fix and vendor willingness to accommodate those desires. Think back to the hype versus the reality of ERP solutions in 1992 to 1995, or Internet technologies from 1996 to 2000. But, the realities of benefits from Smart Computing will in time come close to matching the promises.
- **The growth cycle will end at some point, probably around 2017.** Nothing lasts forever, and that will certainly be true of Smart Computing. The period of growth in IT market revenues that we have predicted in this report will run for several years, but will come to an end by 2017 at the latest, and earlier if there is another global recession in the next three to five years.

## ENDNOTES

[1] Since I first proposed this thesis five years ago, I have often been asked why the periods of tech innovation and growth and the periods of tech digestion and refinement each seem to be about eight years long. I think the answer lies in the tenure and mindset of CEOs, who are the ones who set the strategic and investment priorities for their companies. As it turns out, the average tenure of a CEO (depending on the survey and when it was conducted) is eight to 10 years. And most CEOs tend to be herd creatures, responding to and following the key strategic moves of other CEOs. I think what happens is that at the start of a tech cycle, CEOs at a few companies learn about this new technology from innovative colleagues in their company, from a consultant, or from a key technology vendor. The success stories of these firms hit the media and spread interest to other CEOs. However, the followers don't see the same benefits as the early adopters, or they miss the hidden process changes and organizational changes that the successful implementers had done. So, these CEOs shift from being technophiles, in love with the promise of the new technology, to techno-skeptics, unwilling to invest in new technology unless it has a hard, provable return on investment.

[2] The mainframe computer got its start with pioneering products like ENIAC in 1946, Remington-Rand's UNIVAC I (delivered to the US Census Bureau in 1951), and the IBM 701 in 1953 and IBM 650 in 1954. 1960 ushered in the first DEC minicomputer, the first modem, and the COBOL programming language. Over the next nine years, IBM released the IBM 1400 series mainframe (1961), the first disk storage unit (1961), and especially the IBM System/360 (1964), which gave a major push to mainframe adoption. Control Data released the CDC 6600 supercomputer in 1964, with DEC, Hewlett-Packard, and Data General offering their own minicomputers in 1965, 1966, and 1969, respectively. The era of innovation closed in 1969 with the release of the UNIX operating system.

[3] While SAP had been selling versions of ERP software for the mainframe since the 1970s, and Oracle had released UNIX-based applications starting in 1987, the SAP R/3 client-server-architecture-based ERP product caught the attention of business and grew rapidly.

[4] IBM owns Cognos and recently acquired SPSS, SAP owns Business Objects, Oracle has BI Enterprise Edition (formerly Siebel Analytics) and Hyperion Essbase, TIBCO Software acquired Spotfire, and Microsoft has several small BI vendors. Other leading vendors are private, such as SAS Institute, Information Builders, and QlikTech.

[5] For background information on business intelligence vendors as well as data warehouse vendors, see the July 31, 2008, "The Forrester Wave™: Enterprise Business Intelligence Platforms, Q3 2008" report and see the February 6, 2009, "The Forrester Wave™: Enterprise Data Warehousing Platforms, Q1 2009" report.

[6] Digital Business Architecture was the conceptual framework that Forrester used to pull together new developments in four domains of technology that were helping make it systems more adaptable, more flexible, more extended, and more interconnected, and thus better able to match business needs and requirements See the November 7, 2005, "Digital Business Architecture: IT Foundation For Business Flexibility" report.

[7] Not all awareness technologies are new of course. Special areas of application have used technologies like telemetry for years. Even more important are the awareness technologies at Internet sites of what customers

are doing in real-time, using clicksteam analysis of page views, etc. In fact, many of the analytical tools that exist and will be deployed against data coming from sensors, RFID, video analysis, GPS locators, etc., originated with analysis of clickstream activity.

[8] The following report provides more insight into the role of rules engines in combination with business intelligence and business process management in creating more optimal business results. See the May 14, 2008, "How The Convergence Of Business Rules, BPM, And BI Will Drive Business Optimization" report.

[9] The September 2009 issue of *The Economist* magazine in the "Technology Quarterly" section provided this profile of the future of satellite navigation devices. Source: "Rational Consumer: The Road Ahead" *The Economist,* September 3, 2009 (http://www.economist.com/search/displaystory.cfm?story_id=14299710).

[10] Forrester Vice President and Research Director Connie Moore and Vice President and Principal Analyst John R. Rymer introduced the concept of Dynamic Business Applications at Forrester IT Forum conferences in 2007 and in their report in September 2007. See the September 24, 2007, "The Dynamic Business Applications Imperative" report.

[11] We first wrote about Accruent in a report on four vendors that had adapted their software solutions to address critical balance sheet issues in vertical industries. See the March 12, 2008, "Small App Vendors: Optimize Business Results" report.

[12] Forrester has initiated a series of reports on smart grids and their IT implications. See the October 19, 2009, "Smart Grid Technologies: Coming To A Utility Near You" report. *The Economist* has written two good summaries of trends in the smart grid/smart meter market. Source: "Smart grids: Wiser wires," *The Economist,* October 8, 2009 (http://www.economist.com/displaystory.cfm?story_id=14586006&CFID=86549758&CFTOKEN=72102578#); and "An internet for Electricity," *The Economist*, June 4, 2009 (http://www.economist.com/search/displaystory.cfm?story_id=E1_TPSNVRQP&CFID=87559706&CFTOKEN=86972983&source=login_payBarrier).

[13] *The Economist* magazine has also written a comprehensive review of healthcare information technology, with a focus on patient records management systems. Source: "Medicine goes digital," *The Economist*, April 16, 2009 (http://www.economist.com/specialreports/displaystory.cfm?story_id=E1_TPQPSJJD).

[14] One early profile of these types of solutions comes from *The Wall Street Journal*. Source: Michael Totty, "Smart Roads. Smart Bridges. Smart Grids," *The Wall Street Journal*, February 17, 2009 (http://online.wsj.com/article/SB123447510631779255.html)

[15] ERP vendors like SAP and Oracle are starting to focus on a couple of dozen verticals each while retaining presences in others. Smaller ERP vendors have been concentrating on a narrower set of verticals. See the November 2, 2009, "The State Of ERP 2009: Market Forces Drive Specialization, Consolidation, And Innovation" report.

[16] The data for this statement comes from Forrester's report on US enterprise versus SMB IT budgets in 2009, which had our projections for IT spending by industry. See the May 7, 2009, "US Enterprise Versus SMB IT Budgets In 2009" report.

[17] The data for this statement comes from our report on the IT vendor opportunities in the economic stimulus programs in the US and other economies. See the July 7, 2009, "There's Gold For Vendors In Stimulus Packages" report.

[18] Forrester has published a long series of documents on the Information Workplace market and vendor landscape. See the March 28, 2008, "Information Workplace Platform Vendors Light Up The World Of Work" report.

[19] We introduced the Tech Twelve concept in our January 2009 report on the global IT market. See the January 12, 2009, "Global IT Market Outlook: 2009" report.

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